“I Fought the Law and the Law Won” Regulatory Initiatives & Enforcement

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NEW YORK
STATE OF
OPPORTUNITY

Department of
Environmental
Conservation

I Fought the Law and the Law Won- Regulatory Initiatives & Enforcement

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Deputy Commissioner and General Counsel

Play List

Police on My Back – Operation Trash Net

Straight to Hell – Tonawanda Coke

Should I Stay or Should I Go – FMC

Complete Control – Northrup Grumman Plume

Do it Now– Dunn Landfill

Cool Under Heat – Implementation of the 2019 Climate Leadership and Community Protection Act (CLCPA)

Illegal Disposal came to the forefront in 2014 after contaminated C&D was dumped at the Town of Islip's Roberto **Clemente** Park, resulting in the park's closure for several years

Material contained elevated levels of organic compounds, metals, pesticides, PCB's, asbestos, as well as physical contaminants

Roberto Clemente Park

Illegal dumping of approximately 40,000 tons of C&D from NYC

Investigation revealed 4 sites in Suffolk County that were the dumping ground for the illegal disposal of solid waste

Toxic Dumping Trial

4 sites in Suffolk County illegally dumped with contaminated solid waste

Roberto Clemente Park – Brentwood

Sage Street – Central Islip

Veterans Way – Islandia

Brook Ave – Deer Park

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People v. Thomas Datre, et al

(Toxic Dumping Trial)

- Biggest Criminal Environmental Trial in Suffolk County
- 10 Defendants – individuals and corporations
- Special Grand Jury – Sept 2014 – November 2014
- 32 Count Indictment – ECL felonies, PL felonies dealing with environmental crimes and government corruption

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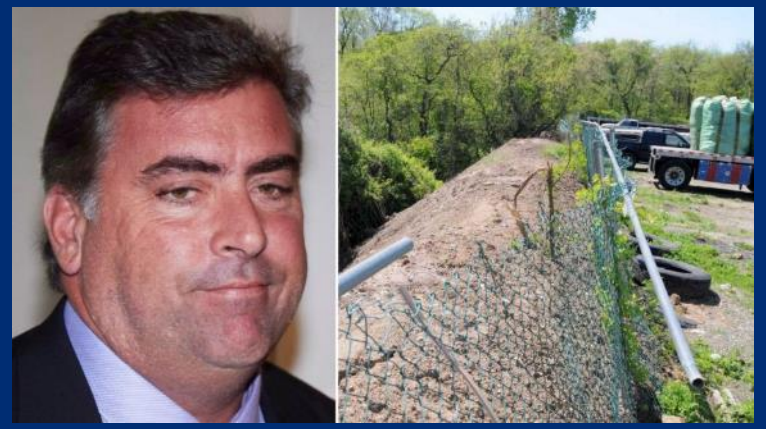
People v. Datre (cont.)

- Trial – February 2016- March 2016
  - 66 witnesses – 9 total DEC personnel testified for GJ & trial
  - 338 exhibits – majority was documentary evidence and photographs
- RESULT =

GUILTY

Datre Part 2



- People v. Ronald Ciancuilli
- Datre co-defendant who was severed from the first trial and had his own trial in May 2016
- RESULT=

GUILTY

OPERATION TRASH NET

In 2017 DEC lead a multi agency crackdown on the illegal disposal of C&D waste and strengthened NY's solid waste regulations to deter illegal dumping, address the growing threat and protect NY's water quality, especially on LI

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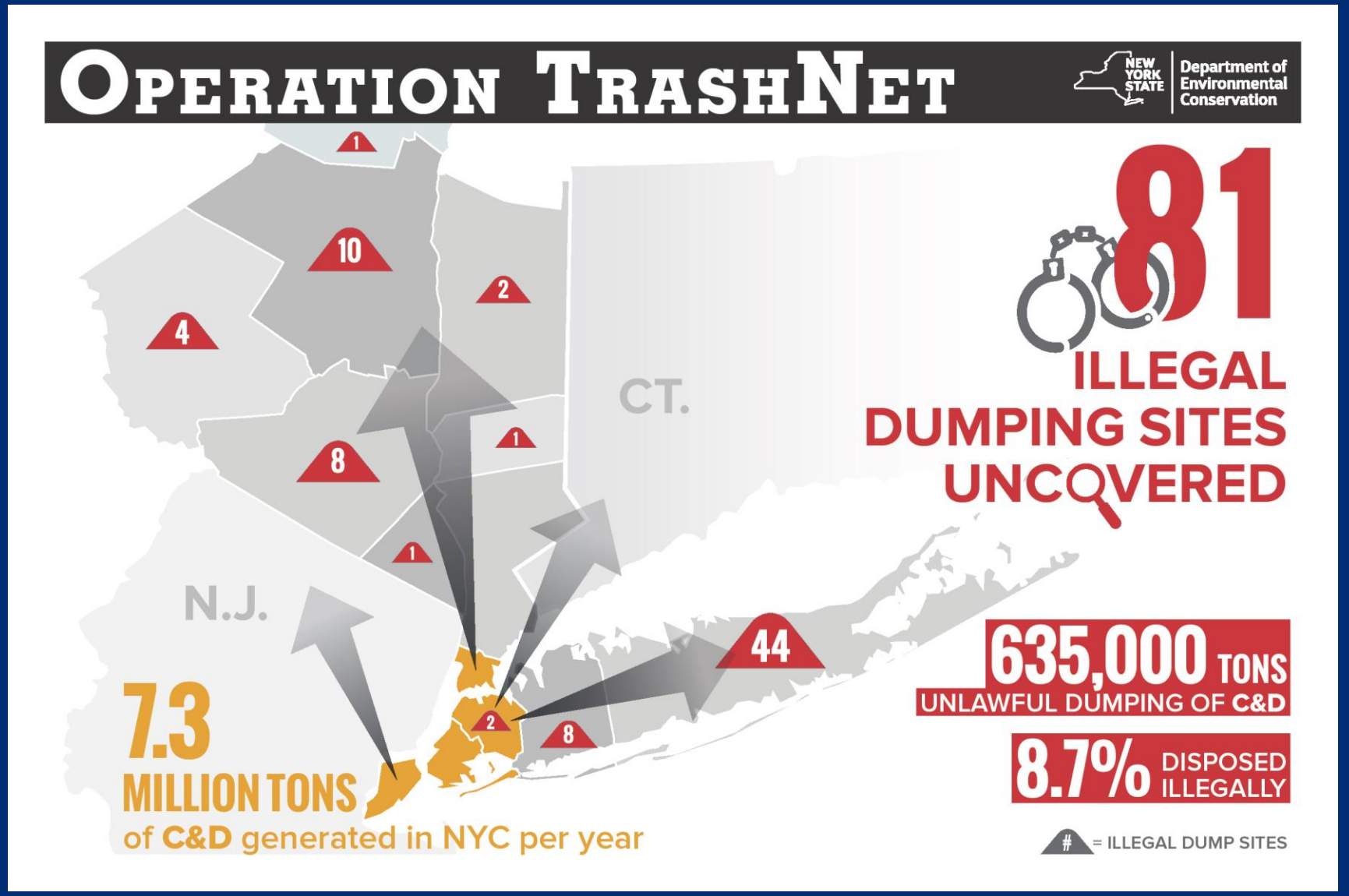
OPERATION TRASH NET

DEC's ECO's and DMM teamed up with district attorney's offices, NYS Police, State DOT and local law enforcement agencies to launch an enforcement blitz on LI and in the Mid-Hudson Valley on the illegal disposal of C&D and other solid waste violations.

This collaboration has spearheaded dozens of undercover details and truck surveillance operations to uncover dozens of crimes.


OPERATION TRASHNET
NEW YORK STATE
Department of Environmental Conservation
1
10
2
4
CT.
8
1
1
N.J.
44
2
8
81
ILLEGAL DUMPING SITES UNCOVERED
635,000 TONS
UNLAWFUL DUMPING OF C&D
8.7% DISPOSED ILLEGALLY
7.3
MILLION TONS
of C&D generated in NYC per year
= ILLEGAL DUMP SITES

Actions taken during Operation TrashNet on Long Island and in the Mid-Hudson Valley:

- Over 550 total tickets issued, and charges filed for various misdemeanors and other serious safety violations during enforcement actions
- More than 170 tickets issued for unlawful disposal of solid waste
- More than 40 trucking companies identified
- 81 new illegal dumping sites uncovered
- 26 trucks seized and impounded
- 53 search warrants executed

Operation Pay Dirt

Executed by the Suffolk County District Attorney's Office in partnership with the DEC in 2018:

- 24 offenders arrested
- 12 corporations charged with crimes
- 12 trucks seized
- Dozens of new illegal dump sites uncovered

Typical contaminants found in the illegally disposed fill:

- Metal
- Treated lumber
- Textile
- Slag
- Coal
- Ash
- Tile
- Wire
- Plastic
- Glass
- Foam insulation
- Asbestos

What's next?

- Monitoring and preventing illegal dumping remains a top priority of the DEC

- New regulations are being written and implemented to deter illegal dumping and protect our environment

DEC Strengthened Part 360 Solid Waste Management Regulations in 2017 Concerning C&D Debris

- Enhanced tracking for transport of C&D debris generated in New York City
- Required registration (Part 364) for transportation of C&D debris
- Expanded beneficial use determinations for select types of C&D debris
- Set limits on allowable storage volumes at C&D debris processing facilities
- Required analysis of all fill material leaving all C&D debris processing facilities

Strengthened regulations specific to Long Island

- Restricted-use and limited-use fill generated outside Long Island is now prohibited from begin transported onto Long Island
- Restricted-use fill must meet general fill requirements for protection of groundwater
- Limited-use fill is prohibited from reuse

NEW YORK STATE | Department of Environmental Conservation

Tonawanda Coke Corporation

Tonawanda Coke Corporation (TCC) was a former merchant byproduct coke manufacturing facility that had been in operation since 1978 in the Town of Tonawanda.

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TCC - No Stranger to Enforcement

2009 - joint state and federal multi-media inspection that detected numerous federal and state laws.

2010 - DEC and EPA issued parallel administrative orders that required repairs and modification to TCC's by-products area due to the significant emissions of hazardous air pollutants, including benzene.

2015 - DEC and EPA reached a settlement with TCC on the remaining violations not covered by the 2010 Orders which was embodied in a federal Consent Decree. The settlement required the payment of a $4 million penalty and numerous injunctive relief items.

Criminal Conviction – Second Criminal Prosecution Nationally Under the CAA

2010 - Criminal indictment issued against TCC and its environmental control manager for violating the CAA, RCRA and for obstruction of justice (concealing a pressure relief valve that released uncontrolled benzene).

2013 – TCC and its environmental control manager were guilty.

2014 - TCC was sentenced and required to pay a $25 million dollar fine and given five years probation ($12.5 million fine and $12.2 million to fund two environmental studies). TCC's environmental control manager was fined $20,000 plus sentenced to one year in prison.

DEC Administrative Enforcement Continued After the Criminal Conviction

DEC issued numerous Notices of Violation to and entered into 7 Orders on Consent with TCC from the sentencing in 2014 to 2018. The violations involved Title V permit violations, petroleum spills, chemical and bulk storage spills, SPDES violations and improper disposal of hazardous waste. These matters were in addition to several actions against TCC for non-compliance with the joint federal and state Consent Decree.

2018 Brought Significant Opacity and Other Violations

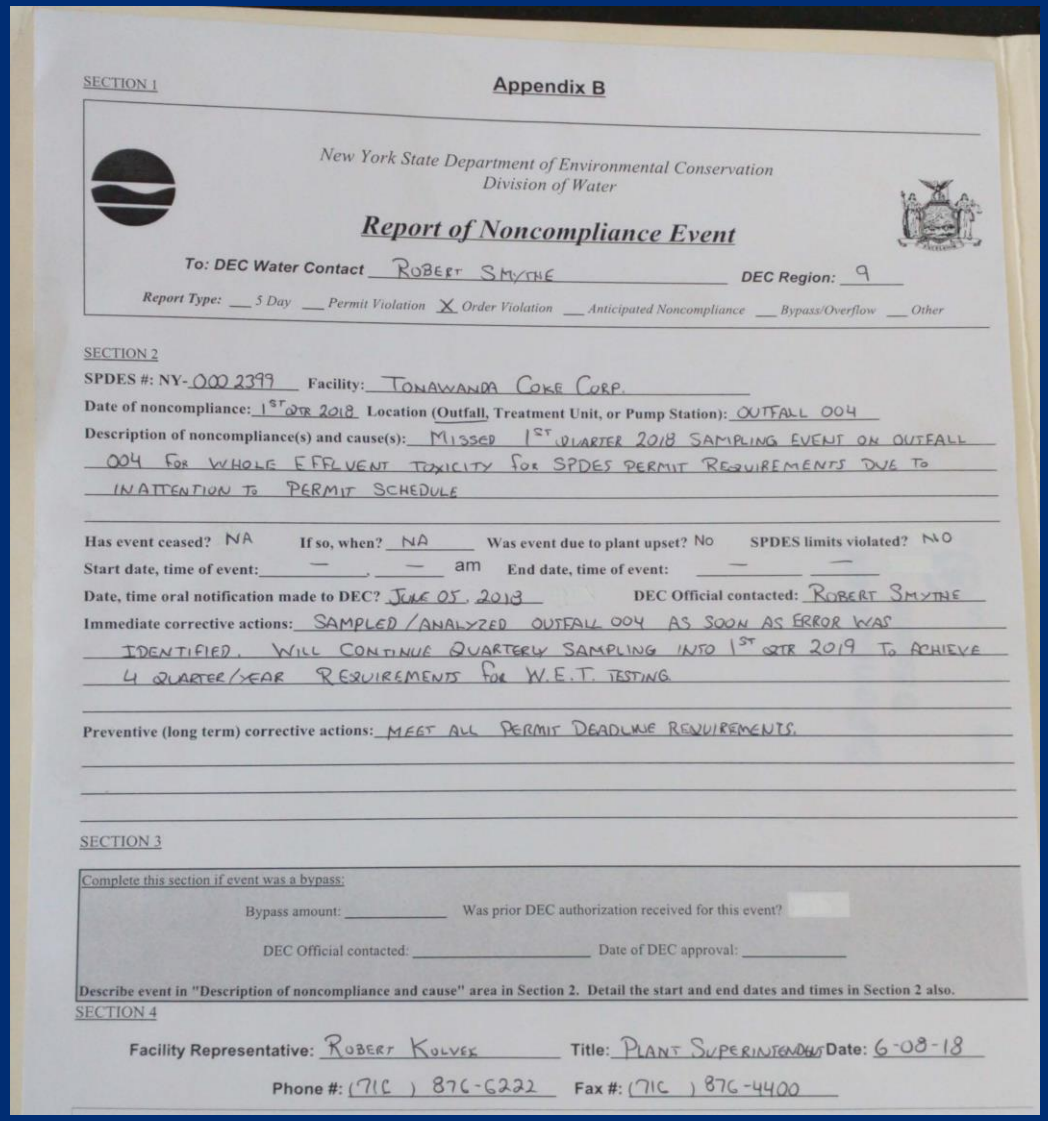
- Opacity violations started occurring at TCC on a regular basis in January 2018. Opacity exceedances then became a daily occurrence through the spring and fall of 2018.
- TCC also violated several CBS, PBS, SPDES and RCRA laws and regulations and its Title V permit for coke oven gas emissions during this time.

Sodium hydroxide spill

Weak Ammonia Liquor release due to hole in tank

PBS Discharges

TCC reported to DEC that it failed to perform a SPDES required sampling event "due to inattention to permit schedule."



SECTION 1

Appendix B

New York State Department of Environmental Conservation
Division of Water

Report of Noncompliance Event

To: DEC Water Contact ROBERT SMYTHE **DEC Region:** 9

Report Type: ___ 5 Day ___ Permit Violation X Order Violation ___ Anticipated Noncompliance ___ Bypass/Overflow ___ Other

SECTION 2

SPDES #: NY- 000 2399 **Facility:** TONAWANDA COKE CORP.

Date of noncompliance: 1ST QTR 2018 **Location (Outfall, Treatment Unit, or Pump Station):** OUTFALL 004

Description of noncompliance(s) and cause(s): MISSED 1ST QUARTER 2018 SAMPLING EVENT ON OUTFALL 004 FOR WHOLE EFFLUENT TOXICITY FOR SPDES PERMIT REQUIREMENTS DUE TO INATTENTION TO PERMIT SCHEDULE

Has event ceased? NA **If so, when?** NA **Was event due to plant upset?** NO **SPDES limits violated?** NO

Start date, time of event: ___ ___ am **End date, time of event:** ___ ___

Date, time oral notification made to DEC? JUNE 05, 2018 **DEC Official contacted:** ROBERT SMYTHE

Immediate corrective actions: SAMPLED/ANALYZED OUTFALL 004 AS SOON AS ERROR WAS IDENTIFIED. WILL CONTINUE QUARTERLY SAMPLING INTO 1ST QTR 2019 TO ACHIEVE 4 QUARTER/YEAR REQUIREMENTS FOR W.E.T. TESTING

Preventive (long term) corrective actions: MEET ALL PERMIT DEADLINE REQUIREMENTS.

SECTION 3

Complete this section if event was a bypass:

Bypass amount: ___ **Was prior DEC authorization received for this event?**

DEC Official contacted: ___ **Date of DEC approval:** ___

Describe event in "Description of noncompliance and cause" area in Section 2. Detail the start and end dates and times in Section 2 also.

SECTION 4

Facility Representative: ROBERT KOLVEK **Title:** PLANT SUPERINTENDENT **Date:** 6-08-18

Phone #: (716) 876-6222 **Fax #:** (716) 876-4400

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Cease and Desist and Air Permit Revocation

TCC's continuous operation in conscious disregard for environmental laws led to the issuance of a Cease and Desist and Notice of Intent to Revoke TCC's air permits which was served in July 2018.

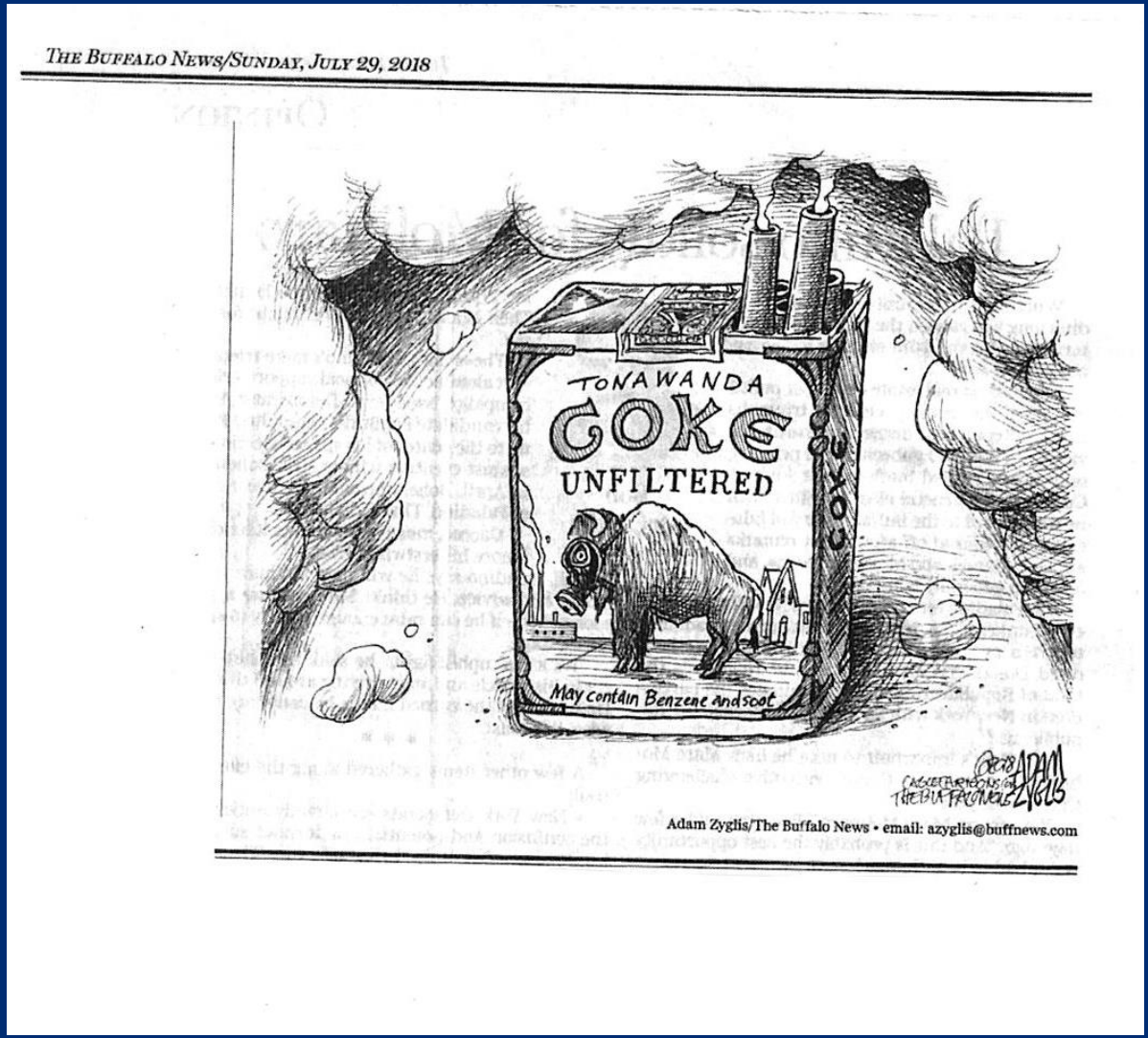
Rather than cease operations, TCC requested a hearing that was scheduled to begin on October 10, 2018.

TCC Criminal Probation Violation

A few months after the service of the cease and desist/permit revocation notice, the federal probation department filed a petition alleging that TCC violated the terms of its probation due to the continued federal and state opacity limit violations and emissions of coke oven gas from the facility.

Following a hearing, Judge Skretny (who presided over the 2013 criminal trial) found that TCC violated the terms of its probation and required that TCC perform a battery stack test, undertake various repairs to the battery in an attempt to stop the opacity violations and required a third party compliance monitor.

Common Theme – Profits Over Environmental Compliance



Harsh Words from Judge Skretny

At the sentencing, Judge Skretny told TCC's President – "You cannot operate like this anymore. You cannot continue to shirk your environmental responsibilities. You cannot continue to elevate cost over compliance."

He further stated that "with this present probation violation, Tonawanda Coke has failed this community again," the "culture of profit over environmental consciousness appears to persist" and "put simply, Tonawanda Coke continues to place a low priority on environmental compliance."

Permit Revocation Proceeding Settled

TCC agreed to shut down operations on October 10, 2018 – day that the proceeding was to begin.

TCC started shutdown procedures on October 14, 2018.

TCC filed for bankruptcy on October 15, 2018.

TCC vacated the site on October 28, 2018.

Chapter 11 Bankruptcy

The bankruptcy proceeding is on-going. Proofs of claims have been filed. The main secured creditor is Honeywell International (former owner and operator of the site) who holds mortgages on TCC's property for funds lent to TCC to pay the criminal fine.

TCC sold various assets last month at an auction.

DOJ recently served a motion for discovery to understand the disbursements made and funds owed to various sister and related corporate entities of TCC.

DEC and EPA Oversight Since Shutdown

The agencies have worked closely to ensure a safe shutdown of the operating components of the facility. Steps have also been taken to address possible incidents, including:

- stabilizing and/or eliminating areas of potential releases of contaminants
- properly storing various chemicals the remained after shutdown
- cleaning and decommissioning sumps and trenches in the process area

Oversight Efforts

- treatment of contaminated wastewater in process tanks
- excavation of impacted soils
- continuous operation and maintenance of the facility's stormwater management system
- negotiation with a former PRP regarding the removal of the abandoned coal tar storage tanks at the site across the road from the plant referred to as Site 108

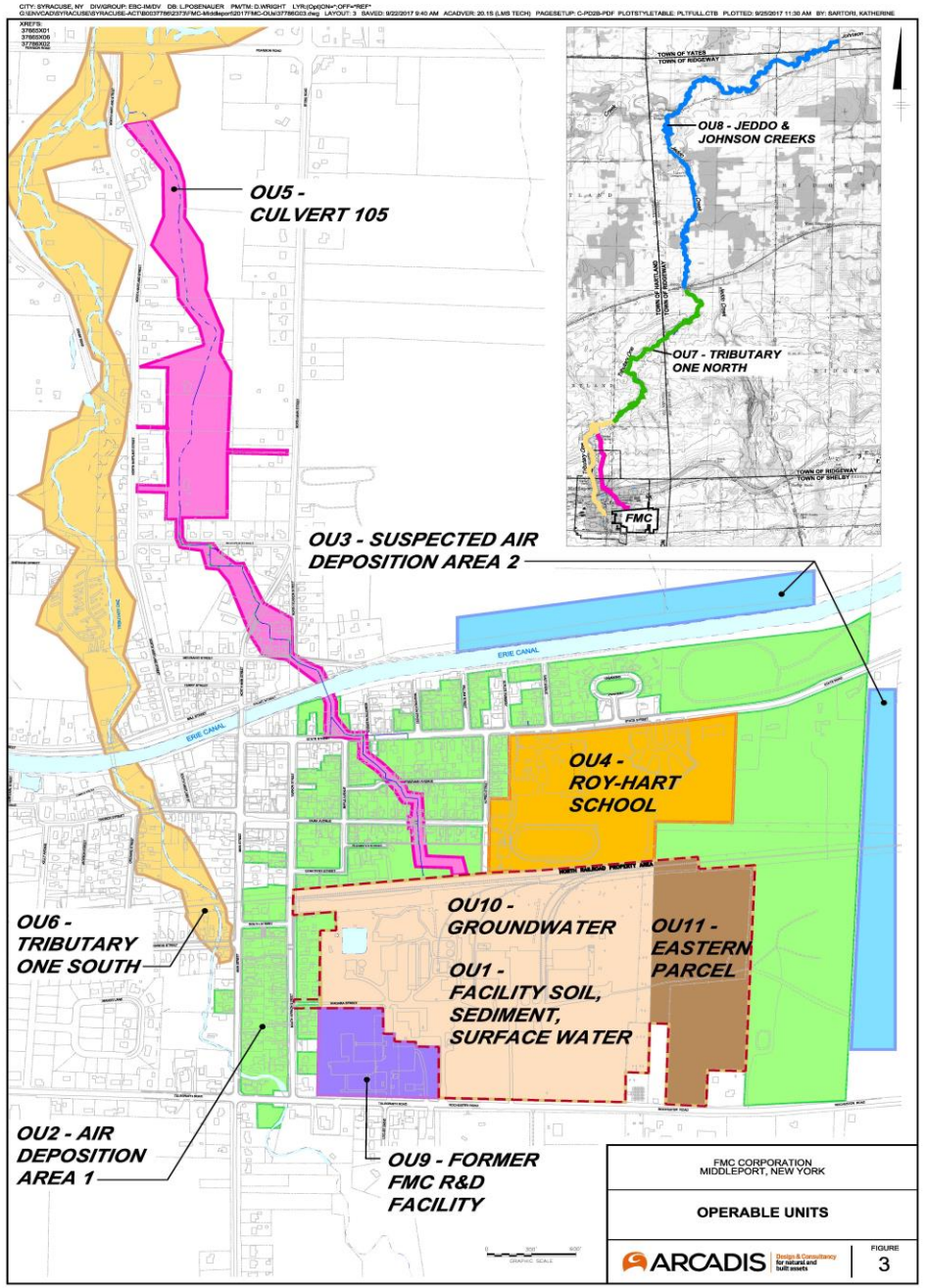
Next Steps – Clean up and Future Redevelopment

DEC shares the common goal of implementing a comprehensive investigation and cleanup that is fully protective of public health and the environment in order to bring the site back into productive reuse.

Options include the federal superfund program, the state superfund program, the brownfield cleanup program and/or a combination of these programs for various areas of the site.

FMC Corporation - Arsenic contamination in WNY

- FMC Corporation owns a 103-acre pesticide repackaging facility in Middleport, NY
- Historical pesticide manufacturing at the facility resulted in arsenic, DDT, and other hazardous waste contamination at the facility and in off-site areas (including residential yards and a school in the village)
- The facility is subject to RCRA permitting and compliance, and the off-site areas require investigation and remediation under state hazardous waste laws (Article 27, Title 13 of the ECL)
- From the early 1990s until recently, a minimal amount of remediation, other than interim actions, had been performed



FMC Site
11 Operable Units
Most are Off-Site

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FMC fought the Law

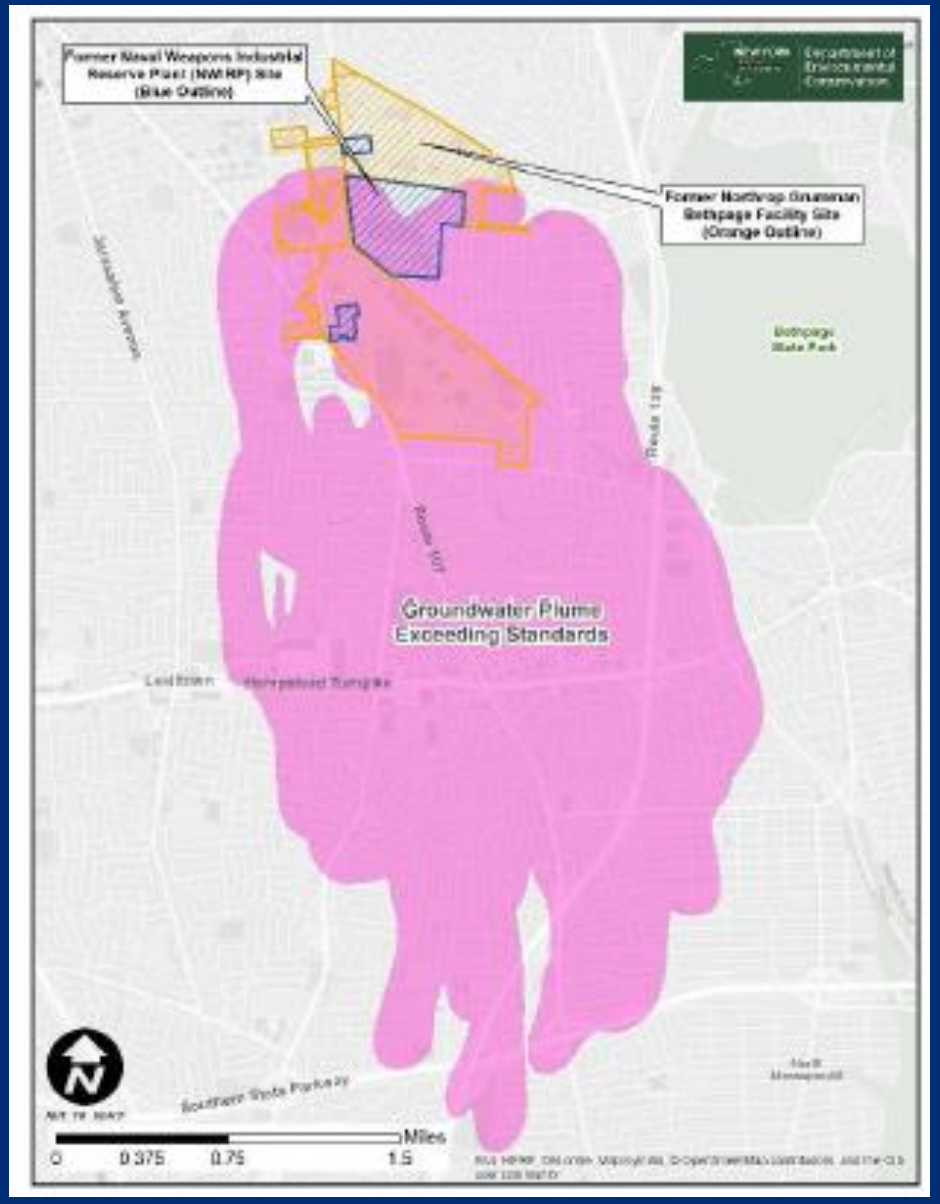
- After DEC issued a remedy decision for over 200 residences and a school (a decision which FMC believed was too stringent), FMC filed an Article 78 to challenge the decision
- FMC also sought to prevent the Department from implementing the remedy using its own state funds
- **And the law won**…After several appeals, the Court of Appeals ruled completely in the Department's favor: *FMC v. NYSDEC,* 31 N.Y.3d 332 (May 2018)

FMC then pursued settlement

- After the loss at the Court of Appeals, FMC was facing a significant cost recovery case and many years of litigation and expert consultant costs to keep fighting
- FMC also received notices of violation for several on-site activities that violated state hazardous waste laws, including an unauthorized demolition of a building containing hazardous wastes
- On June 6, 2019, FMC and NYSDEC entered into a comprehensive consent order, one of the largest environmental enforcement settlements to date:
  - Payment of over $31M for past NYSDEC costs
  - Payment of $2.4M penalty and implementation of a $1M Environmental Benefit Project
  - Posting of $80M in Financial Assurance
  - Reimbursement of NYSDEC future costs and takeover of remediation after 2020 (finishing remediation of all OUs will likely cost over $100M)

Northrup Grumman – Long Island Groundwater Plume

- A portion of Long Island's sole source aquifer, in and around the community of Bethpage, has been impacted by legacy contamination from previous industrial operations by Northrup Grumman and the US Navy
- A massive plume of contaminated groundwater, measuring approximately 2 miles wide and 4 miles long, has already impacted several water districts and could impact future water districts if not contained
- Previous remedial decisions by the DEC, including pumping and treating of contaminated groundwater by Grumman, the Navy, and several water districts, has been the main remedial approach



- Previous modeling and studies determined that levels of VOCs would attenuate – recent studies have shown minimal attenuation
- Also, older models showed the plume would not move considerably to the south – new modeling shows the opposite, the plume is moving
- Public sentiment – the plume should be contained, so that other water districts and the citizens that are served by them are not affected

Grumman – updated modeling and new amended remedy

- Legislation passed in 2014 seeking a reassessment of the feasibility of containment of the plume
- DEC, in conjunction with its contractors and the USGS, performed state-of-the-art modeling over the last several years, and in May of 2019 issued a supplemental feasibility study and a proposed amended remedy, which states that full containment is feasible and would be the action most protective of public health and the environment
- DEC anticipates issuing the final amended remedy shortly, and the Department will seek implementation of the amended remedy by the Navy and Grumman
- Entire approach to the Navy Grumman plume shows how government should work – base decisions on science and be willing to adapt to changes in technology and circumstances – USEPA should consider this approach to the Hudson River

Rensselaer, New York- Dunn Land Fill

Background

Facility: Sand and gravel mine with phased conversion to a construction and demolition (C&D) debris disposal facility

Location: Urban location in close proximity to public school and residential neighborhoods, within the viewshed of downtown Albany, on municipal border of City of Rensselaer and City/Town of North Greenbush

Primary Community Complaints: Dust, truck traffic, odors

DEC Enforcement – Order on Consent 2018

Violations:

- Use of unpermitted access points
- Off-site placement of mined material
- Off-site stormwater discharge
- Off-site dust migration

Assessed Civil Penalty:

- $100,000

Environmental Benefit Project:

- $225,000 for benefit of school and local community

Schedule of Compliance:

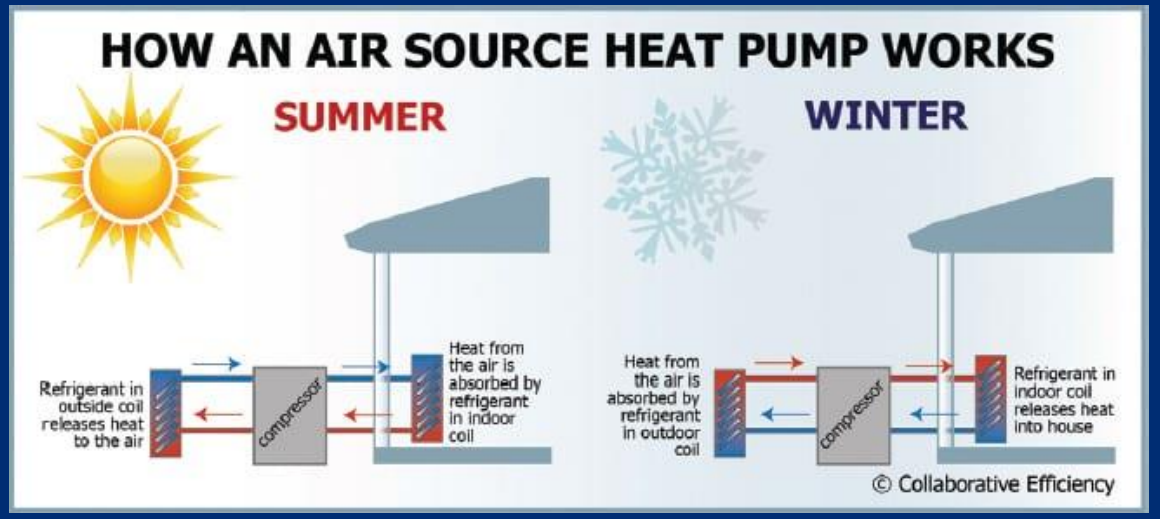
- Site stabilization
- Fugitive dust control plan
- Haulageways improvement
- Dust mitigation measures, including hydromulching, fencing, street sweeping, and truck washing

DEC Enforcement – Order on Consent 2019

- **Violations**:
  - Failure to properly hydromulch wind-sided slopes of mine site
  - Failure to properly apply water and approved dust palliatives to prevent dust from leaving mine site
- **Civil Penalty**:
  - $35,000
- **Schedule of Compliance**:
  - Appointment of third-party monitor
  - Revised Dust Control Plan
  - Construction of soil berm (permit modification)

Climate Leadership and Community Protection Act (CLCPA)

2030		**Statewide GHG Emissions Limit: 60% of 1990 levels**
2030		Clean Energy Goal: 70% renewable energy
2030		Clean Energy Procurement Goal: 3,000 MWs of energy storage
2035		Clean Energy Procurement Goal: 9,000 MWs of offshore wind
2040		Clean Energy Goal: Net zero emissions for the electric sector
2050		Statewide GHG Emissions Limit: 15% of 1990 levels



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Department of Environmental Conservation

January 2021	DEC	DEC shall, pursuant to rules and regulations promulgated after at least one public hearing, establish a statewide GHG emissions limit as a percentage of 1990 emissions • 2030: 40% below 1990 emissions • 2050: 85% below 1990 emissions
July, 2024	PSC	PSC shall establish programs to require the procurement by the state's load serving entities of 6,000 MWs of solar generation by 2025, 3,000 MWs of energy storage by 2030, and 9,000 MWs of offshore wind by 2035
January 2024	DEC	DEC shall promulgate rules and regulations to ensure compliance with the statewide emissions reduction limits Before promulgating rules and regulations DEC shall: • Hold no less than 2 public hearings • Consult with the council, the EJ Advisory Group, the Climate Justice WG, representatives of regulated entities. Community organizations, environmental groups, health professionals, labor unions, municipal corporations, trade associations and other stakeholders

Thank You

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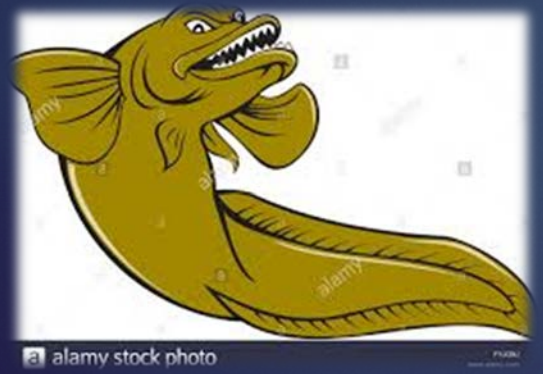
EPA REGION 2 UPDATE

NYSBA EELS Fall Meeting
September, 2019



WALTER MUGDAN

DEPUTY REGIONAL ADMINISTRATOR

US EPA REGION 2

EPA Strategic Plan 2018-2022

- Three major Goals:
  - Core Mission
  - Collaborative Federalism
  - Rule of Law & Process
- Six overarching priorities:
  - attainment of national ambient air quality standards;
  - modernize aging drinking water and wastewater infrastructure;
  - accelerate the pace of site cleanups and promote site reuse;
  - comply with statutory requirements and mandatory deadlines of recently-amended TSCA statute for ensuring the safety of chemicals;
  - increase environmental law compliance rates; and
  - accelerate permit related decision-making.

EPA Policy on Federal/State Enforcement Partnerships

- Policy issued 7/11/2019; replaces January 2018 interim policy.
- Three major components:
  - Joint work planning
    - Strategic planning & targeting
    - Scheduling inspections
    - Consider enforcement response
  - Roles of states & EPA
  - Rapid elevation of issues

EMERGING CONTAMINANTS

- **PFAS** (per- and poly-fluoroalkyl substances)
  - **PFOA**
    - **Teflon**
    - **Fire-fighting foam**
    - **Wide-spread; relatively easy to treat**
  - **GenX**
    - **Replacement for Teflon**
    - **Somewhat less easy to treat**
  - **PFNA, PFOS, etc.**
- **1,4-dioxane**
  - **Wide-spread; relatively difficult to treat**

EMERGING CONTAMINANTS

- No federal regulatory standards
  - 70 ppt Health Advisory level for PFOA/PFOS
- State regulatory standards include:
  - NY: MCLs of 10 ppt planned for PFOA & PFOS; and 1 ppb for 1,4-dioxane
  - NJ: 13 ppt MCL for PFNA; proposed 14 ppt MCL for PFOA
  - NC: “Health goal” of 140 ppt for GenX
  - CO: 0.35 ppb for 1,4-dioxane in drinking water supplies
- Local regulatory standards
  - Rensselaer County, NY: 0.35 ppb for 1,4-dioxane discharge from Superfund site treatment plant located on County land.

EMERGING CONTAMINANTS

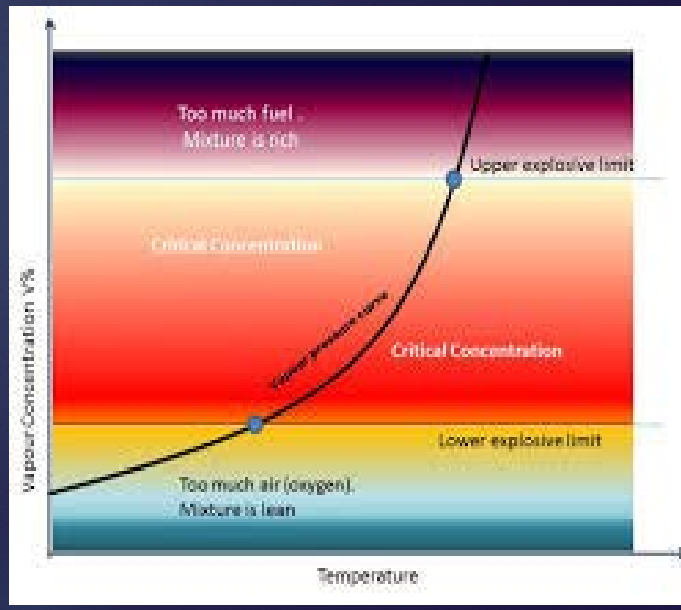
- EPA PFAS Summit, May 2018: EPA will --
  - Initiate steps to evaluate need for an MCL for PFOA & PFOS;
  - Convene federal partners and examine what is known about PFOA & PFOS in drinking water;
  - Begin necessary steps to propose designating PFOA and PFOS as "hazardous substances" through on or the available statutory mechanisms, including potentially CERCLA §102;
  - Develop groundwater cleanup recommendations for PFOA & PFOS at contaminated sites; and
  - Develop toxicity values for GenX and PFBS.

Notable R2 Enforcement Developments

- Methyl Bromide Cases
  - Esmond Family poisoned in May 2015 by illegal application of methyl bromide pesticidal fumigant
  - Application carried out by Terminix franchisee
  - Criminal prosecution of applicator, Terminix, others
    - Guilty pleas in all cases
  - Civil investigations revealed other instances of illegal application
  - Administrative enforcement actions initiated against twelve applicators & two distributors
    - Penalties and injunctive relief sought
    - Most now resolved

Notable R2 Enforcement Development

- *Total Petroleum* CAA §303 Emergency Order issued 5/20/2019
- Order addresses four tanks at Total's Guaynabo facility reported on 5/8/19 to have elevated Lower Explosive Limit (LEL) levels, indicating dangerous fire hazard
  - NFPA standard for such tanks: LEL not to exceed 25%
  - Five tanks had LELs between 39% and 100%
  - After 10 days only 1 tank had LEL <25%
  - Order required 4 tanks to be emptied, de-gassed within 3 days; then repair tanks; and not put tanks back into service without prior EPA approval



Notable R2 Enforcement Developments

- **NYC Hillview Reservoir Cover Judicial Consent Decree**
  - **90-acre reservoir is last stop for finished water before entering NYC distribution system.**
  - **Disinfection takes place upstream of Hillview, but reservoir is not covered so pathogens can enter water there.**
    - ***Giardia*, *Crytopsporidium* and other pathogens from animal waste**
  - **1999 NYS administrative order required cover**
  - **2005 federal SDWA regulation required cover**
  - **2010 EPA administrative order required cover**
  - **3/18/2019 judicial consent decree requires cover**
    - **Lengthy compliance schedule – cover to be installed NLT 2049**
    - **Cost likely to exceed $1.6 billion**
    - **$1 million civil penalty; $50K payment + $200K SEP to settle State claims**

Notable R2 Enforcement Developments

- New York City Housing Authority Administrative Agreement
  - Judicial complaint & proposed consent decree filed EDNY on 6/11/2018
  - Cited multiple HUD & EPA violations, including violations of EPA's Renovation, Repair & Painting (RRP) rule applicable to lead-based paint
  - Court rejected proposed consent decree; parties thereafter negotiated administrative agreement.
    - Agreement is with HUD; EPA is not a party, but EPA lead-based concerns are addressed.
    - Agreement includes requirement for federal monitor.
      - Selected by HUD in consultation w/ US Attorney, NYCHA and City
      - Paid for by City
      - Monitor has broad powers to ensure action plans are implemented and compliance achieved

Interim Remedies at R2 Sediment Sites

- Berry's Creek -- $332 M interim remedy selected Sept. 2018
  - Extensive mercury & PCB contamination
  - Contributes to contamination of Hackensack River
  - Dredge & cap upper section of creek
  - Additional Operable Unit(s) to follow
  - Interim remedy proposed by PRPs
  - All parties understand this is not the final remedy, and more work may be needed, including in the upper section of creek

Interim Remedies at R2 Sediment Sites

- Upper 9 Miles of Lower Passaic River (LPR)
  - LPR contaminated with dioxin, PCBs, other substances
  - EPA selected bank-to-bank dredge-and-cap remedy for lower 8 miles of LPR; $1.4 billion project now in design; construction to begin ~2021.
  - PRPs proposed interim remedy (estimated $300-$500 M) for upper 9 miles, to include selected areas for dredge-and-cap
  - Focused Feasibility Study being performed by PRPs; draft FFS scheduled for 8/2019; proposed cleanup plan by 9/2020.
    - Accelerated process will allow use of cleanup infrastructure for lower 8 miles
    - All parties understand final remedy could require additional work

Early Remedy at a R2 Sediment Site

- Newtown Creek Superfund Site -- CSO Mitigation Project
  - 12/2018 EPA administrative consent order with NYCDEP
  - NYCDEP will perform Focused Feasibility Study evaluating CSO controls necessary for Superfund purposes
  - FFS expected to result in early selection of a CSO remedy, prior to selection of a site-wide remedy
  - FFS will evaluate NYCDEP's 2017 Clean Water Act Long Term Control Plan for Newtown Creek CSOs
    - LTCP proposed a $1.4 billion CSO capture tunnel
    - NYCDEP hopes to demonstrate that LTCP proposal will be sufficient for Superfund

Interim Remedies at R2 Sediment Sites

- Newtown Creek Superfund Site – Lower Two Mile Study
  - 7/25/2019 EPA administrative consent order with five private PRPs ("Newtown Creek Group" or NCG)
  - NCG will perform FFS evaluating interim remedy options for lower two miles the five-mile Creek
  - FFS expected to result in early selection of interim remedy for that section of the creek, prior to selection of a site-wide remedy.
  - Anticipated that final remedy for lower two miles will be included in final site-wide remedy.

NYSBA Environmental & Energy Law Section 2019 Fall Meeting

Regulatory Initiatives & Enforcement

EPA REGION 2 UPDATE

Walter Mugdan
Deputy Regional Administrator
U.S. EPA Region 2
August 2019

I. EPA Strategic Plan

EPA's Strategic Plan[1] for the period from Fiscal Years 2018-2022 identifies three major Goals for EPA, titled (1) Core Mission, (2) Collaborative Federalism, and (3) Rule of Law & Process. The document also identifies six overarching priorities: attainment of national ambient air quality standards; modernize aging drinking water and wastewater infrastructure; accelerate the pace of site cleanups and promote site reuse; comply with the statutory requirements and mandatory deadlines of the recently amended TSCA statute for ensuring the safety of chemicals; increase environmental law compliance rates; and accelerate permit-related decision-making.

Within Goal 1 there are four major "Objectives" focusing on air, water, land and chemicals; and within these there are a total of 13 specific Strategic Measures. For example, under the air quality objective, the Strategic Measure is to reduce the number of NAAQS non-attainment areas nationwide to 101 by the end of federal Fiscal Year 2022. Under the clean and safe water objective there are three Strategic Measures, including reduction of the number of non-compliant community water systems to 2,700 by the end of FY-2022. Under the Land Revitalization Objective, one of the four Strategic Measures is to make 255 additional Superfund sites ready for anticipated use site-wide. And under the Chemical Safety Objective several of the five Strategic Measures set out the commitment to achieve various TSCA-related actions by the statutory deadlines.

Goal 2 includes a focus on enhanced Compliance Assurance, among other issues.

Goal 3 provides additional focus on compliance and enforcement, and includes several Strategic Measures including reduction of the average time from violation identification to correction; and increasing the environmental law compliance rate.

1 <https://www.epa.gov/planandbudget/fy-2018-2022-epa-strategic-plan>

II. EPA Policy on Federal/State Enforcement Partnerships

On July 11, 2019 EPA issued its policy on *Enhancing Effective Partnerships Between EPA and the States in Civil Enforcement and Compliance Assurance Work*.[2] This supersedes the January 2018 Interim Guidance on the same topic, and provides a roadmap for engaging states in discussions about the environmental enforcement and compliance assurance work that we collectively address. The policy has three major components. The first calls for periodic joint work planning between states and EPA. The purpose is to collaboratively engage in strategic planning to identify and prioritize compliance issues and appropriate areas of focus; to plan inspections so as to share the workload while avoiding unnecessary duplication, and schedule joint inspections where appropriate; and plan the enforcement response to non-compliance, including discussion of which agency will handle a given matter and what kind of response is contemplated.

The second major component of the policy addresses the roles of EPA and the states, considering specialized capabilities and expertise; resource demands and availability; and whether a particular matter advances a national compliance initiative (e.g., focusing on a particular pollutant or industry) or involves facilities in multiple states or a federal facility.

The third component establishes a process for rapid elevation of issues that arise between EPA and a state, moving up to senior career officials and finally to senior political appointees in both agencies.

III. Emerging Contaminants

In recent years, a number of un-regulated chemicals have generated considerable concern with respect to drinking water contamination and other possible exposure pathways. One such chemical is 1,4-dioxane, a semi-volatile organic compound that is both ubiquitous and difficult to manage. Also of growing concern is a group of compounds known as per- and polyfluoroalkyl substances (PFAS); perhaps most common among these is perfluoroctanoic acid (PFOA), which was used to make non-stick materials like Teflon, and was also used widely in fire-fighting foam.

These chemicals are not currently regulated under federal environmental laws[3]; in particular, there are no Maximum Contaminant Levels (MCLs) that have been established under the Safe Drinking Water Act, nor are they are "hazardous wastes" under RCRA or "hazardous substances" under CERCLA. If disposed of they are "solid wastes" under RCRA; and, if released into the environment, they are "pollutants or contaminants" under CERCLA. However, though some action can be taken under each statute, these contaminants do not trigger corrective

2 < https://www.epa.gov/newsreleases/epa-announces-policy-enhance-enforcement-and-compliance-assurance-partnerships-states>

3 In December 2017 EPA announced a cross-agency effort to address PFAS. *See*: <https://www.epa.gov/pfas>

action obligations under RCRA, and the government's enforcement authorities under CERCLA are significantly circumscribed.

PFOA and other PFAS are being found in groundwater across the U.S.[4] These compounds have adverse health effects at very low concentrations. On May 25, 2016 EPA published a health advisory setting out the Agency's determination that 70 parts per trillion is the concentration in drinking water of PFOA and a related compound, PFOS, at or below which adverse health effects are not anticipated to occur over a lifetime of exposure.[5] As discussed below, in the absence of federal regulatory action some states have moved ahead with regulatory standards of their own.

Fortunately, PFOA and some other PFAS can be removed from water relatively easily, with common treatment technologies such as air stripping or activated carbon. Unfortunately, some PFAS (including compounds intended as a replacement for PFOA and given the trade name "GenX" by manufacturer DuPont,) are somewhat less easily removed from water.[6]

DuPont, the maker of Teflon, faced some 3,500 toxic tort suits in Ohio, alleging injuries from PFOA-contaminated drinking water. In December 2016 a jury in the first of these to go to trial awarded $2 million to the plaintiff in compensatory damages, and in January 2017 it awarded a further $10.5 million in punitive damages.[7] A few weeks later, in February 2017, DuPont and Chemours (its former subsidiary, which it spun off in 2015) settled these cases for a cash payment of $671 million.[8]

On August 3, 2017 EPA added to the Superfund National Priorities List (NPL) the St. Gobain Performance Plastics McCaffrey St. facility in the Village of Hoosick Falls, NY because of PFOA discharges that contaminated the municipality's public drinking water supplies.[9] This is only the second time EPA has proposed to add a site to the NPL based on discharges of a "pollutant or contaminant" (rather than a "hazardous substance"), and the first time involving PFOA or any PFAS.

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4 PFAS were recently found in bottled water from Massachusetts. <https://thehill.com/policy/energy-environment/455175-senator-pushes-fda-action-as-forever-chemicals-spread-to-bottled>

5 < https://www.epa.gov/ground-water-and-drinking-water/drinking-water-health-advisories-pfoa-and-pfos>

6 Information about GenX can be found in Wikipedia at: <https://en.wikipedia.org/wiki/GenX>. During 2017 the discovery of GenX in the Cape Fear River and associated drinking water supplies in North Carolina brought … well, considerable fear to local communities. *See, e.g.:* <http://www.capefearriverwatch.org/advocacy/genx-what-happened>. The state established a "health goal" of 140 ppt for drinking water; *see:* <https://files.nc.gov/ncdeq/GenX/FAQ_updated_100417-5.pdf>. EPA has not established any advisory or regulatory limits.

7 *See:* <http://www.law360.com/articles/875696/dupont-owes-2m-in-teflon-testicular-cancer-trial-jury-says?article_related_content=1> *and* <http://www.law360.com/environmental/articles/877780/breaking-dupont-hit-with-10-5m-punitive-verdict-in-cancer-trial?nl_pk=39e483ab-a175-4cb9-9e56-1b4eb4bff18d&utm_source=newsletter&utm_medium=email&utm_campaign=environmental>

8 *See:* <https://www.reuters.com/article/us-du-pont-lawsuit-west-virginia/dupont-settles-lawsuits-over-leak-of-chemical-used-to-make-teflon-idUSKBN15S18U>

9 *See*: <https://www.gpo.gov/fdsys/pkg/FR-2017-08-03/pdf/2017-16172.pdf>

1,4-dioxane is also common; it was used as a stabilizer for other solvents, and was also used in many consumer products including paint strippers, dyes, greases, varnishes, waxes and even baby shampoo. It is classified by EPA as a likely human carcinogen.[10] Unlike PFAS, it is comparatively difficult to extract from water. Its discovery at some Superfund sites has generated considerable public concern.[11] Reference doses have been established for several exposure pathways, but the chemical is not currently regulated under federal environmental laws.[12]

In May 2018 EPA held a "PFAS Summit" with representatives of nearly all the states, and other stakeholders, in attendance.[13] The purpose of the meeting was to share information on ongoing efforts to characterize risks from PFAS and develop monitoring and treatment/cleanup techniques; to identify specific near-term actions, beyond those already underway, that are needed to address challenges currently facing states and local communities; and to develop risk communication strategies that will help communities to address public concerns with PFAS. After the meeting EPA announced these follow-up actions:

- EPA will initiate steps to evaluate the need for an MCL for PFOA and PFOS. EPA will convene its federal partners and examine everything the agencies know about PFOA and PFOS in drinking water.
- EPA is beginning the necessary steps to propose designating PFOA and PFOS as "hazardous substances" through one of the available statutory mechanisms, including potentially CERCLA Section 102.
- EPA is developing groundwater cleanup recommendations for PFOA and PFOS at contaminated sites.
- EPA is developing toxicity values for GenX and PFBS.

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10 <https://www.epa.gov/sites/production/files/2014-03/documents/ffrro_factsheet_contaminant_14-dioxane_january2014_final.pdf>

11 A number of such sites are within the author's area of responsibility, including the Dewey Loeffel site in NY and the Ringwood Mines site in NJ. At the former site, the PRP carrying out the groundwater pump-and-treat remedy (selected based on the presence of other chemicals that are "hazardous substances") agreed to install additions to the treatment train designed to remove 1,4-dioxane.

12 *See* EPA's fact sheet at: <https://www.epa.gov/sites/production/files/2014-03/documents/ffrro_factsheet_contaminant_14-dioxane_january2014_final.pdf> which includes the following: "EPA risk assessments indicate that the drinking water concentration representing a 1 x 10^{-6} cancer risk level for 1,4-dioxane is 0.35 µg/L [ppb]."

13 For information about the PFAS Summit *see* <https://www.epa.gov/pfas/pfas-national-leadership-summit-and-engagement>

A number of bills have been introduced in Congress that would require EPA to establish enforceable standards for some of these pollutants, and/or set those standards directly through legislation.[14] To date, none of these have successfully made it to the point of enactment.

Meanwhile, several states have established their own standards or guidelines for these emerging contaminants, which are often more stringent than the federal health advisory. In March 2017 New York State became the first in the nation to designate PFOA and PFOS as "hazardous substances" under the state's Superfund-analog statute.[15] And in July, 2019 New York Governor Cuomo directed the NYS Department of Health to establish MCLs for PFOA, PFOS and 1,4 dioxane.[16] The Governor's press release on this directive noted that the State Health Commissioner had already accepted the recommendations made in December 2018 by the NYS Drinking Water Quality Council. The Council recommended that the MCLs for PFOA and PFOS should be set at 10 parts per trillion (ppt), and that the MCL for 1,4-dioxane (which would be the nation's first such MCL) should be set at 1 part per billion (ppb).[17]

New Jersey has added PFNA to its List of Hazardous Substances under the New Jersey Spill Act (the NJ analog to CERCLA); proposed an MCL for drinking water of 14 ppt for PFOA; and adopted an MCL of 13 ppt for PFNA.[18] Vermont has established an MCL of 20 ppt for PFOA[19]; North Carolina set a "health goal" of 140 ppt for GenX,[20] Dupont's Teflon replacement compound (actually, a group of compounds); and Colorado set 0.35 ppb as the maximum level for 1,4-dioxane in drinking water supplies.[21]

At least one local government has also legislated in this arena. In December 2017, Rensselaer County, NY passed a law setting a limit on discharges of 1,4-dioxane from any Superfund site that operates a groundwater treatment plant located on County-owned land.[22] There is only one such site -- the Dewey Loeffel Superfund site, at which a pump-and-treat remedial response action is ongoing. In 2014, at EPA's request, the groundwater treatment plant at the site was

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14 See, for example, <https://www.congress.gov/bill/116th-congress/house-bill/535/all-info> and <https://www.congress.gov/bill/116th-congress/house-bill/2377>

15 *See* < https://www.dec.ny.gov/chemical/108831.html>

16 <https://www.governor.ny.gov/news/governor-cuomo-announces-availability-350-million-water-system-upgrades-statewide-and-directs>. New York State has a number of locations where elevated levels of PFAS have been found in drinking water, including Hoosick Falls and Newburgh. In July 2019, NY was named as one of six recipients of federal funding from the Centers for Disease Control and Prevention to expand biomonitoring programs to better assess the extent of PFAS accumulation in people. NY is expected to receive about $5 million in federal funding for the study over a five year period. <https://midhudsonnews.com/2019/07/27/congress-approves-federal-funding-for-cdc-study-of-pfa-chemicals-in-new-york/>

17 *See:* <https://www.health.ny.gov/press/releases/2018/2018-12-18_drinking_water_quality_council_recommendations.htm>

18 *See*: <https://www.nj.gov/dep/srp/emerging-contaminants/>

19 *See:* <http://www.wateronline.com/doc/vermont-sets-new-drinking-water-standard-for-pfoa-0001>

20 NC established a "health goal" of 140 ppt for drinking water; *see:* <https://files.nc.gov/ncdeq/GenX/FAQ_updated_100417-5.pdf>.

21 <https://www.colorado.gov/pacific/sites/default/files/41_2016%2812%29.pdf>

22 *See:* <http://www.ny1noticias.com/nyc/noticias/news/2017/12/13/rensselaer-county-passes-law-to-protect-clean-water>

modified by the PRP, General Electric, to treat 1,4-dioxane. The treated effluent discharges to a surface stream that is not used for drinking water. However, the County legislation sets a stringent discharge limit of 0.35 ppb, a level apparently based on the above-mentioned Colorado limit applicable to drinking water supplies.[23] Although the treatment system has been optimized and is functioning well, it probably cannot meet the 0.35 ppb limit on a steady basis. EPA expressed concerns to the County legislature about the proposed law before it was passed, advising, *inter alia*: "[W]e believe a federal judge would find that the County law is preempted by CERCLA under the Supremacy Clause of the U.S. Constitution [and a]n attempt by the County to enforce its standard might also be considered a premature challenge to a [Superfund] response action, under Section 113(h) of CERCLA."[24]

IV. Notable Region 2 Enforcement Developments

A. Methyl Bromide Misuse Cases: In May 2015 a family of four vacationing in a luxury condo on St. John in the U.S. Virgin Islands was tragically poisoned by an illegal application of methyl bromide in the unit below where they were staying. The chemical is a pesticide, regulated under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA). Methyl bromide is a gas used as a fumigant; permissible uses are strictly limited, and it is not permitted to be used in residential settings. The applicator was a Terminix franchisee. The unit where the pesticide was illegally applied had not been properly sealed. The gas leaked out and reached the unit above, where the members of the Esmond family were exposed. All four became gravely ill, and suffered varying degrees of permanent neurological damage; the two teenage sons were the most seriously affected with paralysis and other effects, and the father remains in a wheelchair, unable to walk.[25]

Criminal enforcement actions against, among others, Terminix and Jose Rivera, the local applicator, were concluded with guilty pleas. Civil investigations revealed additional instances of methyl bromide having been applied in residential settings in Puerto Rico and the USVI, and resulted in administrative enforcement actions being taken against twelve applicators and two distributors. The actions cited numerous violations of FIFRA, and also a number of reporting and record-keeping violations of the Clean Air Act. The enforcement actions sought both penalties and injunctive relief. Many of them have since been settled. Several respondents did not timely respond, and EPA has filed motions for default judgments in those cases.

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23 *See:* <https://www.colorado.gov/pacific/sites/default/files/31_2018%2801%29.pdf> at page 41; the Colorado limit is presumably based on the EPA risk assessment cited in Note 66, above.

24 Letter dated Nov. 13, 2017 from Sharon Kivowitz, Assistant Regional Counsel, EPA Region 2, to Stephen Pechenik, Rensselaer County Attorney.

25 The story was widely reported, but there has been little publicly reported information about the current conditions of the various family members. One story that provided some information can be found at: <https://www.delawareonline.com/story/news/crime/2018/04/13/man-indicted-using-pesticide-poisoned-delaware-family-vacation-st-john/514704002/>

B. Total Petroleum Emergency CAA Order: On May 20, 2019 EPA issued an emergency order to Total Petroleum Puerto Rico Corp. under Section 303 of the Clean Air Act. The order addresses elevated lower explosive limit ("LEL") measurements at four gasoline storage tanks at the Total facility in Guaynabo, which indicate a dangerous fire hazard. EPA became aware of the elevated LEL measurements for five tanks when, on the evening of May 8, 2019, Total submitted its response to a CAA §114 information request for LEL testing. Total's measurements showed that all five tanks were over 25% LEL concentration. The National Fire Protection Association, which sets fire safety standards, has a standard for tanks such as these (internal floating roof tanks) to not exceed a 25% LEL in the headspace. Two of the five tanks initially tested as high as 100% LEL; two between 50 and 75%; and another at 39%. On May 9 EPA communicated with Total about the results, and remained in regular and frequent communication with the company in the days thereafter. Ten days later, Total had only emptied one tank; the remaining four tanks remained at elevated LEL levels. EPA therefore issued the emergency order, which required that Total take the following actions:

- Immediately stop adding gasoline to the tanks;
- within 3 days of the order, provide a timeline to empty, de-gas, and clean the four tanks as soon as possible, and to inspect and identify the cause of the elevated LEL levels in each tank;
- identify and complete any necessary repairs to the tanks while they are out of service, and notify EPA of the repairs; and
- take daily measurements of the LEL in the headspace of each tank and provide that information to EPA.

Once Total believes that operating a given tank would not cause imminent and substantial endangerment to public health or welfare or the environment, Total may ask EPA for permission to restart use of that tank. Total may not resume use of a tank without EPA approval.

C. Hillview Reservoir Cover: On March 18, 2019 a complaint and consent decree were concurrently filed in the Eastern District of New York initiating and simultaneously proposing resolution of an enforcement action brought by EPA against the City of New York under the Safe Drinking Water Act. The suit cited the City for failure to cover the Hillview Reservoir, located in Yonkers, in violation of federal regulatory requirements, and federal and state administrative orders. The consent decree requires the City to cover the reservoir and pay a civil penalty.[26]

The reservoir is part of the City's public water system. It is an open storage facility and is the last stop for finished drinking water before it enters the City's water tunnels for distribution to residents. The 90-acre reservoir receives nearly a billion gallons of water each day through the

26 Much of the information in the text above is contained in the press release issued by the U.S. Department of Justice on the occasion of the lodging of the proposed consent decree: < https://www.justice.gov/usao-edny/pr/city-new-york-agrees-settle-federal-complaint-covering-hillview-reservoir-prevent>

Catskill and Delaware Aqueducts, and serves as a holding tank that allows the City to meet daily peak water demand. It is divided into two segments, the East and West Basins. Prior to the water entering the reservoir, it receives a first treatment of chlorine and ultraviolet treatment. Since the reservoir is downstream of these treatments and is an open storage facility, the finished water in the reservoir is subject to recontamination with microbial pathogens, such as viruses, *Giardia* and *Cryptosporidium*, from birds, animals and other sources. Sufficient microbial treatment is not available downstream of the reservoir, so a cover is necessary to prevent recontamination by such pathogens. Until the cover is in operation, the City is required to take active measures to control wildlife in and around the reservoir and monitor to ensure that the water is safe for drinking.

The City has been required to cover the reservoir since it first executed an Administrative Order with the State of New York in January 1999. In March 2006 the City also became obligated to cover the reservoir under federal regulation pursuant to the Safe Drinking Water Act; the regulation required uncovered finished water storage facilities to be covered by April 1, 2009 (or for there to be further downstream treatment). In May 2010, EPA entered into an Administrative Order requiring the City to meet a series of milestones leading to the completion of a cover for the reservoir. The first milestone date was January 31, 2017; the City failed to meet that date, and this judicial enforcement action followed.

The schedule in the decree is an extended one. The East Basin cover is to be constructed and operational by 2042, and the West Basin cover by 2049. The City's estimate in 2009 for the cost of its then-planned concrete cover for the 90-acre reservoir was $1.6 billion. (The actual cost of the cover may be lower, should the City choose a different type of cover.) The schedule is so extended because two other related, major projects need to be completed before the Hillview cover work is started. These are the Kensico Eastview Connection and the Hillview Reservoir Improvements. The completion of the former is expected to take until 2035, with an estimated cost of about $1 billion; the latter project will be conducted concurrently and is anticipated to be completed by 2033 at a cost of about $375 million. (The decree provides for potential schedule acceleration, which could be possible under certain circumstances.)

The decree also requires various interim measures to protect the water until the reservoir cover is in full operation, including: (1) enhanced wildlife management at the reservoir; (2) weekly sampling of source water for *Cryptosporidium* and *Giardia* at the Kensico and Hillview Reservoir effluents; (3) quality control sampling of the Hillview effluent; and (4) implementation of a *Cryptosporidium* and *Giardia* Action Plan for response procedures for elevated *Cryptosporidium* and *Giardia* at Hillview.

In addition, the decree requires that the City pay a civil penalty of $1 million for its past violations of federal requirements. The City will also pay New York State $50,000, and implement a state Water Quality Benefit Project in the amount of $200,000, to settle the State's claim for penalties for violations of the State administrative order.

D. New York City Housing Authority: On January 31, 2019, the U.S. Department of Housing and Urban Development and the New York City Housing Authority signed an administrative agreement requiring NYCHA, under the supervision of a federal monitor, to fundamentally reform its operations and remedy living conditions for its residents, including lead paint hazards, mold growth, pest infestations, lack of heat, and inadequate elevator service.[27] The agreement, which went into effect immediately and does not require court approval, resolves the United States' claims against NYCHA detailed in a judicial complaint filed on behalf of HUD and EPA in federal district court on June 11, 2018.[28] At that time, the parties had also submitted to the court a proposed consent decree that would resolve the cited violations. The court subsequently rejected the proposed decree; the parties thereafter negotiated the administrative agreement. (The judicial complaint was dismissed without prejudice after the monitor was appointed in February 2019.)

EPA's claim in the judicial complaint concerned NYCHA's long-term and ongoing violations of regulations concerning lead-based paint hazards, specifically the Renovation, Repair, and Painting Rule (RRP) Rule promulgated under TSCA and set out at 40 C.F.R. Part 745 subpart E. In addition to requiring NYCHA to comply with the RRP Rule, the remedial relief mandated by the administrative agreement sets out compliance actions under the RRP Abatement (subpart L) and Disclosure Rules (subpart F) as well. Specifically, the administrative agreement requires NYCHA to remediate living conditions at NYCHA properties by specific deadlines and meet strict, objective compliance standards regarding lead paint hazards. For example, NYCHA is required to take action within 30 days to visually inspect all non-exempt units built before 1978 where NYCHA believes a child under 6 resides or routinely visits, and remediate any deteriorated lead-based paint in the apartment; and, over time, to abate all lead paint in all NYCHA developments in accordance with the applicable work-practice standards.

The administrative agreement obligates NYCHA to establish three new critical functions: a Compliance Department, an Environmental Health and Safety Department, and a Quality Assurance Unit. In addition, the agreement requires the City to select a new chief executive officer for NYCHA from a list of qualified professionals jointly compiled by HUD, the U.S. Attorney's Office, and the City. The agreement also renews the City's commitment, reflected in the June 2018 proposed Consent Decree, to provide an additional $1 billion in capital funds to NYCHA over the next four years and an additional $200 million in capital funds each subsequent year for the duration of the Agreement. Also, the agreement locks in an additional $4 billion in City funds budgeted through 2027.

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27 <https://www.hud.gov/sites/dfiles/PA/documents/HUD-NYCHA-Agreement013119.pdf>

28 That judicial complaint was accompanied by a proposed Consent Decree that had been negotiated in advance by the parties. *See:* <https://www.epa.gov/newsreleases/manhattan-us-attorney-announces-settlement-nycha-and-nyc-fundamentally-reform-nycha-0>. However, the district court ultimately rejected the proposed Consent Decree, which led the parties to instead negotiate the administrative agreement.

Pursuant to the agreement, a federal monitor, selected by HUD and the U.S. Attorney's Office in consultation with NYCHA and the City and paid for by the City, will oversee NYCHA's reform efforts.[29] Beyond the specifically enumerated remedial actions required under the Agreement, NYCHA will develop action plans, subject to the monitor's approval, to remediate living conditions at NYCHA and meet the compliance standards set forth in the Agreement. The monitor and NYCHA also will collaboratively develop a plan to overhaul NYCHA's organizational, management, and workforce structure, informed by a new comprehensive study from an independent third-party consultant. Throughout the term of the Agreement, the monitor is required to engage with the community, including NYCHA residents, resident groups, and stakeholders, regarding matters covered by the Agreement, and provide public reports detailing NYCHA's progress. The monitor has wide-ranging powers to ensure that the action plans are implemented, and compliance achieved.

V. Interim and Early Remedies at Region 2 Superfund Sediment Sites

EPA Region 2 has recently announced its intention to proceed with "interim remedies" at two major Superfund sediment sites; and to proceed with an early action at a third. The first of these to be announced was an interim remedy at the Berry's Creek site in New Jersey. Three federal Superfund sites are situated on the banks of the creek, which is a tributary of the Hackensack River. In September 2018 EPA selected a $332 million dredge-and-cap remedy for the upper portion of the creek, which is heavily contaminated with mercury and other hazardous substances.[30] The interim approach explicitly recognizes that more work in the lower portion of the creek, and in the surrounding marshes, and even in the upper portion of the creek itself, might be required in the future; and, in any event, a future Record of Decision (ROD) will be necessary to select a final remedy. Nevertheless, the extensive interim remedy – which was proposed by the PRPs themselves – is expected to dramatically reduce contaminant loadings to the rest of the creek and the Hackensack River, and it can be carried out quite a bit earlier than if a final remedial selection were awaited.

The PRPs for the nearby Passaic River made a similar proposal for the upper nine miles of the Lower Passaic River, and EPA has preliminarily endorsed that approach and proceeded with a focused feasibility study, recently completed.[31] The PRP's proposal contemplates an interim

29 The monitor's first report was issued in July 2019, in which he expressed concerns about the pace of actions to assess and address lead paint problems. The report notes that as of 5/31/19 NYCH was awaiting lab results for nearly 1000 units, and had yet to inspect over 600 units. 18 cases of children with elevated blood lead levels had been reported since January, and 10 of those between April and June. *See* <http://www.nydailynews.com/new-york/ny-federal-monitor-report-nycha-20190722-xz6gguijabenlfjr65irogvxua-story.html>

30 *See*: < https://www.epa.gov/newsreleases/epa-moves-forward-332-million-cleanup-berrys-creek-bergen-county-nj>

31 *See* < https://semspub.epa.gov/work/02/534002.pdf>

dredge-and-cap remedy, with the understanding that a later, final remedy selection might require additional work.

And at the Newtown Creek site in New York, EPA in December 2018 executed an administrative consent order with the City of New York for performing a focused feasibility study (FFS) to evaluate a possible early remedy for control of combined sewer overflows (CSO) into the creek.[32] Here, too, the selection of such a CSO remedy would precede a final site-wide remedy selection. A full remedial investigation and feasibility study (RI/FS) for the site is being conducted by six parties – the five members of the "Newtown Creek Group" (NCG) plus New York City -- under a separate administrative settlement agreement issued in 2011 to address site conditions throughout the five-mile long creek. However, the selection of a final, site-wide remedy based on that RI/FS is still a number of years off. In the meantime, the FFS being conducted by the City will evaluate the sufficiency for CERCLA purposes of the CSO controls proposed by the City in the Long Term Control Plan for Newtown Creek issued in 2017 pursuant to the Clean Water Act.[33] If the FFS demonstrates that those CSO controls are sufficient for CERCLA purposes and would be consistent with any eventual site-wide remedy for the Creek, then EPA expects to proceed with that early remedy selection. The City's interest in this process is to secure confirmation that the very extensive and expensive CSO control work proposed in the LTCP is indeed consistent with what would be required under CERCLA, so that it can proceed with development of those projects with confidence that more or different work would not later be required under a final site-wide CERCLA remedy.

And on July 25, 2019 EPA issued an Administrative Order on Consent to the five members of the NCG[34] requiring them to undertake a separate FFS to investigate hazardous substances in the lower two miles of Newtown Creek. Following completion of that FFS, EPA Region 2 anticipates that, if appropriate, it will select a remedy for an interim early action to be carried out in the lower two miles of the site. It is anticipated that the final remedy decision for those lower two miles will be memorialized as part of the future site-wide remedy to be selected once the RI/FS is completed.

VI. ***Burlington Northern*** **CERCLA Decision Progeny**

On May 4, 2009 the Supreme Court handed down its decision in *Burlington Northern & Santa Fe Railway Co., et al v. United States, et al.* [35] The decision is of major significance with respect to two areas of Superfund jurisprudence: "arranger" liability, and divisibility or apportionment of harm.

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32 < https://semspub.epa.gov/src/document/02/528368>

33 < http://www.nyc.gov/html/dep/pdf/cso_long_term_control_plan/ltcp-newtown-creek-cso.pdf>

34 Phelps Dodge Refining Corporation, Texaco, Inc., BP Products North America Inc., Brooklyn Union Gas Company d/b/a National Grid NY, and ExxonMobil Oil Corporation

35 129 S. Ct. 1870.

The Court held that defendant Shell was not liable as an "arranger," observing that the term is not defined in CERCLA, so it should have its ordinary meaning. The Court held that the word "arrange" implies "action directed to a specific purpose" and therefore liability as an arranger would attach only if one takes "intentional steps to dispose of hazardous substances." Acknowledging that Shell knew of spillage at the Brown & Bryant facility -- which became the Superfund site in question -- the Court held that "knowledge alone is insufficient to prove that an entity 'planned for' disposal, particularly when the disposal occurs as a peripheral result of the legitimate sale of an unused, useful product." The Court noted that Shell took a number of steps to encourage B&B to reduce the likelihood of spills. The court did observe that circumstantial evidence can be sufficient to prove intent: "In some instances, an entity's knowledge that its products will be leaked, spilled dumped or otherwise discarded may provide evidence of the entity's intent to dispose of its hazardous wastes."[36]

The Court also held that the district court had a reasonable basis for apportioning liability. The Court noted with apparent approval the long line of cases holding that the standard of liability under CERCLA is joint and several, unless the harm at the site is divisible and can reasonably be apportioned, and that the burden is with the defendants to prove that "a reasonable basis for apportionment exists." The Court quoted with approval the Restatement of Torts, holding that when "two or more causes produce a single, indivisible harm, 'courts have refused to make an arbitrary apportionment for its own sake, and each of the causes is charged with responsibility for the entire harm'." The Court nevertheless concluded that in this instance the District Court had a reasonable basis for apportioning the defendant railroads' liability at 9%.[37] The Court further confirmed that equitable considerations play no role in divisibility analysis, which is a purely legal issue. (Equitable considerations may be employed to *allocate* costs in contribution actions among joint and severally liable parties, but not to *apportion* legal liability.[38])

Is joint and several liability still the default standard? The Supreme Court indicated it was so. At the time, some commentators expected that the high court's approval of the apportionment carried out by the district court (based on a very simplistic and arguably nonsensical methodology[39]) would open the door for apportionment in many more cases; but that has not happened.

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36 This acknowledgement by the Supreme Court is relevant when considering whether the *Aceto* decision, discussed further in the text below, is still good law.

37 This author contends that the district court's basis for assigning the two defendant railroads a 9% apportioned share was fundamentally flawed. *See:* Walter Mugdan, *The Burlington Court's Flawed Arithmetic*, 40 Envtl. L. Rep. News & Analysis 10637 (2010). Similar criticisms are made by William C. Tucker in: *All is Number: Mathematics, Divisibility, and Apportionment under Burlington Northern*, Fordham Env. L. R., Fall 2010. Note that while the Supreme Court in Burlington accepted the district court's apportionment calculation, it did not mandate the sort of arithmetic used by the district court.

38 A number of courts have confused apportionment with allocation, and have purported to apportion when in fact they were carrying out an equitable allocation. *See*, e.g., *The City of Gary v. Paul Shafer d/b/a Paul's Auto Yard and Paul's Auto Yard, Inc.*, 2011 WL 3439239 (N.D. Ind. August 5, 2011), in which the two terms are used interchangeably, suggesting the court did not understand the difference. And in *Reichhold v. United States Metals Refining Co.*, 2009 WL 1806668 (D.N.J. June 22, 2009), the court purported to carry out an apportionment but relied explicitly on equitable considerations.

39 *See* note 37, above.

Is the *Aceto* line of cases still good law with respect to "arranger" liability? In *U.S. v. Aceto*,[40] manufacturers were held liable for spills on the property of a repackager. There are important distinctions from *Burlington*, however, suggesting that *Aceto* is still good law. In *Aceto*, the manufacturers retained ownership of the chemicals throughout the repackaging and subsequent reshipment processes. By contrast, Shell simply sold a useful product to B&B, a type of transaction that has long been held to *not* give rise to "arranger" liability. As noted above, in *Burlington* the Supreme Court wrote: "In some instances, an entity's knowledge that its products will be leaked, spilled dumped or otherwise discarded may provide evidence of the entity's intent to dispose of its hazardous wastes." The *Aceto* manufacturers did not take any precautions against spillage and had knowledge of the likelihood of spillage; indeed, they had "tolling agreements" with the repackager which recognized that a certain amount of spillage (and thus product loss) would occur. The Restatement of Torts, cited with approval by the Supreme Court in *Burlington*, was also cited by the *Aceto* court for its proposition that those who employ independent contractors to perform abnormally dangerous activities will be subject to strict liability for the harms therefrom. In other words, an entity cannot escape liability by contracting out dangerous parts of a process.

Several lower courts have indicated that *Aceto* is still good law. In *American International Specialty Lines Insurance Co. v. U.S.*, 2010 WL 2635768 (C.D. Cal. Jun 30, 2010) the district court cited *Aceto* and distinguished *Burlington* in its decision holding the U.S. government liable as an arranger. In *Duke Energy Progress, Inc. v. Alcan Aluminum Corp.*, 2013 U.S. Dist. LEXIS 65165 (E.D.N.C. May 6, 2013) the court also cited *Aceto*. Both decisions are summarized below.

Recent Lower Court Decisions: There have been dozens of district court opinions, and a growing number of Circuit Court opinions, that have interpreted or applied *Burlington*.[41]

Arranger Liability Decisions:

Defendants have had some success escaping "arranger" liability. The courts have agreed that these cases are fact-driven; most have focused on trying to ascertain the intent or purpose of the alleged "arranger," but the analyses have led to sometimes inconsistent outcomes. Following are a few recent examples of how courts have ruled.

- ***U.S. v. Dico***, 8th Circuit, Jan. 15, 2019, Case No. 17-3462. The case involves Dico's sale of a contaminated building to a purchaser who dismantled it for saleable steel scrap. In 2015 the Circuit reversed and remanded for trial the district court's summary judgment finding that Dico was liable as an arranger. To determine Dico's intent it instructed the lower court to consider the sale price of the materials in comparison with the cleanup cost liability avoided by the sale; and the usefulness of the materials sold in general, without reference to how the

40 872 F.2d 1373 (8th Cir. 1989).

41 The author is deeply indebted to his colleagues in EPA's Office of Site Remediation Enforcement for compiling the information on which these very brief summaries are based. Any errors that may be contained in these summaries are, however, solely the authors' responsibility.

buyer actually used the materials. The district court conducted a bench trial in 2017, and found that Dico and its co-defendant Titan arranged to dispose of a hazardous substance, and held them jointly and severally liable for EPA's response costs. It further held Dico liable for the same amount in punitive damages, and found Dico and Titan jointly and severally liable for all costs not yet reported, all future costs, all enforcement costs, and attorney's fees. Dico and Titan appealed. In this 2019 decision the Circuit affirmed the district court's judgment.

- ***New Mexico v. EPA et al., 2018 U.S. Dist. LEXIS 22548 (D.N.M. Feb. 12, 2018).*** Plaintiffs sued EPA and its contractor, Environmental Restoration (ER), for releasing acid mine drainage and heavy metals from the Gold King Mine in Colorado, into the Animas River watershed. Plaintiffs asserted that Defendants were liable as operators, arrangers, and transporters of hazardous substances. ER contended it was not liable as an arranger because the discharge of acid mine drainage was accidental. The district court rejected ER's argument, concluding that ER's sole purpose was the disposal of hazardous substances that were no longer useful. The court found that the "intent to dispose" analysis set forth in *Burlington* is not applicable to "plain" arranger liability, which the court described as a transaction with the sole purpose of discarding substances that are used and no longer useful (*i.e.*, wastes). Because the acid mine drainage was used and no longer useful, the court denied ER's motion to dismiss the arranger claim.

- ***Pakootas v. Teck Cominco Metals, Ltd.,*** No. 15-35228 (9th Cir. July 27, 2016). The 9th Circuit Court of Appeals reversed the trial court decision from the Eastern District of Washington denying Teck's motion to dismiss certain CERCLA claims against it. The appellate court held that the term "disposal," as defined in RCRA and cross-referenced in CERCLA (and as used in the arranger liability provision of Section 107 of that law, *i.e.*, "arranged for disposal…"), does not include aerial emissions of hazardous substances that were carried by the wind from Teck's smelter smokestacks in Canada to the Upper Columbia River (UCR) Superfund site in the U.S. The 9th Circuit had previously held that Teck, a Canadian corporation, could be held liable for releases of hazardous substances into the UCR site. The case had been remanded to the district court for a determination on Teck's CERCLA liability. Plaintiffs then filed an amended complaint to add the CERCLA claim based on air emissions from the stacks, and Teck moved to strike that claim. The trial court denied Teck's motion, but certified the case to the 9th Circuit after that court's 2014 decision on a similar question in a RCRA case, *Ctr. for Cmty. Action & Envtl. Justice (CCAEJ) v. BNSF Ry. Co.*, 764 F.3d 1019 (9th Cir. 2014).

  This 9th Circuit's decision is directly contrary to an earlier decision out of the Southern District of Ohio, ***The Little Hocking Water Association, Inc., v. E.I. du Pont de Nemours & Co.,*** Case No. 2:09-CV-1081, March 10, 2015,[42] holding that air emissions that are deposited

42 <https://insideepa.com/sites/insideepa.com/files/documents/mar2015/epa2015_0626.pdf>

onto the ground *do* constitute "disposal" under RCRA. The Ohio court expressly declined to follow the 9th Circuit's 2014 *CCAEJ* decision.

Divisibility or Apportionment Decisions:

Defendants have generally been less successful overcoming traditional joint and several liability, though there are some notable exceptions. In some cases, it appears the courts have confused legal "apportionment" and equitable "allocation." Examples include:

- ***Pakootas v. Teck Cominco Metals, Ltd,*** **2018 U.S. App. LEXIS 26098 (9th Cir. Sept. 14, 2018).** The circuit court affirmed the district court's ruling on summary judgment rejecting Teck's divisibility defense. Plaintiffs alleged that Teck discharged hazardous substances from its smelter, which is located 10 miles north of the US/Canadian border, into the Upper Columbia River (UCR). These discharges flowed downstream into the United States. The 9th Circuit began its analysis by classifying divisibility as the "rare" exception to CERCLA joint and several liability. The Court rejected Teck's divisibility defense under both prongs of the two-part divisibility analysis – finding that Teck failed to show the harm is theoretically capable of apportionment and that Teck failed to establish a reasonable factual basis to apportion the harm. None of the apportionment methods posed by Teck's expert considered threatened releases of hazardous substances, the mixture and synergistic effects of contaminants, or the full range and extent of contaminants. Thus, Teck failed to meet its burden of showing that the entire harm caused by Teck's wastes combined with all other pollution in the UCR was theoretically capable of apportionment. Teck erred in considering "the effects of its waste in isolation from the other contaminants at the site." Further, all three of the apportionment methods offered by Teck's expert were some variation of a volumetric approach, but Teck failed to take into consideration other critical factors, such as the geography of the site (*e.g.*, how far the slag travels down the River, variations in conditions in the river), the time when the wastes entered the river, and the relative toxicity and migratory potential of the hazardous substances. Without evidence of how these factors affected the contamination at the Site, an apportionment would be arbitrary. The court noted that Teck could bring a contribution action against other sources to mitigate any inequity as a result of the unavailability of apportionment.

- ***United States v. NCR Corp. ("Fox River"),*** 688 F.3d 833 (7th Cir. August 3, 2012). The Fox River site has proved to be one of the most fertile for post-*Burlington* judicial decisions, though the jurisprudence has not necessarily been the clearest or most consistent. The river was contaminated with PCBs from multiple sources, mostly involving (directly or indirectly) the manufacture or recycling of PCB-impregnated "carbonless carbon paper." In this 2012 decision the 7th Circuit held that NCR failed to prove the harm was capable of apportionment because PCB levels contributed by NCR caused sufficient contamination to warrant the clean-up of river sediments. The court described this case as an example of "multiple sufficient causes" of environmental harm. NCR's expert asserted NCR had only contributed about 6% to 9% of the PCBs in the river. The court held, however, it did not follow that NCR was only responsible for 6% - 9% of the clean-up costs. Had NCR been the only party to dump PCBs into the river, the

river would still have to be dredged and capped, because PCB levels contributed by NCR exceeded EPA's threshold. There was no linear correlation between the cost of cleanup and the level of PCBs in the river. Once the PCBs reached a threshold level, cleanup became necessary. The court concluded that in this case, "contamination traceable to each defendant" is the proper measure of harm, though other measures of harm may be appropriate in different circumstances. This legal conclusion was confirmed after an 11-day bench trial (2013 U.S. Dist. LEXIS 62265 (E.D. Wis. May 1, 2013)).

However, in ***United States v. P.H. Glatfelter Co***., 2014 U.S. App. LEXIS 18436 (7th Cir. Sept. 25, 2014)**,** the Seventh Circuit reversed the district court's ruling from that trial, finding that the harm by NCR is theoretically capable of apportionment and remanding for further proceedings. On May 15, 2015, the District Court in ***U.S. v. NCR Corp***., Case No 10-C-910, ruled that in view of the Circuit Court's opinion, NCR indeed established its divisibility defense. This is a case where only one contaminant – PCBs -- is present; there are records sufficient to provide reliable estimates of the amounts of PCBs discharged by the various PRPs; and those various PRPs are all viable and involved in the case. The court held that NCR showed the harm was theoretically capable of division, and that NCR was able to suggest a reasonable basis on which to apportion its share of the remediation. (The apportionment basis suggested by NCR was, essentially, the relative amounts of PCBs contributed by the PRPs.)

BUT WAIT, THERE'S MORE! In a further twist, on October 19, 2015 the District Court reversed its May 15 decision, holding instead that NCR had ***not*** demonstrated a reasonable basis for ***not*** being held jointly and severally liable. Ruling on Motions for Reconsideration, the court analyzed expert opinion testimony and ultimately concluded that "NCR has failed to meet its burden to demonstrate both that the harm is theoretically capable of divisibility and that there is a reasonable basis for apportionment." Slip Opinion at 9.

VII. Other Notable CERCLA Case Developments

A. Statute of Limitations

In August, 2017 in *Asarco LLC v. Atlantic Richfield Co.*,[43] the 9th Circuit overturned a decision by the District Court for Montana[44] which had held that the three-year statute of limitations in CERCLA applied to Asarco's contribution claim against Atlantic Richfield, and ran from the date Asarco entered into a judicially approved settlement of its liability for environmental cleanup of an old lead smelter site, even though the settlement was under the RCRA and Clean Water Act statutes and *not* under CERCLA. Asarco had

43 No. 14-365723 (9th Cir., August 10, 2107) <https://law.justia.com/cases/federal/appellate-courts/ca9/14-35723/14-35723-2017-08-10.html>

44 Civil Action No. 12-53-H-DLC (District of Montana, Helena Division, August 26, 2014)

entered into a later judicial settlement that purported to be under CERCLA, but which imposed no different requirements than did the earlier non-CERCLA settlement. On appeal, the Circuit agreed that a non-CERCLA settlement can be the basis for a CERCLA contribution action because a "corrective measure" under a different law can quality as a CERCLA "response" action. But the court disagreed that the 1998 RCRA decree in this case resolved ASARCO's liability, and so the SOL did not begin to run at that time.

In *Hobart Corp. v. Waste Management*[45] the Supreme Court declined to hear an appeal from the Sixth Circuit's opinion ruling that CERCLA §113 contribution claims are subject to a three year statute of limitations, and that the "most logical" triggering event in this case was the effective date of an administrative order that the plaintiff entered into with EPA to conduct a remedial investigation and feasibility study (RI/FS). This is potentially troubling, because a cooperative PRP may enter into an agreement to perform an RI/FS early in the process, before much is known about the likely cost of cleanup. In the absence of that information, settlement among PRPs is likely to be more difficult.

In *New York v. Next Millennium Realty, LLC,*[46] the Second Circuit addressed the distinction between Superfund "remedial" and "removal" actions. CERCLA establishes different statutes of limitation for the two types of response action. The Circuit Court overturned a district court decision dismissing plaintiff's cost recovery claim as time-barred because the money was spent on remedial response work; the appellate court held that the work was removal response, which has a more lenient statute of limitations.

B. Owner Liability Rulings

In July 2017 the 10th Circuit Court of Appeals ruled that the U.S. government is an "owner" and therefore potentially liable under CERCLA for cleanup costs at a former mining site located on U.S.-owned National Forest lands.[47] The court found that the U.S. clearly held title to the land in question, and was therefore an owner in the widely accepted common sense of the word, notwithstanding that it did not control or direct the mining operations that caused the contamination. (The court also found that the U.S. was not liable as an "arranger"; see the discussion, above, of arranger liability under the Supreme Court's *Burlington Northern* decision.)

The Supreme Court has been asked to resolve a difference between the 2nd and 9th Circuits regarding the determination of when a tenant can be considered an "owner" for

45 758 F.3d 757 (6th Cir. 2014), *cert denied* 2015 WL 231991 (U.S. Jan. 20, 2015)
46 No. 12-2894 (2d Cir. Oct. 15, 2013)
47 *Chevron Mining, Inc., v. U.S.*, No. 15-2209, 10th Circuit, July 19, 2017;
<https://www.ca10.uscourts.gov/opinions/15/15-2209.pdf>

purposes of Superfund liability.[48] The owners of a site in NY have asked the Court to reverse a 2nd Circuit decision holding a tenant is not an owner under CERCLA even if it meets the common law definition of an owner, the test adopted by the 9th Circuit. The 2nd Circuit declined to adopt the common law standard, instead following its own earlier decision that established a more complicated test to determine if a tenant/sublessor is an owner under CERCLA. The petitioners assert that the actions of the tenant "when the pollution occurred, without any involvement, consent or oversight by the [petitioners], confers owner liability under CERCLA on Tenant/Subleasor, for the contamination discharged by its Subtenant." They urge the Court to adopt the 9th Circuit's 2011 ruling in *City of Los Angeles v. San Pedro Boat Works*,[49] which expressly rejected the 2nd Circuit's standard.

C. Tort Claims Against the U.S. for Hazardous Waste Disposal Practices

In *Angela Pieper, et al., v. United States*,[50] the Court declined to review a case concerning the U.S. government's past waste disposal practices at a military installation in Frederick, MD. The Army disposed of hazardous waste there decades ago; the property has since been named a federal Superfund site. Plaintiffs alleged the waste caused health problems and sued under the Federal Tort Claims Act, which waives sovereign immunity for some but not all acts. Excluded from the waiver are actions that involve judgment and discretion on policy and similar issues. The 4th Circuit affirmed the district court's holding that the decisions of Army personnel on how and where to dispose of hazardous substances represented an exercise of such discretion, and the Supreme Court declined to hear the appeal.

D. Successful Challenge to Inclusion of a Site on the NPL

In *Genuine Parts Company v. EPA*[51] the D.C. Circuit Court removed a site from the Superfund National Priorities List – a rare outcome in NPL challenges. At the West Vermont Drinking Water Contamination site in Indiana, a dry cleaner had discharged perchloroethylene into a sewer system that leaked; a separate manufacturing facility also had discharges into the system. Plaintiffs argued there was a "confining layer" that prevented contamination from reaching water supplies. The court held that EPA didn't adequately address several diagrams that "appear to contradict the agency's position" that two aquifers beneath the site are interconnected. "Because EPA 'entirely failed to consider an important aspect of the problem' by failing to address evidence that runs

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48 *Next Millennium Realty, LLC, et al., Petitioners, v. Adchem Corp. et al., Respondents, Petition for Writ of Certiorari*, filed Sept. 25, 2017. *See:*
<https://insideepa.com/sites/insideepa.com/files/documents/oct2017/epa2017_2091.pdf>

49 <http://cdn.ca9.uscourts.gov/datastore/opinions/2011/03/14/08-56163.pdf>

50 No. 17-1324, Supreme Court of the United States, May 21, 2018.

51 D.C. Circuit Court, No. 16-1416, May 18, 2018.

counter to the agency's decision we must hold that the listing of the site is arbitrary and capricious."

E. Scope of Judicial Review of EPA Remedy Selection

In *Emhart Industries v. U.S. Department of the Air Force, et al.*,[52] plaintiff challenged EPA's selection of the remedy for an NPL site, and asserted a "sufficient cause" defense for its non-compliance with an EPA unilateral administrative order under CERCLA §106 requiring it to carry out that remedy. In its remedy challenge, Plaintiff sought to introduce evidence, including expert testimony, that it had not presented to EPA prior to issuance of the Record of Decision, and that was therefore outside the scope of the agency's administrative record. The District Court took note of CERCLA's directive that review of remedy selection "shall be limited to the administrative record."[53] Citing general principles of administrative law, the court identified several very narrow exceptions that would allow it to consider evidence outside that record. Among these was one on which the court relied in admitting plaintiff's additional expert witness testimony. The court citied a First Circuit decision that allowed an exception to the "rule against supplementation [of the record]" where "additional testimony by experts" will "aid to understanding highly technical, environmental matters."[54] The court found that the subject matter in this case was indeed "high technical" and that additional expert testimony (from both the plaintiff and the government) would aid its understanding. The court acknowledged that the additional testimony is only for the purpose of assisting it in understanding information contained in the administrative record, and that the court must still look "first and foremost" at the administrative record, "not some new record" made in the current trial.[55]

The court went on to note that pursuant to CERCLA and the National Contingency Plan regulations, plaintiff should ordinarily be limited to arguments that it advanced prior to EPA's final remedy decision, particularly during the public comment period on the proposed remedial plan, and which were therefore available to the agency for consideration at the time of the administrative decision-making process. But here, again, the court identified a narrow exception, to wit that EPA must explain any "key assumptions" that underpin its decisions, and that plaintiff's evidence may be received on the specific question of whether EPA adequately did so in this matter.[56]

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52 U.S. District Court for Rhode Island, C.A. No. 06-218 S, August 17, 2017 <http://www.lawandenvironment.com/wp-content/uploads/sites/5/2017/08/Opinion-Emhart-Indus.-v.-New-England-Container-Co..pdf>

53 42 U.S.C. §113(j)(1), which goes on to specify that the agency's decision must be upheld unless a challenger can demonstrate, on that record, that the decision was arbitrary and capricious.

54 *Emhart, id.* at 23.

55 *Id.* at 25.

56 *Id.* at 30.

The court in fact did find that EPA's remedy selection decision was "arbitrary, capricious or otherwise not in accordance with law" with respect to three specific EPA findings; and that therefore plaintiff had sufficient cause not to comply with EPA's unilateral administrative order.[57]

57 *Id.* at 106 *et seq.*

Outline of Cases and other Materials

Environmental Law Section Fall Meeting 2019
NYS Bar Association

Lemuel M. Srolovic
Bureau Chief, Environmental Protection Bureau
Office of New York Attorney General Letitia James
(September 2019)

I.

Select Challenges by the New York Attorney General to Actions by Federal Agencies to Roll Back Protections of Human Health and the Environment

Challenging Rollback Action by the Department of Agriculture (USDA)

- Lawsuit challenging USDA's rollback of nutritional standards for sodium and whole grains in breakfast and lunch foods served to schoolchildren at low- or no-cost (April 3, 2019). https://ag.ny.gov/press-release/2019/attorney-general-james-and-multistate-coalition-sue-trump-administration-gutting

Challenging Rollback Actions by the Department of Commerce

- Intervened in action challenging National Oceanic and Atmospheric Administration's authorization of incidentally harassing marine mammals during seismic testing for oil and gas in the Atlantic Ocean (Mar. 6, 2019). https://ag.ny.gov/press-release/2019/attorney-general-james-joins-states-efforts-halt-seismic-testing-atlantic-coast

- Rulemaking comments opposing three proposed rules by the National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (Fish & Wildlife) amending regulations implementing the Endangered Species Act to pull back on the Act's protections of endangered species (Sept. 25, 2018). https://ag.ny.gov/press-release/attorney-general-underwood-opposes-trump-administrations-proposed-rollbacks-endangered

- Lawsuit challenging the decision by the Secretary of Commerce to require citizenship information in taking the 2020 census (Aril 3, 2018). https://ag.ny.gov/press-release/2018/ag-schneiderman-files-suit-block-trump-administration-demanding-citizenship-info U.S. Supreme Court rules against Commerce and remands the matter to the district court. *Department of Commerce v. New York*, ___US___, 139 S. Ct. 2551 (2019).

Challenging Rollback Actions by the Council on Environmental Quality (CEQ)

- Rulemaking comments opposing CEQ's proposed guidance to federal agencies regarding assessing greenhouse gas emissions and climate change impacts of federal actions subject to the National Environmental Policy Act (Aug. 27, 2019). https://ag.ny.gov/press-release/2019/attorney-general-james-condemns-trump-admin-policy-ignoring-climate-change

Challenging Rollback Actions by the Department of Energy (DOE)

- Lawsuit challenging DOE's failure to publish final efficiency standards for five product categories: portable air conditioners, power supply devices, air compressors, walk-in coolers and freezers, and commercial packaged boilers (June 13, 2017). https://ag.ny.gov/press-release/2017/attorney-general-schneiderman-announces-lawsuit-and-other-legal-action-against

- Petition challenging DOE's delay of final rule establishing efficiency standards for electric ceiling fans (April 3, 2017). https://ag.ny.gov/press-release/2017/attorney-general-schneiderman-announces-lawsuit-and-other-legal-action-against In May 2017, DOE published the final standards. https://ag.ny.gov/press-release/2017/trump-administration-reverses-course-energy-efficiency-standard-following-ag

Challenging Rollback Actions by the Environmental Protection Agency

- Petition challenging EPA rules rescinding the Clean Power Plan and adopting the Affordable Clean Energy (ACE) rule (Aug. 13, 2019). https://ag.ny.gov/press-release/attorney-general-james-leads-fight-against-trumps-dirty-power-rule

- Rulemaking comments opposing EPA's proposed "Science Transparency Rule" to exclude from EPA decision making any scientific studies, models, and other information that have been validated by peer review but where not all of the underlying data are available to the public because of medical privacy protections or other reasons (Aug. 16, 2018). https://ag.ny.gov/press-release/ag-underwood-leads-coalition-23-states-counties-and-cities-opposing-trump-epa-plan

- Rulemaking comments opposing EPA's proposed rule regarding changes to cost/benefit analyses in rulemaking under various federal statutes (Aug. 13, 2018). https://ag.ny.gov/press-release/ag-underwood-leading-coalition-13-ags-state-agencies-tells-trump-epa-drop-proposed

- Petition challenging EPA's suspension of the 2016 Glider Truck Rule, which limited and then sunset the number of "glider trucks" – new heavy-duty truck bodies outfitted with refurbished or rebuilt pre-2010 highly polluting engines -- that could be exempt from new truck emissions standards (July 19, 2018). https://ag.ny.gov/press-release/2018/ag-underwood-part-coalition-16-ags-sues-epa-over-former-administrator-pruitts

- Petition challenging EPA "guidance" that effectively rescinded a prior rule prohibiting the use of hydrofluorocarbons (HFCs) – potent greenhouse gases – in commercial refrigeration units (June 27, 2018). https://ag.ny.gov/press-release/ag-underwood-sues-epa-over-illegal-rollback-key-climate-protection-regulation

- Lawsuit challenging EPA's suspension of new training requirements to protect workers in agriculture and their families from exposure to agricultural pesticides (May 30, 2018). https://ag.ny.gov/press-release/2018/ag-underwood-leads-suit-against-trump-administration-protect-farmworkers

- Lawsuit challenging EPA's suspension of the Clean Water Rule defining the "waters of the United States" covered by the Clean Water Act (Feb. 6, 2018). https://ag.ny.gov/press-release/2018/ag-schneiderman-leads-coalition-11-ags-suing-trump-epa-illegal-rollback-clean

- Petition challenging EPA's delay of final "Chemical Accident Safety Rule (July 24, 2017). https://ag.ny.gov/press-release/2017/ag-schneiderman-leads-lawsuit-against-trump-epa-blocking-vital-rule-protect-ny DC Circuit vacates EPA's delay rule, *Air Alliance Houston v. EPA*, No. 17-1155 (D.C. Cir. Aug. 17, 2018).

- Intervened in petition challenging EPA's action allowing the continued use of the pesticide chlorpyrifos on food crops even though the agency failed to determine a safe level for residue of the chemical on food (July 5, 2017). https://ag.ny.gov/press-release/2017/ag-schneiderman-leads-legal-challenge-against-epa-over-toxic-pesticide

- Intervened in petition challenging EPA's stay of New Source Performance Standards for greenhouse gas emissions from new sources in the oil and gas sector (June 20, 2017). https://ag.ny.gov/press-release/2017/ag-schneiderman-joins-14-ags-filing-intervention-lawsuit-against-epa-secure

Challenging Rollback Action by the Federal Energy Regulatory Commission (FERC)

- Rulemaking comments opposing adoption of a federal rule subsidizing coal and nuclear electric generating plants on the grounds that those plants are "fuel secure" (Oct. 23, 2017). https://ag.ny.gov/press-release/ag-schneiderman-opposes-unlawful-trump-bailout-plan-coal-burning-power-plants

Challenging Rollback Actions by the Department of the Interior

- Rulemaking comments opposing three proposed rules by Fish & Wildlife and NMFS amending regulations implementing the Endangered Species Act to pull back on the Act's protections of endangered species (Sept. 25, 2018). https://ag.ny.gov/press-release/attorney-general-underwood-opposes-trump-administrations-proposed-rollbacks-endangered

- Lawsuit challenging Interior's reinterpretation of the Migratory Bird Treaty Act as not applying to "incidental take" of migratory birds covered by the Act (Sept. 5, 2018). https://ag.ny.gov/press-release/ag-underwood-leads-suit-against-trump-administration-abandoning-longstanding

Challenging Rollback Actions by the National Highway Traffic Safety Admin (NHTSA)

- Petition challenging NHTSA's rollback of enhanced civil penalty rate for automakers that violate the Corporate Average Fuel Economy (CAFE) Standards (Aug. 2, 2019). *New York v. NHTSA*, No. 19-2395 (2d Cir. Aug. 2, 2019).

- Rulemaking comments opposing NHTSA's proposed rollback of enhanced civil penalty rate for automakers that violate CAFE Standards (May 2, 2018).

- Second Circuit vacates NHTSA's rule delaying the civil penalty enhancement rule. *NRDC v. NHTSA*, 894 F.3d 95 (2d Cir. June 29, 2018).

- Petition challenging NHTSA's delay of final rule enhancing the civil penalty rate for automakers that violate the CAFE Standards (Sept. 11, 2017). https://ag.ny.gov/press-release/2017/ag-schneiderman-leads-new-lawsuit-protect-fuel-efficiency-standards

II.

Exxon Litigation

People of the State of New York v. Exxon Mobil Corporation, Index No. 452044/2018 (Sup. Ct. N.Y. Cnty.) (Justice Ostrager).

Exxon Mobil Corp. v. Healey, No. 18-1170 (2d Cir.).

III.

The Responsible Corporate Officer Doctrine

New York v. C and J Enterprises, LLC, No. 2688-10 (Sup. Ct. Albany Cnty., decision & order of Apr. 12, 2018), appeal pending, No. 528430 (3d Dept. 2019).

“She Blinded Me with Science” – New Technology as a Tool in Environmental Cases

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"She Blinded Me with Science" – New Technology as a Tool in Environmental Cases

Selected Resources for Further Reading

Publications on strengthening citizen science partnerships

EPA, Environmental Protection Belongs to the Public: A Vision for Citizen Science at EPA (Dec 2016)
https://www.epa.gov/sites/production/files/2018-04/documents/nacept_citizen_science_publication_eng_022318_rf508_508.pdf

EPA, Information to Action: Strengthening EPA Citizen Science Partnerships for Environmental Protection (Apr 2018)
https://www.epa.gov/sites/production/files/2018-04/documents/nacept_2018_citizen_science_publication_eng_final_v2_508_0.pdf

Wilson Center, Crowdsourcing, Citizen Science, and the Law: Legal Issues Affecting Federal Agencies (2015)
https://www.wilsoncenter.org/sites/default/files/CS_Legal_Barriers_Gellman.pdf

Wilson Center and ELI, Clearing the Path: Citizen Science and Public Decision Making in the United States (2016)
https://www.eli.org/sites/default/files/eli-pubs/clearing-path-eli-report.pdf

Annie Brett, "Putting the Public on Trial: Can Citizen Science Data be Used in Litigation and Regulation?" 28 Vill. Envtl. L.J. 163 (2017)
https://digitalcommons.law.villanova.edu/cgi/viewcontent.cgi?article=1395&context=elj

NYSDEC Programs

Citizens Statewide Lake Assessment Program (CSLAP)
https://www.dec.ny.gov/chemical/81576.html

Water Assessments by Volunteer Evaluators (WAVE)
https://www.dec.ny.gov/chemical/92229.html

Professional External Evaluations of Rivers and Streams (PEERS)
https://www.dec.ny.gov/chemical/105026.html

Citizen Science Organizations in NY

Public Lab
http://publiclab.org

Citizen Science Community Resources, western New York
https://csresources.org/

Great video introducing the work of Public Lab, HabitatMap, and UPROSE gathering and assembling data in NYC
https://www.redhat.com/en/open-source-stories/collective-discovery

The Crowd & the Cloud website including video episodes on citizen science that aired on PBS
http://crowdandcloud.org

YORK
ANALYTICAL LABORATORIES INC

"Listology"

YORKLAB.COM
800-306-YORK
clientservices@yorklab.com

ORGANICS

VOC

8260
- Std 8260
- CT RCP
- CP-51 (STARS)
- TCL
- NJDEP
- Part 375
- TCLP RCRA
- Suffolk Co.
- Nassau Co.
- Site Specific

624
- Std 624
- TCL
- NYC DEP sewer
- NYC DEC discharge

TO-15
- Std TO-15
- CT RCP
- NJ DEP
- Site Specific

524
- Std 524.2
- Std 502.2

SVOC

8270
- Std 8270
- CT RCP
- CP-51 (STARS)
- TCL
- NJDEP
- Part 375
- TCLP RCRA
- Suffolk Co.
- Nassau Co.
- Site Specific

625
- Std 625
- TCL
- NYC DEP sewer
- NYC DEC discharge
- Site Specific

PEST

8081
- Std 8081
- CT RCP
- TCLP RCRA
- TCL
- NJ DEP
- Part 375

8141
- Std 8141

608
- Std 608

PCB

8082
- Std 8082

608
- Std 608

680 (Homologs)

TPH

8015 GRO

8015 DRO

State Specific
- CT ETPH
- NJ EPH
- NJ QAM
- NY 310-13

HERB

8151
- Std 8151
- CT RCP
- Part 375

EMERGING CONTAMINANTS

537.1
- PFAS (DW)

537m
- PFAS (GW / S)

8270 SIM
- 1,4-dioxane

Packages

Disposal	*Landfill*
- Full TCLP	- Part 360
- Full RCRA Haz Waste Characterization	- Routine
	- Baseline
- Facility Specific	- Expanded

Remedial Activities	*Drinking Water Source*
- Full Part 375	- Subpart 5
- Full NJ DEP	
- TCL/TAL	*SPDES*
- Full CT RCP	- NYC DEP Discharge
	- NYS DEC Discharge

INORGANICS

METALS

6010/6020
- CT RCP 15
- TCLP RCRA
- TAL
- NJ DEP
- PP 13
- Indiv. metals
- Suffolk Co.
- Nassau Co.
- Site Specific

200.7/8
- PP 13
- Indiv. metals
- Site Specific

WET CHEM

Minerals
- K
- Ca
- Mg
- Na
- Cl
- SO_4

Nutrients
- NO3
- NO2
- P
- NH4
- TKN

Physical
- Color
- Odor
- Turbidity
- pH

Other
- Ignitability
- Flash Point
- O+G
- BOD
- COD
- Cyanide
- Sulfide

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ORGANICS (Soils / Solids / Oils / Solvents)	Holding Time	Volume
Volatiles, 8260, 524.2 Method 5035A	**48 hours to freeze, 14 days to analysis**	(2) vials DI Water (1) vial w/ MeOH (1) unpres. vial
	48 hours to lab extrusion	(3) 5g Encores & (1) 2oz jar
Semi Volatiles	14 days	4oz jar
Pesticides/PCBs	14 days	4oz jar
Herbicides	14 days	4oz jar
TX or EOX	14 days	4oz jar
TPH	14 days	4oz jar

ORGANICS (Water)	Holding Time	Volume
Volatiles	14 days	(3) VOA w/ HCl
Semi Volatiles	7 days	(2) 1Liter Amber
Pesticides/PCBs	7 days	(2) 1Liter Amber
Herbicides	7 days	1Liter Amber
TOC (Organic Carbon)	28 days	(2) VOA w/ HCl

TCLP (Soil)
A Full TCLP for solid matrices can be combined into (1) 2oz & (2) 8oz jars.

TCLP (Water)
A full TCLP for aqueous matrix can be combined into (3) 1L Amber glass bottles, (1) 500mL plastic bottles, and (3) 40mL VOA w/ HCl.

INORGANICS (Soil)	Holding Time	Volume
CHROMIUM (Hex.)	28 days	2oz jar
CYANIDES	14 days	2oz jar
FLASHPOINT	28 days	4oz jar
METALS, Total	6 months	2oz jar
MERCURY	28 days	2oz jar
NITROGEN TOT-TKN	28 days	2oz jar
NITRATE	**48 hours**	2oz jar
NITRITE	**48 hours**	2oz jar
OIL & GREASE	28 days	4oz jar
pH	**IMMEDIATE**	2oz jar
SOLIDS (Total, Volatile)	7 days	2oz jar
SULFIDE	7 days	2oz jar

INORGANICS (Water)	Holding Time	Volume
ACIDITY	14 days	250mL plastic
ALKALIINITY	14 days	250mL plastic
AMMONIA	28 days	250mL plastic H2SO4
BOD	**48 hours**	1L plastic
BROMIDE	28 days	50mL in plastic
COD	28 days	50mL plastic H2SO4
CHLORIDE	28 days	50mL plastic
CHLORINE Residual	**IMMEDIATE**	50mL plastic
CHROMIUM (Hex.)	**24 hours**	100mL plastic
COLOR	**48 hours**	100mL plastic
CYANIDES	14 days	250ml plastic NaOH
FERROUS IRON	**24 hours**	100mL plastic
FLASHPOINT	28 days	250mL plastic
FLUORIDE	28 days	50mL plastic
HARDNESS	6 months	100mL plastic HNO3
HYDROGEN ION (pH)	**IMMEDIATE**	100mL plastic HNO3
INORGANICS (Water) Continued		Volume
IGNITABILITY	14 days	100mL Amber
METALS, Total	6 months*	250mL plastic HNO3
METALS, Dissolved	6 months*	250mL plastic
	*28 days for Mercury	
NITROGEN TOT-TKN	28 days	500mL plastic H2SO4
NITRATE/NITRITE	**48 hours**	50mL plastic
OIL & GREASE	28 days	1L Amber H2SO4
ODOR	**24 hours**	100mL plastic
ORTHOPHOSPHATE	**48 hours**	100mL plastic
pH	**IMMEDIATE**	100mL plastic
PHENOLICS	28 days	1L Amber H2SO4
PHOSPHOROUS	28 days	250mL plastic H2SO4
SALINITY	28 days	100mL plastic
SOLIDS-SUSPENDED	7 days	100mL plastic
SOLIDS-TOTAL	7 days	100mL plastic
SOLIDS-VOLATILE	7 days	100mL plastic
SPECIFIC CONDUCTANCE	28 days	100mL plastic
SULFATE	28 days	50mL plastic
SULFIDE	7 days	500mL plastic Zn Acetate + NaOH
SULFITE	**24 hours**	250mL plastic
SURFACTANTS (MBAS)	**48 hours**	1L plastic
TURBIDITY	**48 hours**	100mL in plastic

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"Sample Volume & Holding Time Requirements"

EMERGING CONTAMINANTS (Soil)	Holding Time	Volume
PFAS (EPA 537m)	14 days	(1) 250 mL HDPE
1,4-Dioxane	**48 hours to freeze, 14 days to analysis**	(2) vials DI Water (1) vial w/ MeOH (1) unpres. vial

EMERGING CONTAMINANTS (Water)	Holding Time	Volume
PFAS (EPA 537.1, 537m)	14 days to extraction and 28 days to analysis	(2) 250 mL HDPE
1,4-Dioxane (EPA 522)	28 days to extraction	1L Amber
1,4-Dioxane (8270 SIM)	7 days to extraction	1L Amber

PETROLEUM (Soil)	Holding Time	Volume
TPH (HEM-SGT)	28 days	4oz jar
ETPH	14 days	4oz jar
EPH	14 days	4oz jar
VPH	28 days	(2) Methanol VOA
NJ QAM025	14 days	4oz jar
TPH GRO	14 days	2oz jar
TPH DRO	14 days	4oz jar

PETROLEUM (Water)	Holding Time	Volume
TPH-IR	28 days	(2) 1L Amber w/ H2SO4
ETPH	7 days	(2) 1L Amber
EPH	14 days	(2) 1L Amber w/ HCl
VPH	14 days	(2) 40mL VOA w/ HCl
NJ QAM025	14 days	(2) 1L Amber w/ HCl
TPH GRO	14 days	(2) 40mL VOA w/ HCl
TPH DRO	7 days	(2) 1L Amber

AIR	Summa Can	Tedlar bag
Volatiles - TO-15	30 days	72 hours
Petroleum Hydrocarbons - VP	30 days	3 days
Permanent Gasses - 3C	30 days	72 hours
Helium - GC/TCD	30 days	72 hours
Hydrogen - GC/TCD	30 days	72 hours
Methane - GC/FID	30 days	72 hours

PFAS Field Sampling Guidelines for Groundwater

PLEASE READ THESE INSTRUCTIONS PRIOR TO CONDUCTING SAMPLING

Sampling for PFAS for determination using EPA 537m can be challenging due to the prevalence of these compounds in consumer products. The following guidelines reflect current knowledge and are recommended when conducting sampling.

Consider Sampling for PFAS First...

Sample containers for other methods may have PFAS present on their sampling containers which could cross-contaminate your sample(s). We are analyzing down to the low parts-per-trillion (ppt) range so cross-contamination prevention is an important consideration.

SAMPLING

All Sampling done with Nitrile Gloves, provided by YORK

SAMPLE CONTAINERS

All sample containers - HDPE ONLY (Target list of 21 PFAS)

Caps are unlined and made of HDPE (no Teflon® lined caps)

Bottles are Batch Certified to be Target PFAS-free (< Reporting Limit)

FIELD EQUIPMENT

-Must not contain Teflon® (aka PTFE) or LDPE materials

-All sampling materials must be made from stainless steel, HDPE, acetate, silicone, or polypropylene

-No waterproof field notebooks can be used

-No plastic clipboards, binders, or the like

-No adhesives (e.g.Post-It® Notes, Duct tape) can be used

-Sharpies and permanent markers not allowed; regular ball point pens are acceptable

-Aluminum foil must not be used

-Keep PFAS samples in separate cooler, away from sampling containers that may contain PFAS

-Coolers filled with regular ice only - Do not use chemical (blue) ice packs

EQUIPMENT DECON

-"PFAS-free" water (e.g. Poland Spring*)-on-site for decontamination

-Only Alconox and Liquinox can be used for decontamination

* *Poland Spring has been demonstrated to be PFAS -free when freshly opened*

FIELD SAMPLING CLOTHING CONSIDERATIONS

Do not use fabric softener on clothing to be worn in field

Do not used cosmetics, moisturizers, hand cream, or other related products the morning of sampling

Do not use sunscreen or insect repellants

No materials containing Tyvek®

All safety boots made from polyurethane and PVC

No clothing or boots containing Gore-Tex®

Wet weather gear made of polyurethane and PVC only

FOOD CONSIDERATIONS

No food or drink when PFAS Sampling with exception of bottled water and/or hydration drinks (i.e., Gatorade and Powerade) that is available for consumption only in the staging area.

SAMPLE CONTAINER HANDLING

-Each sample set contains 2 x 250 mL containers. Fill to neck

-No preservative is necessary for this appliction at this time.

-Place closed, labeled Sample bottles into ZipLock bag.

-Dispose of Nitrile gloves in provided waste bag.

-Place in separate cooler from other samples, WET ICE only

-Follow instructions on next page for more detail.

-If you have a Quality Assurance Project Plan follow that guidance

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Rev 1.0 3/19

PFAS -Recommended Field Sampling Guidelines

PLEASE READ INSTRUCTIONS ENTIRELY PRIOR TO SAMPLING EVENT

Sampler should wash hands before wearing nitrile gloves in order to limit contamination during sampling. Each sample set* requires a set of containers to comply with the method as indicated below. **Sample set is composed of samples collected from the same sample site and at the same time.* **A pair of Nitrile gloves is included with each sample Zip-lock bag/bottle set. One Field Blank set per day is provided.**

Sample Containers	Bottle Type	Preservation
2 Sampling Containers - Empty- per sample	250 mL HDPE container	None, Cool <6C
1 HDPE Bottle with PFAS-free Water for Field Blank	250 mL HDPE container	None, Cool <6C
1 Field Blank (FRB) - Empty-per sampling day	250 mL HDPE container	None, Cool <6C
2 - Empty HDPE bottles for MS/DUP where needed	250 mL HDPE container	None, Cool <6C

NOTE: Sampling containers must be filled to the neck.

FIELD BLANK and MS/DUP Bottles are labeled with NEON GREEN LABELS

Field blanks are required per sampling event day and the containers have been provided. Follow the instructions below.

Field Blank Instructions:

1. Locate the PFAS Field Blank bottle (empty, labeled) supplied The PFAS Field Blank Water container is pre-filled at YORK with PFAS-free water to transfer to the empty PFAS Field Blank bottle.
2. Locate the empty container labeled "Field Blank" with Neon green labels
3. Open both containers and proceed to transfer contents of the "PFAS FIELD BLANK WATER" container into the "PFAS FIELD BLANK" Bottle
4. Field Blanks to be analyzed must be listed on the Chain-of-Custody.
5. Both the empty Field Blank water container and the filled Field Blank container must be returned to YORK along with the samples taken.

Matrix Spike/ Matrix Dup Instructions:

1. Locate the PFAS MS and DUP bottles (empty, labeled-NEON GREEN) supplied -normally 1 set per 20 field samples
2. Transfer chosen Field MS /Dup as a normal sample and indicate sample ID on container and on Chain-of-Custody

Sampling Instructions: ALL SAMPLE BOTTLES HAVE NEON YELLOW LABELS

1. Do not overfill or rinse the container. Any sample(s) for Matrix Spike and Matrix Duplicates are treated similarly.
2. Close containers securely. Label legibly and place containers in ZipLoc® bags, and in a separate cooler (no other container types).
3. Ensure Chain-of-Custody and all sample labels contain required information. Place all samples in separate coolers (separate from other samples for different parameters). Place wet ice (bagged) on samples for return to YORK. Samples should be kept at 4°C ±2. Samples must not exceed 10°C during first 48 hours after collection. **Hold time is 14 days.**

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15 USCS § 3724

Current through Public Law 116-39, approved August 6, 2019.

United States Code Service > TITLE 15. COMMERCE AND TRADE (Chs. 1 — 114) > CHAPTER 63. TECHNOLOGY INNOVATION (§§ 3701 — 3724)

§ 3724. Crowdsourcing and citizen science

(a) Short title. This section may be cited as the "**Crowdsourcing and Citizen Science Act**".

(b) Sense of Congress. It is the sense of Congress that—

(1)the authority granted to Federal agencies under the America COMPETES Reauthorization **Act** of 2010 (Public Law 111-358; 124 Stat. 3982) to pursue the use of incentive prizes and challenges has yielded numerous benefits;

(2)crowdsourcing and **citizen science** projects have a number of additional unique benefits, including accelerating scientific research, increasing cost effectiveness to maximize the return on taxpayer dollars, addressing societal needs, providing hands-on learning in STEM, and connecting members of the public directly to Federal **science** agency missions and to each other; and

(3)granting Federal **science** agencies the direct, explicit authority to use **crowdsourcing** and **citizen science** will encourage its appropriate use to advance Federal **science** agency missions and stimulate and facilitate broader public participation in the innovation process, yielding numerous benefits to the Federal Government and **citizens** who participate in such projects.

(c) Definitions. In this section:

(1)Citizen science. The term "**citizen science**" means a form of open collaboration in which individuals or organizations participate voluntarily in the scientific process in various ways, including—

(A)enabling the formulation of research questions;

(B)creating and refining project design;

(C)conducting scientific experiments;

(D)collecting and analyzing data;

(E)interpreting the results of data;

(F)developing technologies and applications;

(G)making discoveries; and

(H)solving problems.

(2)Crowdsourcing. The term "**crowdsourcing**" means a method to obtain needed services, ideas, or content by soliciting voluntary contributions from a group of individuals or organizations, especially from an online community.

(3) Participant. The term "participant" means any individual or other entity that has volunteered in a **crowdsourcing** or **citizen science** project under this section.

(d) Crowdsourcing and citizen science.

(1) In general. The head of each Federal **science** agency, or the heads of multiple Federal **science** agencies working cooperatively, may utilize **crowdsourcing** and **citizen science** to conduct projects

designed to advance the mission of the respective Federal **science** agency or the joint mission of Federal **science** agencies, as applicable.

(2) Voluntary services. Notwithstanding section 1342 of title 31, United States Code, the head of a Federal **science** agency may accept, subject to regulations issued by the Director of the Office of Personnel Management, in coordination with the Director of the Office of **Science** and Technology Policy, services from participants under this section if such services—

(A)are performed voluntarily as a part of a **crowdsourcing** or **citizen science** project authorized under paragraph (1);

(B)are not financially compensated for their time; and

(C)will not be used to displace any employee of the Federal Government.

(3) Outreach. The head of each Federal **science** agency engaged in a **crowdsourcing** or **citizen science** project under this section shall make public and promote such project to encourage broad participation.

(4) Consent, registration, and terms of use.

(A) In general. Each Federal **science** agency shall determine the appropriate level of consent, registration, or acknowledgment of the terms of use that are required from participants in **crowdsourcing** or **citizen science** projects under this section on a per-project basis.

(B) Disclosures. In seeking consent, conducting registration, or developing terms of use for a project under this subsection, a Federal **science** agency shall disclose the privacy, intellectual property, data ownership, compensation, service, program, and other terms of use to the participant in a clear and reasonable manner.

(C) Mode of consent. A Federal agency or Federal **science** agencies, as applicable, may obtain consent electronically or in written form from participants under this section.

(5) Protections for human subjects. Any **crowdsourcing** or **citizen science** project under this section that involves research involving human subjects shall be subject to part 46 of title 28, Code of Federal Regulations (or any successor regulation).

(6) Data.

(A) In general. A Federal **science** agency shall, where appropriate and to the extent practicable, make data collected through a **crowdsourcing** or **citizen science** project under this section available to the public, in a machine readable format, unless prohibited by law.

(B) Notice. As part of the consent process, the Federal **science** agency shall notify all participants—

(i)of the expected uses of the data compiled through the project;

(ii)if the Federal **science** agency will retain ownership of such data;

(iii)if and how the data and results from the project would be made available for public or third party use; and

(iv)if participants are authorized to publish such data.

(7) Technologies and applications. Federal **science** agencies shall endeavor to make technologies, applications, code, and derivations of such intellectual property developed through a **crowdsourcing** or **citizen science** project under this section available to the public.

(8) Liability. Each participant in a **crowdsourcing** or **citizen science** project under this section shall agree—

(A)to assume any and all risks associated with such participation; and

(B)to waive all claims against the Federal Government and its related entities, except for claims based on willful misconduct, for any injury, death, damage, or loss of property, revenue, or profits (whether direct, indirect, or consequential) arising from participation in the project.

(9) Research misconduct. Federal **science** agencies coordinating **crowdsourcing** or **citizen science** projects under this section shall make all practicable efforts to ensure that participants adhere to all relevant Federal research misconduct policies and other applicable ethics policies.

(10) Multi-sector partnerships. The head of each Federal **science** agency engaged in **crowdsourcing** or **citizen science** under this section, or the heads of multiple Federal **science** agencies working cooperatively, may enter into a contract or other agreement to share administrative duties for such projects with—

(A)a for profit or nonprofit private sector entity, including a private institution of higher education;

(B)a State, tribal, local, or foreign government agency, including a public institution of higher education; or

(C)a public-private partnership.

(11) Funding. In carrying out **crowdsourcing** and **citizen science** projects under this section, the head of a Federal **science** agency, or the heads of multiple Federal **science** agencies working cooperatively—

(A)may use funds appropriated by Congress;

(B)may publicize projects and solicit and accept funds or in-kind support for such projects, to be available to the extent provided by appropriations **Acts**, from—

(i)other Federal agencies;

(ii)for profit or nonprofit private sector entities, including private institutions of higher education; or

(iii) State, tribal, local, or foreign government agencies, including public institutions of higher education; and

(C)may not give any special consideration to any entity described in subparagraph (B) in return for such funds or in-kind support.

(12) Facilitation.

(A) General Services Administration assistance. The Administrator of the General Services Administration, in coordination with the Director of the Office of Personnel Management and the Director of the Office of **Science** and Technology Policy, shall, at no cost to Federal **science** agencies, identify and develop relevant products, training, and services to facilitate the use of **crowdsourcing** and **citizen science** projects under this section, including by specifying the appropriate contract vehicles and technology and organizational platforms to enhance the ability of Federal **science** agencies to carry out the projects under this section.

(B) Additional guidance. The head of each Federal **science** agency engaged in **crowdsourcing** or **citizen science** under this section may—

(i)consult any guidance provided by the Director of the Office of **Science** and Technology Policy, including the Federal **Crowdsourcing** and **Citizen Science** Toolkit;

(ii)designate a coordinator for that Federal **science** agency's **crowdsourcing** and **citizen science** projects; and

(iii)share best practices with other Federal agencies, including participation of staff in the Federal Community of Practice for **Crowdsourcing** and **Citizen Science**.

(e) Report.

(1) In general. Not later than 2 years after the date of the enactment of this **Act** [enacted Jan. 6, 2017], the Director of the Office of **Science** and Technology Policy shall include, as a component of an annual report required under section 24(p) of the Stevenson-Wydler Technology Innovation **Act** of 1980 (15 U.S.C. 3719(p)), a report on the projects and activities carried out under this section.

(2) Information included. The report required under paragraph (1) shall include—

(A)a summary of each **crowdsourcing** and **citizen science** project conducted by a Federal **science** agency during the most recently completed 2 fiscal years, including a description of the proposed goals of each **crowdsourcing** and **citizen science** project;

(B)an analysis of why the utilization of a **crowdsourcing** or **citizen science** project summarized in subparagraph (A) was the preferable method of achieving the goals described in subparagraph (A) as opposed to other authorities available to the Federal **science** agency, such as contracts, grants, cooperative agreements, and prize competitions;

(C)the participation rates, submission levels, number of consents, and any other statistic that might be considered relevant in each **crowdsourcing** and **citizen science** project;

(D)a detailed description of—

(i)the resources, including personnel and funding, that were used in the execution of each **crowdsourcing** and **citizen science** project;

(ii)the project activities for which such resources were used; and

(iii)how the obligations and expenditures relating to the project's execution were allocated among the accounts of the Federal **science** agency, including a description of the amount and source of all funds, private, public, and in-kind, contributed to each **crowdsourcing** and **citizen science** project;

(E)a summary of the use of **crowdsourcing** and **citizen science** by all Federal **science** agencies, including interagency and multi-sector partnerships;

(F)a description of how each **crowdsourcing** and **citizen science** project advanced the mission of each participating Federal **science** agency;

(G)an identification of each **crowdsourcing** or **citizen science** project where data collected through such project was not made available to the public, including the reasons for such action; and

(H)any other information that the Director of the Office of **Science** and Technology Policy considers relevant.

(f) Savings provision. Nothing in this section may be construed—

(1)to affect the authority to conduct **crowdsourcing** and **citizen science** authorized by any other provision of law; or

(2)to displace Federal Government resources allocated to the Federal **science** agencies that use **crowdsourcing** or **citizen science** authorized under this section to carry out a project.

History

HISTORY:

Act Jan. 6, 2017, P. L. 114-329, Title IV, § 402, 130 Stat. 3019.

Annotations

Notes

HISTORY; ANCILLARY LAWS AND DIRECTIVES

References in text:

Explanatory notes:

References in text:

“The America COMPETES Reauthorization **Act** of 2010”, referred to in this section, is **Act** Jan. 4, 2011, P. L. 111-358. For full classification of such **Act**, consult USCS Tables volumes.

The “annual report required under section 24(p) of the Stevenson-Wydler Technology Innovation **Act** of 1980”, referred to in subsec. (e)(1) and appearing in 15 USCS § 3719(p), was changed to a biennial report by **Act** Jan. 6, 2017, P.L. 114-329, Title IV, § 401(b), 130 Stat. 3016.

Explanatory notes:

For definitions of terms used in this section, see **Act** Jan. 6, 2017, P.L. 114-329, § 2, 130 Stat. 2970, which appears as 42 USCS § 1862s.

This section was enacted as part of **Act** Jan. 6, 2017, P. L. 114-329, and not as part of **Act** Oct. 21, 1980, P.L. 96-480, which generally comprises this chapter.

Research References & Practice Aids

Code of Federal Regulations:

Economic Development Administration, Department of Commerce—Regional innovation program, 13 CFR 312.1 et seq.

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U.S. DEPARTMENT OF ENERGY

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ENERGY EFFICIENCY & RENEWABLE ENERGY

2018 **Offshore Wind Technologies Market Report**

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2018 Offshore Wind Technologies Market Report

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Nomenclature or List of Acronyms

AC	alternating current
BESS	battery energy storage system
BNEF	Bloomberg New Energy Finance
BOEM	Bureau of Ocean Energy Management
BPU	Board of Public Utilities
CapEx	capital expenditures
CIP	Copenhagen Infrastructure Partners
COD	commercial operation date
DOE	U.S. Department of Energy
EDF	Électricité de France Renouvelables
EDPR	Energias de Portugal Renováeis
EnBW	Energie Baden-Württemberg AG
GW	gigawatt
HVDC	high-voltage direct current
IEC	International Electrotechnical Commission
IRENA	International Renewable Energy Agency
ITC	investment tax credit
kV	kilovolt
km	kilometer
LEEDCo	Lake Erie Energy Development Corporation
Berkeley Lab	Lawrence Berkeley National Laboratory
LCOE	levelized cost of energy
m	meter
MW	megawatt
MWh	megawatt-hour
nm	nautical mile
NOAA	National Oceanic and Atmospheric Administration
NREL	National Renewable Energy Laboratory
NYSERDA	New York State Energy Research and Development Authority
O&M	operation and maintenance
OEM	original equipment manufacturer
OpEx	operational expenditures
OREC	offshore renewable energy certificate
OWDB	offshore wind database
PPI	Principle Power Inc.
PPA	power purchase agreement
REC	renewable energy certificate
RPS	renewables portfolio standard
s	second
SIOW	Special Initiative on Offshore Wind
TBD	to be determined
WEA	wind energy area

Executive Summary

Offshore wind energy is a rapidly growing global industry that creates electricity from wind turbines installed in coastal waters on either rigid or floating substructures anchored to the seabed or lake bottom. The *2018 Offshore Wind Technologies Market Report* was developed by the National Renewable Energy Laboratory (NREL) with support from the U.S. Department of Energy (DOE) and is intended to provide offshore wind policymakers, regulators, developers, researchers, engineers, financiers, supply chain participants, and other stakeholders with up-to-date quantitative information about the offshore wind market, technology, and cost trends in the United States and worldwide. This report provides detailed information on the domestic offshore wind industry to contextualize the U.S. market and help policymakers, researchers, and the general public understand technical and market barriers and opportunities. Globally, the scope of the report covers the status of the 176 operating offshore wind projects through December 31, 2018, and provides the status of, and analysis on, a broader global pipeline of 838 projects in various stages of development.[1] To provide the most up-to-date discussion of this dynamically evolving industry, this report also tracks the most significant domestic developments and events from January 1, 2018, through March 31, 2019. The following is a summary of the key offshore wind market findings.

U.S. Offshore Wind Energy Market—Key Findings

The U.S. offshore wind energy project development and operational pipeline[2] grew to a potential generating capacity of 25,824 megawatts (MW), with 21,225 MW under exclusive site control.[3] The overall size of the U.S. offshore wind pipeline grew from 25,464 MW to 25,824 MW in 2018—about 1.4% growth. The 25,824 MW that make up the U.S. offshore wind project development and operating pipeline comprise one operating project (Block Island Wind Farm), eight projects that have reached the permitting phase with either a construction and operations plan or a viable offtake mechanism for sale of electricity, 15 commercial lease areas in federal waters with exclusive site control, two unleased wind energy areas, and five projects (all Pacific-based) that have submitted unsolicited applications to the Bureau of Ocean Energy Management (BOEM),[4] the government agency that regulates energy development in federal waters. The pipeline has three projects located in state waters, including the operating Block Island Wind Farm, the Aqua Ventus I floating-wind project in Maine, and the Lake Erie Energy Development Corporation Icebreaker Wind project on Lake Erie. In addition, there is one BOEM research lease in Virginia federal waters.

Offshore wind project development and regulatory activities span multiple U.S. regions. Historic development and regulatory activities were concentrated in the North Atlantic region from Virginia northward. New offshore wind activities have been initiated in the Pacific, Great Lakes, and South Atlantic regions as well. In the past, there have been project proposals and leasing activity in the Gulf of Mexico that have been limited to Texas state waters, but in 2018 offshore wind development and regulatory activity in this region was inactive. Figure ES-1 shows a map of offshore wind pipeline activity as of March 31, 2019, as well as BOEM Call Areas, for the entire United States.

[1] Note that the *2016 Offshore Wind Technologies Market Report* covered operating projects through June 30, 2017, with a focus on developments in 2016 and the first half of 2017 (Musial et al. 2017).

[2] The project development and operational pipeline, commonly referred to as "the pipeline," is represented by the database that the National Renewable Energy Laboratory uses to monitor the progress of the commercial offshore wind industry. It includes sites under development as well as operating projects. In the United States, the pipeline does not include Call Areas because their boundaries are not fixed. Unleased wind energy areas in the United States are included because they have a defined area.

[3] Federal law requires the Bureau of Ocean Energy Management to conduct a fair public auction for offshore wind sites in which there is interest from more than one developer (i.e., "competitive interest"). A developer cannot proceed until they have been awarded exclusive rights to the site through the competitive auction process.

[4] A lease area is a parcel of ocean area that is auctioned to prospective developers. Wind energy areas can comprise one or more lease areas. A Call Area is a precursor to a wind energy area.

State-level policy commitments accelerated, driving increased market interest. At the end of 2017, U.S. offshore state wind procurement policies totaled over 5,300 MW targeted for deployment by 2030. By early 2019, the sum of official state offshore wind capacity commitments increased to 19,968 MW by 2035. In 2018, new commitments were added in Massachusetts (additional 1,600 MW authorized by 2035), New York (6,600 MW added by 2035), and New Jersey (2,400 MW added by 2030), while Connecticut and Rhode Island both agreed to purchase power from Ørsted's 600-MW Revolution project. In 2019, new policy commitments were enacted in Connecticut (2,000 MW) and Maryland (1,200 MW). In some states without offshore-wind-specific targets, like California and Hawaii, 100% renewables portfolio standards and carbon reduction policies are driving these markets, which are progressing toward the creation of new offshore wind lease areas.

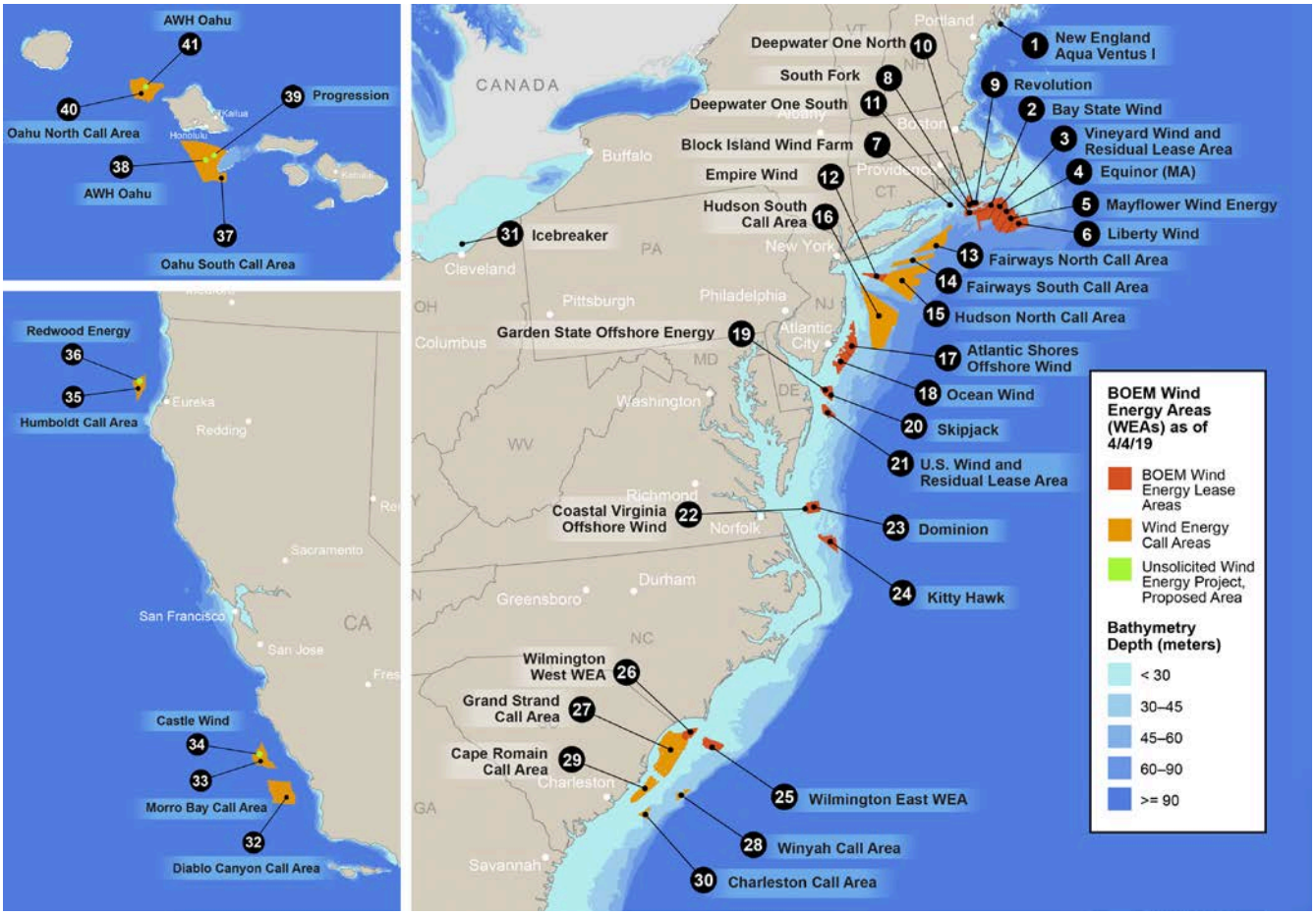

Figure ES-1. Locations of U.S. offshore wind pipeline activity and Call Areas as of March 2019. *Map provided by NREL*

Increased U.S. market interest spurred strong competition at offshore wind lease auctions. BOEM auctioned a total of 1,573 square kilometers (km^2), an area about half the size of Rhode Island, in three adjacent offshore wind lease areas off Massachusetts in December 2018. Each winner (Equinor, Mayflower Wind, and Vineyard Wind) submitted a bid of $135 million, more than tripling the previous lease area sale price record for a single lease area of $42 million in 2016 for the New York lease area submitted by Equinor. Higher offshore wind lease sale prices indicate 1) increased confidence in future market growth driven by state policies, 2) confidence in the regulatory and financial institutions to support offshore wind project development in the nascent U.S. market, 3) continued cost reductions, and 4) heightened demand for offshore wind in the northeastern United States.

Several U.S. projects advanced in the development process. U.S. offshore wind market progress was more evident from the advancement of major projects in the pipeline in 2018 than the capacity growth of the pipeline. Most notably, the commercial-scale Vineyard Wind project and Ørsted's Revolution project negotiated electricity sale offtake agreements with major electric distribution companies and utilities and took major steps in permitting at both the state and federal level. Overall, in the United States, four projects have submitted construction and operations plans, nine projects have had site assessment plans approved, and six have signed power offtake agreements. Vineyard Wind and South Fork are the most advanced commercial-scale U.S. projects, having both obtained a power purchase agreement (PPA) and completed state permits and site surveys, with a construction and operations plan under review by BOEM. Vineyard Wind reports a commercial operation date of 2022 for their Phase 1 facility, consisting of the first 400 MW.

Industry forecasts suggest U.S. offshore wind capacity could grow from 11 to 16 gigawatts (GW) by 2030. Figure ES-2 shows three industry forecasts for offshore wind deployment in the United States for the period extending to the year 2030. These estimates were developed by Bloomberg New Energy Finance (BNEF 2018a), 4C Offshore (2018), and University of Delaware's Special Initiative on Offshore Wind (SIOW 2019),[5] respectively. Together, they illustrate the degree of possible market growth as well as the potential variability associated with future deployment.

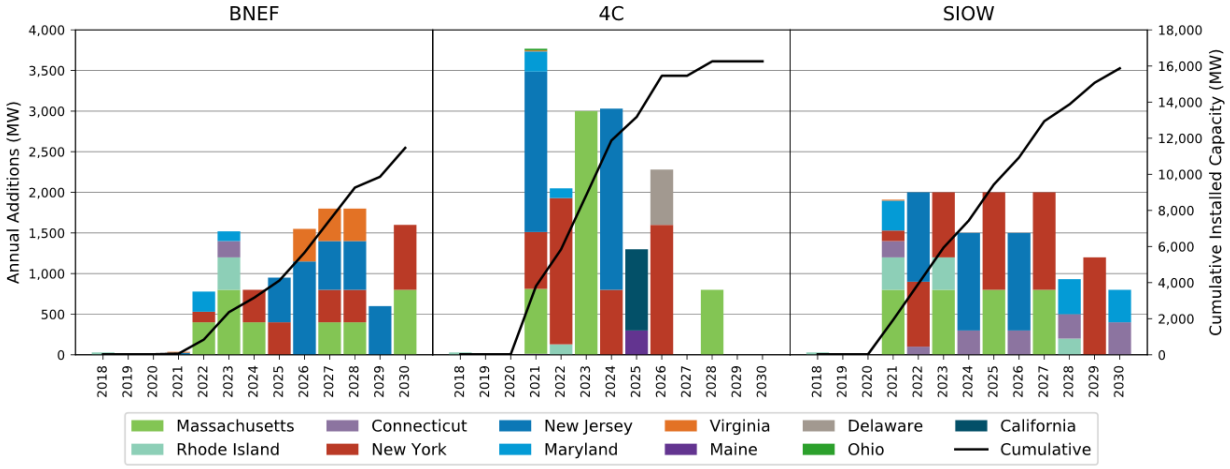

Figure ES-2. U.S offshore wind market forecasts for annual additions (left axis) and cumulative capacity (right axis) through 2030

Offtake prices for the first commercial-scale offshore wind project in Massachusetts were lower than expected. On July 31, 2018, Massachusetts electric distribution companies and Vineyard Wind LLC negotiated a PPA for delivery of offshore-wind-generated electricity at a first-year price of $74/megawatt-hour (MWh) (2022$) for Phase 1 (400 MW) and $65/MWh (2023$) for Phase 2 (400 MW). An NREL study showed that these PPA prices may not accurately reflect the true cost of the project at face value because other revenue sources, such as the investment tax credit, are not accounted for (Beiter et al. [2019]; see Section 5). Nevertheless, this price was lower than expected given the presumed risks associated with building the first U.S. commercial project with an immature U.S. supply chain. Vineyard Wind's apparent ability to access relatively low-cost financing and take advantage of the waning federal investment tax credit helped them set a competitive benchmark for the U.S. offshore wind industry. The Vineyard Wind PPA price provides a reference point for commercial-scale offshore wind generation in the United States that falls within the price

[5] Please note University of Delaware's SIOW forecast is based on the expected date a state selects to procure offshore wind capacity. A 3-year time lag is assumed from the time the procurement occurs until the project becomes fully operational.

range of European offshore wind projects scheduled to begin commercial operations in the early- to mid-2020s. Additional commercial price points are anticipated in New York and New Jersey in 2019.

Attention to offshore wind in California increased in 2018. California passed Senate Bill 100, The 100 Percent Clean Energy Act of 2018, making it the largest state to establish a 100% electric renewable energy goal, and setting a carbon-free target year of 2045. Amid continued negotiations with the U.S. Department of Defense, on October 18, 2018, BOEM published a Call for Information and Nominations and received 14 nominations from companies interested in commercial wind energy leases within three proposed Call Areas off central and northern California. All together, these three Call Areas total approximately 2,784 km^2 (687,823 acres), which could support an offshore-wind-generating capacity for nascent floating wind technology of up to 8.4 GW.

New national technical research consortium was launched to spur innovation. DOE has committed $20.5 million to the New York State Energy Research and Development Authority to form a National Offshore Wind R&D Consortium. The New York State Energy Research and Development Authority agreed to match the DOE contribution and launched a funding organization to make research and development awards on prioritized topics that will support developers in achieving their near-term deployment and cost targets. The first solicitation was released on March 29, 2019, and the first awards are expected in 2019.

Global Offshore Wind Energy Market–Key Findings

Globally, industry installed a record 5,652 MW of offshore wind capacity in 2018. Annual capacity additions increased by more than 50% relative to 2017. The increase in global generating capacity can be attributed to increased deployment in China, with 2,652 MW of new capacity, followed by 2,120 MW commissioned in the United Kingdom, 835 MW in Germany, 28 MW in Denmark, and about 17 MW divided among the rest of the world. By the end of 2018, cumulative global offshore wind installed capacity grew to 22,592 MW from 176 operating projects. Projections indicate 2019 global capacity additions will be even higher based on projects currently under construction. As of December 31, 2018, the global pipeline for offshore wind development capacity was about 272,000 MW.

The pace of European auctions slowed in the second half of 2018, but forecasts show sustained industry growth. European auction strike prices[6] in 2018 validated earlier cost reduction trends (see Section 5) but the number of auctions decreased, with only three occurring in the first two quarters of 2018. Adjusted strike prices[7] for these auctions ranged from $74/MWh to $79/MWh for commercial-scale projects. The slowdown can be partially attributed to the depletion of viable grid connections in the German markets (Foxwell 2018a). However, long-term forecasts indicate that this trend may be temporary as global offshore wind capacity is projected to reach between 154 and 193 GW by 2030, with more than 50% coming from Europe (and another major fraction coming from China).

Offshore Wind Energy Technology Trends–Key Findings

Industry is seeking accelerated cost reductions through larger turbines with rated capacities of 10 MW and beyond. Through technology innovation, turbine original equipment manufacturers have been able to limit the rise in turbine cost ($/kilowatt) and manage the increase in mass (kilogram/kilowatt) to allow turbine growth to continue upward to at least 12 MW, if not 15 MW, in the next decade. There are no indications that

[6] The strike price for an offshore wind project from an auction is usually the lowest bid price at which the offering can be sold. It usually covers a specific contract term for which that strike price will be paid for the energy produced. The offeror of that strike price is awarded the rights to develop a particular parcel under predetermined conditions set in the tender offer that may vary by country or market. It should not be confused with levelized cost of energy, which may be calculated using different financing and cost assumptions.

[7] The strike prices were adjusted to enable comparisons among projects in different countries to consider a range of possible subsidies and benefits that are available to some projects, such as the cost of the electrical grid connections.

turbine growth is slowing or has reached a limit for offshore wind. Although the market has experienced a steady upgrade of turbine drivetrain nameplate generating capacity, turbine rotor diameters have grown more slowly. The Vestas V174-9.5 is currently the largest machine in the commercial market (Richard 2019). However, the next generation of turbines promises larger rotors and lower specific power ratings[8] suited for U.S. offshore markets in the next few years. Specific examples of next-generation turbines include Siemens Gamesa SG 10.0–193DD turbine announced in January 2019, which is planned by Siemens Gamesa to be market ready by 2022, and the GE Haliade-X 12-MW turbine, which should arrive on the market by 2021 (Siemens 2019; GE 2018b).

Adoption of 66-kV(kilovolt) array cables is increasing to lower electrical infrastructure costs. As the rated power capacity of offshore wind turbines continues to grow, project developers and operators are increasing their use of 66-kV array cable technology instead of the conventional 33-kV systems to connect individual turbines within an array. In 2018, three projects incorporated 66-kV array cables versus only one in 2017. Operation at a higher voltage offers important life cycle cost-efficiency benefits, such as the possibility of reducing the number of offshore substations, decreasing the overall length of installed cables, and minimizing electric losses. During 2018, the 66-kV technology was demonstrated by Nexans in three pilot wind power plant projects: the Blyth Offshore Demonstrator (United Kingdom), Nissum Bredning Vind (Denmark), and Aberdeen Bay (United Kingdom).

The floating wind energy project pipeline is growing, with multiple floating pilot projects advancing. The global pipeline for floating offshore wind energy reached 4,888 MW in 2018. The pipeline comprises 38 announced projects, including 46 MW of operating projects. The floating offshore wind energy industry is well into a second-generation, multiturbine, precommercial pilot phase. There are 14 projects representing approximately 200 MW that are currently under construction, having achieved either financial close or regulatory approval. These projects are distributed over nine countries. Figure ES-3 shows a turbine in Equinor's 30-MW floating array off the coast of Peterhead, Scotland—the world's first commercial floating wind energy project—which is now operating into its second year.

[8] Specific power is the ratio of the nameplate rating of the turbine divided by the rotor's swept area and is given in Watts per meter squared.

Figure ES-3. A 6-MW floating wind turbine in Equinor's 30-MW array near Peterhead, Scotland.
Photo from Walt Musial, NREL

Semisubmersible substructures dominate the market for floating support structures, but new hybrid platform technologies are being introduced that could compete in future projects. Semisubmersibles, which use buoyancy and the water plane area to achieve stability, make up 94% of floating projects on a capacity-weighted average because they are inherently a stable buoyant floating substructure with low draft that allows for in-port or nearshore assembly. Several new hybrid technologies (platforms that combine the characteristics of spars, tension-leg platforms and semisubmersibles) are being introduced this year that may rival these substructures. Stiesdal Offshore Technologies's TetraSpar and the SBM tension leg platform are highlighted in Section 4 and may be deployed as early as 2019.

Offshore Wind Energy Cost and Price Trends–Key Findings

Offshore wind auction strike prices in 2018 validate current cost reduction trends. Prices from European offshore wind auctions and PPAs in 2018 help validate the previously documented trends indicating prices dropping from approximately $200/MWh for projects beginning operation between 2017 and 2019 to approximately $75/MWh for projects beginning operation between 2024 and 2025. In the United States, Vineyard Wind LLC signed two PPAs with Massachusetts electric distribution companies in July 2018 for a combined 800 MW of offshore wind capacity expected to become operational in 2022 and 2023, respectively. After adjusting for contract type, transmission, policy, and access to external revenue, the Vineyard Wind project has an all-in price of $98/MWh. The Vineyard Wind price point indicates that U.S. projects may not be subject to a large price premium because of nascent U.S. market structures or a limited domestic supply chain. Figure ES-4 indicates the adjusted Vineyard Wind PPA prices are competitive with European offshore wind prices.

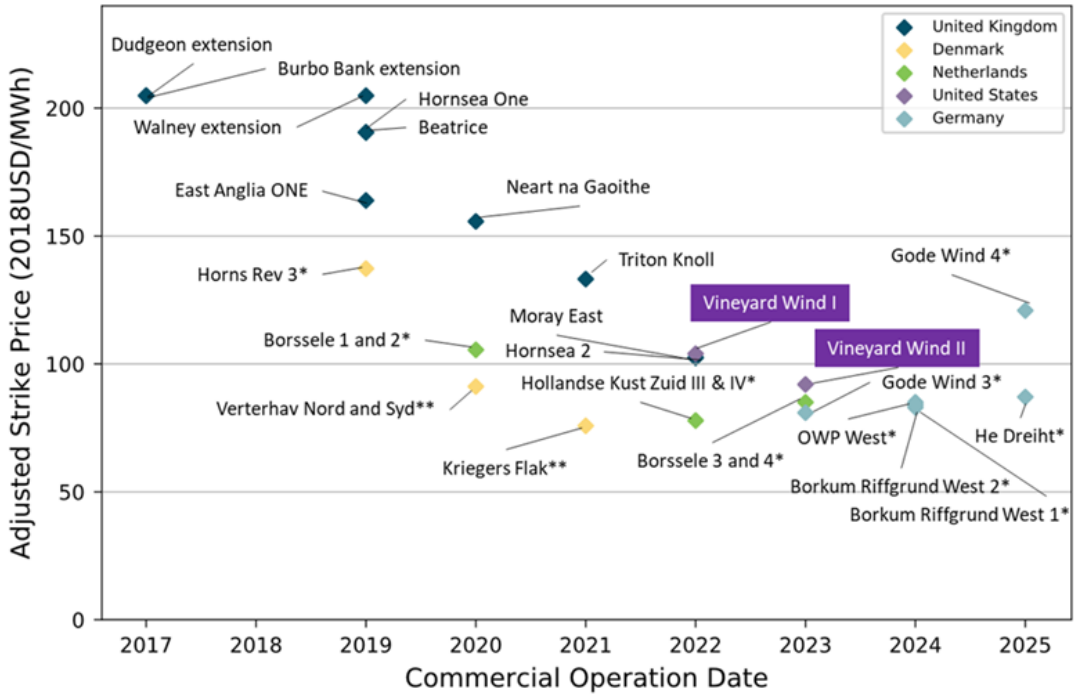

Figure ES-4. Adjusted strike prices from European offshore wind auctions

Sources: 4C Offshore (2018, 2019) and Beiter et al. 2019
Notes: *Grid and development costs added; **Grid costs added and contract length adjusted

Future Outlook

Offshore wind market projections show accelerated growth in the next decade, with cumulative capacity ranging from 154 to 193 GW by 2030, and long-range predictions of over 500 GW by 2050 (BNEF 2018a; 4C Offshore 2018; International Renewable Energy Agency 2018). In this context, offshore wind is still at an early stage with respect to the maturity of the technology, supply chain, and infrastructure. The pace of progress and development of the global supply chain is likely to be strongly influenced in the near term by the growth in turbine generating capacity, rising toward 15 MW. Although larger turbines improve project costs in the long run, they may also delay industry maturity. It may take several years for the corresponding industrial facilities and infrastructure needed for fabrication, installation, and maintenance to stabilize at ever-increasing turbine scales. This upscaling issue is likely to persist not only in the United States but globally as well.

In the United States, individual states may continue to push for greater commitments for offshore wind, but further declines in offshore wind offtake prices are far from certain in the near term. Offshore wind projects, such as Vineyard Wind, will be able to take advantage of the expiring investment tax credit (see Section 5.1.1.), which will enable low prices (on par with Europe) for the first commercial solicitation in Massachusetts. However, as the investment tax credit expires in 2020, projects will have to make up the difference by raising prices or lowering costs. This may increase the urgency to implement near-term solutions to manage costs, such as developing U.S.-flagged Jones-Act-compliant vessels or accelerating the growth and maturity of the domestic manufacturing supply chain (see Section 4).

If demand for offshore wind energy continues to increase in states along the U.S. Atlantic and Pacific coasts, as it did in 2018, state policy commitments that are now almost 20 GW could exceed the capacity of the available sites. Presently, there is just over 21 GW of capacity in BOEM lease areas where developers have been granted exclusive site control. Additional state policy commitments may create possible site shortages in some regions, which could trigger the development of more lease areas.

1 Introduction

Offshore wind energy is a rapidly growing global industry that creates electricity from large wind turbines installed in coastal waters on either rigid or floating substructures anchored to the seabed or lake bottom. The *2018 Offshore Wind Technologies Market Report* was developed by the National Renewable Energy Laboratory (NREL) for the U.S. Department of Energy (DOE) to provide offshore wind policymakers, regulators, developers, researchers, engineers, financiers, and supply chain participants with up-to-date quantitative information about the offshore wind market, technology, and cost trends in the United States and worldwide. This report includes detailed information on the domestic offshore wind industry to provide context to help navigate technical and market barriers and opportunities. It also covers the status of the 176 operating offshore wind projects in the global fleet through December 31, 2018, and provides the status and analysis on a broader global pipeline of 838 projects at varying stages of development. In addition, this report provides a deeper assessment of domestic developments and events through March 31, 2019, for this dynamically evolving industry.

This report includes data, obtained from a wide variety of sources about offshore wind projects that are both operating and under development, to offer current and forward-looking perspectives. It is a companion to the *2018 Wind Technologies Market Report* and *2018 Distributed Wind Market Report* funded by DOE and written by the Lawrence Berkeley National Laboratory (Berkeley Lab) (Wiser et al. 2019) and Pacific Northwest National Laboratory (Orrell et al. 2019), respectively. The reports cover the status of utility-scale and distributed, land-based wind energy located primarily in the United States, and provide quantitative, independent data for use by the wind industry and its various stakeholders.

Global offshore wind deployment in 2018 set a new record for a single year (5,652 megawatts [MW]), and optimism for the future is high, with long-term industry projections of over 150 gigawatts (GW) by 2030 and over 500 GW by 2050 (Bloomberg New Energy Finance [BNEF] 2018b; 4C Offshore 2018; International Renewable Energy Agency [IRENA] 2018). However, 2018 was somewhat unusual by historical standards as the Chinese market saw its largest deployment ever, with over 2,600 MW of new installations. Offshore wind in Europe installed 2,994 MW, representing about 50% of the new installed capacity.

The offshore wind market in the United States evolved rapidly in 2018 because of a series of positive global and domestic market growth indicators. After bids for a few offshore wind projects in Europe reinforced developers' confidence of zero-subsidy projects in some markets, the United States also saw low-price signals from its first commercial project. In 2018, the U.S. market logged the first competitive bid for an 800-MW commercial wind power plant—Vineyard Wind—in Massachusetts, which seemed to indicate that European market prices can be achieved in the northeastern United States for projects commissioned as early as 2022. The possibility of achieving European offshore wind price levels in U.S. waters coincided with a new wave of state policy support for offshore wind, which originally began in 2016, but increased in late 2018 through the present day. Several new states made offshore wind commitments in 2018, whereas several of the already-committed states aggressively increased their commitments (McClellan 2019). In addition, market optimism likely helped drive lease area auction prices to record highs, as observed in the Massachusetts wind energy area (WEA) lease sales in December 2018 ($135 million per lease area), which were each three times higher than the previous winning lease area bid in New York just 2 years earlier. These record-high prices may indicate a heightened demand for new WEAs as well as an increase in the financial caliber of the bidders, as new members of well-capitalized oil companies and utilities try to establish themselves as offshore wind developers in the emerging U.S. market. All told, the U.S. market developments in 2018 appear to be laying the groundwork for the formation of a new multibillion-dollar offshore wind industry that is likely to bear fruit in the next 5 to 10 years (BNEF 2018a; 4C Offshore 2018; McClellan 2019).

The data and information in this report provide insight into the domestic and global market status, technology trends, and costs, and are key inputs to the annual *Cost of Wind Energy Review* report, which provides an

updated summary of the cost of land-based and offshore wind energy in the United States to support DOE's programmatic reporting on the cost of wind energy (Stehly et al. 2017, 2018).

1.1 Approach and Method

1.1.1 NREL Offshore Wind Database

The *2018 Offshore Wind Technologies Market Report* uses NREL's internal offshore wind database (OWDB), which contains information on more than 1,700 offshore wind projects located in 49 countries and totaling approximately 623,329 MW of announced project capacity (both active and dormant). The database includes both fully operational projects dating back to 1990 and anticipated future projects that may or may not have announced their commercial operation date (COD). The OWDB contains information on project characteristics (e.g., water depth, wind speed, distance to shore), economic attributes (e.g., project- and component-level costs and performance), and technical specifications (e.g., component sizes and masses). The database also contains information on installation and transport vessels, as well as ports used to support the construction and maintenance of offshore wind projects.

The OWDB is built from internal research using a wide variety of data sources including peer-reviewed literature, press releases, industry news reports, manufacturer specification sheets, subscription-based industry databases, and global offshore wind project announcements. Unless stated otherwise, the data analysis in this report—both globally and domestically—is derived by NREL from the OWDB and reflects the best judgment of the authors and industry subject matter experts that were consulted. To ensure accuracy, NREL verified the OWDB against the following sources:

- The 4C Offshore Wind Database
- The Bureau of Ocean Energy Management (BOEM)
- The WindEurope Annual Market Update
- BNEF's Renewable Energy Project Database
- The University of Delaware's Special Initiative on Offshore Wind (SIOW).

Although the data were validated and harmonized with these other sources, minor differences in their definitions and methodology may cause the data in this report to vary from data reported in other published reports. For example, the method for counting annual capacity additions often varies among different sources, because of terms such as "installed" or "operational," and "first power" or "commercial operation date" are defined differently. NREL considers a project to be commercially operational when all turbines are fully operational and transmitting power to a land-based electricity grid (see Table 1). Data may also vary in quality and are subject to high levels of uncertainty, especially data for future projects that are subject to change based on developer and regulatory requirements. Despite annual variability and potential future project-level uncertainty, longer-term trends reported elsewhere are consistent with long-term market trends in NREL's OWDB.

Cost and pricing data in the OWDB span a lengthy time period and are reported in different currencies. To analyze these data, all information in this report were normalized into 2018 U.S. dollars (USD) by:

- Converting costs and prices to USD, using the exchange rate for the year in which the latest data were reported (United States Treasury Bureau of Fiscal Service 2019)
- Inflating the values, which are in nominal USD after the exchange rate conversion, to 2018 USD using the U.S. Consumer Price Index (United States Department of Labor Bureau of Statistics 2019).

1.1.2 Classification of Project Status

The "pipeline" is an offshore wind project development and operating project tracking process, which provides the ability to follow the status of a project from early-stage planning through decommissioning. The primary tracking method is aligned with the regulatory process. All offshore wind projects must navigate through the regulatory process that formally begins when a regulator initiates a leasing process to offer developers the opportunity to bid for site control through a competitive lease auction[9] or when an unsolicited project application is formally submitted. In parallel with the regulatory process is the developer's efforts to characterize the economic viability of the project and its capability for long-term energy production to obtain financing. The parallel regulatory and financing pathways have several dependencies, but information about the regulatory path is more easily accessed in the public domain and is therefore the primary method used to track projects in this report. Therefore, the "pipeline" is defined as the set of all offshore wind projects, beginning with those that have formally entered the regulatory leasing process to bid for site control and development rights through projects that have been decommissioned. If known, information on a project's offtake mechanisms and financial close is specifically reported as well.[10]

Offshore wind projects remain in the pipeline from early-stage planning through the operating and decommissioning phases. In the early stages of a project, the exact project footprints and capacities are not always known, but NREL assumes that all lease areas will eventually be fully developed with an array density of 3 MW/square kilometer (km^2). This is a common metric for computing the available wind resource over an area but is not meant to be restrictive (Musial et al. 2013, 2016). Some developers may want higher array densities for their lease areas, or conversely, could decide or be required to leave areas undeveloped for various reasons. The pipeline is adjusted when these decisions are publicly announced.

Table 1 describes the system used in this report for classifying and tracking the development of offshore wind projects and that has been used in past DOE-sponsored offshore wind market reports (Smith, Stehly, and Musial 2015; Musial et al. 2017; Beiter et al. 2018). Note that the criteria used in Table 1 also apply to the global project classification, but some differences may not allow for direct comparisons, especially during the earlier stages of planning. This disconnect is mainly because some countries have different methods of establishing "site control."

[9] Applies to U.S. projects on the Outer Continental Shelf but varies internationally and in state waters.
[10] The "pipeline" is often measured by the quantity of policy commitments made by states. These figures are tracked separately in Section 2.4.2 and offer a good metric for comparison.

Table 1. Offshore Wind Project Pipeline Classification Criteria

Step	Phase Name	Start Criteria	End Criteria
1	Planning	Starts when a developer or regulatory agency initiates the formal site control process	Ends when a developer obtains control of a site (e.g., through competitive auction or a determination of no competitive interest in an unsolicited lease area [United States only])
2	Site Control	Begins when a developer obtains site control (e.g., a lease or other contract)	Ends when the developer files major permit applications (e.g., a construction and operations plan for projects in the United States) or obtains an offtake agreement
3	Permitting = Site Control + Offtake Pathway	Starts when the developer files major permit applications (e.g., construction and operations plan or obtains an offtake agreement for electricity production)	Ends when regulatory entities authorize the project to proceed with construction and certify its offtake agreement
4	Approved	Starts when a project receives regulatory approval for construction activities and its offtake agreement	Ends when sponsor announces a "financial investment decision" and has signed contracts for construction work packages
5	Financial Close	Begins when sponsor announces a financial investment decision and has signed contracts for major construction work packages	Ends when project begins major construction work
6	Under Construction	Starts when offshore construction is initiated[11]	Ends when all turbines have been installed and the project is connected to and generating power for a land-based electrical grid
7	Operating	Commences when all turbines are installed and transmitting power to the grid; COD marks the official transition from construction to operation	Ends when the project has begun a formal process to decommission and stops feeding power to the grid
8	Decommissioned	Starts when the project has begun the formal process to decommission and stops transmitting power to the grid	Ends when the site has been fully restored and lease payments are no longer being made
9	On Hold/Cancelled	Starts if a sponsor stops development activities, discontinues lease payments, or abandons a prospective site	Ends when a sponsor restarts project development activity

1.2 Report Structure

The remainder of the report is divided into four sections:

- Section 2 summarizes the status of the offshore wind industry in the United States, providing in-depth coverage on the project development pipeline, regulatory activity, offtake mechanisms, infrastructure trends, and regional developments.
- Section 3 provides an overview of the global offshore wind market. Operational and proposed future projects are tracked by country, status, commercial operation date, and capacity. Developments on international floating offshore wind projects are also covered in detail.
- Section 4 describes offshore wind siting and technology trends focusing on turbine technologies, turbine manufacturers, project performance, fixed-bottom substructures, electrical power, export systems, and floating technologies.
- Section 5 provides insight into global and domestic offshore wind prices, capital and operational costs, and financing trends for both fixed-bottom and floating technologies. This section also compares historical and forecasted future prices between the European and U.S. offshore wind markets.

[11] Note that some developers may elect to start construction at an onshore landing area to secure certain subsidies or tax incentives.

2 U.S. Offshore Wind Market Assessment

2.1 U.S. Offshore Wind Industry Overview

In 2018, the U.S. offshore wind market continued to attract significant attention from the global community, primarily brought on by a large increase in state policy commitments. From the end of 2017 until June 10, 2019, the total offshore wind capacity that was committed by the states nearly quadrupled. At the end of 2017, U.S. state offshore wind procurement policies required over 5,300 MW of offshore wind by 2030. By June 2019, the sum of official state offshore wind targets increased to 11,468 MW by 2030 and 19,968 MW by 2035. Even in states without offshore wind procurement targets like California and Hawaii, 100% renewables portfolio standards (RPS), clean energy, or carbon reduction goals are driving new market activity and the potential development of new offshore wind lease areas.

The U.S. offshore wind project pipeline was 25,824 MW at the end of 2018, remaining relatively constant, with only a 1.4% increase in total pipeline capacity relative to 2017. Multiple projects made significant progress with electricity offtake agreements and environmental permitting at both the state and federal level. Currently, nine projects have an offtake agreement or are negotiating offtake terms. State-level procurement goals have increased the attractiveness of the U.S. offshore wind market and encouraged competition between developers at recent BOEM auctions. BOEM's auction of three offshore wind lease areas off Massachusetts in December 2018 established a new lease sale price record of $135 million each, more than tripling the previous record of $42 million, signaling increased market confidence, higher demand, and the existence of a committed pool of well-capitalized bidders (BOEM 2019a, 2019b). Interest in the Pacific offshore wind markets also continued to grow in 2018 (BOEM 2019c). BOEM issued Calls for Information and Nominations for offshore wind development in California prompted by multiple prospective floating wind developers. In addition, a 20-year power purchase agreement (PPA) signed with Vineyard Wind in 2018 revealed a first-year price of $74/megawatt-hour (MWh) (2022$) and $65/MWh (2023$), respectively (Beiter et al. 2019).

Despite an increasing number of offshore wind projects submitting their construction and operations plans and engaging local suppliers, supply chain investment in the United States was not commensurate with regulatory advancement. There has yet to be a U.S.-flagged installation vessel or any domestic manufacturing centers built. Also, states have not yet engaged significantly in land-based grid planning or transmission infrastructure upgrades necessary to integrate the expected levels of offshore wind power (Lefevre-Marton et al. 2019). Nevertheless, two U.S.-flagged crew transfer vessels are being built, multiple ports received significant investments to upgrade infrastructure, and states have developed portals to connect developers with local suppliers. Moreover, the near-term lag in the development of a robust domestic supply chain may not be a barrier to the first few commercial-scale projects because the European supply chains can serve the U.S. market in the near term. At the same time, delays in the development of the domestic supply chain could force U.S. project costs above European market costs for large-scale commercial deployment in the mid-2020s and beyond. New technical programs sponsored by DOE and others aim to spur innovation and increase industry supply chain activity (New York State Energy Research and Development Authority [NYSERDA] 2019).

2.2 U.S. Offshore Wind Market Potential and Project Pipeline Assessment

2.2.1 U.S. Offshore Wind Pipeline

As of December 31, 2018, NREL estimates the U.S. offshore wind pipeline to be 25,824 MW of capacity, which is based on the sum of current installed projects, existing lease areas, unleased WEAs, and unsolicited project applications. Table 2 shows the U.S. market broken into five segments by capacity. The U.S. pipeline capacity has one operational project (30 MW), 15 lease areas where developers have site control (estimated 19,151 MW), two unleased WEAs (estimated 2,250 MW), and five unsolicited project applications (2,350 MW). Only installed projects (30 MW) and projects with site control that have advanced through the initial permitting process and are negotiating offtake agreements (2,043 MW) use actual developer-specified capacity values. This is roughly 8% of the total capacity, or 2,073 MW. These projects have a clear project plan and a site boundary that has been specified including much of the design details.

The rest of the pipeline capacity in the other three categories—lease areas with site control, unleased WEAs, and unsolicited project applications—are all estimations based on the potential of the lease area using a capacity density function of 3 MW/km^2 (Musial et al. 2016). Therefore, these estimated values are likely to change over time as project parameters are defined more precisely and lease areas are converted from an unspecified or residual area to actual project capacity. Figure 1 shows each of those categories as a percent of the total U.S. pipeline.

Table 2. U.S. Offshore Wind Pipeline Capacity for Five Categories

	Status	Description	Capacity
1	**Installed**	The project is fully operational with all turbines generating power to the grid.	30 MW
2	**Projects Permitting with Site Control and Offtake Pathway**	The developer has site control and has initiated permitting processes to construct the project and sell its power.	2,043 MW
3	**Lease Areas with Site Control**	Developer has acquired the rights to a lease area. Capacity is estimated using a turbine density of 3 MW/km^2. Depending on market demand, developers may or may not incrementally build out projects to use a given lease area's entire size/potential.	19,151 MW (Estimated)
4	**Unleased Wind Energy Areas**	The rights to lease areas have yet to be auctioned to developers. Capacity is estimated using a 3 MW/km^2 turbine density function.	2,250 MW (Estimated)
5	**Unsolicited Project Applications**	Developer lacks site control but has submitted a project proposal to BOEM. Project application capacities estimated using a 3-MW/km^2 density and project footprint size identified in the proposal.	2,350 MW (Estimated)
		Total	**25,824 MW**

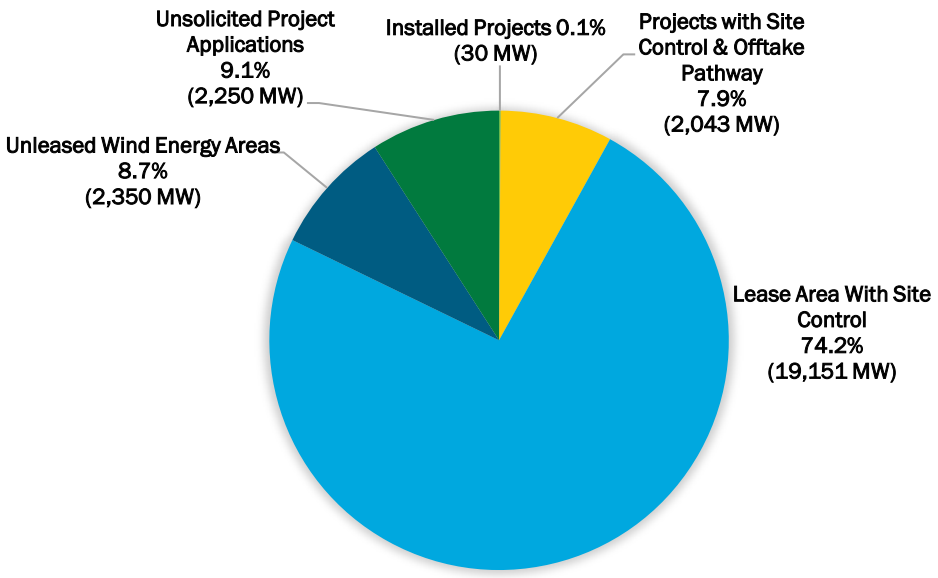

Figure 1. Percentages of U.S offshore wind pipeline (25,824 MW) by classification category

Figure 2 shows the U.S. pipeline activity as of June 10, 2019, for all categories shown in Table 1 by state.[12] Breaking down the 2018 U.S. pipeline by project status: one project (30 MW) has been installed; nine projects (2,043 MW) have site control, made major permitting progress, or secured a power offtake contract or have a viable pathway to obtaining one; developers have the rights to possibly develop projects in 15 lease areas with a technical potential of 19,151 MW; two unleased WEAs have the potential to support 2,250 MW; and six unsolicited project applications (2,350 MW) may be developed but must comply with BOEM's competitive leasing processes. Projects progressing through offtake and permitting approval processes continued to be primarily located in the northeast United States, where state-level procurement drives the market and project development. However, there is also an increased interest in developing floating projects along the Pacific Coast, as described in Section 2.3.2.

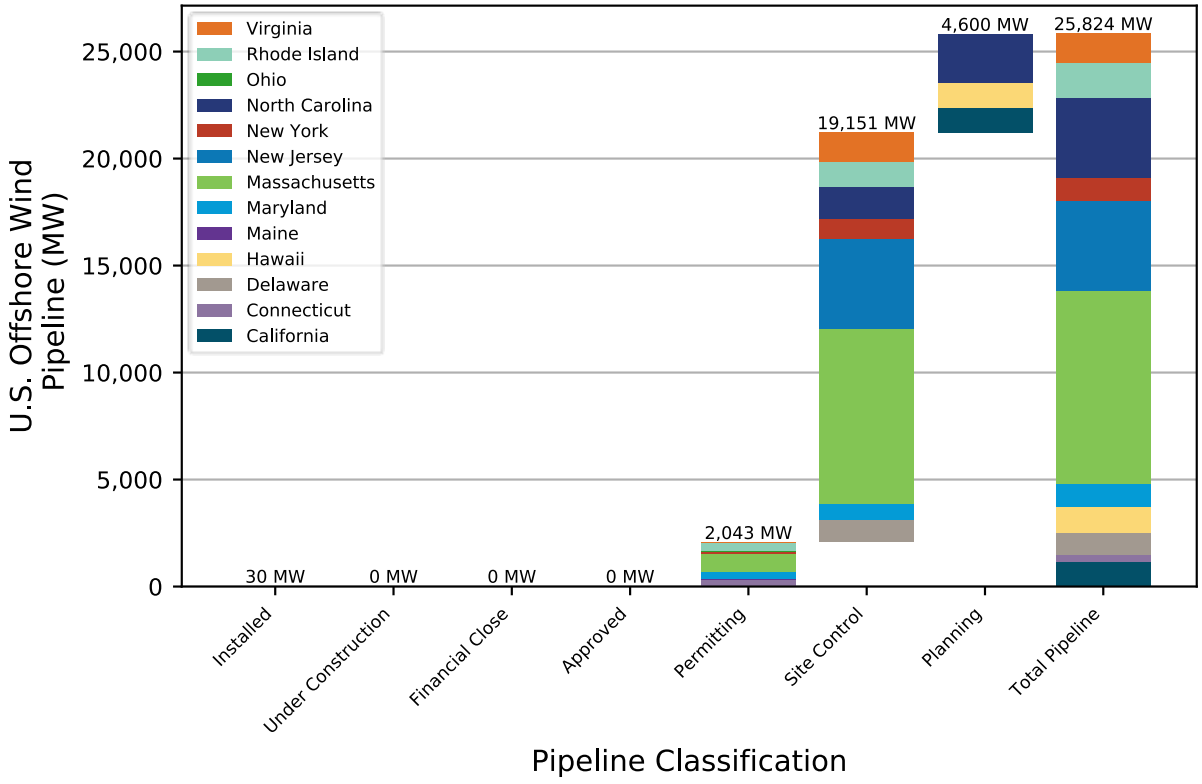

Figure 2. U.S. project pipeline classification by state[13]

There were only minor changes in NREL's estimation of the U.S. offshore wind pipeline from 2017 to 2018 (reporting 25,464 MW in 2017 [Beiter et al. 2018]). The cancellation of the Nautilus Offshore Wind Project in New Jersey accounted for a 24-MW reduction; the expansion of South Fork from 90 MW to 130 MW shifted 40 MW from the Deepwater One North lease area; the Redwood Coast Offshore Wind Project in California added 150 MW; and the proposed Castle Wind Project in California increased its capacity from 765 MW to 1,000 MW. All told, the pipeline only increased by a slight 1.4%.

[12] State in Figure 2 refers to the state the project intends to sell its power to. If a project has not signed an offtake agreement, the state refers to its physical location.

[13] The location of the project is defined by where the project's power is intended to be sold. If the project does not have an offtake agreement, the location is its physical location. This clarification is needed where projects are located in a certain location but sell their power to a neighboring state market.

Figure 3 provides a different breakdown of the U.S. pipeline by state. From the chart, Massachusetts, New Jersey, and North Carolina possess the most offshore wind potential[14] as of March 31, 2019. Note that the hashed bars on the chart indicate the pipeline capacity that was estimated on a 3 MW/km^2 area basis and the solid (green) colored bars are specific projects.

It is important to be cautious about interpreting these geographic lease areas that have been assigned to specific states, because their physical location does not indicate where the offshore wind power will ultimately be delivered. For example, power from Massachusetts can feasibly be delivered to New York and vice versa. In this sense, projects being developed in nearby WEAs may sell power and other grid services to adjacent states because of market demand, state-level offtake policies, or other factors. Current projects in the pipeline that plan to sell power to neighboring markets include:

- Revolution Wind in the Rhode Island/Massachusetts WEA is planning to deliver power to both Connecticut and Rhode Island
- South Fork in the Rhode Island/Massachusetts WEA is planning to deliver power to Long Island New York
- Skipjack in the Delaware WEA is planning to deliver power to the Delmarva grid in Maryland.

Accordingly, state policy may be a more important driver in determining what projects move forward and which markets they serve than the physical location of the leases.

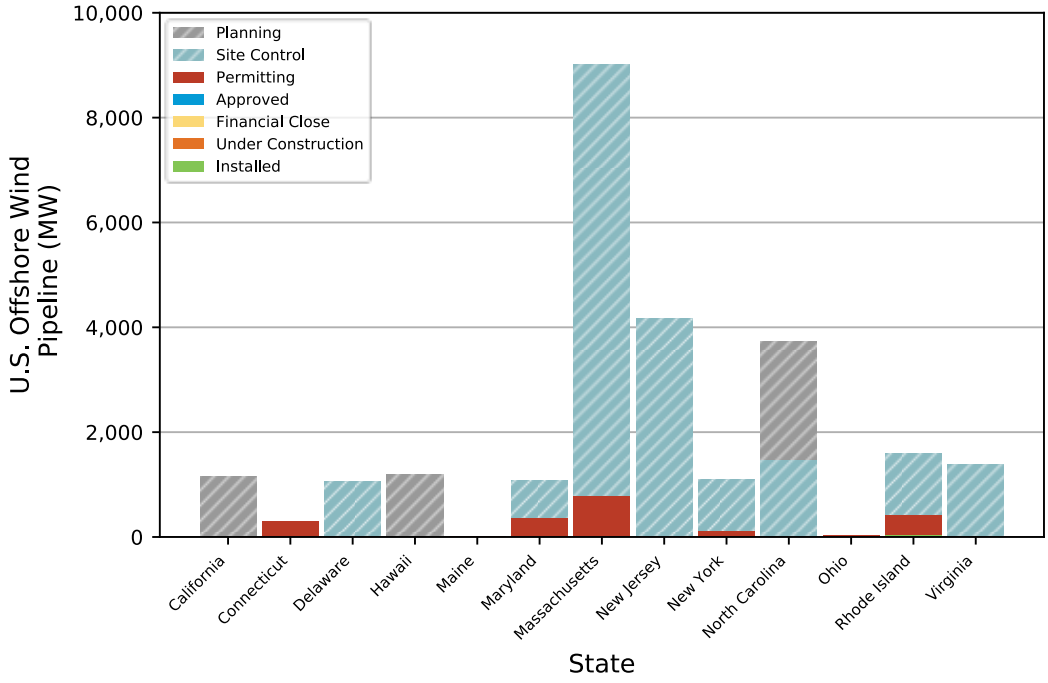

Figure 3. U.S. project pipeline by state[15]

[14] Offshore wind potential estimates are made with a significant amount of uncertainty. Uncertainty comes from future market demand, assumed density function, and regulatory proceedings.

[15] The location of the project is defined by where the project's power is sold to. If the project does not have an offtake agreement, the location is the project's physical location. This clarification is needed for projects located in a state's WEA that sells their power to a neighboring state market.

All of the 25,824 MW that make up the U.S. offshore wind pipeline in the United States are itemized as an individual project or project opportunity in Table 3, and in the maps shown in Figures 4, 5, and 6, corresponding to the eastern Atlantic Coast (and Great Lakes[16]), California Coast, and Hawaii, respectively.

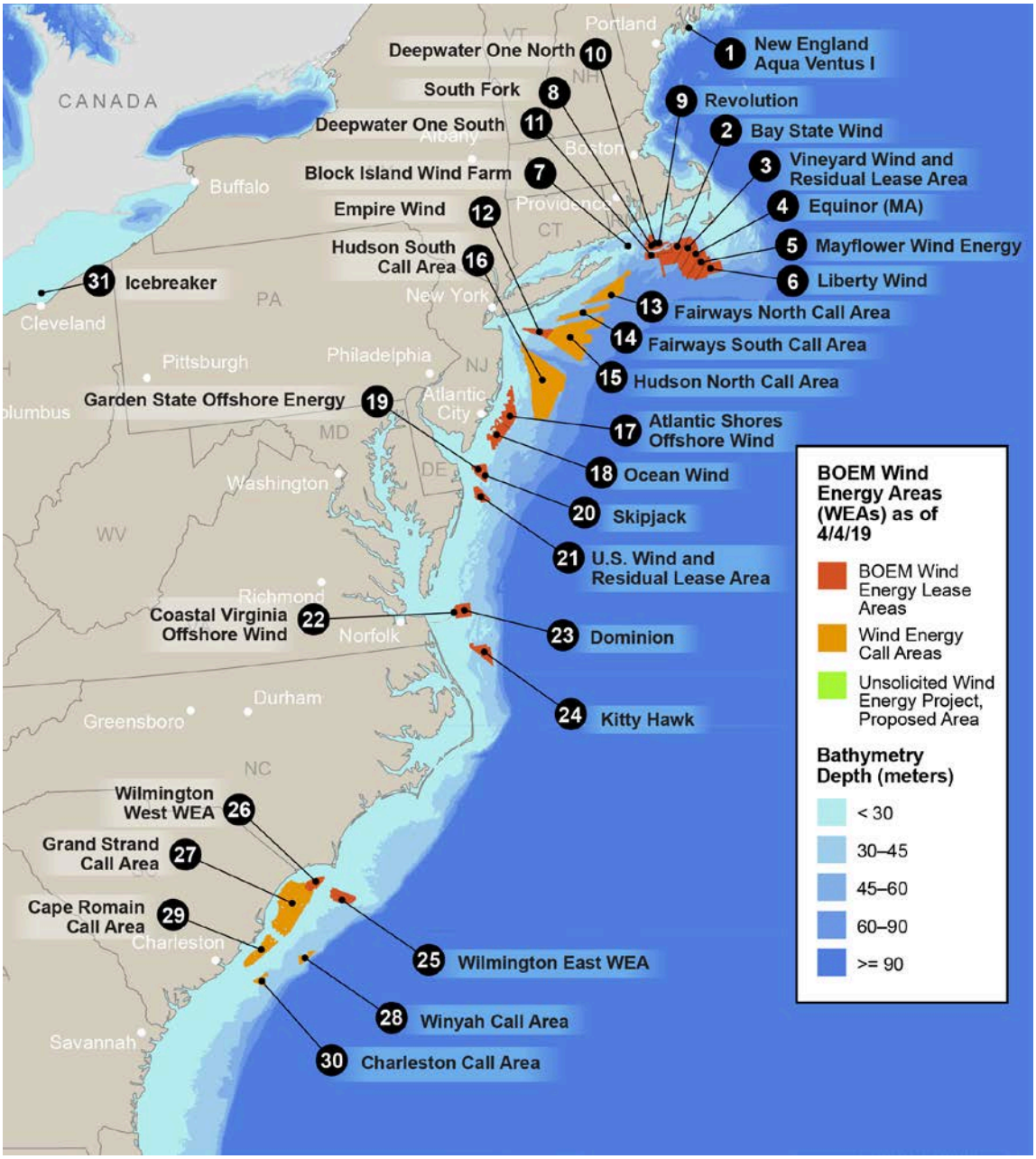

Figure 4. Locations of U.S. Atlantic Coast offshore wind pipeline activity and Call Areas as of March 2019.
Map provided by NREL

[16] Please note the Great Lakes are outside BOEM's jurisdiction.

Most activity is concentrated in the North Atlantic region (Figure 4), but the pipeline activities extend to the Pacific, Great Lakes, and South Atlantic regions. Although there is interest in offshore wind development in the Gulf of Mexico, proposed projects and leasing activities have remained inactive since 2014.

In addition, Table 3 includes 13 Call Areas[17] that are located in three regions, but the capacity of the Call Areas is not calculated or counted in the total pipeline capacity because Call Areas are too preliminary and likely to change in size and location. In total, there are 41 sites in the United States (as shown on the maps) where there is significant offshore wind development activity. The 25,824 MW of pipeline activity comprises

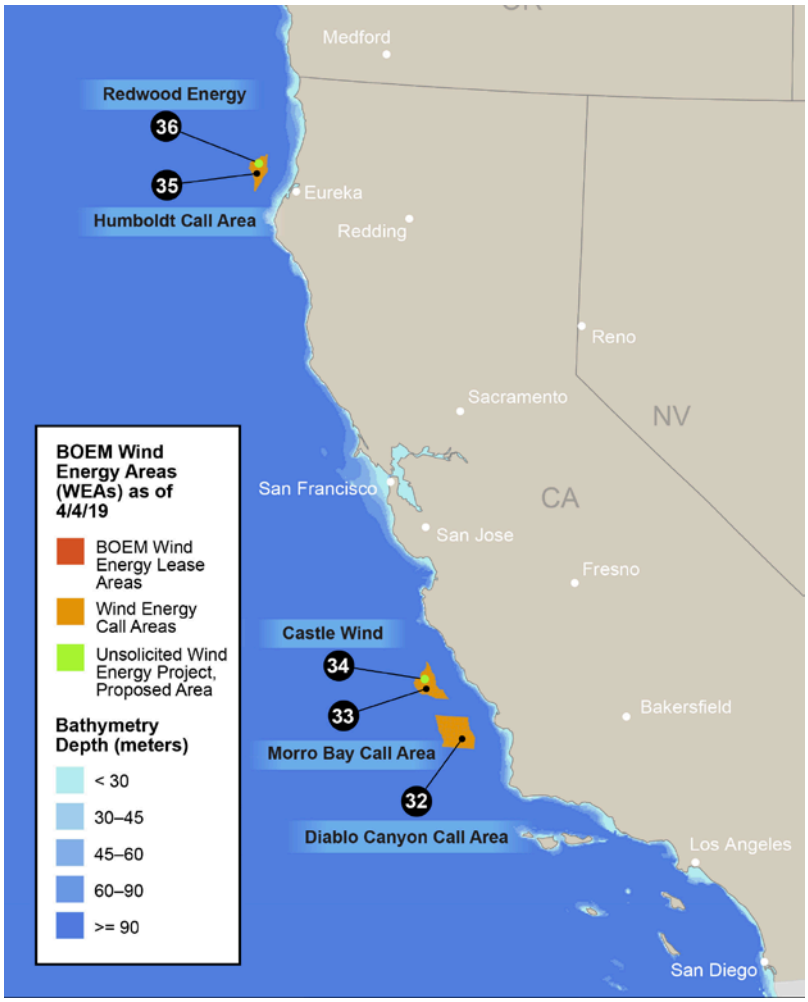

Figure 5. Locations of U.S. West Coast offshore wind pipeline activity and Call Areas as of March 2019.
Map provided by NREL

one operating project (Block Island Wind Farm), nine projects at the permitting phase with an offtake strategy, 15 lease areas with exclusive site control, two unleased WEAs, and five projects (all Pacific-based) that have submitted unsolicited applications to BOEM (BOEM 2019c, 2019d). The pipeline has three projects located in state waters, including the operating Block Island Wind Farm in Rhode Island, New England Aqua Ventus I in Maine, and the Lake Erie Energy Development Corporation (LEEDCo) Icebreaker project located in Lake

[17] BOEM periodically issues calls for information and nominations (Call Areas) to obtain public and developer feedback on what ocean areas may be suitable for future commercial offshore wind development.

Erie, just north of Cleveland. Both Aqua Ventus and Icebreaker were originally funded under the DOE Advanced Technology Demonstration Project program, which began in 2012 (DOE 2019). As a result, they have advanced further in the permitting process than many other projects, having acquired most site approvals from their respective states and establishing reasonable pathways to finalize their PPAs.

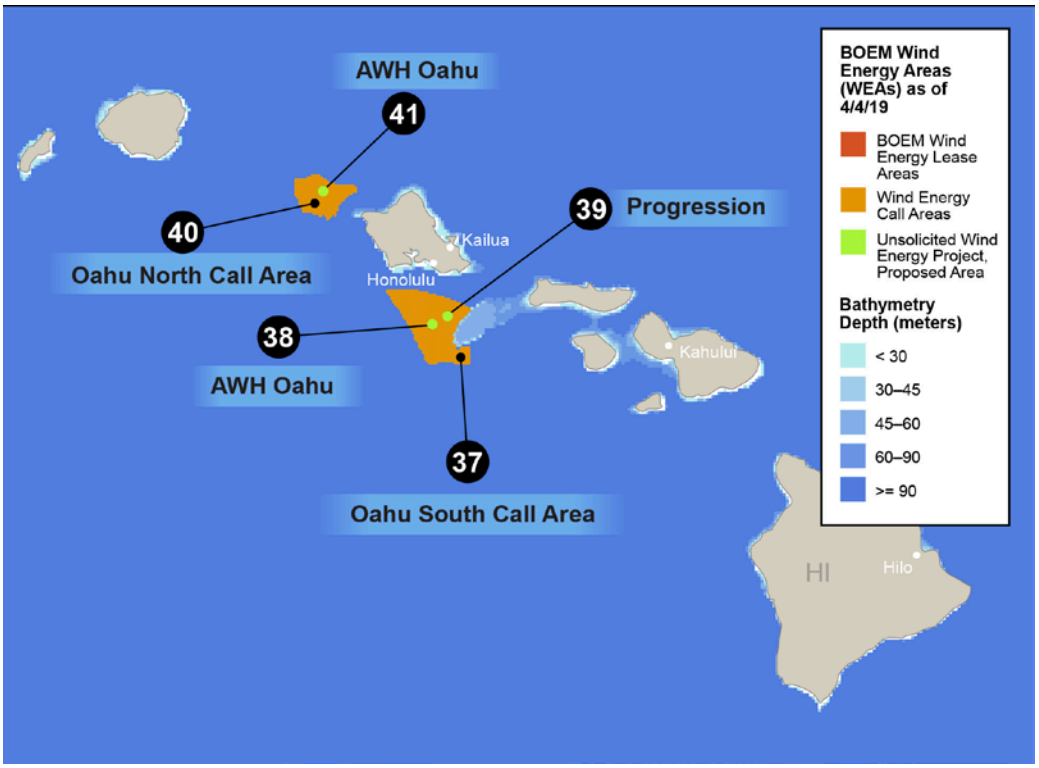

Figure 6. Locations of Hawaiian offshore wind pipeline activity and Call Areas as of March 2019.
Map provided by NREL

Table 3. 2018 U.S. Offshore Wind Pipeline

#	Location[1]	Project Name[2]	Status	COD[3]	Announced Capacity (MW)[4]	Lease Area Potential (MW)[5]	Pipeline Capacity (MW)[6]	Lease Area	Size (km^2)[7]	Offtake (MW)	Developer(s)
1	ME	New England Aqua Ventus I	Permitting	2022	12	0	12	State Lease	9	ME-12	Aqua Ventus
2	MA	Bay State Wind	Site Control	-	0	2,277	2,277	OCS-A 0500	759	TBD	Ørsted/Eversource
3	MA	Vineyard Wind + Residual[8]	Permitting	2023	800	1,225	2,025	OCS-A 0501	675	MA-800	Avangrid/CIP
4	MA	Equinor (MA)	Site Control	-	0	1,564	1,564	OCS-A 0520	521	TBD	Equinor
5	MA	Mayflower Wind Energy	Site Control	-	0	1,547	1,547	OCS-A 0521	516	TBD	EDPR/Shell
6	MA	Liberty Wind	Site Control	-	0	1,607	1,607	OCS-A 0522	536	TBD	Avangrid/CIP
7	RI	Block Island Wind Farm	Installed	2016	30	0	30	State Lease	10	RI-30	Ørsted/Eversource
8	RI	South Fork	Permitting	2022	130	0	130	OCS-A 0486	395	NY-130	Ørsted/Eversource
9	RI	Revolution	Permitting	2023	700	0	700	OCS-A 0486		CT-300 RI-400	Ørsted/Eversource
10	RI	Deepwater ONE North	Site Control	-	0	355	355	OCS-A 0486		TBD	Ørsted/Eversource
11	RI	Deepwater ONE South	Site Control	-	0	816	816	OCS-A 0487	272	TBD	Ørsted/Eversource
12	NY	Empire Wind	Site Control	-	0	963	963	OCS-A 0512	321	TBD	Equinor
13	NY	Fairways North	BOEM Call Area	-	-	-	-	N/A	-	-	-
14	NY	Fairways South	BOEM Call Area	-	-	-	-	N/A	-	-	-
15	NY	Hudson North	BOEM Call Area	-	-	-	-	N/A	-	-	-
16	NY	Hudson South	BOEM Call Area	-	-	-	-	N/A	-	-	-
17	NJ	Atlantic Shores Offshore Wind	Site Control	-	0	2,226	2,226	OCS-A 0499	742	TBD	EDF/Shell
18	NJ	Ocean Wind	Site Control	-	0	1,947	1,947	OCS-A 0498	649	TBD	Ørsted
19	DE	Garden State Offshore Energy	Site Control	-	0	1,050	1,050	OCS-A 0482	284	TBD	Ørsted
20	DE	Skipjack	Permitting	2023	120	0	120	OCS-A 0519	107	MD-120	Ørsted
21	MD	US Wind + Residual[8]	Permitting	2023	248	718	966	OCS-A 0490	322	MD-248	US Wind
22	VA	Coastal Virginia Offshore Wind	Permitting	2022	12	0	12	OCS-A 0497	9	VA-12	Ørsted/Dominion Energy
23	VA	Dominion	Site Control	-	0	1,371	1,371	OCS-A 0483	457	TBD	Dominion Energy
24	NC	Kitty Hawk	Site Control	-	0	1,485	1,485	OCS-A 0508	495	TBD	Avangrid
25	NC	Wilmington East WEA	Unleased[9]	-	0	1,623	1,623	N/A	209	-	-
26	NC	Wilmington West WEA	Unleased[9]	-	0	627	627	N/A	541	-	-
27	SC	Grand Strand	BOEM Call Area	-	-	-	-	N/A	-	--	-
28	SC	Winyah	BOEM Call Area	-	-	-	-	N/A	-	-	-
29	SC	Cape Romain	BOEM Call Area	-	-	-	-	N/A	-	-	-
30	SC	Charleston	BOEM Call Area	-	-	-	-	N/A	-	-	-
31	OH	Icebreaker	Permitting	2022	21	0	21	State Lease	10	OH-21	LEEDCo/Fred Olsen
32	CA	Diablo Canyon	BOEM Call Area	-	-	-	-	-	-	-	-
33	CA	Morro Bay	BOEM Call Area	-	-	-	-	-	-	-	-
34	CA	Castle Wind	Unsolicited Project Application	-	0	1,000	1,000	N/A	334	TBD	Trident Winds/EnBW
35	CA	Humboldt	BOEM Call Area	-	-	-	-	-	-	-	-
36	CA	Redwood Energy	Unsolicited Project Application	-	0	150	150	N/A	50	TBD	EDPR/PPI
37	HI	Oahu South	BOEM Call Area		-	-	-	-	-	-	-
38	HI	AWH Oahu South	Unsolicited Project Application	-	0	400	400	N/A	133	TBD	AW Wind
39	HI	Progression	Unsolicited Project Application	-	0	400	400	N/A	133	TBD	Progression Wind
40	HI	Oahu North	BOEM Call Area	-	-	-	-	-	-	-	-
41	HI	AWH Oahu North	Unsolicited Project Application	-	0	400	400	N/A	133	TBD	AW Wind
Total					**2,073 MW**	**23,751 MW**	**25,824 MW**				

1. Location refers to physical location of the project. The offtake column identifies where the project sells its power and other attributes.
2. Some project names may change based on successful bids to state procurement solicitations
3. Future commence operation dates are subject successfully negotiating offtake agreement and may change
4. Announced capacity describes the size of a project as stipulated by a developer to regulators
5. Lease Area Potential describes the potential capacity that could be installed in a lease area using a 3MW/km^2 density
6. Pipeline capacity represents the lease area potential minus any developer announced capacity
7. Sizes for Unsolicited Project Applications are likely to change during stakeholder and regulatory review processes and may be eliminated in the future
8. Lease areas can often accommodate multiple projects or project phases built incrementally. The "+ Residual" refers to remaining space in the lease area that may be utilized in the future
9. The two Wind Energy Areas in North Carolina have currently not been leased by BOEM

2.2.2 U.S. Offshore Wind Market Forecasts to 2030

Figure 7 is a compilation of three independent industry forecasts for offshore wind deployment in the United States for the period extending to the year 2030. These estimates were developed by BNEF (2018b), 4C Offshore (2018), and University of Delaware's SIOW (2019),[18] respectively. Combined, they illustrate the degree of expected market growth and the possible variability associated with the year, size, and location of future projects.

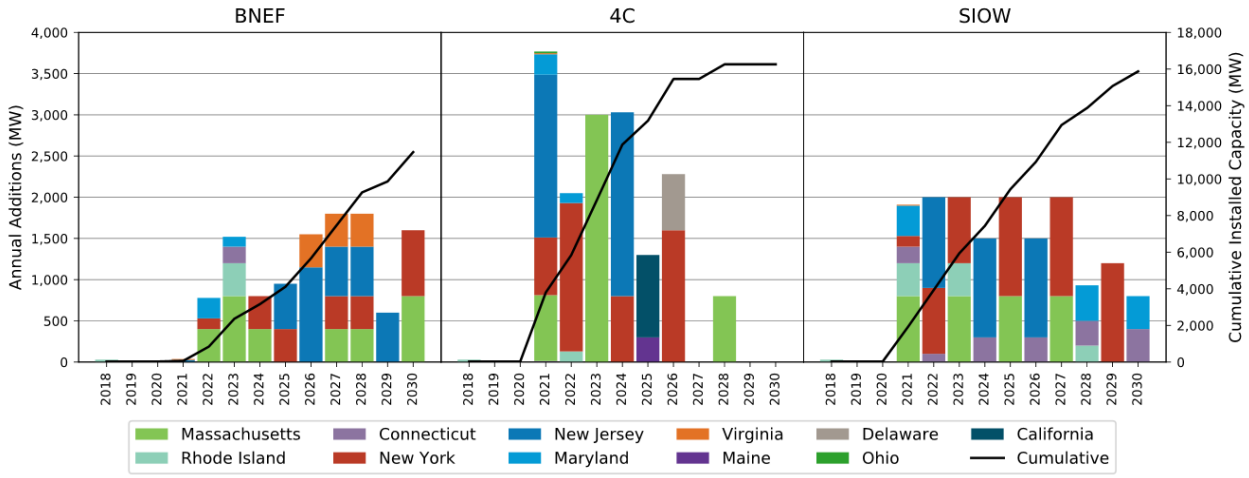

Figure 7. U.S offshore wind market forecasts (annual additions–left axis) (cumulative capacity through 2030–right axis)

The forecasts estimate that the U.S. offshore wind market will cumulatively deploy between 4 and 13 GW by 2025, and 11 and 16 GW by 2030. All three forecasts agree that the U.S. market has the potential to be greater than 10 GW by 2030, but the size and speed of build-out are likely to be impacted by regulatory uncertainty, availability of installation vessels and port infrastructure, land-based grid planning and upgrades, and evolving market demand. All forecasts predict the majority of future offshore wind deployment out to 2030 will occur on the East Coast in states with currently existing or planned offshore wind procurement goals. Only 4C Offshore's forecast includes commercial-scale floating projects by 2030: one on the West Coast off California, and one off the state of Maine.

The main factor causing variability in the forecasts is uncertainty regarding state policy as well as the size and regularity of future procurements beyond state-level solicitations that have already been announced. Other significant factors include potential problems acquiring project financing, vessel availability, cost reduction challenges, problems with environmental and geotechnical surveys, and unexpected issues with competing ocean uses. The forecasts likely assume the creation of new offshore wind lease areas to fully support state procurement targets, but this is not stated explicitly. For example, New York's 9-GW-by-2035 target may necessitate obtaining capacity from neighboring WEAs in states like Rhode Island, Massachusetts, and New Jersey, and establishing new lease areas. As such, there has been much speculation over the four Call Areas in the New York Bight but at this time it is not known if or when BOEM will propose new WEAs (BOEM 2019b).

[18] Please note University of Delaware's Special Initiative for Offshore Wind forecast is based on the expected date a state selects to procure offshore wind capacity. A 3-year time lag is assumed from the time the procurement occurs until the project becomes fully operational.

2.3 Regulatory Activity

2.3.1 Lease Activity

Acquiring exclusive rights to develop a lease area in federal waters (where most lease areas are located) is the first fundamental step toward building an offshore wind project in the United States. Market consolidation was a major trend in 2018, driven by international developers purchasing the assets of smaller U.S. companies. Although construction for commercial projects has not yet begun in earnest, approximately $1.39 billion was exchanged in the United States this year in gross revenue involving lease areas and corporate acquisitions:

- In April 2018, Ørsted asked BOEM to reassign 107 km^2 in the southern portion of lease area OCS-A 0482 (Garden State Ocean Energy) in Delaware to the Skipjack project. Skipjack now has its own lease area: OCS-A 0519.
- In December 2018, Atlantic Shores Offshore Wind, a partnership between Électricité de France Renouvelables (EDF) and Shell New Energies, bought lease area OCS-A 0499 from US Wind for $215 million pending regulatory approval (offshoreWIND.biz 2018a).
- In November 2018, Ørsted completed the acquisition of Deepwater Wind's offshore assets including their lease areas for a reported $510 million (Ørsted 2018).
- In February 2019, Ørsted sold a partial ownership stake for $225 million in some of their newly acquired Deepwater projects to Eversource Energy, a utility serving Connecticut, Rhode Island, and Massachusetts (Eversource Energy 2019).

Another major market trend in 2018 was an increase in offshore lease area prices, as demonstrated in BOEM's sale of three offshore wind lease areas in the Massachusetts WEA. Each lease area sold for at least $135 million. The lease areas had previously been up for auction in January 2015 but did not receive any bids. The results of this auction are shown in Table 4.

Table 4. BOEM's Massachusetts Offshore Wind Auction Results from December 2018

State	Lease Area	Auction Date	Provisional Winner	Winning Bid	Size (km^2)	Lease Area Potential
MA	OCS-A 0520	12/14/18	Equinor	$135,000,000	521	1,564 MW
MA	OCS-A 0521	12/14/18	Mayflower Wind Energy	$135,000,000	516	1,547 MW
MA	OCS-A 0522	12/14/18	Vineyard Wind	$135,100,000	536	1,607 MW

In aggregate, the three lease areas in Massachusetts have the potential to support at least 4.7 GW of new capacity. Figure 8 shows the overall trend of increasing lease sale prices in the United States since 2013, on the basis of $/km^2.

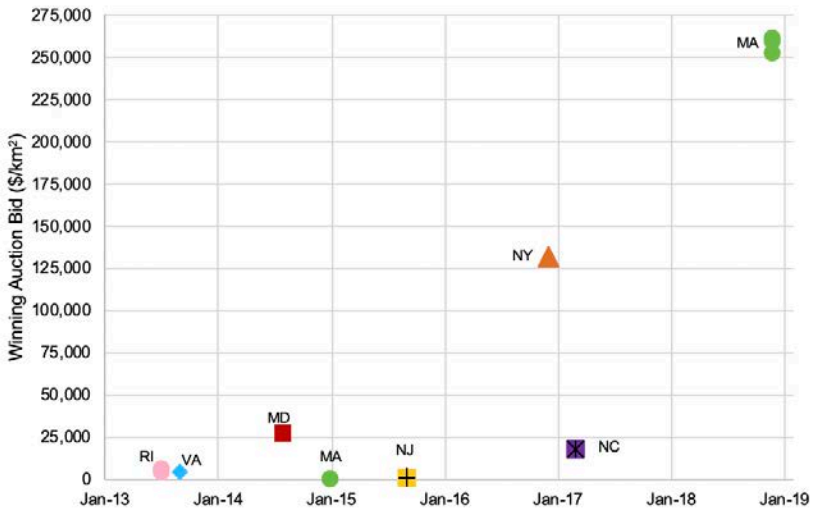

Figure 8. U.S. offshore wind lease sale prices to date by year

Notably, the winning auction bid price of $135 million surpassed the previous record-winning sale price of $42.4 million in Equinor's 2016 acquisition of the New York lease area. Not surprisingly, the highest-priced leases were in states with both proposed and implemented offshore wind offtake policies (e.g., Massachusetts, New York, Maryland, and Massachusetts) in 2018.

Although increased lease sale prices may be a signal that the offshore wind market is maturing and the bankability of future projects is increasing, it may also offset some expected (or required[19]) project price reductions and could increase the delivery price of a project's electricity. As an example, NREL calculated that recent Massachusetts lease sale prices could increase the levelized cost of energy (LCOE) for a hypothetical 800-MW project by about 5% relative to U.S. projects that acquired lease areas prior to 2016.

2.3.2 New Area Identification

BOEM periodically publishes Calls for Information and Nominations to assess commercial competitive interest for offshore wind development on specific parcels of ocean acreage in federal waters. The information gathered during these calls is used by BOEM in conjunction with other stakeholder input to identify future WEAs and subsequent lease area auctions. A Call Area is a precursor to a defined wind energy area, but not all Call Areas become wind energy areas, and they are typically modified (reduced in size) to address stakeholder input. In 2015, BOEM issued calls for four areas in federal waters off South Carolina and in 2016 issued calls for two areas off the Hawaiian island of Oahu (BOEM 2019d). There are currently 13 Call Areas for offshore wind today in the United States. Table 5 lists the seven newest Call Areas created by BOEM in 2018, including four in New York and three in California. These can also be found on the maps in Figures 4 and 5, and in Table 3 (BOEM 2019b, 2019c).

Table 5. 2018 BOEM Offshore Wind Call Areas

State	Name	Call Period
NY	Fairways North Call Area	4/11/2018–7/30/2018
NY	Fairways South Call Area	4/11/2018–7/30/2018
NY/NJ	Hudson North Call Area	4/11/2018–7/30/2018

[19] Some states, such as Massachusetts, have procurement policies that mandate that project prices in future solicitations must be lower than previous project prices to require a downward cost trend.

NY/NJ	Hudson South Call Area	4/11/2018–7/30/2018
CA	Humboldt Call Area	10/19/2018–1/28/2019
CA	Morro Bay Call Area	10/19/2018–1/28/2019
CA	Diablo Canyon Call Area	10/19/2018–1/28/2019

2.3.3 Stakeholder Engagement

The offshore wind industry in the United States continues to look for strategies to responsibly develop projects that minimize interference with the environment as well as the following preexisting ocean uses:

- **Fishing**. In cooperation with the Rhode Island Coastal Resources Management Council and local fishermen, Avangrid-Copenhagen Infrastructure Partners (CIP) established a $12.5-million trust fund to compensate fishermen who may be negatively impacted[20] by Vineyard Wind's construction (Rhode Island Coastal Resources Management Council 2019). The Responsible Offshore Science Alliance has partnered with fishermen, the National Oceanic and Atmospheric Administration (NOAA), Equinor, EDF, Shell, and Ørsted to disseminate salient and credible fisheries data (Froese 2019a). Ørsted partnered with the Responsible Offshore Development Alliance to improve communication between fishermen and their project planners (Saltzberg and Dowd 2019). Equinor and EDF also joined the alliance's Joint-Industry Task Force to ensure fishing and offshore wind development can coexist (Froese 2019b). The Responsible Offshore Development Alliance has also partnered with BOEM, NOAA, the U.S. Coast Guard, and other fishing industry liaisons to ensure that stakeholder concerns and best mitigation practices are incorporated into regulatory review processes. The group conducted multiple workshops in 2019 to minimize potential impacts of offshore wind development on fishermen.

- **Environmental**. Offshore wind construction and operations could potentially impact marine mammals,[21] fisheries, or avian species. Of specific interest in the northeast is the North Atlantic right whale, one of the world's most endangered marine mammals with historical migration routes that transit multiple offshore WEAs. In April 2018, Bay State Wind announced it would provide $2 million in research grants to help protect New England marine mammals (Bay State Wind 2018). In 2019, Equinor partnered with the Conservation Society and Woods Hole Oceanographic Institute to deploy acoustic buoys to better understand whale activities near proposed construction areas (Lillian 2019). Vineyard Wind signed an agreement with the National Wildlife Federation, Natural Resources Defense Council, and Conservation Law Fund to develop a construction strategy that minimizes pile driving and geophysical surveys during North Atlantic right whale migration periods, sets vessel speed limits to minimize marine mammal collision, and adopts new technologies like bubble screens to minimize installation noise (Skopljak 2019a). Vineyard Wind is also accepting proposals from universities and private companies for new passive acoustic monitoring systems to detect when whales are in the vicinity and appropriately pause construction activities to mitigate negative impacts (Skopljak 2019b). LEEDCo continues to work through federal and state regulations to minimize the impact of offshore wind energy on bird and bat species. As a resource for the public, DOE's Tethys database[22] provides users with access to scientific studies that can help developers, regulatory staff, stakeholders, and researchers effectively site renewable projects and employ installation and operations techniques that minimize impact to the environment (DOE 2018). Additional public resources relevant to offshore wind include BOEM's Environmental Science Database (BOEM 2019e), the Northeast Regional Ocean Council Data Portal (NOAA 2019a), and the Mid-Atlantic Ocean Data Portal (NOAA 2019b).

[20] Offshore wind construction may impact the availability of certain fish species or interfere with the ability of fishermen to fish in certain locations.
[21] Underwater noise associated with offshore wind construction (especially pile driving) may impact marine mammal communication and migration.
[22] Please visit DOE's Tethys database at https://tethys.pnnl.gov/.

- **Navigation**. To avoid collisions and entanglement of fishing gear, Vineyard Wind proposed maritime transit corridors through their lease area with the support of BOEM, local stakeholders, and the U.S. Coast Guard (Vineyard Wind 2018d).

- **Military**. As reported in the *2017 Offshore Wind Technologies Market Update*, offshore wind developers, state agencies, the U.S. Department of Defense, and BOEM have been working together to resolve potential offshore wind conflicts with military operations, training, and radar. Areas with military activities and potential offshore wind development include California, Hawaii, New York, Delaware, Maryland, North Carolina, and South Carolina. These discussions are continued in 2018 and are likely to remain active in the foreseeable future.

2.4 U.S. Offshore Wind Project Offtake and Policy Assessment

2.4.1 Project Offtake Agreements

In addition to obtaining site control and regulatory approval, negotiating an offtake agreement to sell the electricity and other possible clean power attributes (e.g., offshore renewable energy credits [ORECs]) is one of the three crucial steps to developing a bankable project. In the United States, each state has unique procurement targets and uses different mechanisms to negotiate the duration and terms of buying an individual project's electrical generation from a developer.[23] Eight offtake agreements have been signed for seven U.S. projects and two projects are in the process of negotiating terms with electric distribution companies, as shown in Table 6. (Note that Revolution is one project but is selling power to two different states.)

Table 6. U.S. Offshore Wind Offtake Agreements as of June 10, 2019

Project	Offtake State	Offtake Mechanism	Public Utility Commission Approved	Offtake Mechanism Price	Description
Block Island Wind Farm	RI	PPA	Yes	$244/MWh	In 2014, Deepwater Wind signed a 20-year PPA with National Grid for $244/MWh, with a 2.5% annual escalator.
South Fork	NY	PPA	Yes	Undisclosed	In 2017, Deepwater Wind signed a 20-year PPA with Long Island Power Authority for 90 MW at an undisclosed price. In 2019, Long Island Power Authority executed an amendment in the PPA to increase the offtake agreement to 130 MW.
US Wind	MD	MD ORECs	Yes	$131.92/MWh	In 2017, Maryland awarded US Wind ORECs[24] for 248 MW of capacity for 20 years. Each year, 913,945 ORECs will be sold. The levelized OREC price is $131.94/MWh.
Skipjack[25]	MD	MD ORECs	Yes	$131.92/MWh	In 2017, Maryland awarded Skipjack ORECs for 120 MW of capacity for 20 years. Each year, 455,482 ORECs will be sold. The levelized OREC price is $131.94/MWh.
Vineyard Wind	MA	PPA	Yes	$74/MWh $65/MWh	In 2018, Vineyard Wind signed two 400-MW PPAs with Massachusetts utilities for 20 years. The levelized first-year prices of the PPAs were $74/MWh (2022$) and $65/MWh (2023$), respectively.
Coastal Virginia Offshore Wind	VA	Utility Owned	Yes	$780/MWh[26]	In 2018, Virginia regulators approved Dominion/Ørsted to construct a 12-MW demo project. The estimated levelized cost of energy is $780/MWh.

[23] As shown in Table 6, some of the most common offtake agreement types are PPAs; legal contracts where a developer sells a project's power and other attributes to a buyer for a specified price and term; offshore renewable energy credits, in which each credit represents 1 MWh of energy and other attributes generated from an offshore wind energy project; and utility owned, wherein an offshore wind project is fully owned by a utility and sells power directly to utility customers.

[24] Each OREC represents 1 MWh of offshore wind generation and is a remuneration mechanism for the environmental attributes of offshore wind generation.

[25] Note that Skipjack is both a lease area and a project.

[26] Please note the levelized price for Coastal Virginia Offshore Wind is significantly higher than other projects because it is a demonstration project and is unable to leverage economies of scale.

Project	Offtake State	Offtake Mechanism	Public Utility Commission Approved	Offtake Mechanism Price	Description
Revolution Wind	CT	PPA	Yes	$94/MWh	In 2018, Ørsted signed a 20-year PPA with Eversource and United Illuminating for 200 MW, with a levelized PPA price of approximately $94/MWh. Ørsted has been approved to start negotiations on an additional 100 MW.
Revolution Wind	RI	PPA	Yes	$98.43/MWh	In 2019, Ørsted signed a 20-year PPA with National Grid for 400 MW. The proposal was approved by the Public Utility Commission, and the all-in price is $98.43/MWh.
Icebreaker	OH	PPA	Pending	TBD	LEEDCo is working to secure offtake with multiple partners for the project's electricity.
Aqua Ventus I	ME	PPA	Pending	TBD	Aqua Ventus I is negotiating a PPA with Central Maine Power.

2.4.2 State Policies

The U.S. offshore wind market continues to be driven by an increasing amount of state-level offshore wind procurement activities and statutory policies. In aggregate, these activities now call for the deployment of 19,968 MW of offshore wind capacity by 2035, almost four times the aggregate state-level targets identified at the end of 2017. These commitments are shown in Table 7.

Note that the states that have adopted offshore wind energy policies listed in Table 7 may not have their own offshore wind resources. For several projects (e.g., Revolution, Skipjack, South Fork), deployment is being planned in a WEA adjacent to the state[27] that will receive the power, generally at a location where the most favorable PPAs can be negotiated. The primary requirement is that the project is close enough to the onshore injection point to avoid prohibitive costs for the export cables.

Table 7. Current U.S. Offshore Wind State Policies and Activity as of June 10, 2019

State	2018 Capacity Commitment[28] (MW)	Offshore Wind Solicited (MW)	Contract Type	Target Year	Statutory Authority	Year Enacted	RPS Goal[29]	State RPS Year
MA	**1,600**	1600	PPA	2027	An Act to Promote Energy Diversity (H.4568)	2016	35%	2030
	1,600[30]	-	PPA	2035	An Act to Advance Clean Energy (H.4857)	2018		
RI[31]	**400**	400	PPA	-	-	-	31%	2030
NJ	**3,500**	1,100	OREC	2030	Executive Order 8 AB No. 3723	2018	50%	2030
MD	**368**[32]	368	OREC	2030	Maryland Offshore Wind Energy Act	2013	24%	2020
	400	-	OREC	2026		2019		

[27] For example, the Phase 1 New York offshore wind solicitation allows generators to interconnect with other markets (PJM Interconnection or ISO New England), as long as the power can be sold into the New York control area.
[28] State commitments in this table are listed incrementally and are additive (e.g., New York has a 9,000 MW goal by 2035).
[29] RPS goals are often staged over time; for this table, only the nearest-term RPS goal is included for simplification purposes.
[30] H.4857 authorized Massachusetts Department of Energy Resources to consider an additional 1,600 MW procurement by 2035. On May 31, 2019, the Department of Energy Resources said it would use the authorization and hold ~800-MW solicitations in 2022 and 2024, and in 2026, if needed.
[31] Rhode Island has a strategic goal to increase the state's clean energy to 1,000 MW by 2030. However, the state has no offshore-wind-specific statutory requirement or goal.
[32] The Maryland Offshore Wind Energy Act of 2013 limits an offshore wind RPS carve-out to 2.5% of total retail electric sales in state. This proportional goal corresponds to the OREC award on May 11, 2017, for 368 MW awarded to Skipjack Offshore Energy (120 MW) and US Wind (248 MW). (Total retail electric sales in Maryland were 59,303,885 MWh in 2017 [Energy Information Administration 2019]).

	400	-		2028	Senate Bill 516[33]			
	400	-		2030				
NY	**2,400**	930[34]	OREC	2030	Case 18-E-0071 Order Establishing Offshore Wind Standard and Framework for Phase 1 Procurement	2018	50%	2030
	6,600	-	TBD	2035	Climate Leadership and Community Protection Act	2019		
CT	**300[35]**	300	PPA	2020	House Bill 7036 (Public Act 17-144)	2017	44%	2030
	2,000	-	TBD	2030	House Bill 7156[36]	2019		
VA	-	12	Utility Owned	2028	Virginia Energy Plan	TBD	-	-
TOTAL	**19,968 MW**	**4,710 MW**						

In April 2018, New Jersey increased its RPS goal to 50% by 2030 and its offshore wind goal from 1,100 MW to 3,500 MW by 2030 (New Jersey State Legislature 2018). In August 2018, Massachusetts passed new legislation to increase its offshore wind procurement goal from 1,600 MW by 2027 to 3,200 MW[37] by 2035 (Commonwealth of Massachusetts 2018). In October 2018, Virginia published a state energy plan that proposed an offshore wind target of 2,000 MW by 2028 (BVG Associates 2018a).[38] In January 2019, New York's Governor Cuomo increased the state's offshore wind goal to 9,000 MW by 2035 (New York State 2019a), which was codified into law in the *Climate Leadership and Community Protection Act* in June 2019 (New York State 2019b). Maryland also passed legislation in April 2019 to mandate the deployment of an additional 1,200 MW of offshore wind by 2030 (Maryland General Assembly 2019). In June 2019, Connecticut passed new legislation to procure 2,000 MW of offshore wind capacity by 2030 (Connecticut General Assembly 2019).

To meet their committed procurement targets, multiple states issued solicitations for commercial projects in 2018, and executed significant planning around future solicitations including the following:

- In New York, NYSERDA issued a solicitation for approximately 800 MW of capacity worth of ORECs. Bids were due February 19, 2019, and NYSERDA announced that Atlantic Shores Offshore Wind (EDF/Shell), Empire Wind (Equinor), Liberty Wind (Avangrid/CIP), and Sunrise Wind (Ørsted and Eversource) all responded to the solicitation. Winners are expected to be announced in spring 2019.

- New Jersey issued a solicitation for 1,100 MW of ORECs that was open from September 20 to December 28, 2018. Three developers responded to the solicitation: Board Walk Wind (Equinor), Atlantic Shores Offshore Wind (EDF/Shell), and Ocean Wind (Ørsted). The Board of Public Utilities (BPU) is expected to announce a winner by summer 2019.

- NYSERDA plans to have another 800-MW solicitation in 2019 (NYSERDA 2019).

- The New Jersey BPU also announced plans for two additional solicitations for 1,200 MW in 2020 and 2022 (New Jersey BPU 2019).

[33] Maryland legislature passed SB516 May 25, 2019. It mandates the procurement of 400 MW by 2026, 800 MW by 2028, and 1,200 MW by 2030.
[34] Long Island Power Authority solicited 90 MW for the South Fork project in 2017. The project size was later increased to 130 MW. NYSERDA solicited 800 MW in 2018.
[35] Public Act 17-144 limits authority to procure offshore wind to 3% of Connecticut electric distribution companies' total electric, which corresponds to approximately 200 MW. The other 100 MW come from technology-neutral auctions.
[36] CT House Bill 7156 was signed into law June 10, 2019. It requires Connecticut to procure 2,000 MW by 2030 and DOE and Environmental Protection to issue a solicitation by June 24, 2019.
[37] Note the additional 1,600 MW is at the discretion of the Massachusetts Department of Energy Resources, so the ultimate procurement target could change.
[38] The state energy plan recommends 2,000 MW and is awaiting action from the governor.

- Maryland's new offshore wind procurement legislation requires the state to procure 400 MW by 2026, 800 MW by 2028, and 1,200 MW by 2030 (Maryland General Assembly 2019).

- Massachusetts Department of Public Utilities issued its second offshore wind solicitation on May 27, 2019, to meet the state's 1,600-MW-by-2027 goal. The request for proposals asks developers to submit plans for designs between 400 and 800 MW (Massachusetts Department of Energy Resources 2019a). Bids are due by August 9, 2019.

- The Massachusetts Department of Energy Resources conducted an offshore wind study to investigate the necessity, benefits, and costs of requiring Massachusetts's electric distribution companies[39] to conduct additional offshore wind generation solicitations of up to 1,600 MW. The agency found that the additional capacity was in the best interest of the state and announced it will hold additional solicitations for up to 800 MW of offshore wind in 2022 and 2024, and if necessary to meet the 1,600 MW target, in 2026 (Massachusetts Department of Energy Resources 2019b).

2.5 U.S. Infrastructure Trends

2.5.1 Vessels and Logistics

A lack of specialized, U.S.-flagged offshore wind installation vessels and limitations imposed by the Jones Act[40] continues to be a potential bottleneck for the nascent U.S. offshore wind industry. As reported in past market reports, multiple marine engineering companies (e.g., Gusto MSC, Zentech, AK Suda) have drafted designs and conducted cost studies for U.S.-flagged installation vessels, but no offshore installers publicly announced construction of a new vessel in 2018. The only known vessel development in 2018–2019 was Ørsted entering into partnership with WindServe Marine to construct two crew transfer vessels—one in North Carolina and the other in Rhode Island—for use at the Coastal Virginia Offshore Wind and Revolution Wind projects (Foxwell 2019). The lack of specialized U.S.-flagged installation and support vessels will likely prompt initial commercial-scale projects to use foreign-flagged installations vessels and U.S.-flagged feeder barges.

2.5.2 Ports and Harbors

Although no investments have been made for U.S.-flagged offshore wind installation vessels, developers and state bodies have started to make investments in port infrastructure to make sure there are sufficient cranes and laydown space required for large-scale commercial projects. There are a number of ports in the United States that are potentially suitable for offshore wind construction, staging, and assembly. The few ports that have made recent infrastructure investments to upgrade and prepare for the first wave of projects are listed in Table 8. Going forward, this list is expected to grow.

Table 8. Ports with Recent Investments for the U.S. Offshore Wind Industry

State	Location	Description	Offshore Wind Projects
MA	Port of New Bedford	Vineyard Wind is leasing the New Bedford Commerce Terminal for 18 months as the primary staging and deployment base for its 800-MW project (Mass Live 2018).	Vineyard Wind
MA	Brayton Point	Anabaric and Commercial Development Company signed an agreement to invest $650 million into Brayton Point's Commerce Center to create an offshore wind hub that has a 1.2-GW high-voltage direct-current converter, 400-MW battery storage, and additional wind turbine component laydown space.	Multiple in MA and RI

[39] Electric distribution companies are regulated entities that purchase wholesale energy and sell it to retail customers.
[40] The Jones Act prohibits the maritime shipment of merchandise and passengers between two points in the United States by any vessel that is not U.S.-flagged (domestically manufactured, owned, and operated). For offshore wind development, this means foreign-flagged turbine installation vessels are unable to carry turbine components from a U.S. port to a construction site in U.S. waters.

CT	New London	Ørsted, the Connecticut Port Authority, and Gateway will invest $93 million in the State Pier at New London to expand the laydown space, increase its heavy-lift capacity, and add other features necessary for large-scale offshore wind development activities. Ørsted will lease rights to use the pier for 10 years.	Revolution Wind
MD	Tradepoint Atlantic (Formerly Sparrow Point)	In 2017, US Wind and Deepwater Wind agreed to invest $115 million in new manufacturing and port infrastructure.	US Wind and Skipjack

The development and timing of port infrastructure could become a significant bottleneck for the industry. This may be especially true as wind turbines and project sizes continue to grow and put a strain on the capacity of existing infrastructure in terms of heavy lifting, ship access, clearances, channel draft, and physical laydown space. According to a recent McKinsey report, approximately five staging ports will be required to meet the needs for the first 10 GW of offshore wind deployment on the Atlantic Coast alone (Lefevre-Marton et al. 2019).

2.6 Other Regional Developments

Most activity is centered on the WEAs and states that have specific offshore wind procurement activities. The activities highlighted here by region are notable yet were not documented earlier in this report.

2.6.1 North Atlantic

Other offshore wind activities for the North Atlantic region included the following:

- In February 2019, Maine's Governor Janet Mills signed an Executive Order to end a 2018 moratorium on the issuance of offshore wind permits in the state (Mills 2019). The University of Maine is now in the process of renegotiating the Aqua Ventus I PPA for its 12-MW floating demonstration project. If built, this project would likely be the first wind project using floating turbines in the United States.
- In January 2019, New Hampshire's Governor Christopher Sununu requested that BOEM establish an intergovernmental offshore renewable energy task force to coordinate renewable energy activities on the New Hampshire Outer Continental Shelf, including potential commercial leases for offshore wind (Sununu 2019).
- The New Jersey BPU denied EDF's application for 20 years of ORECs for its 24-MW Nautilus demonstration project (formerly known as Fishermen's Energy) (New Jersey BPU 2018). This ends a long process, which began in 2008, to build this offshore wind demonstration project approximately 2.8 miles off the coast of Atlantic City, New Jersey. Ultimately, the project failed because it was unable to demonstrate net-economic benefits, as required under law by the Offshore Wind Economic Development Act.

2.6.2 South Atlantic

Offshore wind activities for the South Atlantic region included the following:

- In September 2018, BVG Associates and the Sierra Club published their *Offshore Wind in Virginia: A Vision* report. This study recommended that the state set a target to support 2 GW of offshore wind development by 2028 and claimed this policy could create thousands of local jobs and make the state an offshore wind hub (BVG Associates 2018a). In 2018, *The Virginia Advantage: The Roadmap for the Offshore Wind Supply Chain in Virginia* assessed the state's port infrastructure and found that five ports could support offshore wind construction and manufacturing activities without significant upgrades (BVG Associates 2018b).
- In March 2019, North Carolina Governor Roy Cooper approved an offshore wind study to assess the state's ability to develop successful ports and manufacturing facilities (Durakovic 2019).

2.6.3 Pacific

Offshore wind activities for the Pacific region included the following:

- In 2018, California passed SB 100 (*100 Percent Clean Energy Act*), committing the state to realizing 100% of its total retail electricity sales from eligible renewable energy and zero-carbon resources by 2045. To comply with this mandate, California will consider the large-scale development of offshore wind. The state's offshore wind technical resource has been determined by NREL to be over 100 GW, and offshore wind deployment scenarios studied suggest that a potential build-out of several gigawatts may be feasible using floating technology. Floating technology is expected to be commercially available by the mid-2020s (Musial et al. 2016, 2017).

- On October 18, 2018, BOEM published a Call for Information and Nominations to gauge interest from prospective floating wind developers in commercial wind energy leases within three proposed areas off central and northern California (BOEM 2019c). The Call Areas are shown in Figure 5 on the central and northern California coasts. All together, these three Call Areas total approximately 2,784 km^2 (687,823 acres), which could potentially deliver a generating capacity of up to 8.4 GW. In response to the call, BOEM received 14 nominations from developers identifying their interest in developing certain portions of the Call Areas. Interested developers include Algonquin Power Fund, Wpd Offshore Alpha, Avangrid Renewables, Castle Wind/Energie Baden-Württemberg AG (EnBW), Cierco Corporation, EDF Renewables, EDP Renewables North America, E.ON Development, Equinor Wind US, Mission Floating Wind, Northcoast Floating Wind, Northland Power America, Redwood Coast Energy Authority, and US Mainstream Renewable Power.

3 Overview of Global Offshore Wind Development

3.1 Global Offshore Wind Market

Following the 2017 deployment of more than 3,500 MW, a record capacity of 5,652 MW new offshore wind was commissioned globally in 2018, as shown in Figure 9. The increase in global capacity can be attributed to a strong increase in deployment from the Chinese market, with 2,652 MW of new Chinese offshore wind capacity coming on line, followed by 2,120 MW commissioned in the United Kingdom, 835 MW in Germany, 28 MW in Denmark, and about 17 MW divided between the rest of Europe and Vietnam. By the end of 2018, the global offshore wind installed capacity grew to 22,592 MW from 176 operating projects. Projections for 2019 indicate greater amounts of new global capacity based on projects currently under construction.

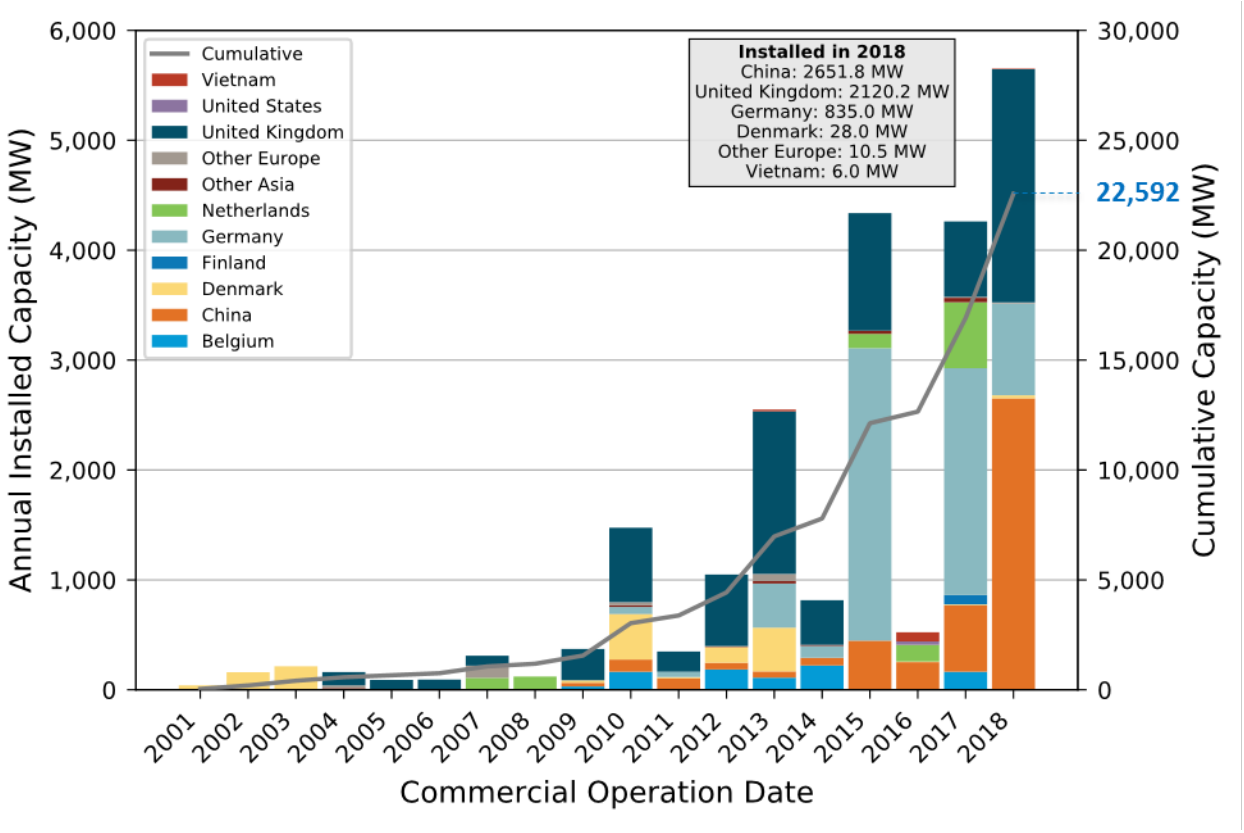

Figure 9. Global offshore wind in 2018 (annual installed capacity–left axis) (cumulative capacity–right axis)

The global offshore wind market is still centered in Europe, with approximately 17,979 MW of installed cumulative capacity. Asia is the second largest regional market, with 4,639 MW, and North America is the third largest market, with only 30 MW of capacity installed today. The OWDB indicates that future market growth will shift toward the Asian and U.S. markets.

Europe's large regional offshore wind market is sustained in part because it has the most transparent national offshore wind procurement schedules, regionally based original equipment manufacturers (OEMs) and installers, mature logistical and manufacturing supply chains, and strong research and development networks to support its development. In addition, Europe has had 28 years of offshore wind experience. However, the Asian offshore wind market may soon surpass the European market in terms of annual capacity additions, driven primarily by China's demand for renewable energy and the motivation to advance the country's domestic manufacturing capabilities. This shift is noticeable in the 2018 annual capacity additions. As shown

in Figure 10, there were three main countries contributing to offshore wind capacity in 2018—China, the United Kingdom, and Germany.

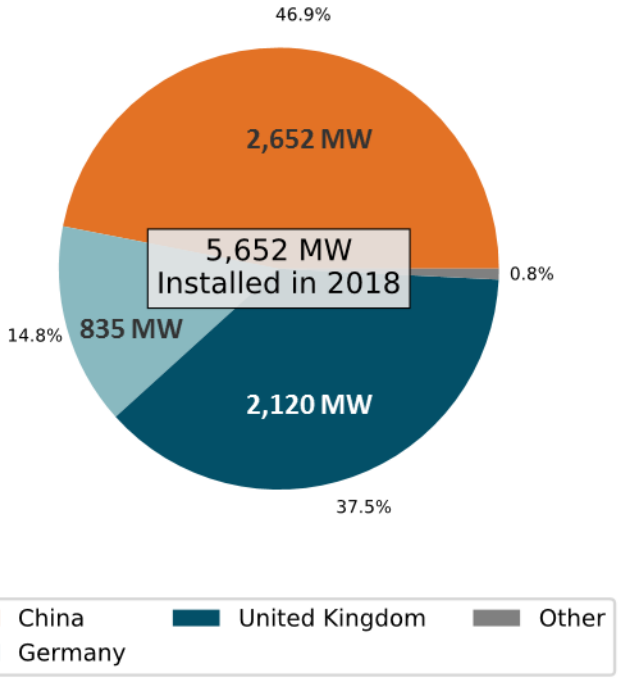

Figure 10. Installed offshore wind capacity by country in 2018

Of the 22,592 MW of cumulative offshore wind deployment recorded by the end of 2018, Figure 11 shows how that capacity is distributed among all countries. The United Kingdom continues to lead the world in terms of total deployment, with 35.2%, followed by Germany (27.4%), China (19.5%), Denmark (6.4%), the Netherlands (5%), and Belgium (3.9%).

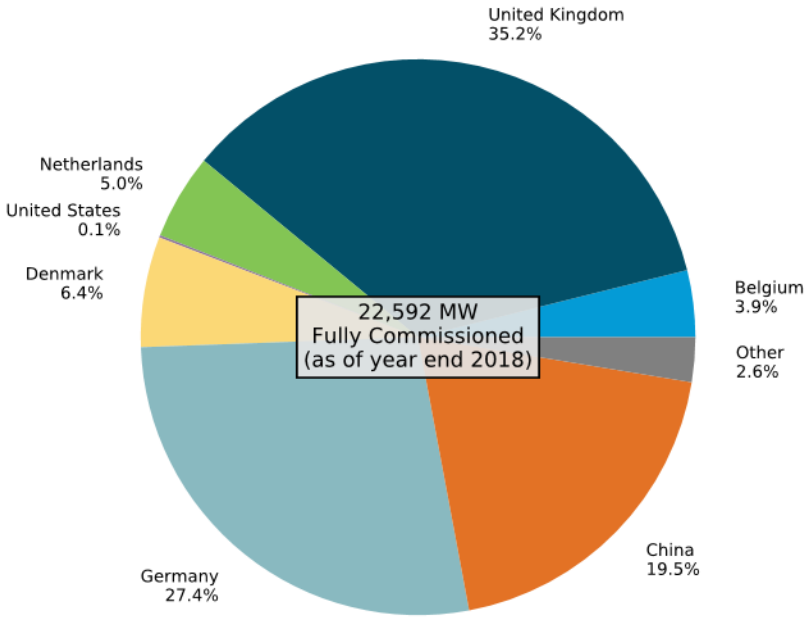

Figure 11. Cumulative offshore wind installed capacity by country

Figure 12 shows the same data plotted in Figure 9 but provides more insight into how the cumulative capacity changed by country.

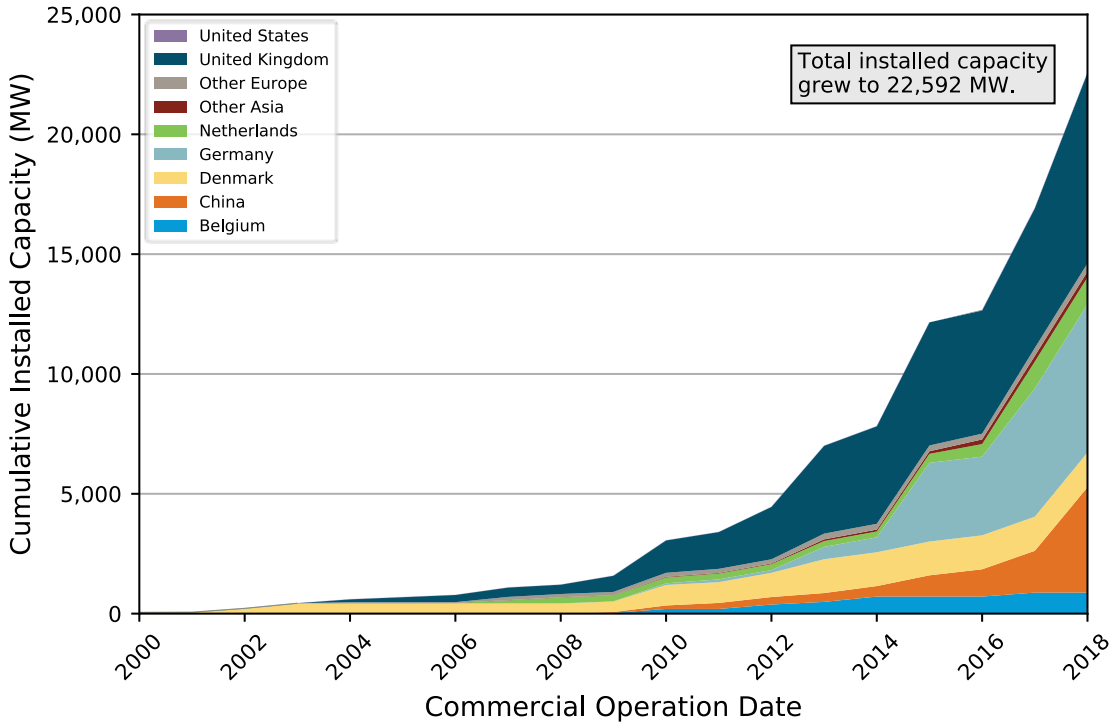

Figure 12. Cumulative installed offshore wind capacity by country over time

Historically, Denmark was clearly the first mover of the industry; however, being a small country, its long-term demand is smaller, and by 2010 the United Kingdom gained more total deployment. Germany began its transition to offshore wind around 2010 and has been increasing its deployment rapidly. Figure 12 also shows the sharp acceleration of the Chinese market, especially this past year—a trend that is likely to continue.

3.1.1 European Market Activities

As of December 31, 2018, 2,994 MW of additional offshore wind capacity was installed in Europe, bringing the total cumulative capacity to 17,979 MW. In 2018, Denmark installed 28 MW, France installed 2.2 MW, Germany installed 835 MW, Spain installed 5 MW, Sweden installed 3.3 MW, and the United Kingdom installed 2,120 MW. Table 9 provides a list of all the projects that reached commercial operation in 2018 by country. The table provides the project capacity values in megawatts and the name of the developer. Note that both of the French projects are subscale floating demonstration projects.

Table 9. European Projects Installed and Grid Connected in 2018

Country	Project Name	Capacity (MW)	Lead Developer
Denmark	Nissum Bredning Vind	28	Nissum Bredning Vindmallelaug
France	EOLINK 1/10 Scale Prototype	0.2	EOLINK
France	Floatgen	2	Ideol
Germany	Arkona	385	E.ON
Germany	Borkum Riffgrund 2	450	Ørsted
Spain	Elisa/Elican Demonstration	5	Elican and ESTEYCO
Sweden	Bockstigen	3.3	Momentum Gruppen A/S
United Kingdom	Aberdeen Offshore Wind Farm	93.2	Vattenfall
United Kingdom	Blyth Offshore Demonstration Array 2	41.5	EDF
United Kingdom	Galloper	353	Innogy
United Kingdom	Race Bank	573.3	Ørsted
United Kingdom	Rampion	400.2	E.ON
United Kingdom	Walney Extension	659	Ørsted

Looking beyond 2018, there has been a significant amount of additional offshore wind activity in Europe related to new policy, procurements, permits, and offtake agreements, indicating continued market growth. Some of the highlights of these activities by country include the following.

France. Although France initially implemented policies targeting 6 GW of offshore wind by 2020, disagreements over the feed-in tariff prices continually delayed commercial projects that had been approved in two tenders in 2012 and 2014. However, in June 2018, the French government finally approved the construction of six of the previously approved offshore wind projects after reducing the feed-in tariff.[41] Each project is expected to receive between 150 €/MWh and 200 €/MWh (Reuters 2018). The projects, all expected to come on line around 2022, are Saint-Nazaire (480 MW), Courseulles-sur-Mer (496 MW), Fécamp (498 MW), Dieppe-Le Tréport (496 MW), and Ile d'Yeu et Noirmoutier (496 MW) (Espérandieu 2018).

Germany. In April 2018, six projects with CODs from 2022 to 2024 were awarded grid connection in the second German offshore wind tender. The projects were Baltic Eagle (476 MW), Gode Wind 4 (132 MW), Kaskasi (325 MW), Arcadis Ost (248 MW), Wikinger Sud (350 MW), and Borkum Riffgrund West I (420 MW). The German Renewable Source Act drives the German offshore wind market and has targeted installing 6.5 GW by 2020 and 15 GW of offshore wind capacity by 2030. Because the German market is poised to achieve its offshore wind goals ahead of schedule, the German legislature initiated a grid reliability study to assess the feasibility of increasing the country's offshore wind goal to 20 GW by 2030 (Foxwell 2018b).

Poland. Poland held its first offshore wind tender in November 2018, awarding two projects the rights to connect to the grid. Additionally, the Polish Secretary of State announced the country was targeting 8 GW of offshore wind deployment by 2030 (offshoreWIND.biz 2018b).

Portugal. Portugal continues to support the development of the 25-MW floating WindFloat Atlantic project. The project is expected to reach financial close and initiate construction in late 2019 pending government

[41] A feed-in tariff guarantees the amount of compensation a developer receives for every megawatt-hour of electricity that their project supplies to the grid.

approval.

Spain. Spain deployed its first offshore wind project in the Canary Islands, the 5-MW Elisa/Elican, a novel gravity-base float-out system that can be fully assembled inshore, with a telescoping tower. According to 4C Offshore, the turbine became fully operational in March 2019. As such, this project will be counted toward the 2019 capacity additions (Skopljak 2019c).

United Kingdom. The United Kingdom continues to be the world leader in offshore wind, with over 7.9 GW of installed capacity. In November 2018, The Crown Estate announced the fourth round of offshore wind tenders would be held in May 2019 and subsequent tenders would occur every 2 years. Based on "market appetite," the tender was increased from 6 to 7 GW, and wind development regions that were limited to 50-m depths were extended to 60-m depths (The Crown Estate 2018).

3.1.2 Asian Market Activities

By the end of 2018, 2,658 MW of new offshore wind capacity was added in Asia, increasing the region's total cumulative installed capacity to 4,639 MW. In 2018, China added 2,652 MW and Vietnam added 6 MW. Table 10 provides a list of all of the Asian projects that reached commercial operation in 2018 by country.

Table 10. Asian Projects Installed and Grid Connected in 2018

Country	Project Name	Capacity (MW)	Developer
China	Fuqing Xinghua Bay - Phase 1	77.4	China Three Gorges New Energy Co.
China	Guodian Zhoushan Putuo District 6 Zone 2	252	GD Power Development Co.
China	Jiang Su Ru Dong Jiangjiasha H2	300	Shanghai Electric Power
China	Jiangsu Longyuan Chiang Sand H1	300	China Longyuan Power Group
China	Jiangsu Luneng Dongtai	200	Shandong Luneng
China	Laoting Bodhi Island Demonstration	300	Jointo Energy Investment
China	Longyuan Jiangsu Dafeng (H12)	200	China Longyuan Power Group
China	Longyuan Putian Nanri Island I	200	China Longyuan Power Group
China	SPIC Binhai North H2	400	State Power Investment Corporation
China	SPIC Jiangsu Dafeng H3	302.4	State Power Investment Corporation
China	Zhuhai Guishan Hai Demonstration - Phase 1	120	China Southern Power Grid
Vietnam	Ben Tre 10 – Phase 1	6	Mekong Wind Power

Looking beyond 2018, other significant offshore wind activities in Asia related to new policy, procurements, permits, and offtake agreements by country include the following.

China. China has a national offshore wind deployment goal of 5 GW by 2020; however, the rapid increase in the number of proposed projects has been driven by the individual province-level goals in Jiangsu (3.5 GW), Fujian (2 GW), and Guangdong (2 GW) (Deign 2019). In May 2018, China's National Energy Administration determined that offshore wind power prices in 2019 and beyond will be set by competitive auctions instead of feed-in tariffs in an effort to increase competition and spur cost reductions in the industry (Recharge News 2018). These cost-reduction and province-level procurement targets, in conjunction with a rapidly maturing supply chain, are expected to dramatically accelerate the future deployment of offshore wind in China, potentially making it a world leader by 2030 (see Section 3.2).

Japan. In November 2018, the Japanese government passed a bill that created a national framework for offshore wind development. Under the law, the Japanese government will designate at least five offshore wind

lease areas, hold competitive auctions, and award leases for 30-year terms. In January 2019, Tokyo Electric Power Company, Japan's largest utility, signed a memorandum of understanding with Ørsted to develop the Chosi project near Tokyo (Ørsted 2019). Although Japan still lacks firm government targets for offshore wind, outside analysts such as Wood Mackenzie predict that by 2028 the country will have 4 GW of offshore wind (Hill 2019).

Taiwan. Taiwan has a national goal to develop 5.5 GW of offshore wind capacity by 2025 (Jacobsen 2018). In April and June 2018, the government awarded the first tranche of projects (~3.5 GW) the right to connect to the grid. In late 2018, the Taiwanese government proposed to reduce its feed-in-tariff before some of the awardees could finalize their power purchase agreements. This uncertainty led some developers to question the bankability of their projects and temporally suspend project development. Ultimately, the government settled on smaller feed-in-tariff reduction that enabled all projects to stay economically viable. In early 2019, Ørsted reached financial close on Changhua 1 (605 MW) and Changhua 2 (205 MW), Wpd reached financial close on Yunlin (640 MW), and Northland Power reached financial close on Hai Long 2A (300 MW) (4C Offshore 2019a).

South Korea. Although no projects were commissioned in South Korea in 2018, land-use constraints are shifting the focus for renewable energy to offshore wind power. In 2018, the government set a 12-GW offshore-wind-capacity-by-2030 target to help the country meet a 20% renewable energy target set earlier in 2017. In June 2018, the government adjusted the RPS to increase the renewable energy certificate (REC) value for offshore wind because of economic efficiency and ability to meet policy goals (Linklaters 2019). Offshore wind REC values are attractive because they increase with the distance from the interconnection facilities (Linklaters 2019).

3.2 Offshore Wind Market Projections

This report contains both near-term (2024) and medium-term (2030) projections for the global offshore wind market. Near-term trends are based on NREL's OWDB and medium-term trends are based on a collection of outside sources, but primarily BNEF and 4C Offshore. These projections can help illuminate broad market trends, identify different national and regional deployment trajectories, and approximate the level of uncertainty in future deployment estimates.

3.2.1 Project Pipeline Through 2024

The near-term project projection is based on data obtained for NREL's OWDB and represents our best understanding of the global offshore wind market. Note that market dynamics, policies, and future technological innovations are always subject to change, and could impact these projections.

Near-term projections are based on industry data reporting their status in the pipeline and the developers' expected commercial operation dates. Projects that have made it past financial close have a much higher probability of being completed and a much lower uncertainty about when they will be completed. Figure 13 shows that 9,511 MW of new offshore wind is underway globally, which is broken down by key countries.

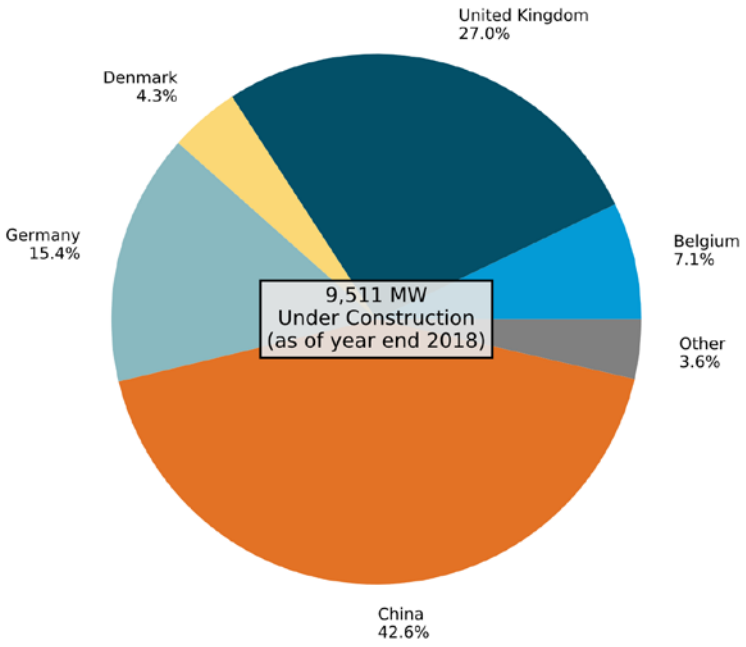

Figure 13. Offshore wind capacity under construction by country as of 2018

By the end of 2018, there were 12 European offshore wind projects under construction, representing 5,115 MW of new capacity to be commissioned.[42] The majority of ongoing construction in Europe is occurring in the United Kingdom (2,520 MW) and Germany (1,460 MW), with smaller amounts in Belgium (678.6 MW) and Denmark (406 MW). In Asia, 17 projects, with a combined capacity of 3,469 MW, are currently under construction. Of the projects under construction, 12 are located in China, three in Vietnam, one in Japan, and one in South Korea. The increased amount of construction in Asia, especially China, represents a new market segment that is expected to grow in future years.

In 2018, just over 10 GW of projects reached financial close. In Europe, 14 projects, representing 6,052 MW of capacity, reached financial close in 2018. In the Asian market, 17 projects, representing 4,178 MW of capacity, reached financial close. In total, there are about 19 GW of projects that have reached financial close or are under construction as of 2018.

Figure 14 provides a yearly estimate of new deployment based solely on the developer's estimation of when they expect their project to be commissioned. Although a project developer may not always be at liberty to disclose detailed updates or information related to their exact deployment schedule, the developer COD data is a rough proxy for near-term deployment. In 2019, annual capacity additions are expected to be dominated by the United Kingdom and China.

Although most deployments until 2024 are located in the United Kingdom and China, other European countries, such as Germany, the Netherlands, and Denmark, continue to approve new projects to meet their national renewable or offshore wind targets. Based on only the projects reporting COD dates in Figure 14, these new additions would result in approximately 44 GW of new capacity from 2019 through 2024.

[42] Generally, a project is assumed to be commissioned 2 years after construction begins.

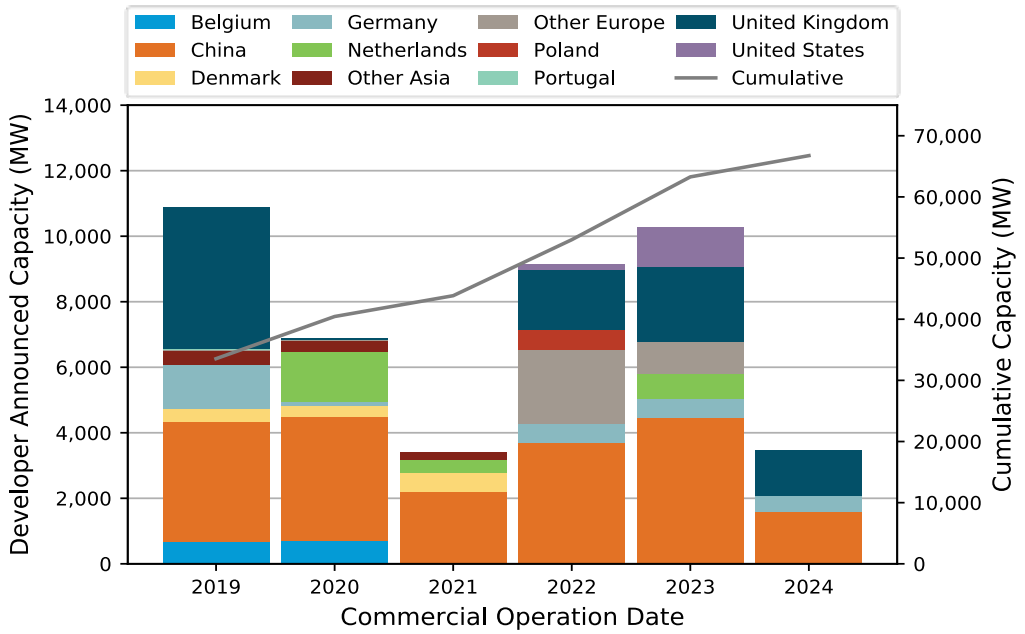

Figure 14. Developer-announced offshore wind capacity through 2024 for projects with financial close

Figure 15 extends Figure 12 beyond the present day using the data shown in Figure 14 as a proxy to estimate near-term offshore wind deployment through 2024.

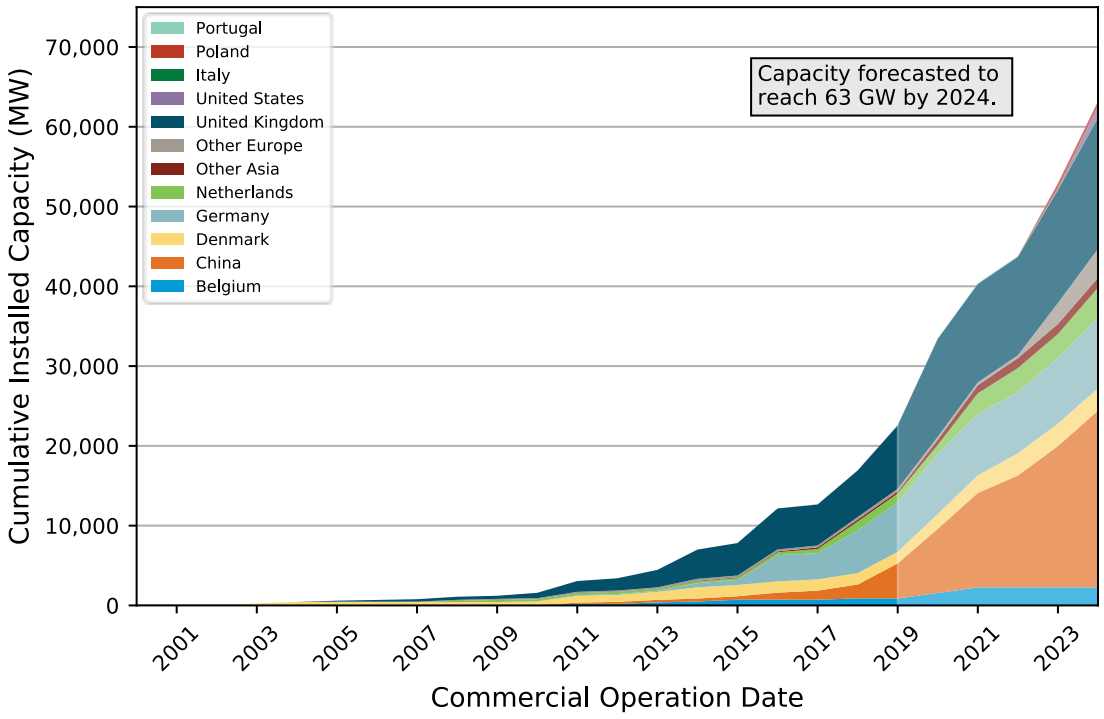

Figure 15. Estimated 2024 cumulative offshore wind capacity by country based on a developer-announced COD (shaded areas represent forecasted deployments)

The figure shows steady or accelerated growth for the next 5 years. Although new markets, such as Poland or Portugal, could help maintain the European share of total global offshore wind capacity, dramatic growth in Asian markets indicates that China may represent almost 50% of the cumulative global capacity in the next 5 years. In aggregate, cumulative global offshore wind deployment is expected to reach over 63 GW by 2024.

3.2.2 Total Global Pipeline

Figure 16 shows the global capacity of the operating and announced development pipeline for all offshore wind projects by region to be 272 GW, compared to approximately 230 GW in 2017. The uptick is primarily attributed to more Asian projects entering the planning phase. This figure does not provide information about the likely timing of developments within the long-term pipeline, but provides overall announced capacity for all active projects recorded in the NREL OWDB.[43] Generally, projects that are more advanced within the pipeline are more likely to reach COD and to be installed sooner than those at an earlier stage; however, international differences in regulatory structure can result in a wide range of development timelines. The global project pipeline illustrates that the majority of the world's installed projects and projects under advanced development are in Europe, but the majority of the world's potential future capacity is in Asia. Looking at project status, there are approximately 63 GW of approved projects in the global pipeline—roughly three times the amount of capacity currently installed today. If all of the approved capacity gets built, the dramatic expansion of the global market will require the further maturation of global supply chains, expansion of manufacturing capabilities, and new installation vessels.

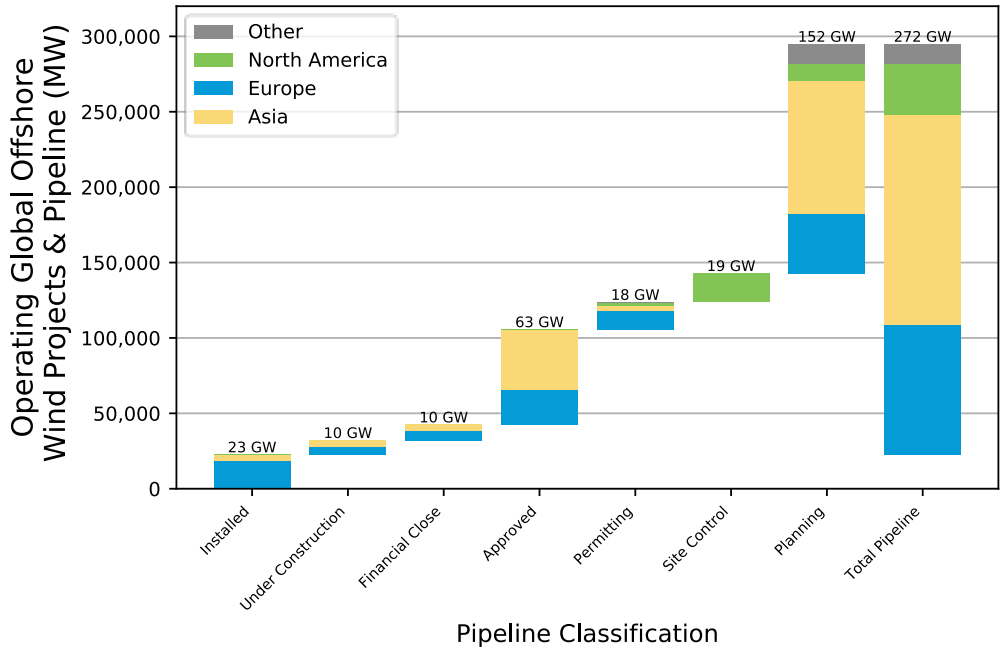

Figure 16. Total global pipeline by status

3.2.3 Medium-Term Projections

Figure 17 illustrates medium-term forecasts of global offshore deployment broken down by country from 2018 through 2030.

[43] The data in Figure 16 do not include projects that are dormant, cancelled, decommissioned, or development zones.

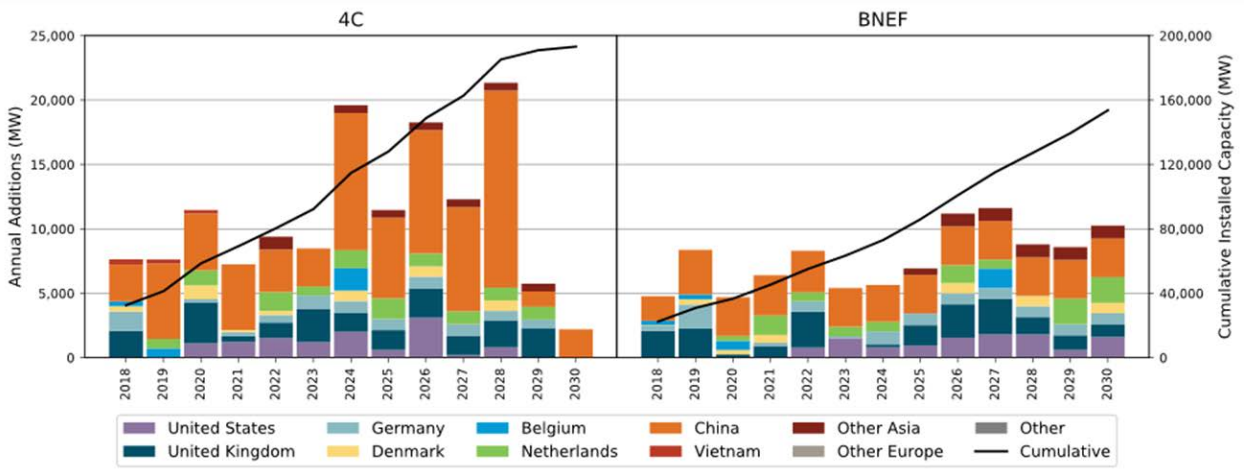

Figure 17. Medium-term wind capacity forecasts by country through 2030

In the figure, two independent forecasts are shown; one by BNEF (2018a) and one by 4C Offshore (2018), which estimate the future growth of the global offshore wind industry. BNEF forecasts offshore wind will reach 154 GW by 2030, whereas 4C Offshore estimates a projected deployment level of 193 GW by 2030. Both forecasts are provided to illustrate the variability and uncertainty associated with longer-range deployment estimates.

Like the near-term forecast to 2024, the most striking shift in offshore wind market dynamics in the 2030 forecast scenarios is the estimated growth of the Chinese market. Both forecasts expect China will cumulatively deploy between 41 GW and 84 GW by 2030. Forecasts also predict European developers will continue to incrementally build projects at a similar rate relative to today, with Europe holding roughly 47% of the total installed global offshore wind capacity by 2030. China itself is expected to represent 27% of the total 2030 installed capacity with the remaining other Asian countries (e.g., Korea, Japan, and Vietnam) accounting for 19%. Depending on the forecast scenario (4C Offshore or BNEF), the U.S. proportion of installed capacity could range from 6.5% to about 8.5% of the global total by 2030.

3.3 Floating Offshore Wind Market Trends

The floating offshore wind market is still driven by the prospect of accessing a much larger resource area with high-quality wind resources, but in water depths that are too deep (nominally greater than 60 m) for conventional fixed-bottom technologies. In the United States, more than 58% of the total technical offshore wind resource is located in water depths greater than 60 m, and in Europe that number is 80% (Musial et al. 2016; WindEurope 2018). Globally, the development of a floating offshore wind market is emerging quickly as experience and knowledge are gained from pilot projects in Europe, Asia, and North America. This pilot phase, which should be mostly operational by 2022, is expected to inform the development of cost-effective commercial-scale projects that may be possible by as early as 2025.

3.3.1 Existing Floating Projects

There are currently eight floating offshore wind projects installed around the world representing 46 MW of capacity. Five projects (37 MW) are installed in Europe and three (9 MW) are in Asia. There are an additional 14 projects representing approximately 200 MW that are currently under construction or have achieved either financial close or regulatory approval. Two projects (488 MW) have advanced to the permitting phase of development, and another 14 are in the early planning stages (4,162 MW). Overall, the 2018 global floating offshore wind pipeline represents approximately 4,888 MW of capacity, growing by 2,000 MW relative to the *2017 Offshore Wind Technologies Market Report Update*. Figure 18 illustrates the current offshore wind market pipeline in terms of market timeline, proposed project size, water depth, and host country. The figure

illustrates how the floating offshore wind market evolved from small-scale, single-turbine prototypes (2009–2015) to multiturbine demonstration projects (2016–2022). Post-2022, the first large-scale floating projects are expected to become commercially viable.

Each of the 38 projects shown in Figure 18 are listed in Table 11, which also includes the project status, capacity developer, and substructure type.

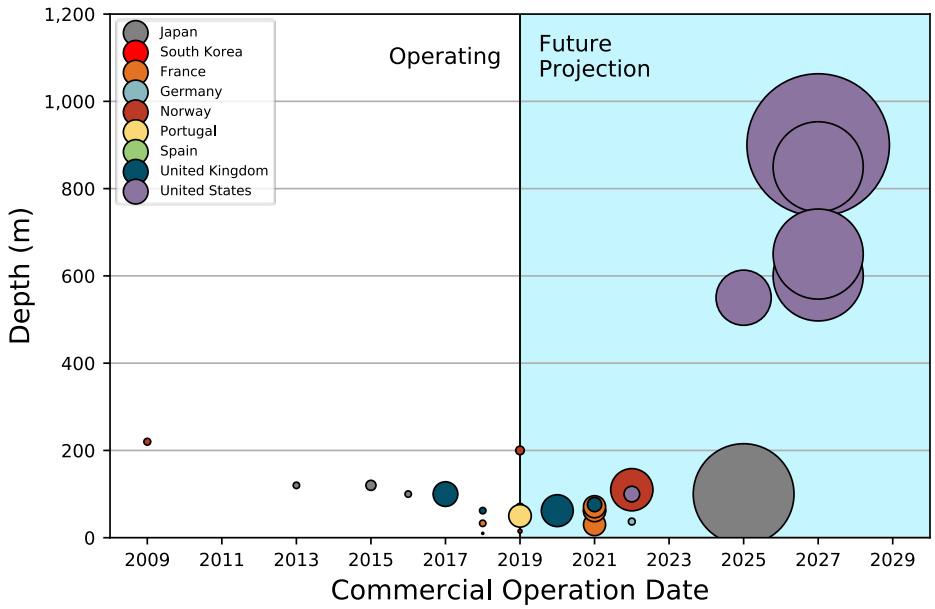

Figure 18. Global floating offshore wind pipeline

Table 11. Current Floating Offshore Wind Projects in Pipeline

Region	Project	Country	Pipeline Status	COD	Capacity (MW)	Water Depth (m)	Developer	Turbine Rating (MW)	Substructure
Asia	**Fukushima Floating Offshore Wind Farm Demo Phase 1**	Japan	Installed	2013	2	120	Marubeni Corporation	2	Semisubmersible
	Fukushima Floating Offshore Wind Farm Demo Phase 2	Japan	Installed	2015	5	120	Marubeni Corporation	5	Semisubmersible
	Sakiyama 2-MW Floating Wind Turbine	Japan	Installed	2016	2	100	TODA Corporation	2	Spar
	Kitakyushu – New Energy Development Organization (NEDO)	Japan	Under Construction	2019	3	70	NEDO/Ideol	3	Semisubmersible
	Hitachi Zosen	Japan	Permitting	2024	400	-	Equinor Hitachi	TBD	Semisubmersible
	Macquarie Japan	Japan	Planning	2025	500	100	Macquarie	TBD	TBD
	Ulsan 750-kilowatt Floating Demo	South Korea	Financial Close	2019	0.75	15	Consortium	0.75	Semisubmersible
	Donghae KNOC - Equinor	South Korea	Planning	2027	TBD	TBD	Equinor/KNOC	TBD	TBD
	Ulsan Shell, Coens, Hexicon	South Korea	Planning	2027	200	TBD	Shell/Coens/ Hexicon	TBD	Semisubmersible
	Ulsan Macquarie	South Korea	Planning	2027	200	TBD	Macquarie	TBD	TBD

Region	Project	Country	Pipeline Status	COD	Capacity (MW)	Water Depth (m)	Developer	Turbine Rating (MW)	Substructure
	Ulsan SK E&S - CIP	South Korea	Planning	2027	200	TBD	SK E&S/CIP	TBD	TBD
	Ulsan KFWind – Principle Power – Wind Power Korea	South Korea	Planning	2027	200	TBD	KFWind/PPI/WPK	TBD	Semisubmersible
	Floating W1N	Taiwan	Planning	2025	500		Eolfi/Cobra	TBD	TBD
Europe	**EOLINK 1/10-scale prototype**	France	Installed	2018	0.2	10	EOLINK S.A.S.	0.2	Semisubmersible
	Floatgen Project	France	Installed	2018	2	33	Ideol	2	Barge
	Groix Belle Ille	France	Approved	2021	24	62	EOLFI	6	Semisubmersible
	Provence Grand Large	France	Approved	2021	24	30	EDF	8	Tension Leg Platform
	Eolmed	France	Approved	2021	24	62	Ideol	6.2	Barge
	Les Eoliennes Flotant du Golfe du Lion	France	Approved	2021	24	71	Engie, EDPR, Caisse de Depots	6	Semisubmersible
	GICON Schwimmendes Offshore Fundament SOF Pilot	Germany	Financial Close	2022	2.3	37	GICON	2.3	Tension Leg Platform
	Hywind - Demo	Norway	Installed	2009	2.3	220	UNITECH Offshore	2.3	Spar
	TetraSpar Demonstrator	Norway	Financial Close	2019	3.6	200	Innogy, Shell, Stiesdal	3.6	Semisubmersible
	Hywind Tampen	Norway	Permitting	2022	88	110	Equinor	8	Spar
	NOAKA	Norway	Planning	2023	TBD	130	Equinor/Aker BP	TBD	TBD
	WindFloat Atlantic (WFA)	Portugal	Financial Close	2019	25	50	WindPlus S.A.	8	Semisubmersible
	DemoSATH - BIMEP	Spain	Approved	2020	2	68	Saitec Offshore Technologies	TBD	Semisubmersible
	X1 Wind prototype PLOCAN	Spain	Approved	2021	TBD	62	X1 Wind	TBD	Tension Leg Platform
	Floating Power Plant PLOCAN	Spain	Approved	2021	TBD	62	FPP	8 MW	Hybrid Wave Power Semisubmersible
	Hywind Scotland Pilot Park	United Kingdom	Installed	2017	30	100	Equinor	6	Spar
	Dounreay Tri	United Kingdom	Approved	2021	10	76	Hexicon	5	Semisubmersible
	Kinkardine Offshore Wind Farm Phase 1	United Kingdom	Installed	2018	2	62	Cobra	2 MW	Semisubmersible
	Kinkardine Offshore Wind Farm Phase 2	United Kingdom	Under Construction	2020	50	62	Cobra	9.5 MW	Semisubmersible
North America	**Castle Wind**	United States	Planning	2027	1,000	900	EnBW/Trident Winds	8+	Semisubmersible
	Redwood Coast Energy	United States	Planning	2025	150	550	EDPR/PPI	8+	Semisubmersible
	Aqua Ventus I	United States	Planning	2022	12	100	University of Maine	6+	Semisubmersible
	Oahu North	United States	Planning	2027	400	850	AW Wind	6+	Semisubmersible
	Oahu South	United States	Planning	2027	400	600	AW Wind	6+	Semisubmersible
	Progression Wind	United States	Planning	2027	400	650	Progression Wind	6+	Semisubmersible

3.3.2 Global Floating Market Assessment

The global offshore wind market continues to mature and show signs that it will accelerate its growth in the future. Major developments and trends in 2018 include the following.

- **Initial pilot and demonstration projects have validated functionality of floating technologies and encouraged further turbine upscaling**. Principle Power indicated that its 25-MW WindFloat Atlantic project in Portugal on its tri-hull asymmetrical semisubmersible substructures will be paired with three MHI Vestas V164-8.4 MW turbines, and the 50-MW Kincardine Floating Offshore Wind Park will use five MHI Vestas V164-9.5 MW turbines and one V80-2.0 MW turbine. Equinor also intends to deploy 8-MW (and above) turbines at its proposed 88-MW Tampen project aimed at powering two offshore oil and gas rigs in Norway. Similar to fixed-bottom technologies, floating systems seek larger turbines to help lower project costs (see Section 4).

- **Ideol installed a 2-MW demonstration project and France approved four demonstration projects**. Ideol's 2-MW Floatgen (dampening pool barge[44]) demonstration project was successfully installed 2 km off Le Crosic and connected to the grid in September 2018. The European Commission has offered financial support and the French government has approved four 24-MW demonstration projects: Groix Belle Ille in the Atlantic as well as Golfe du Lion, Eolmed, and Provence Grand Large on the Mediterranean (European Commission 2019).

- **Interest in offshore wind on the West Coast of the United States increased in 2018**. California's ambitious 100% renewable energy goals could necessitate the development of floating offshore wind projects in water depths up to 1,000 meters (m) (see Section 2). Two unsolicited offshore wind project applications have been filed with BOEM including Redwood Coast Energy (150 MW) and Castle Wind (1,000 MW). Because competitive commercial interest has been established, BOEM initiated three Call Areas (two are around these projects) and is accepting public comments on how to best shape potential future lease areas.

- **Nascent Asian markets showed strong interest in floating wind**. Japan has been interested in offshore wind since 2011 and installed some of the first prototypes using government funding appropriated after the Fukushima nuclear accident. New floating projects in Japan look increasingly promising now that the country has developed offshore wind deployment policies. In the near term, Japan's New Energy and Technology Development Organization announced that it is constructing a 3-MW demonstration project. Equinor has signed a memorandum of understanding with Korea National Oil Corporation to develop a floating project near the Donghae gas platform that is 58 km off the coast of Ulsan City, South Korea. Ulsan Metropolitan City and National Government also signed four memorandums of understanding with developers[45] to each develop 200-MW floating projects with a COD of 2023 (Quest Floating Wind Energy 2019).

[44] A dampening pool barge is a shallow-draft, buoyant foundation with a central opening that damps out platform motion caused by wave action.
[45] Developers include 1) Macquarie, 2) CIP and SK E&C, 3) PPI and Wind Power Korea, and 4) Shell, Coens, and Hexicon.

4 Offshore Wind Technology Trends

Technology advancements have played a key role in achieving the cost reductions experienced over the past few years that are enabling offshore wind energy to compete without subsidies in some energy markets. New technology and technical innovations are leading the industry to both lower costs and create new market regions. Continued cost reductions are allowing fixed-bottom offshore wind systems to compete in high-priced energy markets today, and floating wind technology, when matured, can open new regions that are currently inaccessible with existing technology (Gilman et al. 2016; WindEurope 2018). For many years, offshore wind technology advancements were measured by metrics, such as greater water depths and distances from shore (Beiter et al. 2016). More revolutionary technology advancements, such as floating wind turbines, promise larger payoffs in terms of dramatically greater siting options and wide-ranging increases in global electricity market penetration.

Using NREL's OWDB described in Section 1, this section relies substantially on empirical data for planned projects advancing through the pipeline to provide insight into global technology siting trends through 2024. The OWDB also provides insight regarding offshore wind turbine capacities, substructures, electric infrastructure, and logistical approaches for construction and maintenance activities. Much of the discussion is focused on fixed-bottom technologies, although floating technologies are also included.

4.1 Siting Trends for Global Offshore Wind Projects

Here we update trends observed in offshore wind fixed-bottom technology related to site characteristics of water depth and distance from shore. Figure 19 provides industry trends of four parameters—depth, distance, project status, and project size—and shows these trends for global offshore wind projects that have, at a minimum, advanced to the site-control phase. Global projects are color-coded by the project phase they have advanced to in the pipeline.

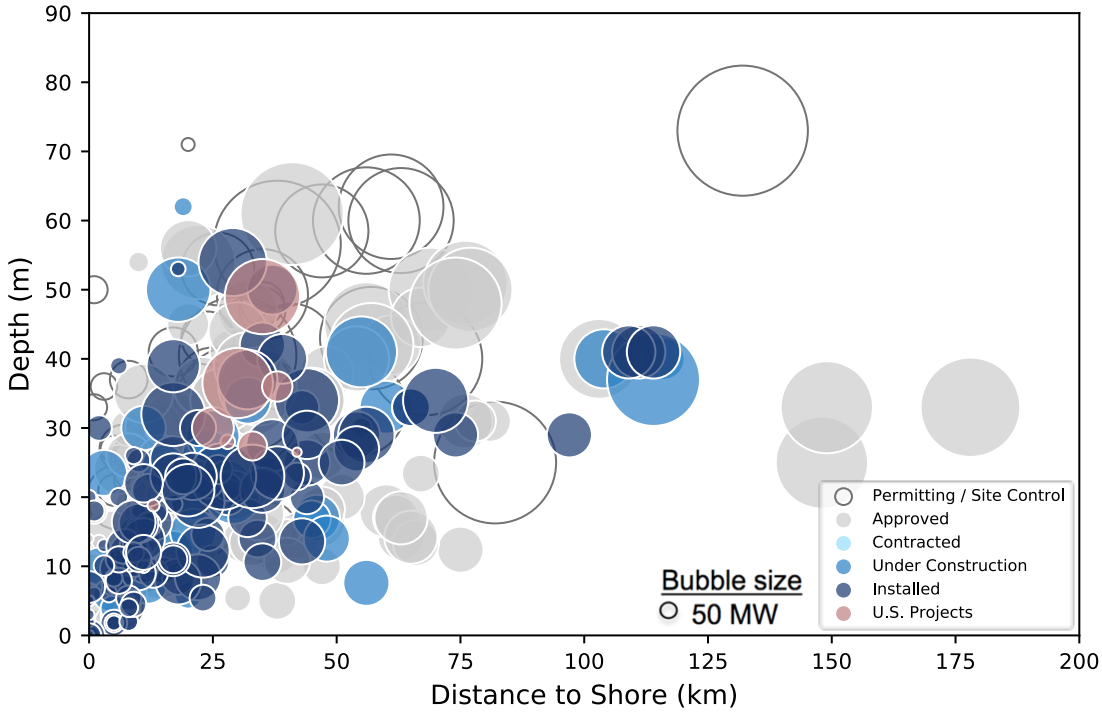

Figure 19. Fixed-bottom offshore wind project depths and distance to shore

In the figure, the project size is indicated by the diameter of the bubbles. The relative scale is shown with a representative 50-MW project in the key. This figure indicates a possible global trend toward larger projects (i.e., larger bubble sizes) sited farther from shore (i.e., the largest bubbles are at the 1,000-MW scale), particularly for those projects in the permitting and approval phase of development. Projects located further distances from shore (as far as 200 km) are enabled by the shallow bathymetry of the North Sea, where projects can be sited far from shore while still using fixed-bottom foundations.

Also included are the eight U.S. offshore wind fixed-bottom projects that have a viable pathway to an offtake agreement, have secured site control, and have significantly advanced in the permitting and regulatory process.[46] These projects have similar characteristics with respect to water depth and distance to shore; however, given the limited sample, it is difficult to judge longer-term trends. There are over 20 GW of capacity in the auctioned lease areas but distances from shore do not exceed 60 km in these areas and depths range from 20 to 65 m (Musial et al. 2013; BOEM 2019f).

Also, projects sited too close to shore can trigger public acceptance issues. Turbines sited beyond a certain distance from shore will generally be less visible and could raise fewer objections. This "acceptable" distance will vary depending on many factors including the land-based terrain and demographics, turbine scale, climate, and proximity to populations (Krueger et al. 2011). In the United States, public acceptance issues led to the demise of the first proposed commercial-scale U.S. project, Cape Wind, which may have contributed to BOEM's informal recommendation that new WEAs be at least 10 nautical miles (nm) from the shore (BOEM 2018). Therefore, with respect to distance from shore, near-term U.S. projects are likely to fall in a narrower vertical band (18–60 km depth) in Figure 19 than the global spread of distances. With respect to depth, some of the lease areas (e.g., Massachusetts WEA) have significant depths between 50 and 65 m, where projects will likely be built (Musial et al. 2013). Therefore, these depths up to 65 m in the existing WEAs will likely result in U.S. projects having slightly higher average depths than current European projects.

However, to judge a project's cost and complexity, it is more important to consider the distance to critical infrastructure than distance to shore. As more projects are permitted and built, developers may have more difficulty finding suitable grid connection points, thereby making export cable runs longer. Further, the cost of the electrical infrastructure for a wind project depends more on the length of the export cable than how far it is offshore. Similarly, the distance to construction and service ports will also be a strong cost factor, because turbine access, as well as construction and operation and maintenance (O&M) costs are directly related (Beiter et al. 2016).

As the industry matures, new technology and experience allows access to greater water depths, but projects with fixed-bottom foundations will pay a premium to access deeper water (Beiter et al. 2016). Floating foundations promise relief from water depth cost penalties, but it is still too early to fully understand these costs relative to fixed-bottom foundations on a commercial scale (Musial et al. 2016). However, if demand for offshore wind continues to increase, higher competing use constraints nearshore (e.g., fishing) may make it necessary to site some future Call Areas farther from shore, and therefore in deeper water where floating technology would be needed (Musial et al. 2016).

In Figure 19, the trends toward distance from shore or deeper water are not clear because new additions are difficult to track on a time-dependent basis. Figure 20 and Figure 21 show distance from shore and water depth as independent variables as a function of time (year of commissioning) for installed projects to help illuminate these trends better. These plots show the span of actual projects built for each year from 2000 to 2018, and projections that were made based on data from projects in the pipeline out to 2024. These data, provided for each year, indicate the capacity-weighted averages, and the range of all projects showing the highest and lowest values. For most years, the number of projects is too small to provide statistical significance, but the

[46] Note Aqua Ventus I is not shown because it is a floating project with different metrics for water depth.

overall trends out to 2024 can be inferred. Figure 20 indicates that the trend toward greater distances from shore may not be very strong. The data show there is a wider degree of variability from year to year, due, in part, to enabling technologies like high-voltage direct current (HVDC) transmission, which has been used in the North Sea to export power long distances to shore in several German projects.

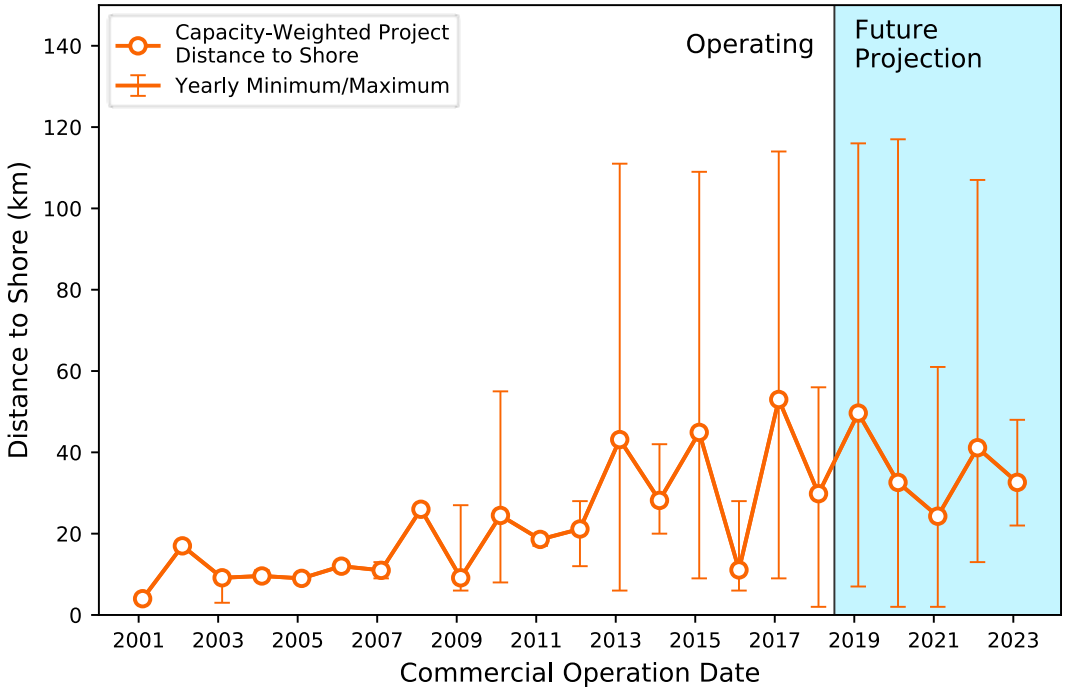

Figure 20. Project distance from shore trend to 2024

Similarly, Figure 21 shows the gradual trend in the global data toward greater water depths.

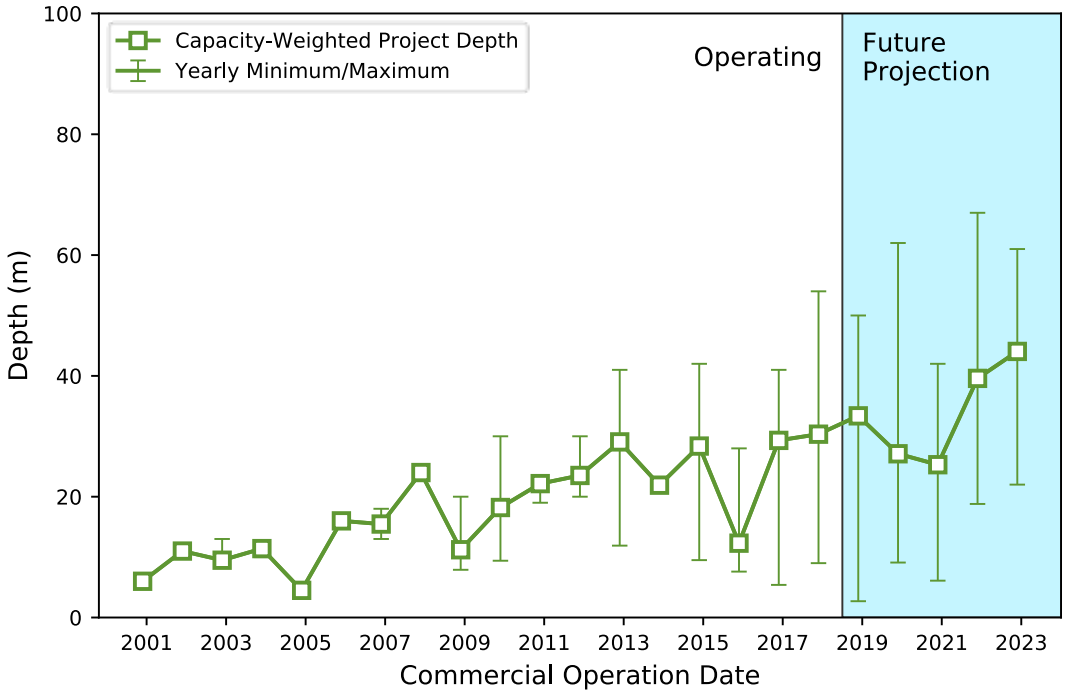

Figure 21. Project depth trend to 2024

The project trend toward deeper water is more defined than the trend toward greater distances to shore. Substructure designs have incrementally improved to overcome depth limits, thereby allowing access to more sites. Some deployments have already been successfully made at 50-m depths, and installations up to 60-m depths and beyond are planned before 2024 (The Crown Estate 2018). In the United States, some of the foundations at the Vineyard Wind site will be near a 50-m water depth (Vineyard Wind 2018a).

4.2 Offshore Wind Turbines

Here we address the trends in offshore wind turbine technology. In 2018, the industry's turbine manufacturers committed more confidently to increases in turbines size, indicating that a new 10-MW to 12-MW platform is under development for the next generation of turbines. This growth is being spurred by overall system cost reductions and energy production improvements associated with larger turbines. In addition, as the industry expands toward the Asian market (especially Taiwan, which committed to 5.4 GW earlier this year), turbine OEMs are beginning a serious effort to adapt turbines to extreme loads that may be generated by typhoons and seismic events.

4.2.1 Offshore Wind Turbine Technology

Offshore wind turbines are generally much larger than their land-based counterparts. Figure 22 shows global offshore wind turbine trends since 2000 along with the capacity-weighted[47] average turbine rating (blue bars; left axis), capacity-weighted average rotor diameter (green line; right axis), and capacity-weighted average hub height (orange line; right axis). Note that the future projection through 2023 for weighted average turbine capacity, rotor diameter, and hub height is based on only the subset of projects (21,037 MW) that have announced an agreement or partnership with a turbine OEM. These projections show that turbines are expected to continue to grow over time.

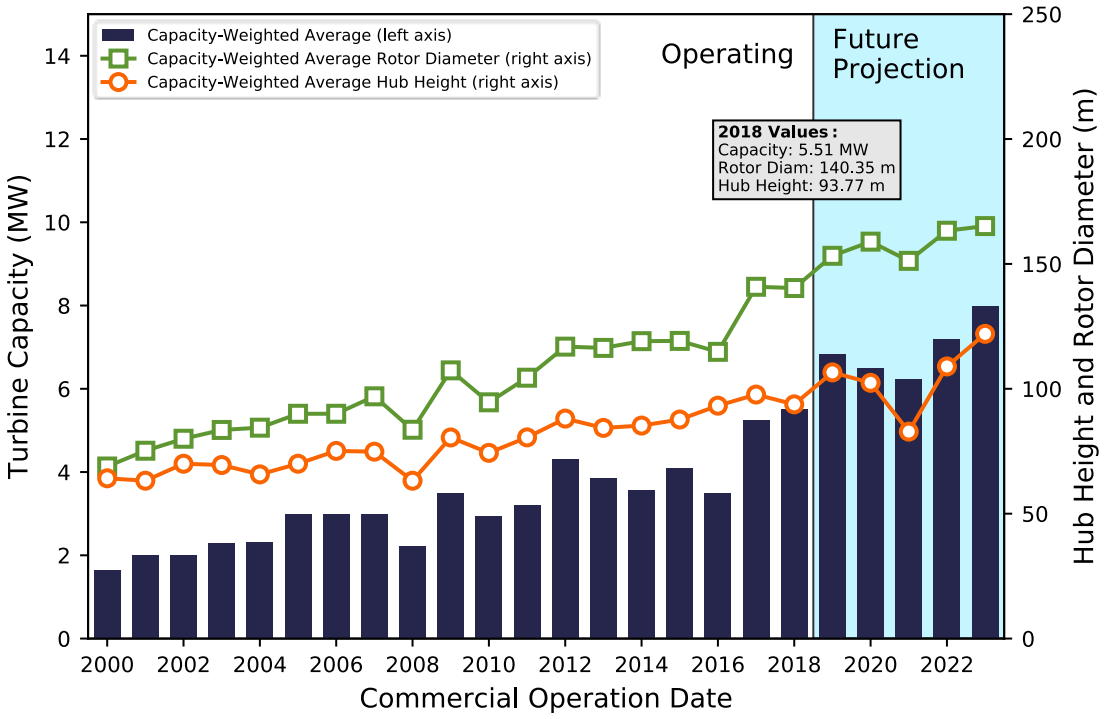

Figure 22. Offshore wind turbine rating, hub height, and rotor diameter

[47] A capacity-weighted average (weighted average) counts the contribution of a given characteristic (e.g., turbine rating) proportional to the amount of capacity (megawatts) the project delivers to the total capacity installed for a given year.

Although Figure 22 shows a steady turbine size growth trend, tracking the current and historical commercial deployments may not be the best way of predicting the absolute size of future wind turbines. To understand the cutting edge of new technology development, it is better to look directly at the turbine prototype development stage. This is especially important for offshore wind because the pace of turbine growth is much faster than land-based technology, and larger turbines are affecting all aspects of industry development including the economics, infrastructure, balance of plant, siting, and supply chain.

Increasing turbine size is one of the major factors that has been attributed to the sharp cost declines in offshore wind. Larger capacity turbines generally yield lower balance-of-plant costs, fewer and faster installations, and lower maintenance, as well as more energy per unit of area. Recent cost information also indicates that in addition to these project cost-scaling benefits, unit turbine costs may not be rising with turbine capacity as originally predicted by early models, such as the 2006 NREL Cost and Scaling Model (Fingersh 2006; for more recent assessments see Graré et al. 2018; Valpy et al. 2017; BNEF 2018e). In fact, a higher turbine rating may not result in an increase in per-unit turbine capital expenditures (CapEx) ($/kilowatt [kW]) at all. This new trend may potentially be a result of efforts by turbine manufacturers to manage increases in component mass using advanced engineering innovations and manufacturing methods, and through improved efficiencies in production and delivery. Therefore, a 6-MW wind turbine might have a similar cost per kilowatt as a 10-MW turbine. This trend may be incentivizing industry's push to further increase turbine capacity.

Because of these cost advantages, on a project level, developers will generally select the largest turbine available. At the end of 2018, the largest turbine installed was the MHI-Vestas V164–8.8 MW turbine at the Aberdeen Bay (European Offshore Wind Development Centre) project in Scotland, but the V174-9.5 is now available for commercial use and was ordered for the Baltic Eagle project in Germany. These Vestas turbines follow another industry trend to extend the nameplate power rating of the current turbine technology platforms for 6- and 7-MW turbines as high as possible by increasing drivetrain/generator capacities while maintaining rotor size. Most turbine manufacturers have conformed to this design approach over the past few years. In doing so, this has driven up the specific power rating[48] for these turbines, which could lower capacity factors in the interim while pushing the turbine technology platforms to their maximum energy extraction and load limits. These high specific power machines may still be well-suited for high wind sites in European waters but may not be the most efficient for lower wind speed sites in countries such as China, Japan, and Korea, and in the Great Lakes, mid-Atlantic, and South Atlantic regions of the United States.

In 2018, this trend in upscaling the existing turbine platforms was disrupted by the announcement of larger prototypes with increased rotor diameters—the next generation of offshore wind turbines on a new 10-MW to 12-MW technology platform. In March 2018, GE announced the 12-MW Haliade-X turbine, which has a prototype in production that is scheduled for installation in Rotterdam in 2019, and ready for market in 2021 (GE 2018b). The turbine is first in class, with a 12-MW direct-drive generator, 220-m rotor, and 140-m hub height. In January 2019, Siemens Gamesa announced the development of the SG10.0-193 DD turbine—a 10-MW direct-drive turbine with a 193-m rotor—which is planned to be ready for market in 2022 (Siemens 2019). This turbine would be a substantial departure from Siemens Gamesa's current SG 8.0-167 DD platform. Other manufacturers, such as Senvion (formally Repower), have been following suit with their own development plans for turbines in the 12- to 16-MW range (Foxwell 2018c). From recent industry trade press, it appears that the industry is likely to increase turbine size beyond 12 MW (Windpower Monthly 2018; Snieckus 2018).

To illustrate the pace at which turbines are growing in the offshore wind industry, Figure 23 shows the average turbine capacity growth from Figure 22 along with data contrasting the capacities of the largest prototypes available in the first year they were built since 2000. The turbine prototypes shown in Figure 23 were all later commercialized and have become part of the industry's commercial pipeline (e.g., blue bars).

[48] Specific power is the nameplate power rating of a turbine divided by its rotor's swept area in Watts/m^2.

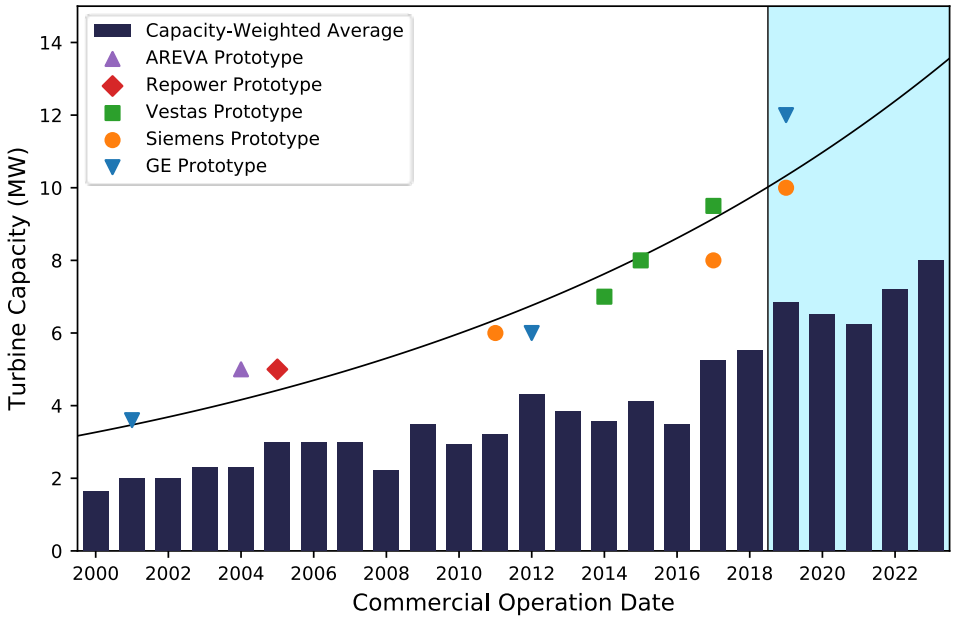

Figure 23. Average commercial offshore wind turbine rating compared to prototype deployment by year

Sources: Ragheb (2019), GE (2018), de Vries (2012), Composites World (2014), Adwen GmbH (2019),[49] Power Engineering (2005),[50] 4C Offshore (2017), Siemens (2013, 2019), Dvorak (2017)

From analysis of press releases, it takes at least 3 years for a turbine manufacturer to go from the first prototype to commercial production (GE 2018a; Siemens 2019). Historically, in many cases, this process is longer. Figure 23 shows that although offshore wind industry turbine size is indeed increasing, the maximum size of wind turbines that will be installed in later years is much larger than the weighted averages, and in 2018 there is no sign that offshore wind turbine growth is slowing down in spite of multiple logistical and infrastructure challenges. As shown, prototype capacity (shown in the colored symbols) has been consistently above the capacity of the weighted average turbine being installed.

4.2.2 Typhoons and Earthquakes

Offshore wind turbines are beginning to see more geographic diversity, especially as developers enter Asian markets wherein typhoons can bring extreme wave heights and wind speeds that exceed design specifications. Class 1A wind turbines are already designed to withstand wind gusts up to 70 meters per second (m/s) (156 miles per hour) but in these Asia-Pacific regions (and later in southern latitudes of the United States), the probability of major tropical cyclones (hurricanes) that produce loads exceeding the present design limits (set by International Electrotechnical Commission [IEC] standards) becomes more likely. Specialized hurricane-resilient designs are being developed to ensure that turbines, towers, blades, and substructures can withstand these extreme weather events.

Offshore wind turbines are currently designed using IEC 61400-01 and IEC 61400-03 standards, which define a 3-second maximum gust condition of 70 m/s (156 miles per hour) (IEC 2019a; 2019b). Oil and gas standards have been applied in the United States to manage the design of substructures. The recently released 2019 edition of IEC 61400-01 and 61400-03-1, the primary design standards for wind turbines, just added

[49] Note that AREVA is now a wholly owned subsidiary of Siemens Gamesa.
[50] Note that Repower now goes by the name Senvion.

provisions for a wind turbine typhoon class. Both Siemens Gamesa and Vestas have begun to ruggedize their turbine designs to adapt them to hurricane loading and comply with a more rigorous certification process to upgrade for the local conditions, particularly as they try and enter the Taiwan offshore wind market (Hill 2018). In some of these new offshore wind regions, there is also an increased threat of earthquakes; therefore, enhanced engineering activity to achieve seismic resilience has also been initiated.

4.2.3 Offshore Wind Turbine Manufacturers

Figure 24 shows the market share of each offshore turbine manufacturer for the cumulative installed capacity up to 2018, as well as the expected installations that have disclosed their intended turbine partner for near-term pipeline projects. After their merger, Siemens Gamesa continues to be the largest global supplier of offshore wind turbines, representing approximately 55% of installed capacity, or 12.3 GW, operating today. Siemens Gamesa is followed by MHI-Vestas, with just over 15% market share.

The right side of Figure 24 shows the OEM suppliers selected by developers for projects in the pipeline that have announced their turbine. The chart shows Siemens Gamesa's share of projected total global capacity is likely to grow to 60.3% for new projects, whereas Vestas is expected to hold on to about 14.5% total installed capacity. In addition, GE's share of total installed capacity is projected to grow to 8.9%. Other OEMs showing increased market share include Goldwind and Ming Yang, companies that are building strength in the emerging Chinese market.

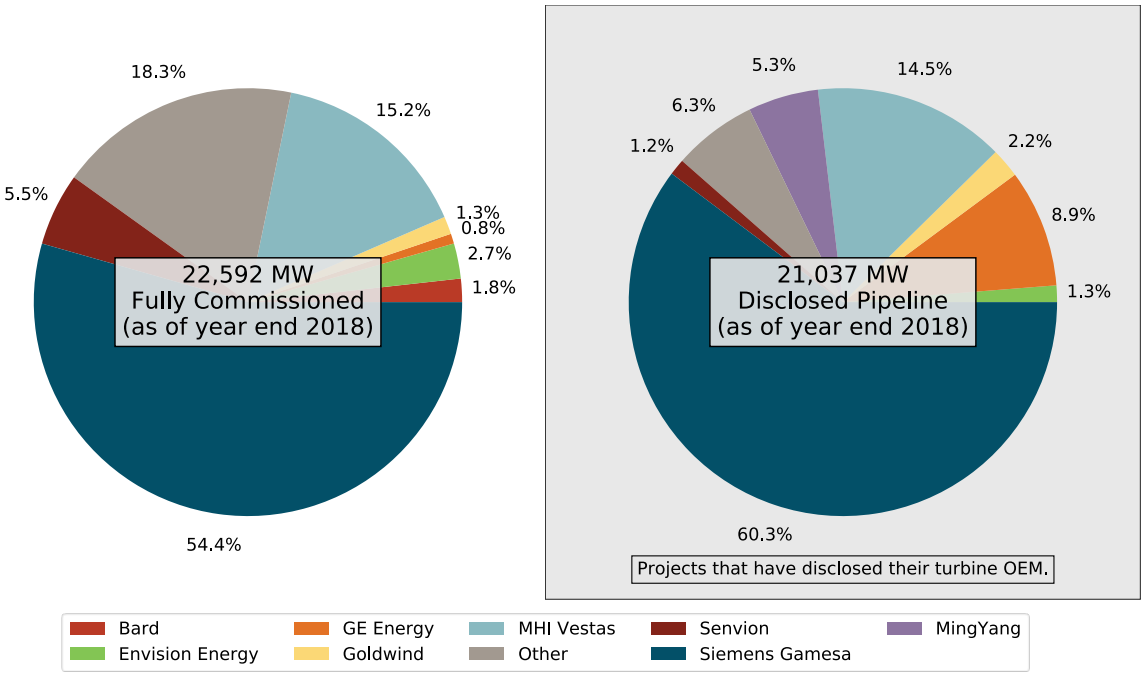

Figure 24. Offshore wind turbine manufacturers by market share for 2018 (left) and future (right)

4.3 Fixed-Bottom Substructures

Figure 25 shows the current mix of substructure types for fixed-bottom foundation projects operating at the end of 2018 along with the expected makeup of substructure types for the 37,203 MW of projects in the pipeline that have announced their intended substructure. In 2018, monopiles continued to dominate the operating fleet of global offshore wind turbines, representing 73.5% of the total market. Alternative substructure types, such as gravity-base, jacket, tripod, and floating foundations, each represent about 5% of the historical market share.

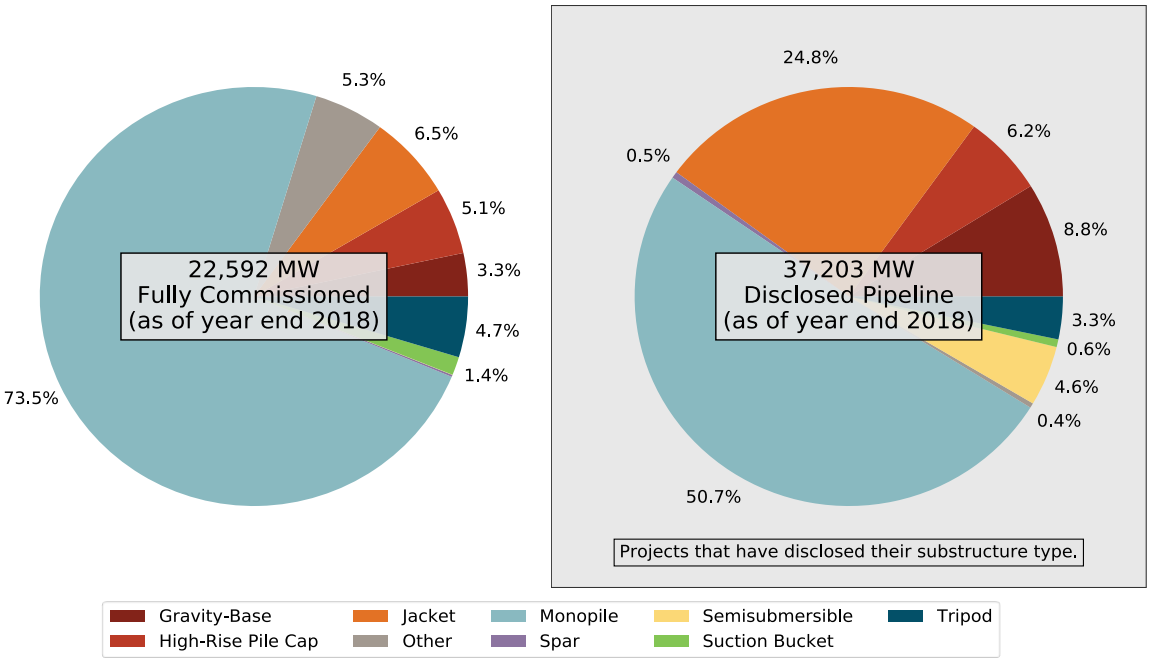

Figure 25. Offshore wind substructure technology trends in 2018[51]

Looking into the future, on the right side of Figure 25, developers have indicated they plan to increase the use of jackets by roughly fourfold. This change corresponds to projects being developed in deeper water depths and increased manufacturing options for jackets. Gravity-base foundations are also slowly increasing their market penetration because they do not require pile driving during installation, which eliminates underwater noise and potential negative impacts to marine mammals. Floating foundations are required for projects in water deeper than approximately 60 m and are discussed later in the report.

4.4 Electrical and Power System Technology

4.4.1 Array Cables and Substations

Buried, insulated, three-core copper cables are typically used for subsea array collector systems. Occasionally, aluminum cables are used as well. The array cables[52] are designed to meet the requirements on physical strength, flexibility, and temperature characteristics of the offshore site. Array cables also incorporate fiber-optic cables, plant control, and communications. Power conductor sizes for array cables are selected based on their current carrying capacity and location in a string of turbines. Array cable cross sections at the end of the string can be as small as 150 mm^2, and cables close to the substation can be 800 mm^2 or larger.

As shown in Figure 26, 42% of new intra-array cables energized in 2018 were supplied by Nexans, whereas JDR Cable Systems supplied 32.1% and Prysmian supplied 16.1%. These shares were calculated by counting the number of grid-connected turbines in each wind power plant during 2018 (WindEurope 2019).

[51] High-rise pile caps are offshore wind foundations that use a group of piles to support a flat, stable pad. The wind turbine tower is then installed on top of the pad. These foundations are primarily found in the Chinese market and deployed in shallow waters.
[52] Array cables are electrical cables that connect individual turbines to each other and an offshore substation or transmission cable.

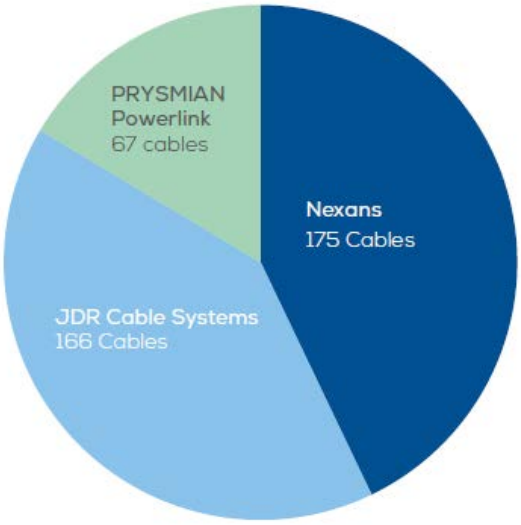

Figure 26. Number of turbines energized by supplier in 2018. *Chart courtesy of WindEurope 2019*

With the commissioning of the Aberdeen Bay offshore wind power plant in 2018, Nexans has now supplied two new offshore wind plants with its new 66-kilovolt (kV) cable technology (Nissum Brending Vind in Denmark and Aberdeen Bay in the United Kingdom). As rated power capacity of offshore wind turbines continues to grow, project developers and operators are increasing use of 66-kV cable technology instead of the conventional 33 kV. In 2018, there were three projects that used 66-kV array cables versus only one project in 2017. Operation at a higher voltage offers important life cycle cost-efficiency benefits, such as the possibility of reducing the number of offshore substations, decreasing the overall length of installed cables, and minimizing electric losses (Nexans 2018). During 2018, the advantages of 66-kV technology have been demonstrated by Nexans in three pilot projects: the Blyth Offshore Demonstrator (United Kingdom), Nissum Bredning Vind (Denmark), and Aberdeen Bay (United Kingdom) wind power plants. All these projects are currently connected to the grid and generating power. Nexans has also supplied a range of products and accessories including 66-kV sea cables (array and export cables), power cable accessories (e.g., equipment bushings, connectors, coupling connectors, surge arresters, dead-end receptacles, junction cabinets), GPH connection technology, and preassembled cables (Nexans 2018).

Continued development of several offshore projects in Southeast Asia has created new market opportunities for the undersea cable industry. For example, Formosa 1 is an offshore wind power plant being developed near Miaoli, Taiwan, by Formosa Wind Power Co in partnership with Macquarie Capital Group Limited, Ørsted, and Swancor Renewable. The 130-MW wind power plant will be Taiwan's first commercial-scale offshore wind project (Power Technology 2018). In 2018, JDR Cable Systems delivered 21 km of interarray cable, 13 km of export cable, and an additional 16 km of land cable to transmit power from the shore to the local substation. The 33-kV cables were manufactured at JDR's facility in Hartlepool, United Kingdom, before being shipped to Taiwan for installation by Jan De Nul. The project is targeted for completion in 2019 (JDR 2019).

4.4.2 Export and Land-Based Interconnect

The electrical grid connection contributes significantly to the cost of an offshore wind power plant. It includes both offshore and land-based infrastructure and connects the wind power plant to the land-based electricity grid. AC offshore substations contain the common busbar for cable termination, protection, and switchgear, transformers that step up the voltage from a 33-kV or 66-kV array level to a 132- to 220-kV export level, and reactive power compensation. There is normally more than one AC substation in a large wind power plant,

thereby providing a higher level of reliability and redundancy in the electrical system to reduce the impact of a single point of failure. Similarly, DC offshore substations contain an AC busbar, protection, and switchgear; AC transformers; HVDC power electronic station; and DC terminals.

Typically, the AC export cables use conductor cores ranging from 600 mm^2 to 1,200 mm^2, although larger cross sections are possible. Various types of armoring can be used depending on seabed conditions, amount of vessel traffic, and water depth.

In terms of export cables in 2018, eight export cables manufactured by NKT Group were energized, representing 53.3% of the annual market. Prysmian, Ls Cable & System, and JDR Cable Systems each had about a 13.3% share, and Nexans represented the remaining 6.7%, as shown in Figure 27 (WindEurope 2019). When calculating these shares in Germany, the export cables are considered to be the cables connecting the offshore wind power plants to the land-based grid, whereas in other countries the export cables are considered to be the high-voltage, alternating-current cables only. Note that these market shares were calculated by considering only the export cables in operating wind power plants.

According to Market Research Consulting, the global submarine cable market accounted for $6.31 billion in 2017 and is expected to reach $25.56 billion per year by 2026 (Market Research Consulting 2018). Such growth is expected because of rising demand in both offshore wind and oil and gas operations. Increasing demand for HVDC submarine power cables is also one of the major electrical supply chain trends for offshore wind observed during the forecast period. By geography, several regions in Europe are dominating the offshore power cable market because of rapid growth in numbers of offshore wind projects and rising demand for intercountry submarine power transmission links. Some key players in the submarine power cable market include Furukawa Electric, General Cable Corporation, Hengtong Group, Hydro Group, KEI Industries, LS Cable & System, Nexans, NKT Holding, Prysmian Group, Sumitomo Electric Industries, Tele-Fonika Kable S.A, ZTT International Limited, and TE Subcom.

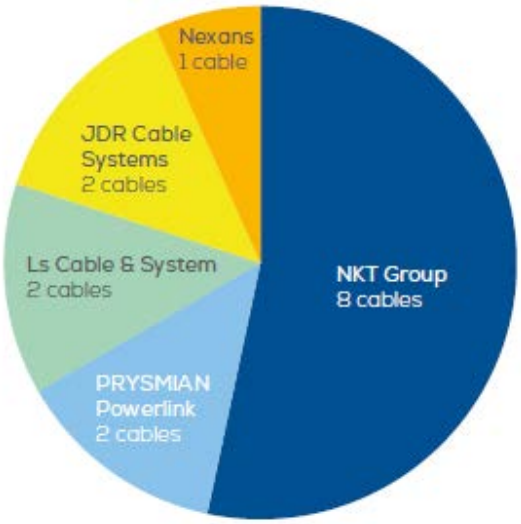

Figure 27. Share of energized export cables by supplier in 2018. *Chart courtesy of WindEurope 2019*

4.4.3 Transmission, Grid Integration, and Storage

As the role of wind energy grows in the U.S. power grid, there is increased interest and requirement for it to provide essential reliability services. These services are critical to maintaining the reliability and stability of the grid, and historically were provided by large synchronous generators, mainly from fossil-fueled and hydroelectric generators (Denholm, Sun, and Mai 2019).

In 2018 and early 2019, as state offshore wind policy commitments grew from near 5 GW to 20 GW by 2035, the challenge of integrating this amount of electricity into the existing land-based grid has begun to resonate as a high priority among the many developers, utilities, and state energy organizations (Business Network for Offshore Wind 2019). For some states like Massachusetts, New York, and New Jersey, injecting this amount of offshore wind represents up to 30% of their current electricity supply, which is likely to have significant impacts to the land-based grid and transmission system that have not been fully quantified. In the next year, the topic of offshore wind grid integration and grid planning is likely to gain more attention.

In most of today's power systems, wind (both offshore and on land) and solar generation still have a limited impact on grid operation because other generation sources can be dispatched. As the share of variable renewable generation becomes a major fraction of the total generation, electricity systems will need more flexibility services that can be potentially provided by the rapid response capabilities of electricity storage. The shift toward large-scale integration of energy storage into the power systems operation will need to be part of the energy planning process.

In 2018, Masdar and the Norwegian company Equinor (formerly Statoil) installed, and started testing, a new battery system designed to store electricity generated by the 30-MW Hywind Scotland, the world's first commercial-scale floating wind power plant. This battery energy storage system (BESS) project coupled with the offshore wind power plant is the first of its kind in the world. The goal of the project is to evaluate the capabilities of advanced storage technologies to optimize the release of electricity from renewable energy plants to transmission grids—from both a technical and commercial perspective. A conceptual diagram of interconnection between the offshore wind power plant located at a short distance from the shore and the land-based BESS is shown in Figure 28 (Equinor 2018b).

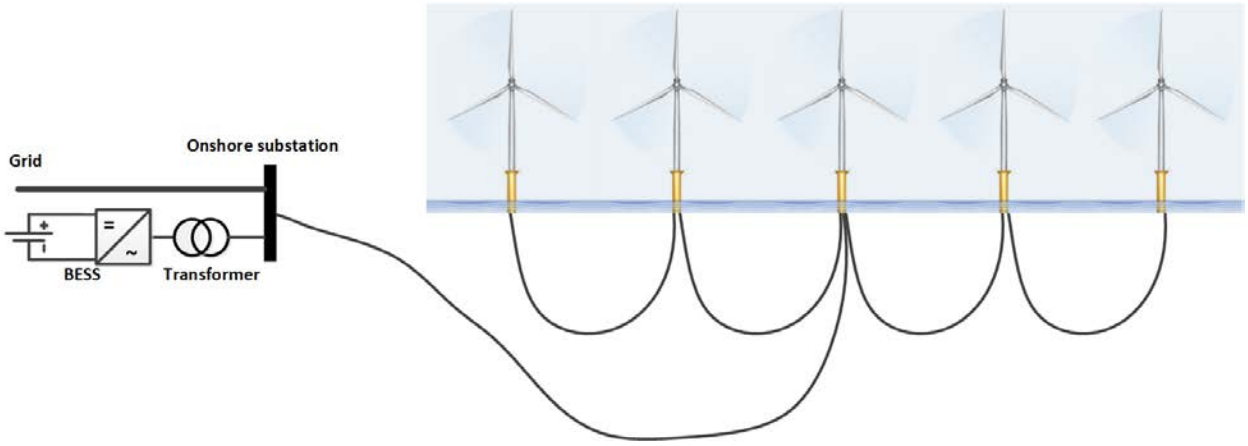

Figure 28. Near-shore offshore wind power plant operating with the land-based BESS. *Illustration by NREL*

The BESS technologies can provide a wide range of utility-controlled and self-directed services (Benson 2018).

4.5 Floating Technology Trends

Floating wind energy technology is advancing rapidly. Based on the resource capacity, the prospect for significant future deployment potential of floating wind seems similar to fixed-bottom wind but there are many technology challenges that must still be solved. Some of these unique technology challenges for floating wind are discussed in this section.

4.5.1 Floating Wind Turbines

Like fixed-bottom technology, developers of floating offshore wind projects generally want to use the largest commercial offshore turbines available on the market. For example, WindFloat Atlantic in Portugal is planning to install three MHI Vestas V164-8.4 MW turbines, and the Kincardine project in Scotland is installing five MHI Vestas V164-9.5 MW turbines (Froese 2018; 4C Offshore 2019; Davidson and Weston 2018). The motivation is the same for both floating and fixed-bottom foundations: project costs are lower with larger turbines. To date, all offshore wind turbines used in floating applications have been designed for fixed-bottom applications. Therefore, the market information for turbines on fixed-bottom foundations applies directly to floating systems. Floating-specific turbines have not yet been designed but conceptual engineering studies suggest a greater value proposition for lightweight turbine components, which may help reduce overall system weight. Because the floating wind pipeline is still small, the demand for these floating-specific offshore wind turbines is not high enough for OEMs to take the turbine development risk. More certainty in a large future floating wind market will be needed to motivate the first generation of customized floating wind turbines.

4.5.2 Floating Support Structures

The cost of a floating offshore wind project depends on the characteristics of the support structure it uses. The cost of the support structure itself is important, but so is the support structure's ability to help lower costs in other parts of the system, such as by enabling serial fabrication, inshore assembly, and commissioning, and by minimizing expensive offshore labor, including O&M. In addition, the coupled hydrodynamic-aerodynamic design of the floating system is the primary method for protecting the turbine from excessive loads and accelerations, especially under extreme conditions. Most floating projects in the pipeline plan to use semisubmersible substructures (see Table 11) because inherently, semisubmersible floating foundations have a shallow draft and are stable even after the turbine is installed. This allows for a full assembly and commissioning at quayside, and allows the full system to be towed from an inshore assembly port to an offshore station without the use of heavy-lift installation vessels.

Figure 29 shows a capacity-weighted average of the substructure choices for all floating projects in the NREL OWDB at the end of 2018.

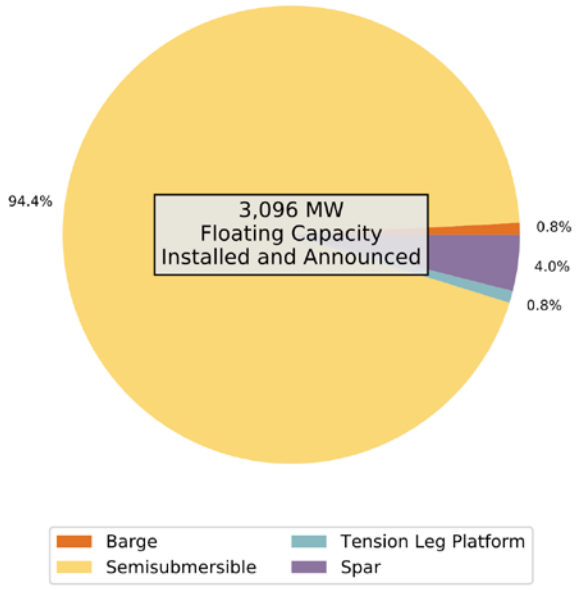

Figure 29. Capacity-weighted average of floating substructure selection for the global pipeline

The chart shows that 94% of projects in the floating wind pipeline plan to use semisubmersible substructures. Approximately 4% use or plan to use spar technology, like the substructures deployed by Equinor on the first commercial floating wind project, shown in Figure 30 (Equinor 2018a). The remaining substructures are tension leg platforms and barges.

As the industry deploys the next generation (second generation) of technology, new hybrid floating platform design concepts are being introduced that have desirable characteristics like the semisubmersible. In 2018, Stiesdal Offshore Technologies introduced the TetraSpar floater, which has a stable buoyant floating substructure with low draft to allow for inshore assembly but uses a flexible cable system to deploy a ballast weight at sea. The design incorporates a tubular steel base with a suspended underwater tetrahedral counterbalance. Innogy and Shell have partnered with Stiesdal to build a single turbine demonstration project in Norway that plans to use a 3.6-MW Siemens Gamesa turbine (Weston 2019). In November 2016, SBM Offshore won a contract to deliver three floating platforms for the 24-MW Provence Grand Large pilot wind energy project in the French Mediterranean. The SBM tension leg platform substructure design is unique because it is stable before attaching the mooring lines—an uncommon characteristic and one of the major drawbacks of conventional tension leg platforms. Both the TetraSpar and the SBM tension leg platform represent hybrid platform technologies that could challenge conventional semisubmersible technology for cost competitiveness and possible future market share. Figure 31 shows both designs.

Figure 30. A 6-MW floating wind turbine in Equinor's 30-MW array near Peterhead, Scotland, supported by a spar buoy floating platform. *Photo courtesy of Walt Musial, NREL*

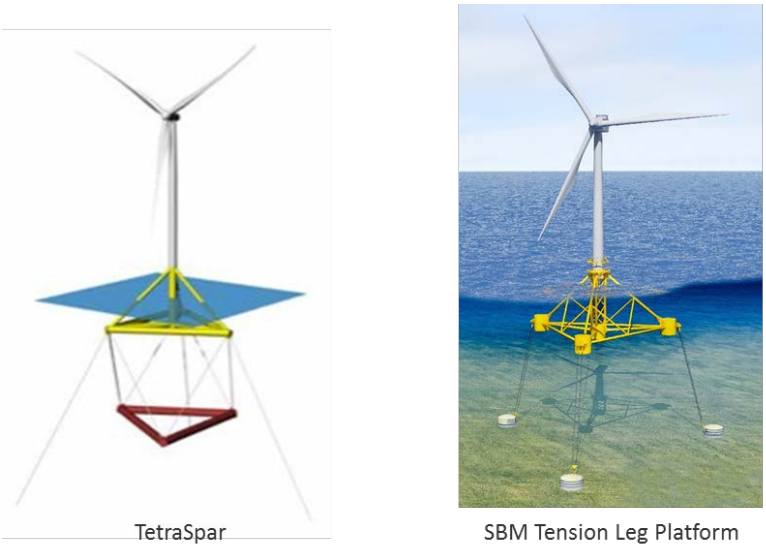

Figure 31. Second-generation floating wind concepts of alternative hybrid substructures. *Images courtesy of Stiesdal Offshore Technologies (left) and SBM Offshore (right)*

One concern for floating projects in the United States and likely other parts of the world is the design of mooring systems for the depth characteristics of the U.S. Outer Continental Shelf.

In the eastern United States, it is likely that floating technology could open large areas in the 60–100-m depth range for offshore wind development. Although this water depth is deep by fixed-bottom wind turbine standards, for floating, these depths are shallower than typical floating oil and gas rigs and are generally unique to offshore wind. Shallow water means shorter mooring lines, which act as shock absorbers to absorb hydrodynamic loading. If they are not long enough or heavy enough, platform loads could increase. New mooring system designs are needed to enable floating technology at shallow water depths. New designs are emerging already to allow projects to be sited in these water depths (4C Offshore 2019b). Conversely, because of the steep shelf on the Pacific Coast, floating projects will be located at sites with water depths up to 1,000 m or more. In these waters, the optimization of deeper water moorings is a different technology challenge because project developers are likely to be encouraged to reduce the footprint of their anchor circle and generally shorten the length of their mooring lines to minimize the impact to other users of the sea. In 2018, DOE and NYSERDA formed the National Offshore Wind R&D Consortium to address technical issues affecting developers in the United States and released a solicitation calling for engineering solutions to shallow and deep-water mooring design issues (NYSERDA 2019).

4.5.3 Electrical Power Systems

Floating turbines allow greater distances from shore, which can have several impacts on cost including the design of subsea electrical cabling and system configuration (e.g., consideration of HVDC) as well as logistical challenges during the project's construction and operation phases (e.g., transport time, effective length of working day).

Floating offshore wind platforms are constantly moving with the waves and winds acting on the structure. As a result, the attachment point for the electric cable is in motion as well. For a fixed-bottom foundation, this attachment point is firmly secured. The dynamic nature of floating platforms will require developers and cable manufacturers to develop dynamic cable designs to ensure that cyclic loads and bends on the cable will not compromise the system. This approach is important for turbine systems as well as possible floating substations. In March 2019, Prysmian announced that it had developed a specialized submarine cable system specifically designed for floating offshore wind applications. The company plans to test their new cable on the 24-MW Provence Grand Large Demonstration in France (T&D World 2019).
JDR, a supplier of subsea power cables and umbilical cables to the global offshore energy industry, has been selected by WindPlus as the preferred cable supplier for the Windfloat Atlantic 25-MW floating wind power plant. The project—located off the coast of Viana de Castelo, Northern Portugal—will be the industry's first application of dynamic cables operating at 66 kV with V164 floating wind turbine generators (WireTech 2019).

In April 2019, the Carbon Trust announced the five winners of its dynamic export cable competition as a part of the Floating Wind Joint Industry Project, which aims to accelerate and support the development of commercial-scale floating wind power plants. The project is a collaboration between industry partners EnBW, ENGIE, Eolfi, E.ON, Equinor, Innogy, Kyuden Mirai Energy, Ørsted, ScottishPower Renewables, Shell, Vattenfall, and Wpd, with support from the Scottish government (Carbon Trust 2019).

4.5.4 Targeted Research in the United States

The U.S. offshore wind industry is poised for substantial deployment of over 10 GW of electric-generating capacity over the next decade, but with only 30 MW operating there is some uncertainty about the transfer of largely European-based technology to the United States. The physical and economic characteristics of U.S. sites, supply chains, and offshore resources may present unique issues that would require additional research conducted outside the scope of individual commercial projects. To help address this concern, a new national technical research consortium was formed in 2018 with the purpose of conducting new technology research to benefit the end users (developers) of the U.S. market. Under an open funding opportunity, DOE committed

$20.5 million in 2018 to NYSERDA to form a National Offshore Wind R&D Consortium. The corporation agreed to match the DOE contribution and launched a funding organization to make research and development awards on prioritized topics that will support developers in achieving their near-term deployment and cost targets. The first solicitation was released by NYSERDA on March 29, 2019, and the first awards are expected in 2019. As the organization matures, NYSERDA envisions that the consortium will become a nonprofit entity with a self-sustaining mission that extends well beyond the initial 4-year time frame (NYSERDA 2019).

5 Cost and Pricing Trends

The PPA and price schedule agreed upon between Vineyard Wind LLC and Massachusetts electric distribution companies in July 2018 offers the first market-based reference point for the price and cost of commercial-scale (800 MW) offshore wind generation in the United States. It suggests that the Vineyard Wind project off Massachusetts falls within the price range of European offshore wind projects, with an expected start of commercial operation between 2022 and 2023. This PPA was established against the backdrop of continued price and commensurate cost reductions in major offshore wind markets from 2016 to 2018. Section 5.1 provides a discussion of price trends for fixed-bottom projects, including an analysis of the PPA price point for the Vineyard Wind project. Section 5.2 summarizes LCOE trends for fixed-bottom projects, with subsections on the constituent parts of LCOE (i.e., CapEx [Section 5.2.2], turbine costs [Section 5.2.3], operational expenditures (OpEx) [Section 5.2.4], and financing [Section 5.2.5]. Section 5.3 summarizes cost trends for floating technology.

5.1 Fixed-Bottom Pricing Trends

Figure 32 shows (adjusted) strike prices from recent offshore wind auctions held in Germany, the United Kingdom, the Netherlands, Denmark, and the United States, for projects to be commissioned between 2017 and 2025.

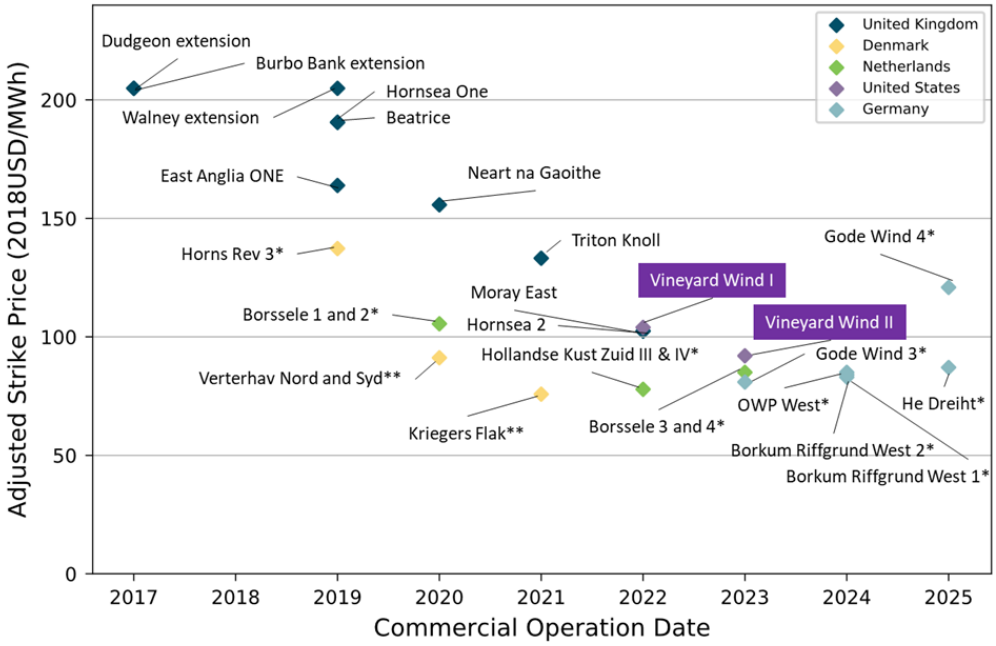

Figure 32. Adjusted strike prices from U.S. and European offshore wind auctions. *Reprinted from Beiter et al. (2019)*

Notes: *Grid and development costs added; **Grid costs added and contract length adjusted; includes data for commercial-scale projects only

The winning auction prices (commonly referred to as "strike prices")[53] that are shown in the figure were adjusted by NREL for contract length, grid connection, and revenue mechanism for an "all-in" price

[53] The strike price for an offshore wind project from an auction is usually the lowest bid price at which the offering can be sold. The strike price usually covers a specific contract term for which the project will be paid for the energy (and possibly other products or attributes) produced. The offeror of that

comparison (see Musial et al. 2017 for a more detailed description).[54] These adjustments were made to account for differences in project scope. For example, under German award terms, the project developer is only responsible for expenditures related to intra-array cabling and the offshore substation but not for the rest of the export cable system. Adjustments were made to the German projects to add the expected cost of the export cable and land-based grid connection back into the price.

The data suggest a trend of declining price levels from approximately $200/MWh (2017–2019 COD) to approximately $75/MWh for projects with a 2024–2025 COD.[55] These reductions in the prices for procuring offshore-wind-produced electricity were achieved through a combination of favorable siting characteristics; increased project size; continued optimization of technology and installation processes; improved market, regulatory, and auction design structures; increased competition within the supply chain; favorable macroeconomic trends; and strategic market behavior.

5.1.1 Vineyard Wind PPA (Lease OCS-A-0501) Analysis

On July 31, 2018, Vineyard Wind LLC and the Massachusetts electric distribution companies submitted a 20-year PPA for 800 MW of offshore wind generation and renewable energy certificates to the Massachusetts Department of Public Utilities for review and approval. The Vineyard Wind/Massachusetts PPA established a contract for procurement of electricity from two 400-MW facilities that enter commercial operation in 2022 (facility 1)[56] and 2023 (facility 2), respectively, at a specified pricing schedule (Massachusetts Department of Public Utilities 2018a, 2018b). Key contractual terms and project filings from the Vineyard Wind LLC Draft Environmental Impact Assessment (Vineyard Wind 2018a), construction and operations plan (Vineyard Wind 2018b), and the independent evaluator report (Peregrine Energy 2018) are shown in Table 12.

The documented first-year price for delivery of offshore wind generation and renewable energy certificates under the Vineyard Wind/Massachusetts PPA is $74/MWh (2022$) for facility 1 (400 MW) and $65/MWh (2023$) for facility 2 (400 MW), but these prices do not reflect all of the revenue that the project will generate, and are therefore lower than the data shown in Figure 32. To allow for a more accurate comparison with the adjusted European auction prices, Beiter et al. (2019) calculated a levelized PPA price, accounted for revenue streams outside of the PPA,[57] and excluded U.S. tax benefits (i.e., election of the investment tax credit [ITC]). The resulting (adjusted) PPA price was estimated to be $98/MWh (2018$).

Although this (adjusted) "all-in" price level of $98/MWh is significantly higher than the reported first-year PPA prices, the data in Figure 32 show that the project costs are in line with European project bids for the same time frame. This suggests that the generally anticipated price (and cost) premium for the nascent U.S. offshore wind industry in comparison to offshore wind projects in the established European markets might be much less pronounced than has widely been expected by many analysts. Earlier cost analyses estimated LCOE between $120/MWh and $160/MWh for a commercial-scale offshore wind project built in the northeastern

strike price is awarded the rights to develop a particular parcel under predetermined conditions set in the tender offer that may vary by country or market. The strike price should not be confused with levelized cost of energy, which may be calculated using different financing and cost assumptions.

[54] In general, these adjusted costs are higher than the unadjusted strike prices but still reflect a steep decline in price for European offshore wind projects installed out to the 2025 COD.

[55] Note that many of the projects shown in Figure 32 with future CODs have not yet reached the financial investment decision, and some caution is appropriate when determining whether these projects will reach COD.

[56] Vineyard Wind LLC has recently reported its intent for both facilities to be in operation by the end of 2022, ahead of the commercial operation date indicated on initial fillings (Vineyard Wind 2018c).

[57] One of the revenue streams outside of the PPA considered is sales into the ISO-New England (ISO-NE) Forward Capacity Market. Note that in its capacity auction FCA #13 held on February 4, 2018, Vineyard Wind did not qualify for the renewable technology resource exemption, which allows a resource to be exempt from the ISO-NE minimum-offer price rule. Vineyard Wind participated in the ISO-NE substitution auction and secured 54 MW of capacity. ISO-NE filed tariff changes on November 30, 2017, to allow offshore wind resources located in federal waters, including Vineyard Wind, to qualify for renewable technology resource treatment in future auctions. These tariff changes were approved by the Federal Energy Regulatory Commission on January 29, 2019 (ISO Newswire 2019).

United States in the early 2020s (see e.g., Beiter et al. 2017; Musial et al. 2016; Maness et al. 2017; Kempton et al. 2016).

Table 12. Vineyard Wind LLC/EDC PPA Contract Terms[58]

	PPA 1	PPA 2	Notes	Source
Capacity [MW]	400	400	N/A	a, b
Commercial operation date	January 15, 2022	January 15, 2023	N/A	a, b
Delivered product	Energy and renewable energy certificates		N/A	a, b
First-year PPA price [$/MWh]	74 $2022/MWh	65 $2023/MWh	N/A	a, b
PPA duration [years]	20		N/A	a, b
Escalation factor [%]	2.5		N/A	a, b
Vineyard Wind LLC Project Filings				
Wind speed [m/s]	9.3		Simple average of the entire Vineyard Wind lease area	c
Net capacity factor [%]	45		Average capacity factor reported by Vineyard Wind; assumed to be net capacity factor	d
Average water depth [m]	42		The construction and operations plan indicates water depths in the northern half of the lease area range from 35 to 49 m; 42 m is the average	d
Substructure type	Monopiles		Vineyard Wind has indicated that it prefers to use monopiles but may deploy jackets for up to 400 MW of capacity depending on seafloor conditions	d
Turbine rating [MW	8		Turbine rating will range between 8 and 10 MW	d
Export cable length [km]	69.2		Generator lead line proposal selected by buyer (Vineyard Wind LLC procures all cables from turbine to point of interconnection); point of cable landfall: New Hampshire Avenue	e
Land-based cable length [km]	9.65		Generator lead line proposal selected by buyer (Vineyard Wind LLC procures all cables from turbine to point of interconnection); interconnection point: Barnstable	e
O&M port distance [km]	60		O&M port: Vineyard Haven	d

[58] These terms are derived from the PPA contract between NSTAR Electric Company d/b/a Eversource Energy and Vineyard Wind LLC; similar contract terms apply to the other electric distribution companies that have separate contracts with Vineyard Wind LLC.

Installation port distance [km]	92		Installation port: New Bedford Commerce Terminal	d
ITC [%]	18	18	Assumes safe harbor provision through expense of 5% of the overall project cost by the end of 2018 (facility 1) and 2019 (facility 2)	f

Source: Reprinted from Beiter et al. (2019)

a Massachusetts Department of Public Utilities (2018a)
b Massachusetts Department of Public Utilities (2018b)
c Musial et al. (2017)
d Vineyard Wind (2018b)
e Vineyard Wind (2018a)
f Peregrine Energy (2018)

The following is a set of factors that may help explain how Vineyard Wind may have been able to achieve lower-than-expected prices, which are on par with the European price reductions shown in Figure 32:

- The ability to import major technology components from Europe and Asia (e.g., nacelles, blades, cables)
- Favorable offtake conditions for electricity produced by offshore wind in the United States (e.g., relatively low merchant risk compared to the terms of recent European tenders)
- Use of state-of-the art technology solutions expected from early U.S. projects (e.g., Vineyard Wind LLC has announced its intent to procure the V164-9.5 MW turbine [MHI Vestas 2018])
- Project size of 800 MW that is comparable to large European projects
- Developer's experience with installing and operating offshore wind plants globally
- Successful demonstration of offshore wind technology at the Block Island Wind Farm may have lowered some risk perceptions
- Strategic bidding by tender participants for entry into emerging U.S. market (e.g., to gain "first-mover" advantages)
- U.S. market pipeline visibility and growing state policies (see Section 2)
- Industry consolidation as evidenced by Deepwater Wind's acquisition by Ørsted in December 2018
- Intensified competition within the global and U.S. supply chain and among bidders.

This price signal from the Vineyard Wind/EDC PPA could be indicative of subsequent procurement prices of U.S. commercial-scale offshore wind generation in the 2020s. However, a combination of factors determines future price and cost levels (Musial et al. 2016). Massachusetts legislation H.4568 requires future offshore wind generation procured under its capacity mandate of 1,600 MW[59] to produce a price below the Vineyard Wind LLC/EDC PPA contract price.[60] This will require additional cost reductions amid a tax environment that is expected to become less favorable with the ITC phase-out underway (see Section 5.2.6). It is also possible that the Vineyard Wind LLC/EDC PPA price could have benefited from one-time effects, such as strategic

[59] Massachusetts legislation H.4568 mandates the procurement of 1.6 GW of offshore wind capacity by 2027.
[60] The Massachusetts legislature is considering a change to this requirement, which would adjust the procurement price of the previous solicitation for the availability of federal tax credits, inflation, and incentives (amendment 280 to H.3800; H.3801).

bidding behavior among market entrants to gain first-mover advantages for subsequent U.S. offshore wind tenders.

Beyond Vineyard Wind, there is only a limited number of price signals from U.S. projects but their project sizes are smaller than 250 MW. The prices for these small-to-medium size projects are shown in Section 2.4.

5.1.2 European Auction Results and Outlook

Major offshore wind auctions were held in Germany and the Netherlands during quarter 1 (Q1) and Q2 of 2018. Auction activity ceased during the second half of 2018. Table 13 lists the auctions held in European markets during 2018. These were described in greater detail in the *2017 Offshore Wind Technologies Market Update* (Beiter et al. 2018), as they all took place in early 2018.

Table 13. Offshore Wind Auctions During 2018

Project	Country	Auction	Award Date	Capacity (MW)	Auction Price (2016$/MWh)	Adjusted Auction Price Estimate (2016$/MWh)
Borkum Riffgrund West 1	Germany	Second Auction (§ 26 WindSeeG)	04/27/18	420	0	~79
Gode Wind 4				132	118	~115
Hollandse Kust Zuid III and IV	Netherlands		03/19/18	700	0	~74
Note: For more details on these auctions, see Beiter et al. (2018).						

In Germany, no further auction activity is expected for a 3-year period after conclusion of the country's first two rounds of auctions held under the §26 *Offshore Wind Act* (*WindSeeG*) during 2017–2018. Although the German coalition government signaled it may hold an extra tender, it has not formally proposed another auction round to date ahead of 2020 (Foxwell 2018a). Industry groups have requested to "advance grid expansion and optimization and reduce regulatory hurdles for sector coupling" (German Offshore Wind Energy Foundation 2019). After awarding Hollandse Kust Zuid I and II projects (700–750 MW) on March 19, 2018, in a zero-subsidy bid, no additional tender was conducted during 2018 in the Netherlands. Tenders for Hollandse Kust (zuid) wind farms III and IV (700 MW) are scheduled to be held in March 2019 with awarded projects expected to commercially operate by 2023. The United Kingdom will continue its tender activity with a third contract-for-difference allocation round ("AR3") in May 2019. The tender budget is specified at £ 60 million, with a delivery cap of 6 GW.[61] The last award in the United Kingdom was made during its contract-for-difference 2 round in 2017 ("AR2"). After inactivity during 2018, Denmark has selected the location of a new offshore wind facility (800 MW) off Nissum Fjord to be auctioned during 2019 with a COD between 2024 and 2027.

[61] Note that various technologies can bid under the United Kingdom tender scheme, including (but not limited to) offshore wind. However, in previous auctions, offshore wind was awarded the largest share.

5.2 Fixed-Bottom Offshore Wind Cost Trends

5.2.1 Levelized Cost of Energy

Offshore wind is among the renewable energy technologies that has experienced a rapid cost decline in recent years. It is commonly expected that this cost reduction trend will continue globally and will be realized in the United States as the market emerges. Figure 33 provides a survey of LCOE estimates and projections for fixed-bottom technologies from a variety of research organizations and consultancies.

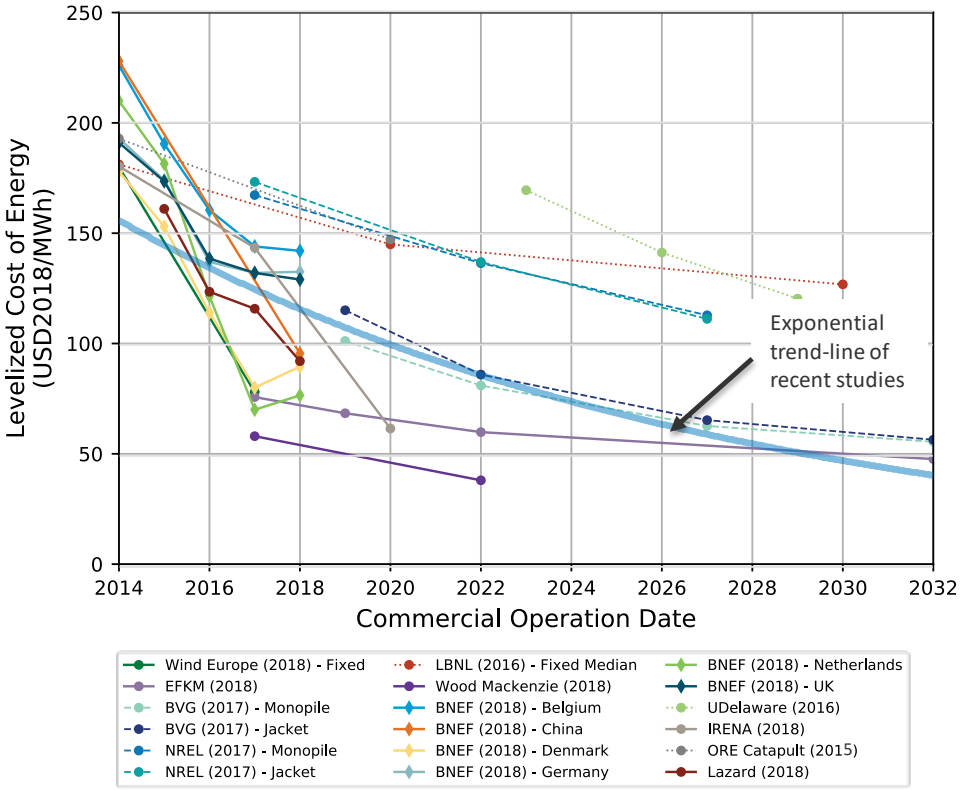

Figure 33. Global LCOE estimates for fixed-bottom offshore wind[62]

Sources: WindEurope (2018), Danish Ministry of Energy, Utilities and Climate (2018), Valpy et al. (2017), Beiter et al. (2017), Wiser et al. (2016), Barla (2018), BNEF (2018b, 2018c), Kempton et al. (2016), IRENA (2018), ORE Catapult (2015), and Lazard (2018)

In Figure 33, the 2018 cost projections are shown in solid lines, whereas earlier studies are plotted with dashed lines. The wide blue trend line represents an exponential fit of the most recent data from studies published in 2018, as well as Valpy et al. (2017) projections, which extend to 2032. This trend line suggests a decrease from LCOE levels of about $120/MWh in 2018 to $50/MWh by 2030. The trend line is meant to serve as a visual reference to focus on the most recent cost projections.

Projections informed by a learning curve approach offer a complementary method for forecasting future cost reductions (Wiser et al. 2016). Based on industry growth projections, the cumulative capacity of the global industry is likely to experience approximately three doublings, or a total growth of eight times its current

[62] "LBNL" in the figure refers to Berkeley Lab

capacity, by 2030. IRENA (2018) estimates a learning rate for offshore wind of approximately 14% per doubling over the period 2010–2020, which would indicate possible LCOE reductions of over 35% based on industry growth projections of 154–193 GW globally by 2030 (see Section 3.2.3).

5.2.2 Capital Expenditures

CapEx are the single largest contributor to the life cycle costs of offshore wind power plants and include all expenditures incurred prior to the COD. Figure 34 shows the reported CapEx over time for operational projects as well as for those in various stages of the near-term project pipeline globally. Each bubble represents the cost estimate (in terms of $/kW) for a single project and bubble size represents the project's capacity.
After a period of increasing project CapEx until 2014 (Musial et al. 2017), an industry trend of declining CapEx has developed, with a capacity-weighted average CapEx of $4,350/kW in 2018 globally. WindEurope reported a European project CapEx of $2,870/kW in 2019, a 45% reduction since 2015 (Brindley 2019). Reported project data suggest a gradual decline of CapEx to levels in the range of $2,500–$4,000/kW between 2020 and 2030. The underlying data for Figure 34 include considerable variation of CapEx within a given year. For projects with a COD in 2018, CapEx ranges from approximately $2,470/kW (Jiangsu Luneng Dongtai project, China [200 MW]) to $6,500/kW (Galloper project, United Kingdom [353 MW]) among projects with capacities greater than 100 MW. Several factors may possibly explain the variation in CapEx within a given year and over time (Smith, Stehly, and Musial 2015), including:

- Varying spatial conditions (e.g., water depth, distance to port, point of interconnection, and wave height of sites that affect technical requirements of installing and operating a wind farm)
- Project size
- Different levels of supply chain shortages (e.g., components, vessels, and skilled labor)
- Changing prices for commodities and energy
- Macroeconomic trends, such as fluctuating exchange rates
- A change in the appreciation of the costs and risks associated with offshore wind project implementation, which reflects in pricing strategies from equipment suppliers and installation contractors.

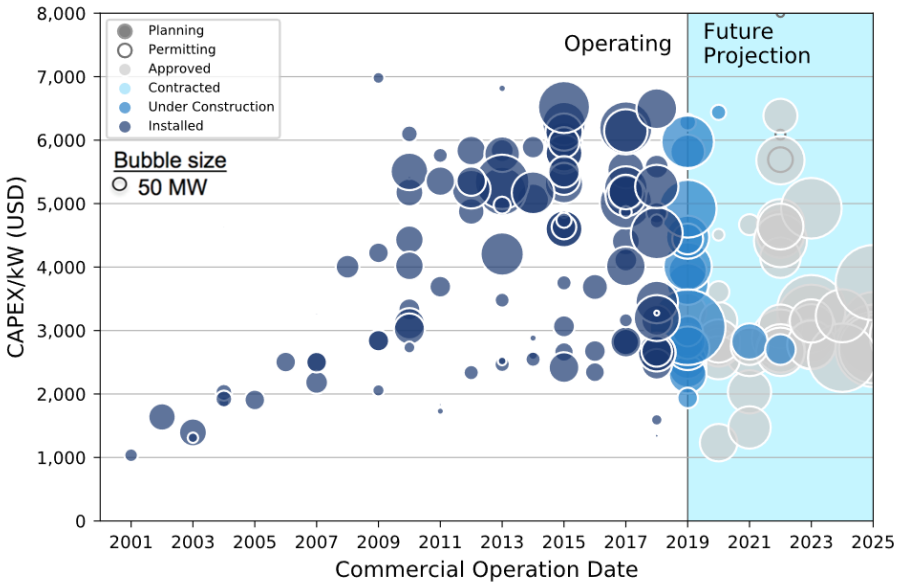

Figure 34. Capital expenditures of global offshore wind projects by commercial operation date and project capacity

Note: Only projects with CapEx greater than $800/kW included.

Note that only limited CapEx data are available for any given year before 2010 and after 2025. As a result of this relatively small sample, and the projects' early planning stages in which firm contracts for capital equipment have yet to be executed, the level of confidence is relatively low for some years.

CapEx has been reported for 67,185 MW of global offshore wind projects. Figure 34 shows the announced costs for 123 installed projects (20,198 MW), 21 projects (7,198 MW) that have started construction, 14 projects (4,848 MW) that have secured financial close, 56 projects (34,009 MW) that have received regulatory approval, 5 projects (575 MW) in the permitting process, 1 project (300 MW) that is still in the planning phase, and 8 projects (58 MW) that are decommissioned. These CapEx data have some uncertainty for various reasons: 1) the CapEx data are normally self-reported by developers and difficult to verify independently, 2) there is limited transparency into the financial impact of cost overruns, and 3) it is often unclear whether the reported CapEx fully captures the total cost of installing the project and connecting it to the grid.[63] When viewed together, though, these data can provide insight into the long-term cost trends. Generally, greater confidence can be placed in cost estimates that are in more mature stages of the project life cycle (i.e., costs for projects that have reached the financial investment decision are typically more accurate than for a project that has not yet received permits); however, preliminary estimates provide insight into developer expectations about cost trends.

5.2.3 Wind Turbine Cost

Offshore turbine costs are estimated to be between 30% and 45% of the total CapEx. Typically, turbine price data come from turbine supply agreements that are negotiated for each project, but because of their proprietary nature these data are very limited. Turbine prices may vary considerably among specific projects. Some of the factors in turbine pricing include delivery costs to the staging port, warranty period (typically 5 years), availability guarantees, project order size, turbine attributes (e.g., turbine rating and drivetrain topology), market competition, timing, and specific strategic market behavior (e.g., first-mover advantages, customer retention). Turbine CapEx has declined rapidly over the last few years, which has led to a considerable spread in price estimates found in publicly available literature sources. Figure 35 shows turbine CapEx estimates published between 2016 and 2019, which illustrate considerable variation yet a general trend of price decline in turbine CapEx between 2010 and 2030.

[63] For example, it is unclear if the announced capital expenditure values include soft costs, such as construction, financing, insurance, or fees.

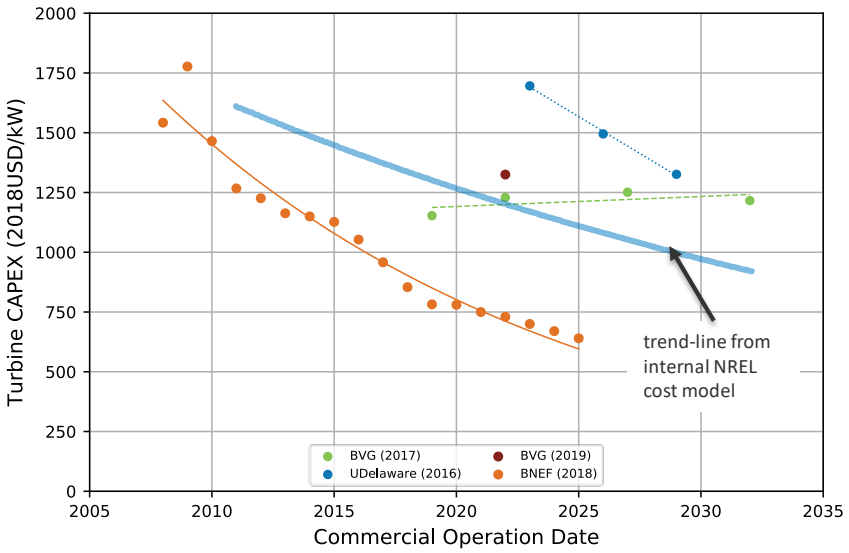

Figure 35. Turbine CapEx trend estimates

Sources: Valpy et al. (2017),[64] Kempton et al. (2016), BVG Associates (2019), and BNEF (2018e)

Available cost studies indicate that turbine CapEx could range between $800/kW and $1,200/kW in 2018–2019. BNEF (2018d) numbers were the lowest and estimate a reduction trend reaching $640/kW by 2025. Valpy et al. (2017) illustrates the impact from larger turbine ratings of 6 MW (2019), 10 MW (2022), and 12 MW (2027 and 2032) on turbine CapEx. The increase in turbine CapEx from Valpy et al. (2017) is found to be relatively small on a $/kW basis, which would allow for a significant decrease of total system costs on a $/MWh basis. Kempton et al. (2016) estimated considerably higher turbine CapEx from their 2016 study but show a similar cost reduction rate as BNEF (2018d).

The highest commercially available turbine rating is expected to grow from 9.5 MW in 2018[65] to 15 MW or higher over the next decade (see Section 4), which presents one of the primary areas for future cost reduction (e.g., Wiser et al. 2016). Using higher-rated turbines for a given project size reduces the number of turbines to be installed and serviced, effectively decreasing the unit costs for balance-of-station ($/kW) and O&M activities ($/kW/year). In addition, consultation with industry experts and turbine manufacturers suggests that higher turbine rating may not necessarily result in an increase in turbine CapEx ($/kW). Turbine manufacturers have reportedly been able to increase turbine rating without increasing the unit cost of the turbine ($/kW). Through continued innovations, such as the use of lightweight materials, advanced manufacturing methods, systemwide load control, and economies of scale in production and delivery, turbine manufacturers may be able to offset other cost increases (such as specific mass increases) caused by upscaling. Some evidence of this trend might be found in a review of the GE Haliade-X technical specifications by Pondera Consult, which reports only a slight increase in specific mass for the Haliade-X turbine at 68.8 tonnes per megawatt (t/MW)—including the nacelle, blades, and hub—compared to the Vestas V164-8MW specific mass of 62.5 t/MW. This

[64] Note: In contrast to the other sources, this estimate from Valpy et al. (2017) explicitly includes the impact from an increase in turbine rating (over time) on turbine CapEx ($/kW) (i.e., from turbine ratings of 8 MW [2018] up to 12 MW ([2027 and 2032]).

[65] MHI Vestas V164-9.5 MW turbine.

emerging trend in turbine lower mass/cost growth must be further validated but could provide a further economic motivation for upscaling to larger turbines (de Vries 2019).[66]

5.2.4 Operational Expenditures

OpEx cover all costs incurred after COD—but before decommissioning—that are required to operate the project and maintain turbine availability to generate power. These expenditures are generally thought to contribute between 20% and 30% to life cycle costs for offshore wind projects, depending on site characteristics. The strongest drivers are distance from the O&M port, accessibility limits related to local meteorological ocean conditions (e.g., wave height), and turbine rating (i.e., fewer, larger turbines suggest lower O&M costs per megawatt). To optimize the balance between OpEx and availability, operators adopt different logistical strategies for individual projects depending on site conditions (DNV GL 2013). OpEx for offshore wind projects are subject to considerable uncertainty because of a lack of empirical data. Although wind project owners commonly report CapEx, they rarely report OpEx.

5.2.5 Financing

In contrast to fossil-fueled power plants (e.g., natural gas or coal), variable costs of offshore wind plants are relatively small, and most lifetime costs are incurred up-front through CapEx for the development and construction of a project. These up-front expenditures generally require investment volumes of more than $1 billion for utility-scale projects (>200 MW).[67] The financing rate of a project, commonly expressed in terms of the weighted-average cost of capital,[68] has considerable impact on lifetime project costs (i.e., LCOE) because it determines the annual debt service and equity repayment for the initial (CapEx) investment.

During 2018, offshore wind projects in Europe and Asia continued to access low-cost capital, consistent with a broader trend of declining equity and debt rates for renewable energy asset financing in recent years. Nearly $12 billion was invested in new European offshore wind capacity (4.2 GW) during 2018, which comprised 24% of the total investment in new power generation assets in Europe.[69] Although the total investment volume is lower compared to the levels between 2015 and 2016, installed capacity levels were considerably higher "as a result of cost reductions and sector maturity, particularly for offshore wind" (Brindley 2019). In Europe, project finance dominated offshore wind investment transactions during 2018 with a share of 77%. This drastically reverses the trend of widespread balance-sheet financing from previous years and reflects growing comfort with the risks associated with constructing and operating an offshore wind plant, as well as the entry of smaller developers who can take advantage of a favorable lending market (Brindley 2019). Table 15 depicts financing conditions typical for European offshore wind projects between 2006 and 2018 (Guillet 2018). The share of debt in European project financing has been consistently at or above 70% since 2012, including in 2018. Brindley (2019) reports debt share of up to 90% for European offshore wind financing in 2018, exceeding those of land-based wind farms. These financing terms are generally expected to carry into 2019 (Brindley 2019).

Table 14. Typical Financing Conditions for European Offshore Wind Projects

Year	Debt-to-Equity Ratio	Pricing[70] (Basis Points)
2006–2007	60:40	150–200

[66] Note that the described trend between turbine rating and turbine CapEx may only apply to a certain range of turbine ratings.
[67] For instance, the 800-MW Vineyard Wind project has a reported investment volume of approximately $2 billion (Renewables Now 2018).
[68] Weighted-average cost of capital is the average cost of all sources of capital based on the percentage contribution to the total capital structure.
[69] Major offshore wind projects that reached their financial investment decision were Moray East and Triton Knoll (both in the United Kingdom) and Borssele III and IV (the Netherlands).
[70] Basis points are indicated above the London Interbank Offer Rate. One basis point is equal to 1/100 of a percent and 100 basis points equals 1%.

2009–2011	65:35	300–350
2012–2013	70:30	200–250
2014–2015	70:30	200–250
2016–2017	75:25	150–225
2018	70:30	120–175

Source: Reprinted from Guillet (2018)

Note: Year 2008 not available from source.

Debt

Debt rates for global offshore wind financing remain at historically low levels, ranging between 3% and 4% for 15-year debt terms (Guillet 2018). Debt maturity (post completion) ranged between 10 and 18 years, depending (among other factors) on the length and structure of the offtake conditions. These debt terms correspond to land-based wind financing in the United States (Wiser and Bolinger 2018). Consultation with industry experts suggests that debt financing rates for commercial-scale offshore wind projects will be similar to commercial-scale projects in the United States.

Equity

Driven by high demand for relatively predictable long-term cash flow and technology characteristics that are increasingly well-understood, equity rates for offshore wind have decreased in recent years. A greater variety of equity investor classes seems to be comfortable with the risk profiles of offshore wind, such as pension and insurance funds. Further, equity refinancing of operational projects has become more prevalent in established offshore wind markets. During 2018, the debt refinancing volume was nearly $10 billion for four European offshore wind farms completing their construction phase (Brindley 2019).

Emerging information for the U.S. market suggests that European financing terms are generally applicable to a U.S. project finance context. In the United States, it is generally expected that several different types of entities will participate in the financing of commercial-scale offshore wind projects, including commercial banks, export credit agencies, and institutional investors (e.g., pension funds, insurance funds, and infrastructure investors). The engagement of Copenhagen Infrastructure Partners in the Vineyard Wind project may indicate that major international infrastructure investors recognize the potential of the U.S. offshore wind market. A similar motivation might apply to the market entry of major oil and gas corporations as well as supply chain companies (i.e., manufacturers and marine contractors) acting as offshore wind investors globally and in the United States.

Important U.S.-specific financing considerations include, but are not limited to:

- **Tax Credits**. Offshore wind projects in the United States may currently elect the ITC or production tax credit. It is commonly expected that U.S. offshore wind projects will have a preference to elect the ITC; however, choosing between election of the ITC versus the PTC depends on a number of financial and legal considerations influenced by the anticipated energy production and operational risks. Pursuant to the Consolidated Appropriations Act, 2016 (P.L. 114-113), these tax credits are on a phase-down schedule (Table 15), thereby limiting the number of offshore wind projects that are expected to benefit from these tax provisions. Some large-scale projects have reportedly grandfathered their election of the ITC/production tax credit by commencing "physical work of a significant nature" on the facility or by incurring at least 5% of the total cost of the facility under the ITC phase-down rate schedule (Deloitte 2017). During 2018, some concerns were raised whether large-scale projects, such as the 800-MW

Vineyard Wind project, would be able to raise unprecedented volumes of tax equity financing for a single project of up to $600 million (Deepwater Wind 2018). Financial close of the Vineyard Wind project is expected during 2019 and will allow for a better understanding of whether enough tax equity is available at these investment levels. Election of these tax credit provisions influences the optimal financing structure of an offshore wind project with a higher share of equity and back-leveraged (i.e., the loan is collateralized by the sponsor's equity in the project), so that the benefits from the tax incentive can be fully utilized. As a result of the tax credit phase out, optimal offshore wind financing structures are expected to be impacted (i.e., lower equity share).

Table 15. ITC Phase-Down Rate Schedule

Construction Start Before	Applicable ITC Rate
1/1/2017	30%
1/1/2018	24%
1/1/2019	18%
1/1/2020	12%
On or after 1/1/2020	0%

Source: Reprinted from Deloitte (2017)

- **Installation and operation contingencies**. Consultation with industry experts suggests that early commercial-scale U.S. projects might expect higher contingency levels relative to the established European offshore wind markets. These serve to account for less experience in U.S. offshore wind power plant installation and operation with the risk of incurring delays and interruptions in the supply chain, marine logistics, and permitting processes.
- **Offtake mechanisms**. Current U.S. offtake mechanisms (Section 2.4.1) are generally seen as attractive to global offshore wind developers because of their relatively low merchant price exposure. Higher uncertainty in revenue streams and declining margins in established offshore wind markets in Europe and Asia might have been primary factors in yielding the high bid prices for lease areas auctioned during 2018.
- **Permitting**. In the United States, a federal, state, and local permit to construct and operate a wind power plant is not included in a lease award. This might introduce additional risk from legal action, permitting delays, and stranded assets compared to acquiring a fully permitted lease area.[71]

The Vineyard Wind PPA pricing suggests that there is only a small premium for "new market" risk (Beiter et al. 2019). Consultation with industry experts suggests that investors are available for the different types of risk profiles of each project phase (e.g., developers, private equity, independent power producers, utilities, tax equity, green banks, export credit agencies, manufacturers). A variety of financial vehicles could be utilized to mitigate the risk exposure of early projects, including tax incentives, bonus appreciation, loan guarantees, and financial hedging products. Coincident with the phase out of tax credits over the next few years, high RPS requirement levels are starting to take effect in coastal states, which might mitigate some of the lost tax benefits.

[71] For instance, in past German offshore wind auctions, prepermitted lease areas were awarded.

5.3 Floating Cost Trends

Although still in the precommercial phase of maturity, floating wind technology has gained greater mainstream recognition over the past year, partially because of Equinor's successful deployment and operation of the Hywind II pilot project near Peterhead, Scotland. Today, floating wind is generally considered a viable technology for the future of offshore wind. Figure 36 depicts LCOE trends estimated by various research organizations and consultancies that show a reduction from levels from above $175/MWh (2018) to $70/MWh (2030).

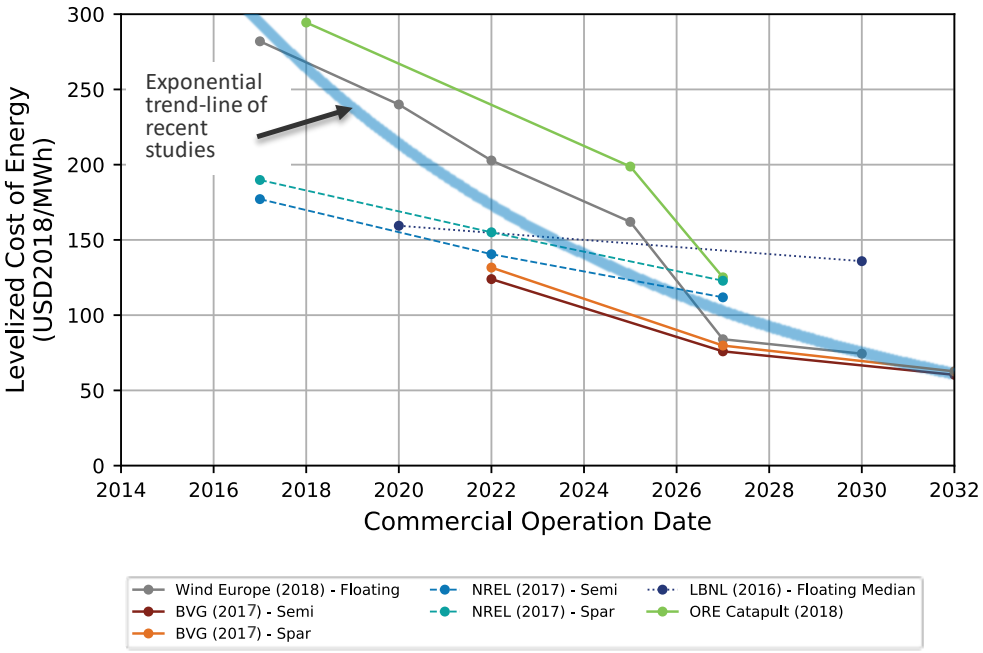

Figure 36. Global LCOE estimates for floating technology[72]

Sources: WindEurope (2018), Hundleby et al. (2017), Beiter et al. (2017), Wiser et al. (2016), ORE Catapult (2018)[73]

Note that the number of sources for floating wind cost is smaller than for the fixed-bottom trends. These estimates, except for those provided by ORE Catapult (2018) prior to 2027, assume commercial-scale floating wind plants and learning curve benefits commensurate with a mature industry. The blue trend line represents an exponential fit of the most recent studies from 2018. This trend line is meant to serve as a visual reference to focus attention on the most recent cost projections. Cost estimates assuming a commercial-scale floating project size, published prior to 2018, predict higher costs than those published more recently. This might reflect more accurate cost data and new data on anticipated fixed-bottom cost reductions that are applicable to floating systems, as well as increased optimism that technical challenges can be overcome.

The anticipated cost reductions between 2015 and 2030 are related to an expected floating deployment trajectory that spans from existing single-turbine demonstration projects (2015–2017) to multiple-turbine demonstration projects (2017–2022), and finally, to medium- to full-scale commercial projects (early to late 2020s). Globally, there is currently a wide range of floating technology concepts under consideration that are at the multiturbine demonstration phase.

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[72] "LBNL" in the figure refers to Berkeley Lab

[73] Estimates from ORE Catapult (2018) were converted from £2012 to $2018 using 2012 exchange rates and applying a cumulative U.S. inflation factor of 9.4% for the period 2012–2018. The ORE Catapult (2018) estimates reflect demonstration (2018), precommercial (2025), and commercial status (2027).

The cost of floating wind technology is currently based on a small set of data from the first phase of prototypes and projects in the design or construction phase. Generally, the potential for cost reduction is high because early-stage technology advances usually result in significant cost reductions. In addition, technological and commercial developments from fixed-bottom wind systems might translate to floating wind systems. Cost estimates from NREL's geospatial analysis (Beiter et al. 2016; Gilman et al. 2016) indicate that floating costs may show a steeper rate of cost reduction than fixed-bottom systems, with the potential for cost parity over the next 10 years. The basis for technology-specific cost reduction potential comes from a range of factors, including (but not limited to) the ability of floating systems to:

- Leverage cost reductions, innovations, and experience from fixed-bottom systems
- Utilize existing supply chains
- Optimize using lighter components and increased modularity
- Reduce the number and complexity of construction steps at sea (e.g., by assembling the turbine and substructure at quayside)
- Automate production and fabrication of the floating platforms
- Access higher wind speeds sufficient to outweigh the higher O&M and installation costs associated with greater distances to shore and harsher meteorological conditions.

For a more detailed discussion of possible methods to reduce the cost of floating systems, see Beiter et al. (2016).

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So Bright You Have to Wear Shades: PACE Financing for Solar Panels and Other Alternative Energy Facilities

So Bright You Have to Wear Shades: PACE Financing for Solar Panels and Other Alternative Energy Facilities

Mark Palmer

Introduction: As competition for tenants continues to heat up in the marketing of commercial, retail, office, multi-family, and other property types, borrowers are exploring new ways of reducing operating costs, including through the use of solar panels and other energy-generating or energy-saving facilities. Property Assessed Clean Energy (PACE) financing is becoming an increasingly popular and preferred means of financing such facilities, and the requirements and terms of such PACE financing present both opportunities and challenges for CMBS loan lenders and servicers.

Although significant savings and better property operating performance may be achieved by installing such facilities, any use of PACE financing involves potential risks that must be carefully considered, especially with respect to the requirement that mortgage liens be subordinated to PACE financing liens. As a result of such required mortgage lien subordination and other risks, loan servicers and rating agencies have been reluctant to consent to and provide no-downgrade confirmations for PACE financing, however, there is, at least on a limited basis, an ongoing re-evaluation of the manner in which PACE financing requests and the risks are being considered and how such risks may be mitigated.

This article focuses on those risks, potential mitigants and credit enhancements, and required consents, including the subordination of the mortgage lien, due on encumbrance and alterations terms, potential reductions in operating costs, and considerations related to foreclosures and REO sales.

PACE Financing: What is it? PACE financing has been established by statute in a majority of the states as a tool to provide access to capital for clean energy and energy-generating and energy-efficiency projects, such as solar panels, tankless water heaters, insulation improvements, electric vehicle charging stations, and upgrading heating and air conditioning systems with more efficient systems. The financing is typically funded by bonds secured by a voluntary assessment lien on the related real property, which

is billed and collected as part of the property tax assessment and, like a property tax lien, a PACE financing lien is superior in priority to mortgage liens and other liens. The lien is "voluntary" because the property owner must request and agree to the PACE financing and the related assessment lien.

The term of PACE financing is customarily twenty years, with annual (or semi-annual, depending on the jurisdiction's method of collecting property taxes) fully amortizing payments. PACE financing interest rates are typically less than market rates offered by banks and other conventional lenders for similar projects, in part as a result of such financing being secured by a superior lien on the entire real property on which the facilities are installed. PACE financing cannot be accelerated upon a default, and any collection action or foreclosure of the lien is limited to the amount of the periodic payment or payments that are past due.

PACE financing requires an audit and a projection of savings in energy costs as a result of the energy generation or improved efficiency of the facilities to be installed and a demonstration of a net savings to the property owner after taking into account the cost and repayment of the financing. Annual savings are typically greater with PACE financing than any savings that could be achieved by installing the facilities using conventional financing because of the lower interest rates and extended terms available through PACE financing programs. The net-savings calculations are, however, determined based on assumptions related to the long-term future cost of traditional energy sources, and, especially in the current energy market with changes in pricing resulting from the discovery and use of new energy resources, the validity of such assumptions must be considered.

Additionally, because PACE financing is established at the state level, enabling legislation varies from state to state, and a loan servicer and its legal counsel should review the applicable statute.

Mortgage Subordination, Due on Encumbrance, and Alterations: As discussed above, assessment liens securing PACE financing projects are given the same priority as property tax liens and are, therefore, superior

in priority to the liens securing mortgage loans. PACE financing liens and the related facilities to be installed require consent under customary loan document provisions relating to additional encumbrances and indebtedness. PACE financing also typically requires rating agency no-downgrade confirmations under pooling and servicing agreements, whether pursuant to specific terms related to PACE financing under more recent pooling and servicing agreements or, even if PACE financing is not specifically referenced, under the due on encumbrance provisions, as a superior lien, and under the consent and modification terms.

Borrowers sometimes encourage servicers to accept a PACE financing lien as an additional permitted encumbrance under loan documents in which permitted encumbrances include property tax liens. Such a position, however, should be rejected. Although PACE financing liens are similar to property tax liens and are billed and collected by the tax assessor as an additional assessment, they are different than property tax liens. Such liens are assessed and created only at the voluntary request of property owners and can be distinguished from property tax assessment liens even under vague permitted encumbrance terms of loan documents. Recent forms of CMBS mortgage loan documents typically expressly define and prohibit PACE financing without the prior written consent of the mortgage lender.

Additionally, PACE financing customarily requires the consent of mortgage lenders under the applicable statutory framework and PACE documentation (note, however, that the enabling legislation in Florida, among other jurisdictions, suggests that mortgage lender consent may not be required for certain PACE financing projects relating to single family residences, which is a topic of ongoing discussions in the applicable jurisdictions).

Because PACE financing is used to alter the collateral property, noteholder consent is also required under the alterations provisions of loan documents, subject to any permitted alterations and cost threshold terms that may be included as an exception to such consent requirements.

Underwriting, Mitigants, and Credit Enhancements: In addition to the usual underwriting performed in connection with requests to consent to

an additional encumbrance, new indebtedness, and alterations projects, additional information relating to PACE financing includes the following, each of which must be reviewed by loan servicers and legal counsel: the state enabling legislation; the audit and projection of savings in energy costs; the company that will coordinate and administer funding and the bonding arrangements; and the requested mortgage lender consent form and other proposed PACE financing documentation. With respect to the audit and projection of savings in energy costs, in particular, the loan servicer must consider the reputation of the firm that prepared such audit and projection and the assumption statements included as part of the projected savings, and, in most situations, such firm must be acceptable to the applicable state or in compliance with any applicable requirements of the enabling legislation.

In discussions concerning underwriting and consideration of PACE financing requests, borrowers (at the urging of the private companies that administer and collect fees from PACE financing) often emphasize that PACE financing loans cannot be accelerated such that collection efforts and foreclosures are limited to the periodic payment or payments that are past due. While that is correct and does have some mitigating effect on the risks of PACE financing, be aware that such inability of a PACE financing lender to accelerate the debt does not mean that a foreclosing mortgage lender will only be liable for the periodic payments that may be past due under the PACE financing. Upon any mortgage loan foreclosure, the remaining balance of any PACE financing loan will remain due and payable and secured by an assessment lien on the collateral property, such that periodic payments must continue to be made by the property owner following any such foreclosure. The manner in which the non-acceleration aspect of PACE financing is described by consultants and others involved in PACE financing, while technically correct, can sometimes be interpreted by those not involved with PACE financing on a regular basis as suggesting that, upon a mortgage loan foreclosure, only the past due PACE financing payments are due and payable, which is incorrect.

As mentioned above, although special servicers and rating agencies have historically been reluctant to consent to and provide no-downgrade confirmations for PACE financing, there has been limited movement toward

re-evaluating the manner in which PACE financing requests and the related risks are being considered and how such risks may be mitigated with credit enhancements and other conditions. In our practice, we have recommended and seen such credit enhancements and conditions include the following:

- New or adjusted reserves for deposit of PACE financing payments, often including an advance deposit and retention in the reserve of an amount equal to an annual payment due in connection with the PACE financing;

- A reserve in the full amount of the PACE financing loan though borrowers would typically elect not to undertake the PACE financing project if such a large reserve were required; and

- More recently, a guaranty from a borrower affiliate to cover any gap between the projected net savings to be achieved by the PACE financing project and the actual savings realized.

With such credit enhancement requirements to mitigate the PACE financing risks, special servicers and rating agencies have consented to and provided (or waived) no-downgrade confirmations to allow certain PACE financing projects to proceed. As a result of these more encouraging recent developments the future for PACE financing may indeed be bright.

Considerations Related to Foreclosure and REO: In considering borrower requests for PACE financing, also be aware that the effects of PACE financing on foreclosure and the eventual sale of the property as REO remain largely unknown. Proponents of PACE financing generally take the position that the related improvements financed on favorable terms with an interest rate of less than conventional financing market rates will be perceived as a benefit and add value because of the net savings in energy costs. The counter argument, however, is that potential buyers of REO may not accept the projections of continued savings as being reliable in a rapidly changing and fluctuating energy market and will focus instead on higher assessments relative to competing properties. As more PACE financing

projects proceed, such effects will become more certain, but at this stage it remains an open matter.

Conclusion: As the use of on-site facilities for energy-generation and energy-savings increases, property owners are likely to explore PACE financing as a favorable means of financing the costs of such facilities. Although there are potential benefits in the nature of anticipated reductions in operating costs, the required mortgage lien subordination and other risks must be considered by loan servicers. Among other issues, the reliability of the projected savings in energy costs must also be evaluated in light of the instability of energy markets and prices and the difficulty of making accurate projections as to future energy costs.

Nonetheless, with suitable mitigants and credit enhancements, PACE financing and the related improvements may be appropriate for certain projects, and, with special servicers and rating agencies being willing to at least review borrower requests, each project and request should be considered rather than being dismissed or denied without further discussion and evaluation.

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MANAGED ENERGY SERVICE AGREEMENTS (MESAs)

Prepared By:
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A Managed Energy Service Agreement (MESA) is a variation of an Energy Service Agreement (ESA). In an ESA, the provider develops, finances, owns, operates, and maintains all energy efficiency measures and equipment installed during the term of the project. A MESA differs from an ESA because the provider also assumes the broader energy management of a client's facility, including the responsibility for utility bills, in exchange for a series of payments based on the customer's historic energy use.

MESAs offer promise for retail energy retrofits when the customer is financially stable, but lacks the expertise or time to undertake the energy efficiency retrofit.

Why should you use it?

- Your company wants to pursue portfolio wide installations or retrofits, but does not have cash for additional capital investments.
- Your company is risk adverse and wants a third-party to take on underperformance risk and provide project management.
- Your company is interested in having a third-party manage your facility to ensure that it is operating as efficiently as possible during the contract term.

Who has used it in the past?

Although MESA is a relatively new market tool that retailers are just beginning to explore, there has been initial uptake in the commercial and higher education sectors.

In 2006, Corporate Office Properties Trust, a REIT based in Maryland, used a MESA to upgrade five buildings. In year one, they averaged over 26% energy savings and by year five, they averaged over 30% energy savings annually.

Drexel University used a MESA to reduce energy consumption by more than 25% in 430,000 square feet of building space. Conservation measures included demand controlled ventilation systems, replacement of the central air chiller, variable air volume units, cooling towers, and lighting controls.

Companies like SCIenergy and Metrus Energy offer MESAs and they report working with BAE Systems, Hyatt Hotels, and other Fortune 500 companies.

What are the advantages?

- **Avoided Capital Outlay** – MESA provider pays for all upfront project costs, enabling customers to conserve capital funds for investment in their core business.
- **MESA Payments Treated as an Operating Expense** – The MESA is designed to be an off-balance sheet financing solution.
- **Enhanced Reliability of Operations** – MESA providers pay for periodic maintenance services to ensure long-term reliability and performance of the project equipment. Customer has a single point of contact and a single payment for all utility expenses and the MESA provider actively manages energy consumption at the facility.
- **Energy Savings Pay for Projects** – The MESA enables customers to redirect a portion of their

Better Buildings®
U.S. DEPARTMENT OF ENERGY

This resource was completed with support from the Department of Energy's Office of Energy Efficiency and Renewable Energy and the Better Buildings Initiative to highlight innovative proven energy solutions from market leaders in the Retail sector. Find more ideas at the Better Buildings Solution Center at betterbuildingssolutioncenter.energy.gov

current utility spending to pay for efficiency improvements; MESA payments are based on realized energy and operational savings.

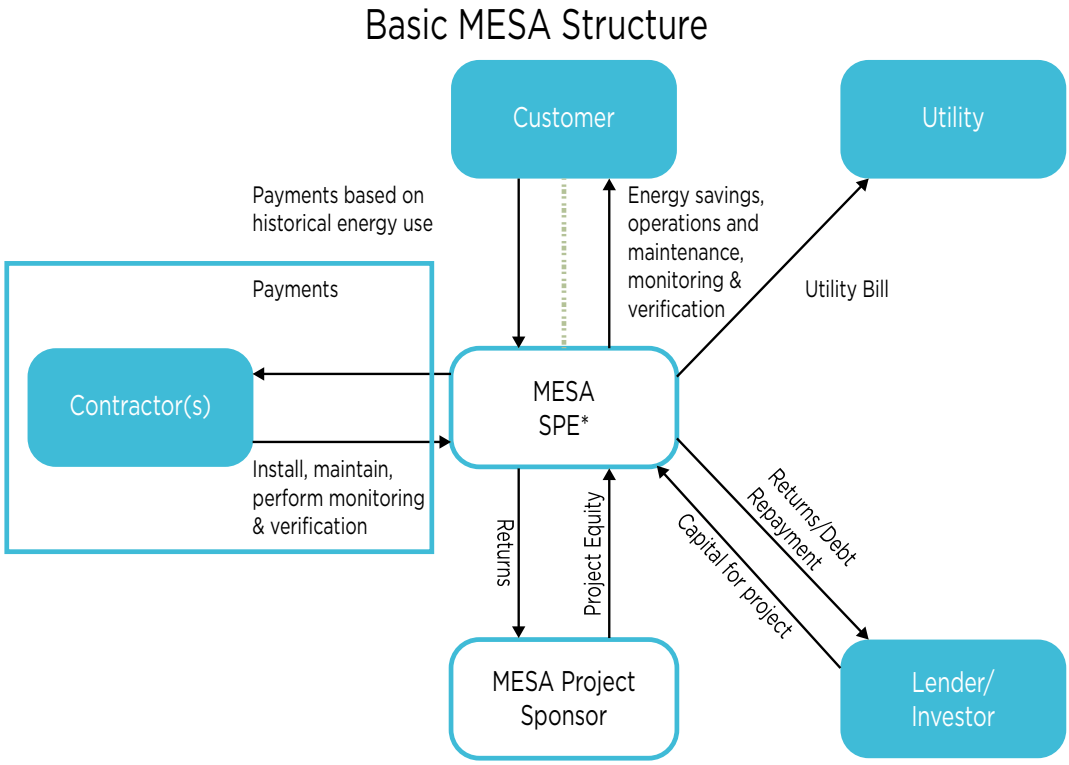
- **Flexible & Scalable Financing –** Under a MESA, as new opportunities for savings are identified they can be funded as they emerge, and rolled out to additional buildings across facilities. MESA providers can bundle together multiple sites that have smaller sized project opportunities ($500,000 or less) into a single MESA financing package (e.g., bundle 10 sites with $500,000 projects into a single $5 million MESA).

What are the downsides?

- MESAs are typically reserved for larger projects ($500,000 and above).
- MESAs are only viable in leased space when the contract term matches the lease term.
- Transaction costs can be high if each deal is heavily negotiated; typical deals have a negotiation period of 9-24 months.

Who should you talk to next?

- Talk to your internal finance team to learn about the company's history and comfort working with energy service providers.
- Reach out to energy service providers like SClenergy and Metrus Energy to learn more about how a MESA can help you meet your project goals.



Source: Wilson Sonsini Goodrich & Rosati, Innovations and Opportunities in Energy Efficiency Finance, Third Edition, May 2013
**SPE stands for Special Purpose Entity, which is typically the established entity that owns the installed equipment.*

MESAs IN THE MARKET

Managed Energy Service Agreements (MESAs) are contracts under which a third-party energy efficiency contractor assumes the energy management of a client's facility, including the installation of energy efficiency upgrades and responsibility for utility bills, in exchange for a series of payments based on the customer's historic energy use. MESAs offer a turn-key energy retrofit and financing approach that limits upfront costs and management burden.

The MESA contract in effect caps the customer's utility payments, while the contractor reaps all or part of the energy savings over the contract term. A MESA customer enjoys lower utility bills throughout the contract term, but does not own installed equipment unless they buy out the contract or purchase the equipment at fair market value at the end of the MESA contract.

More recently, the commercial sector has taken notice of the benefits that MESA provides and several deals have been executed. Corporate Offices Property Trust, a public REIT, utilized SClenergy's MESA Capital product to retrofit five of its buildings in 2006. High efficiency lighting and HVAC systems coupled with digital controls on various systems, accounted for the majority of energy savings. In total, 479,420 square feet of space was made more efficient and by 2010, the energy savings were greater than the annual projected average of 30.8%.

Drexel University also worked with SClenergy to fund $6.5 million worth of improvements in several facilities on campus. The overall reduction in energy consumption is expected to be more than 25% and will account for over 430,000 square feet of building space. The project includes installation of new control systems in 62 laboratories in three different buildings, which will save over 46% of the energy used to operate the lab spaces. Mechanical upgrades in another building include a new chiller, among other things, that will reduce the HVAC load by 35% resulting in $200,000 of savings per year.

While MESAs typically have long negotiation periods, they afford retailers flexibility with regard to site location, building type, and scalability. A MESA can be executed regardless of whether space is leased or owned, provided that the customer pays for their own utility consumption. In addition to improving the energy efficiency of retail stores, MESAs can also address the needs of warehouses, distribution centers, and corporate offices. A single MESA contract can be structured to span multiple locations, cover numerous facility types, and be executed in phases, allowing a customer to pilot a project before scaling it across their portfolio. Although the retail sector has not yet tested MESA as a viable external financing option, its spread into commercial real estate lays the foundation for uptake by retailers.

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LOCAL LAWS
OF
THE CITY OF NEW YORK
FOR THE YEAR 2019

No. 97

Introduced by Council Members Constantinides, The Speaker (Council Member Johnson) and Council Members Torres, Kallos, Rosenthal, Levin, Rivera, Koo, Powers, Levine, Reynoso, Richards, Salamanca, Menchaca, Chin, Lander, Ampry-Samuel, Ayala, Cumbo, Rose, Brannan, the Public Advocate (Mr. Williams), Espinal, Rodriguez, Lancman, Dromm, Gibson, Treyger, Cornegy, Van Bramer, Moya, Holden, Cohen, Eugene, Barron, Adams, Koslowitz, Cabrera and King.

A LOCAL LAW

To amend the New York city charter and the administrative code of the city of New York, in relation to the commitment to achieve certain reductions in greenhouse gas emissions by 2050

Be it enacted by the Council as follows:

Section 1. Chapter 26 of the New York city charter is amended by adding a new section 651 to read as follows:

§ 651. Office of building energy and emissions performance. a. There shall be in the department an office of building energy and emissions performance. The office shall be headed by a director, who is a registered design professional, who shall be appointed by and shall report to the commissioner. The duties of the office shall include, but not be limited to:

1. Overseeing implementation of building energy and emissions performance laws and policies for existing buildings, new construction and major renovations;

2. Establishing or administering protocols for assessing annual energy use in buildings;

3. Monitoring buildings' energy use and emissions, and reviewing building emissions assessment methodologies, building emissions limits, goals and timeframes to further the goal of

achieving a 40 percent reduction in aggregate greenhouse gas emissions from covered buildings by calendar year 2030, relative to such emissions for the calendar year 2005;

4. Creating an online portal for the submission of annual building emissions assessments by owners;

5. Receiving and validating annual building emissions assessments;

6. Auditing building emissions assessments and inspecting covered buildings, as necessary, to ensure proper reporting;

7. Determining recommended penalties, including minimum penalties, for buildings that are noncompliant with applicable emissions limits;

8. Reviewing applications for alternative methods of compliance with building emissions limits, including adjustments of emissions limits, deductions for the purchase of greenhouse gas offsets or renewable energy credits, deductions for the use of distributed energy resources, and adjustments for special categories of buildings or for special use and occupancies;

9. Working in close coordination with the mayor's office of long-term planning and sustainability; receiving advice and recommendations, as applicable, from the advisory board established pursuant to section 28-320.2 of the administrative code; and

10. Ensuring the participation and cooperation of agencies, including but not limited to the department of environmental protection, the department of housing preservation and development and the department of citywide administrative services. Such participation and cooperation shall include, but not be limited to, detailing agency staff to assist office staff consistent with agency and office functions and reporting to the office on building energy performance issues and related enforcement efforts.

§ 2. Subdivision e of section 24-802 of the administrative code of the city of New York, as added by local law number 22 for the year 2008, is amended to read as follows:

e. "City government operations" means [operations described in the Government Inventory Methodology and the Government Inventory Results sections of the Inventory of New York City Greenhouse Gas Emissions, dated April 2007] *operations, facilities, and other assets that are owned or leased by the city for which the city pays all or part of the annual energy bills.*

§ 3. Paragraph (1) of subdivision a of section 24-803 of the administrative code of the city of New York, as amended by local law number 66 for the year 2014, is amended to read as follows:

(1) Reduction of emissions citywide. There shall be, at minimum, a [thirty] *40* percent reduction in citywide emissions by calendar year 2030, and an [eighty] *80* percent reduction in citywide emissions by calendar year 2050, relative to such emissions for the base year for citywide emissions.

§ 4. Subdivision b of section 24-803 of the administrative code of the city of New York, as added by local law number 22 for the year 2008, is amended to read as follows:

b. (1) Reduction of emissions from city government operations. There shall be, at minimum, a [thirty] *40* percent reduction in city government emissions by [calendar] *fiscal* year [2017] *2025, and a 50 percent reduction in city government emissions by calendar year 2030,* relative to such emissions for the base year for city government emissions.

(2) The emissions reduction required by paragraph [one] *1* of this subdivision shall be achieved through the applicable policies, programs and actions included in PlaNYC, *energy efficiency retrofits,* and any additional policies, programs and actions to reduce greenhouse gas emissions that contribute to global warming*, including methods to ensure equitable investment in environmental justice communities that preserve a minimum level of benefits for all communities*

and do not result in any localized increases in pollution. If the office determines that such emissions reduction is not feasible despite the best efforts of city government operations, such office shall report such findings and make recommendations with respect to policies, programs and actions that may be undertaken to achieve such reductions.

(3) Reduction of emissions by the New York city housing authority. The New York city housing authority shall make efforts to reduce greenhouse gas emissions by 40 percent by the year 2030 and 80 percent by the year 2050, relative to such emissions for calendar year 2005, for the portfolio of buildings owned or operated by the New York city housing authority. If the office determines that such emissions reduction is not feasible despite the best efforts of city government operations, such office shall report such findings and make recommendations with respect to policies, programs and actions that may be undertaken to achieve such reductions.

§ 5. Chapter 3 of title 28 of the administrative code of the city of New York is amended by adding a new article 320 to read as follows:

ARTICLE 320

BUILDING ENERGY AND EMISSIONS LIMITS

§ 28-320.1 Definitions. *As used in this article, the following terms shall have the following meanings:*

BUILDING EMISSIONS*. The term "building emissions" means greenhouse gas emissions as expressed in metric tons of carbon dioxide equivalent emitted as a result of operating a covered building and calculated in accordance with rules promulgated by the department in consultation with the mayor's office of long term planning and sustainability. The term "building emissions" shall not include greenhouse gas emissions emitted during a local state of emergency declared by the mayor pursuant to section 24 of the executive law or a state of emergency declared by the governor pursuant to sections 28 of the executive law, where such local or state emergency has an impact on building emissions.*

BUILDING EMISSIONS INTENSITY*. The term "building emissions intensity" means, for a covered building, the number obtained by dividing the building emissions by the gross floor area for such building, expressed in metric tons of carbon dioxide equivalent per square foot per year.*

CARBON DIOXIDE EQUIVALENT. *The term "carbon dioxide equivalent" means the metric used to compare the emissions of various greenhouse gases based upon their global warming potential as defined in the Intergovernmental Panel on Climate Change Fifth Assessment Report (2014).*

CITY BUILDING. *The term "city building" means a building that is owned by the city or for which the city regularly pays all of the annual energy bills.*

Exception: *The term "city building" shall not include any senior college in the city university of New York system.*

CLEAN DISTRIBUTED ENERGY RESOURCE. *The term "clean distributed energy resource" means a distributed energy resource that (i) uses any of the following sources to generate electricity: hydropower, solar photovoltaics, geothermal wells or loops, tidal action, waves or water currents, and wind; or (ii) is designed and operated to store energy, including, but not limited to, batteries, thermal systems, mechanical systems, compressed air, and superconducting equipment.*

COVERED BUILDING. *The term "covered building" means, as it appears in the records of the department of finance, (i) a building that exceeds 25,000 gross square feet or (ii) two or more buildings on the same tax lot that together exceed 50,000 gross square feet (9290 m^2), or (iii) two or more buildings held in the condominium form of ownership that are governed by the same board of managers and that together exceed 50,000 gross square feet (9290 m^2).*

Exceptions:

1. *An industrial facility primarily used for the generation of electric power or steam.*

2. *Real property, not more than three stories, consisting of a series of attached, detached or semi-detached dwellings, for which ownership and the responsibility for maintenance of the HVAC systems and hot water heating systems is held by each individual dwelling unit owner, and with no HVAC system or hot water heating system in the series serving more than two dwelling units, as certified by a registered design professional to the department.*

3. *A city building.*

4. *A housing development or building on land owned by the New York city housing authority*

5. *A rent regulated accommodation.*

6. *The real estate owned by any religious corporation located in the city of New York as now constituted, actually dedicated and used by such corporation exclusively as a place of public worship.*

7. Real property owned by a housing development fund company organized pursuant to the business corporation law and article eleven of the private housing finance law.

***DISTRIBUTED ENERGY RESOURCE**. The term "a distributed energy resource" means a resource comprised of one or multiple units capable of generating or storing electricity, all at a single location that is directly or indirectly connected to an electric utility distribution system. The resource may serve all or part of the electric load of one or more customers at the same location, and it may simultaneously or alternatively transmit all or part of the electricity it generates or stores onto the electric distribution system for sale to or use by other customers at other locations.*

***GREENHOUSE GAS**. The term "greenhouse gas" means a unit of greenhouse gas, including carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6), and nitrogen trifluoride (NF_3).*

***GREENHOUSE GAS OFFSET**. The term "greenhouse gas offset" means a credit representing one metric ton of carbon dioxide equivalent emissions reduced, avoided, or sequestered by a project from a measured baseline of emissions and which has been verified by an independent, qualified third party in accordance with offset standards referenced by rules of the department.*

***FINANCIAL HARDSHIP (OF A BUILDING)**. The term "financial hardship (of a building)" means a building shall be considered to be subject to financial hardship where, for the combined two years prior to the application for an adjustment to annual building emissions limit pursuant to section 28-320.7, the building:*

1. Had arrears of property taxes or water or wastewater charges that resulted in the property's inclusion on the department of finance's annual New York city tax lien sale list;

2. Is exempt from real property taxes pursuant to sections 420-a, 420-b, 446 or 462 of the real property tax law and applicable local law and the owner had negative revenue less expenses as certified to the department by a certified public accountant, or by affidavit under penalties of perjury; or

3. Had outstanding balances under the department of housing preservation and development's emergency repair program that resulted in the property's inclusion on the department of finance's annual New York city tax lien sale list.

***METRIC TONS OF CARBON DIOXIDE EQUIVALENT**. The term "metric tons of carbon dioxide equivalent" means the global standard unit in carbon accounting to quantify greenhouse gas emissions, also expressed as tCO_2e.*

***RENEWABLE ENERGY CREDIT**. The term "renewable energy credit" means a certificate representing the environmental, social and other non-power attributes of one megawatt-hour of electricity generated from a renewable energy resource, which certificate is recognized and*

tradable or transferable within national renewable energy markets or the New York generation attribute tracking system. This term also means the environmental, social, and other non-power attributes of one megawatt-hour of electricity generated from a hydropower resource that does not trade or transfer renewable energy certificates for those hydropower resources in any renewable energy market or via the New York generation attribute tracking system, provided that the hydropower resource owner certifies the amount of energy produced in each reporting year and that it has not sold the non-power attributes equal to its energy production more than once.

RENT REGULATED ACCOMMODATION. *The term "rent regulated accommodation" means a building (i) containing one or more dwelling units with a legal regulated rent pursuant to the emergency tenant protection act of 1974, the rent stabilization law of 1969 or the local emergency housing rent control act of 1962, (ii) containing one or more dwelling units required by law to be registered and regulated pursuant to the emergency tenant protection act of 1974 or the rent stabilization law of 1969, (iii) buildings developed with subsidies received pursuant to section 1701q of title 12 of the United States code and (iv) buildings participating in a project-based assistance program pursuant to section 1473f of title 42 of the United States code.*

§ 28-320.2 Advisory board*. There shall be an advisory board convened, by the office of building energy and emissions performance upon the effective date of this article, in January of 2029 and in January of 2039, to provide advice and recommendations to the commissioner and to the mayor's office of long term planning and sustainability relating to effectively reducing greenhouse gas emissions from buildings. Such recommendations shall include, but not be limited to:*

1. A report to be delivered to the mayor and 1. A report and recommendations to be delivered to the mayor and the speaker of the city council no later than January 1, 2023 for additional or improved approaches to assessing building energy performance. Such report shall include, but not be limited to:

1.1. An approach for buildings to submit energy use or greenhouse gas emissions and other information for the purpose of assessing energy performance of covered buildings;

1.2. A methodology that includes the metric of measure, adjustments to the metric, the approach to comparing the output to a benchmark, alternative compliance paths, credit for beneficial electrification and distributed energy resources, and an approach for a trading mechanism as described in section 28-320.11;

1.3. Recommendations for addressing tenant-controlled energy usage;

1.4. Recommendations for amendments to the audit required under section 28-308.2 of the administrative code, including consideration of whether such audit should be replaced by a capital plan;

1.5 Recommendations for reducing building emissions from rent regulated accommodations;

1.6 Recommendations for allowing additional time to comply with the emissions limits for buildings converting to a new occupancy group or use with lower emissions limits or some other change in status that would affect applicability of the provisions of this article;

1.7 An evaluation of the extent to which the mayor's 80x50 energy infrastructure pathways study is incorporated and addressed within the recommendations made pursuant to items 1.1 through 1.6 of this section; and

1.8 A reference guide to delineate the responsibilities of the building designer and owners to comply with emissions limits.

2. A report to be delivered to the mayor and the speaker of the city council no later than January 1, 2023, providing an analysis of, and any recommendations for improving, energy and emissions performance requirements for covered buildings. Such recommendations shall be targeted to achieve at least a 40 percent reduction in aggregate greenhouse gas emissions from covered buildings by calendar year 2030 relative to such emissions for the calendar year 2005. Such report shall include, but not be limited to assessments of:

2.1. Incentives for reduction of peak energy demand;

2.2. Methods to allow for staggered reporting cycles for compliance with energy and emissions performance improvements;

2.3. Methods for calculating penalties for non-compliance;

2.4. Estimated emissions reductions associated with any recommended energy performance requirements;

2.5. The economic impact, including benefits, of achieving the energy and emissions performance requirements;

2.6. Methods for achieving earlier or larger reductions from city-owned buildings;

2.7 Separate improvement targets for base building energy systems and tenant-controlled energy systems;

2.8 Methods for achieving emissions reductions from manufacturing and industrial processes; and

2.9 Methods for achieving emissions reductions from hospitals while maintaining critical care for human health and safety.

§ 28-320.2.1 Advisory board composition. *Such advisory board shall be staffed with registered design professionals and be composed of 16 members including the chairperson, 8 of the members*

of such advisory board shall be appointed by the mayor or the mayor's designee, and 8 of the members of such advisory board shall be appointed by the speaker of the council. The mayor shall appoint one architect, one operating engineer, one building owner or manager, one public utility industry representative, one environmental justice representative, one business sector representative, one residential tenant representative, and one environmental advocacy organization representative. The speaker shall appoint one architect, one stationary engineer, one construction trades representative, one green energy industry representative, one residential tenant representative, one environmental justice organization representative, one environmental advocacy representative and one not for profit organization representative. The director of such office, or the designee of such director, shall serve as chairperson of the advisory board. The advisory board may convene in working groups. Such working groups may include individuals not on such advisory board to address the recommendations required by this article. The mayor shall invite the appropriate federal, state and local agencies and authorities to participate, including but not limited to the New York state energy research and development authority. Such advisory board shall convene a working group on hospitals that shall be composed of engineers, architects, and hospital industry representatives.

§ 28-320.3 Building emissions limits*. Except as otherwise provided in this article, or otherwise provided by rule, on and after January 1, 2024 a covered building shall not have annual building emissions higher than the annual building emissions limit for such building as determined in accordance with this section based on the occupancy group of the building.*

§ 28-320.3.1 Annual building emissions limits 2024-2029*. For calendar years 2024 through 2029 the annual building emissions limits for covered buildings shall be calculated pursuant to items 1 through 10 of this section. For the purposes of such calculation the department shall provide a method for converting categories of uses under the United States environmental protection agency Portfolio Manager tool to the equivalent uses and occupancy groups set forth in this section. For a covered building with spaces classified in more than one occupancy group, the annual building emissions limit shall be the sum of the calculated values from items 1 through 10 of this paragraph, as applicable for each space.*

1. *For spaces classified as occupancy group A: multiply the building emissions intensity limit of 0.01074 tCO_2e/sf by the corresponding gross floor area (sf);*

2. *For spaces classified as occupancy group B other than as described in item 6: multiply the building emissions intensity limit of 0.00846 tCO_2e/sf by the corresponding gross floor area (sf);*

3. *For spaces classified as occupancy groups E and I-4: multiply the building emissions intensity limit of 0.00758 tCO_2e/sf by the corresponding gross floor area (sf);*

4. *For spaces classified as occupancy group I-1: multiply the building emissions intensity limit of 0.01138 tCO_2e/sf by the corresponding gross floor area (sf);*

5. *For spaces classified as occupancy group F: multiply the building emissions intensity limit of 0.00574 tCO_2e/sf by the corresponding gross floor area (sf);*

6. *For spaces classified as occupancy groups B civic administrative facility for emergency response services, B non-production laboratory, Group B ambulatory health care facility, H, I-2 and I-3: multiply the building emissions intensity limit of 0.02381 tCO_2e/sf by the corresponding gross floor area (sf);*

7. *For spaces classified as occupancy group M: multiply the building emissions intensity limit of 0.01181 tCO_2e/sf by the corresponding gross floor area (sf);*

8. *For spaces classified as occupancy group R-1: multiply the building emissions intensity limit of 0.00987 tCO_2e/sf by the corresponding gross floor area (sf);*

9. *For spaces classified as occupancy group R-2: multiply the building emissions intensity limit of 0.00675 tCO_2e/sf by the corresponding gross floor area (sf);*

10. *For spaces classified as occupancy groups S and U: multiply the building emissions intensity limit of 0.00426 tCO_2e/sf by the corresponding gross floor area (sf).*

§ 28-320.3.1.1 Greenhouse gas coefficient of energy consumption for calendar years 2024 through 2029. *The annual building emissions of a covered building in accordance with this section, greenhouse gas emissions shall be calculated as follows for calendar years 2024 through 2029:*

1. *Utility electricity consumed on the premises of a covered building that is delivered to the building via the electric grid shall be calculated as generating 0.000288962 tCO_2e per kilowatt hour, provided, however, that the department, in consultation with the office of long term planning and sustainability, shall promulgate rules governing the calculation of greenhouse gas emissions for campus-style electric systems that share on-site generation but make use of the utility distribution system and for buildings that are not connected to the utility distribution system.*

2. *Natural gas combusted on the premises of a covered building shall be calculated as generating 0.00005311 tCO_2e per kbtu.*

3. *#2 fuel oil combusted on the premises of a covered building shall be calculated as generating 0.00007421 tCO_2e per kbtu.*

4. *#4 fuel oil combusted on the premises of a covered building shall be calculated as generating 0.00007529 tCO_2e per kbtu.*

5. *District steam consumed on the premises of a covered building shall be calculated as generating 0.00004493tCO_2e per kbtu.*

6. *The amount of greenhouse gas emissions attributable to other energy sources, including but not limited to distributed energy resources, shall be determined by the commissioner and promulgated into rules of the department.*

§ 28-320.3.2 Building emissions limits for calendar years 2030 through 2034. *For calendar years 2030 through 2034 the annual building emissions limits for covered buildings shall be calculated pursuant to items 1 through 10 of this section. For the purposes of such calculation the department shall provide a method for converting categories of uses under the United States environmental protection agency Portfolio Manager tool to the equivalent uses and occupancy groups set forth in this section. For a covered building with spaces classified in more than one occupancy group, the annual building emissions limit shall be the sum of the calculated values from items 1 through 10 of this paragraph, as applicable for each space. The department may establish different limits, set forth in the rules of the department, where the department determines that different limits are feasible and in the public interest. Where such limits are set by rule, the average emission limits for all covered buildings shall not be less restrictive than the average emissions impact of the building emissions limits outlined in items 1 through 10 of this section. The advisory board and the office of long term planning and sustainability shall provide advice and recommendation regarding such limits.*

1. *For spaces classified as occupancy group A: multiply the building emissions intensity limit of 0.00420 tCO_2e/sf by the corresponding gross floor area (sf);*

2. *For spaces classified as occupancy group B other than as described in item 6: multiply the building emissions intensity limit of 0.00453 tCO_2e/sf by the corresponding gross floor area (sf);*

3. *For spaces classified as occupancy groups E and I-4: multiply the building emissions intensity limit of 0.00344 tCO_2e/sf by the corresponding gross floor area (sf);*

4. *For spaces classified as occupancy group I-1: multiply the building emissions intensity limit of 0.00598 tCO_2e/sf by the corresponding gross floor area (sf);*

5. *For spaces classified as occupancy group F: multiply the building emissions intensity limit of 0.00167 tCO_2e/sf by the corresponding gross floor area (sf);*

6. *For spaces classified as occupancy groups B civic administrative facility for emergency response services, B non-production laboratory, Group B ambulatory health care facility, H, I-2 or I-3: multiply the building emissions intensity limit of 0.01193 tCO_2e/sf by the corresponding gross floor area (sf);*

7. *For spaces classified as occupancy group M: multiply the building emissions intensity limit of 0.00403 tCO_2e/sf by the corresponding gross floor area (sf);*

8. *For spaces classified as occupancy group R-1: multiply the building emissions intensity limit of 0.00526 tCO_2e/sf by the corresponding gross floor area (sf);*

9. *For spaces classified as occupancy groups R-2: multiply the building emissions intensity limit of 0.00407 tCO_2e/sf by the corresponding gross floor area (sf);*

10. *For spaces classified as occupancy groups S and U: multiply the building emissions intensity limit of 0.00110 tCO_2e/sf by the corresponding gross floor area (sf).*

§ 28-320.3.2.1 Greenhouse gas coefficients of energy consumption for calendar years 2030 through 2034. *For the purposes of calculating the annual building emissions of a covered building in accordance with this section, the amount of greenhouse gas emissions attributed to particular energy sources shall be determined by the commissioner and promulgated into rules of the department by no later than January 1, 2023. The commissioner shall consult with the advisory board required by this article to develop such greenhouse gas coefficients for utility electricity consumption. When developing such coefficient, the commissioner shall consider factors including, but not limited to, the best available New York state energy research and development authority and State Energy Plan forecasts for Zone J for the end of the compliance period and beneficial electrification.*

§ 28-320.3.4 Building emissions limits for calendar years 2035 through 2050. *No later than January 1, 2023, the commissioner shall establish by rule annual building emissions limits and building emissions intensity limits applicable for calendar years 2035 through 2039 and building emissions limits and building emissions intensity limits applicable for calendar years 2040 through 2049. Such limits shall be set to achieve an average building emissions intensity for all covered buildings of no more than 0.0014 tCO_2e/sf/yr by 2050.*

§ 28-320.3.5 Building emissions limits on and after calendar year 2050. *No later than January 1, 2023 the commissioner shall establish by rule annual building emissions limits and building emissions intensity limits applicable for calendar years commencing on and after January 1, 2050. Such limits shall achieve an average building emissions intensity for all covered buildings of no more than 0.0014 tCO_2e/sf/yr.*

§ 28-320.3.6 Deductions from reported annual building emissions. *The department may authorize a deduction from the annual building emissions required to be reported by an owner pursuant to section 28-320.3 where the owner demonstrates the purchase of greenhouse gas offsets or renewable energy credits, or the use of clean distributed energy resources, in accordance with this section.*

§ 28-320.6.1 Deductions from reported annual building emissions for renewable energy credits. *A deduction from the reported annual building emissions shall be authorized equal to the number of renewable energy credits purchased by or on behalf of a building owner, provided (i) the renewable energy resource that is the source of the renewable energy credits is considered by the New York independent system operator to be a capacity resource located in or directly deliverable*

into zone J load zone for the reporting calendar year; (ii) the renewable energy credits are solely owned and retired by, or on behalf of, the building owner; (iii) the renewable energy credits are from the same year as the reporting year; and (iv) the building that hosts the system producing the energy does not receive a deduction under § 28-320.6.3. Covered buildings claiming deductions for renewable energy credits under this section must provide the department with the geographic location of the renewable energy resource that created the renewable energy credits. The department, in consultation with the mayor's office of long term planning and sustainability, shall promulgate rules to implement this deduction.

§ 28-320.3.6.2 Deductions from reported annual building emissions for purchased greenhouse gas offsets. *For calendar years 2024 through 2029, a deduction shall be authorized for up to 10 percent of the annual building emissions limit. Such a deduction shall be authorized only where within the reporting calendar year, greenhouse gas offsets equivalent to the size of the deduction as measured in metric tons of carbon dioxide equivalent and generated within the reporting calendar year have been (i) purchased by or on behalf of the owner in accordance with an offset standard referenced by rules of the department, (ii) publicly registered in accordance with such offset standard, and (iii) retired or designated to the department for retirement. Such greenhouse gas offsets must exhibit environmental integrity principles, including additionality, in accordance with rules promulgated by the department in consultation with the office of long term planning and sustainability. For the purposes of this section, additionality means a requirement that an offset project is not already required by local, national or international regulations. Prior to the department promulgation of rules, the department shall consult the advisory board on environmental justice as established in local law 64 of 2017.*

§ 28-320.3.6.3 Deductions from reported annual building emissions for clean distributed energy resources. *For calendar years 2024 through 2029, a deduction from the reported annual building emissions shall be authorized based upon the calculated output of a clean distributed energy resource located at, on, in, or directly connected to the building subject to the report. The department shall promulgate rules to set forth how such deduction shall be calculated, in accordance with the following:*

1. *For a clean distributed energy resource that generates electricity, the department shall establish separate calculations for each type of commercially available clean distributed energy resource, which shall not be revised more frequently than once every three years.*

2. *For a clean distributed energy resource that stores electricity, the deduction shall be based on the size of the resource and its ability to reduce greenhouse gas emissions during designated peak periods.*

§ 28-320.3.7 Reports. *By May 1, 2025, and by May 1 of every year thereafter, the owner of a covered building shall file with the department a report, certified by a registered design professional, prepared in a form and manner and containing such information as specified in rules of the department, that for the previous calendar year such building is either:*

1. *In compliance with the applicable building emissions limit established pursuant to section 28-320.3; or*

2. *Not in compliance with such applicable building emissions limit, along with the amount by which such building exceeds such limit.*

§ 28-320.3.7.1 Extension of time to file report. *An owner may apply for an extension of time to file an annual report required by section 28-320.3.7 in accordance with this section and the rules of the department. An extension may be granted where the owner is unable to file the certified report by the scheduled due date despite such owner's good faith efforts, as documented in such application. An extension granted pursuant to this section shall not modify the owner's obligation to comply with the applicable emission limits for such calendar year.*

§ 28-320.3.8 Continuing requirements*. In 2055, the office of building energy and emissions performance shall prepare and submit to the mayor and the speaker of the council recommendations whether to repeal or amend any of the requirements of this article.*

§ 28-320.3.9 Extension for certain income-restricted housing. *This section is applicable to covered buildings that are owned by a limited-profit housing company organized under article 2 of the private housing finance law, or contain one or more dwelling units for which occupancy or initial occupancy is restricted based upon the income of the occupant or prospective occupant thereof as a condition of a loan, grant, tax exemption, or conveyance of property from any state or local governmental agency or instrumentality pursuant to the private housing finance law, the general municipal law, or section 420-c of the real property tax law. Such buildings are exempted from the annual building emissions limits set forth in section 28-320.3.1 and 28-320.3.2 and from any applicable reporting requirements.*

§ 28-320.3.10 Changes in building status. *The department may establish by rule procedures for a building to apply for additional time to comply with the emissions limits when such building converts to a new occupancy group or use with lower emissions limits, or undergoes a change affecting the applicability of this article to such building.*

§ 28-320.4 Assistance*. The office of building energy and emissions performance shall establish and maintain a program for assisting owners of covered buildings in complying with this article, as well as expand existing programs established to assist owners in making energy efficiency and renewable energy improvements. These programs shall be made available to assist building owners without adequate financial resources or technical expertise.*

§ 28-320.5 Outreach and education*. The office of building energy and emissions performance shall establish and engage in outreach and education efforts to inform building owners about building emissions limits, building emissions intensity limits and compliance with this article. The materials developed for such outreach and education shall be made available on the office's website. Such outreach shall include a list of city, state, federal, private and utility incentive programs related to energy reduction or renewable energy for which buildings reasonably could be eligible. The office of building energy and emissions performance shall also provide outreach, education, and training opportunities for buildings' maintenance and operations staff.*

§ 28-320.6 Penalties*. An owner of a covered building who has submitted a report pursuant to section 28-320.3.7 which indicates that such building has exceeded its annual building emissions limit shall be liable for a civil penalty of not more than an amount equal to the difference between the building emissions limit for such year and the reported building emissions for such year, multiplied by $268.*

§ 28-320.6.1 Determination of penalty*. In considering the amount of the civil penalty to be imposed pursuant to this article, a court or administrative tribunal shall give due regard to aggravating or mitigating factors including:*

1. *The respondent's good faith efforts to comply with the requirements of this article, including investments in energy efficiency and greenhouse gas emissions reductions before the effective date of this article;*

2. *The respondent's history of compliance with this article;*

3. *The respondent's compliance with the conditions of any adjustment to the applicable building emissions limit, issued by the department pursuant to section 28-320.7;*

4. *Whether the non-compliance was directly related to unexpected and unforeseeable events or conditions during the calendar year outside the control of the respondent;*

5. *The respondent's access to financial resources; and 6. Whether payment of such penalty would impact the operations of facilities critical to human life or safety .*

§ 28-320.6.2 Civil penalty for failure to file report*. It shall be unlawful for the owner of a covered building to fail to submit an annual report as required by section 28-320.3.7 on or before the applicable due date. An owner of a covered building subject to a violation for failure to file a report shall be liable for a penalty of not more than an amount equal to the gross floor area of such covered building, multiplied by $0.50, for each month that the violation is not corrected within the 12 months following the reporting deadline; provided, however, that an owner shall not be liable for a penalty for a report demonstrating compliance with the requirements of this article if such report is filed within 60 days of the date such report is due.*

§ 28-320.6.3 False statement*. It shall be unlawful to knowingly make a material false statement in a report or other submission filed with the department, pursuant to this article. A violation of this section shall be a misdemeanor and subject to a fine of not more than $500,000 or imprisonment of not more than 30 days or both such fine and imprisonment. A person who violates this section shall also be liable for a civil penalty of not more than $500,000.*

§ 28-320.6.4 Penalty recovery. *Civil penalties provided for by this article may be recovered in a proceeding before an administrative tribunal within the jurisdiction of the office of administrative trials and hearings. Administrative summonses returnable to such tribunal for violations of this*

article may be issued by the department or by an agency designated by the department. Civil penalties provided for by this article may also be recovered in an action by the corporation counsel in any court of competent jurisdiction.

***§ 28-320.7. Adjustment to applicable annual building emissions limit**. The department, in consultation with the mayor's office of long term planning and sustainability or any other agency designated by the mayor, may grant an adjustment of the annual building emissions limit applicable to a covered building in existence on the effective date of this article or for which a permit for the construction of such building was issued prior to such effective date, provided that the owner is complying with the requirements of this article to the maximum extent practicable.*

1. Such an adjustment may be granted upon a specific determination that:

1.1. Capital improvements are necessary for strict compliance with the limit set forth in section 28-320.3 and it is not reasonably possible to make such improvements due to (i) a constraint imposed by another provision of law including but not limited to designation as a landmark, landmark site, interior landmark, or within a historic district pursuant to chapter 3 of title 25 of the administrative code, or (ii) a physical condition of the building or building site including but not limited to lack of access to energy infrastructure, space constraints, or lack of access to a space within a building covered by a lease in existence on the effective date of this section;

1.2. The owner has made a good faith effort to purchase greenhouse gas offsets to comply with section 28-320.3 but a sufficient quantity is not available at a reasonable cost; and

1.3. The owner has availed itself of all available city, state, federal, private and utility incentive programs related to energy reduction or renewable energy for which it reasonably could participate.

2. Such an adjustment may be granted upon a specific determination that:

2.1. The cost of financing capital improvements necessary for strict compliance with the limit set forth in section 28-320.3 would prevent the owner of a building from earning a reasonable financial return on the use of such building or the building is subject to financial hardship as defined in this article. In evaluating the ability of an owner to earn a reasonable financial return, the department may consider future savings expected from such capital improvements;

2.2. The owner is not eligible for any program funded by the city or enabled by a local law that provides financing for the purpose of energy reduction or sustainability measures. Proof of ineligibility for financing must be demonstrated by rejection from any such program funded by the city or enabled by a local law or an affidavit explanation why such owner could not reasonably participate in such programs;

2.3. The owner has made a good faith effort to purchase greenhouse gas offsets or renewable energy credits to comply with section 28-320.3 but a sufficient quantity is not available at a reasonable cost; and

2.4. The owner has availed itself of all available city, state, federal, private and utility incentive programs related to energy reduction or renewable energy for which it reasonably could participate.

§ 28-320.7.1 Effective period. *An adjustment granted pursuant to item 1 of section 28-320.7 may be effective for a period of not more than three calendar years. An adjustment granted pursuant to item 2 of such section may be effective for a period of not more than one calendar year.*

§ 28-320.7.2 Application. *An application for such an adjustment shall be made in the form and manner determined by the department and certified by a registered design professional.*

§ 28-320.8 Adjustment to applicable annual building emissions limit for calendar years 2024-2029. *The department may grant an adjustment of the annual building emissions limit for calendar years 2024 through 2029 applicable to a covered building in existence on the effective date of this article where such covered building emissions in calendar year 2018 exceeds the building emissions limit as prescribed by section 28-320.3.1 by more than 40 percent, as reported to the department by a registered design professional. The adjustment shall result in a required building emissions limit that is 70 percent of the calendar year 2018 building emissions for the covered building. Such adjustment may be granted where:*

1. The owner of a covered building demonstrates that the building emissions in excess of the building emissions limit is attributable to special circumstances related to the use of the building, including but not limited to 24 hour operations, operations critical to human health and safety, high density occupancy, energy intensive communications technologies or operations, and energy-intensive industrial processes;

2. The owner of a covered building demonstrates that the energy performance of the covered building is equivalent to a building in compliance with the New York city energy conservation code in effect on January 1, 2015; and

3. The owner of the covered building has submitted a plan to the department setting forth a schedule of alterations to the covered building or changes to the operations and management of the covered building sufficient to ensure that the covered building will be in compliance with the annual building emissions limits for calendar years 2030 through 2034, as required by section 28-320.3.2.

§ 28-320.8.1 Effective period. *An adjustment granted pursuant to section 28-320.8 may be effective for the reporting years 2025 through 2030, as prescribed by section 28-320.3.7, provided that the certificate of occupancy has not been amended after December 31, 2018.*

§ 28-320.8.1.1 Extension of effective period. *The commissioner may also grant an extension of the effective period of the adjustment to applicable annual building emissions limit for calendar years 2030-2035, as prescribed by section 28-320.3.8. Such extension may be granted upon submission of a schedule of alterations to the covered building or changes to the operations and management of the covered building in accordance with section 28-320.8 sufficient to ensure that by 2035 the covered building will comply with a required building emissions limit that is 50 percent of the reported 2018 building emissions for the covered building.*

§ 28-320.8.2 Application. *An application for an adjustment shall be submitted to the department before July 1, 2021 in the form and manner determined by the department and certified by a registered design professional.*

§ 28-320.9 Adjustment to applicable annual building emissions limit for not-for-profit hospitals and healthcare facilities. *The department shall grant an adjustment of the annual building emissions limits for calendar years 2024-2029 and 2030-34 where:*

1. *The building is classified as a not-for-profit hospital, not-for-profit health center, or not-for-profit HIP center, in existence on the effective date of this article; and*

2. *By no later than July 21, 2021, the owner of the covered building submits an application to the department for such adjustment in a form and manner prescribed by the department.*

For calendar years 2024 through 2029, the adjustment shall result in the covered building being subject to an emissions limit that is 85 percent of the calendar 2018 building emissions for such covered building. For calendar years 2030 through 2034, the adjustment shall result in the covered building being subject to an emissions limit that is 70 percent of the calendar 2018 building emissions for such covered building.

§ 28-320.10 Fee schedule*. The department may establish by rule a schedule of fees that shall be paid upon the filing of a report or an application for an adjustment to the applicable building emissions limit pursuant to this article. Such schedule may include a fee for the late filing of a report.*

§ 28-320.11 Carbon trading study*. The office of long term planning and sustainability shall conduct a study on the feasibility of a citywide trading scheme for greenhouse gas emissions from buildings and submit a report and implementation plan with the findings of such study to the mayor and the speaker of the council no later than January 1, 2021. Such study shall include methods to ensure equitable investment in environmental justice communities that preserve a minimum level of benefits for all covered buildings and do not result in any localized increases in pollution. Such study shall also include an approach to a marketplace for credit trading, pricing*

mechanisms, credit verification, and mechanisms for regular improvement of the scheme. Such study should also consider the reports and recommendations of the advisory board.

§ 6. Chapter 3 of title 28 of the administrative code of the city of New York is amended by adding a new article 321 to read as follows:

ARTICLE 321

ENERGY CONSERVATION MEASURE REQUIREMENTS FOR CERTAIN BUILDINGS

§ 28-321.1 Definitions. *As used in this article, the following terms shall have the following meanings:*

COVERED BUILDING. *The term "covered building" means a building (i) containing one or more dwelling units with a legal regulated rent pursuant to the emergency tenant protection act of 1974, the rent stabilization law of 1969 or the local emergency housing rent control act of 1962, (ii) containing one or more dwelling units required by law to be registered and regulated pursuant to the emergency tenant protection act of 1974 or the rent stabilization law of 1969, (iii) buildings developed with subsidies received pursuant to section 1701q of title 12 of the United States code and (iv) buildings participating in a project-based assistance program pursuant to section 1473f of title 42 of the United States code , (v) real estate owned by any religious corporation located in the city of New York as now constituted, actually dedicated and used by such corporation exclusively as a place of public worship and, as it appears in the records of the department of finance, (i) a building that exceeds 25,000 gross square feet or (ii) two or more buildings on the same tax lot that together exceed 50,000 gross square feet (9290 m^2), or (iii) two or more buildings held in the condominium form of ownership that are governed by the same board of managers and that together exceed 50,000 gross square feet (9290 m^2).*

Exceptions*:*

1. *Real property, not more than three stories, consisting of a series of attached, detached or semi-detached dwellings, for which ownership and the responsibility for maintenance of the HVAC systems and hot water heating systems is held by each individual dwelling unit owner, and with no HVAC system or hot water heating system in the series serving more than two dwelling units, as certified by a registered design professional to the department.*

2. *An industrial facility primarily used for the generation of electric power or steam.*

3. *A covered building as defined in article 320.*

§ 28-321.2 Required energy conservation measures for certain buildings. *A covered building must comply with either section 28-321.2.1 or section 28-321.2.2.*

§ 28-321.2.1 Energy compliant buildings. *The owner of a covered building shall demonstrate that, for calendar year 2024, the annual building emissions of such covered building did not exceed what the applicable annual building emissions limit would be pursuant to section 28-320.3.2 if such building were a covered building as defined in article 320 of this chapter.*

§ 28-321.2.2 Prescriptive energy conservation measures. *By December 31, 2024, the owner of a covered building shall ensure that the following energy conservation measures have been implemented where applicable:*

1. *Adjusting temperature set points for heat and hot water to reflect appropriate space occupancy and facility requirements;*

2. *Repairing all heating system leaks;*

3. *Maintaining the heating system, including but not limited to ensuring that system component parts are clean and in good operating condition;*

4. *Installing individual temperature controls or insulated radiator enclosures with temperature controls on all radiators;*

5. *Insulating all pipes for heating and/or hot water;*

6. *Insulating the steam system condensate tank or water tank;*

7. *Installing indoor and outdoor heating system sensors and boiler controls to allow for proper set-points;*

8. *Replacing or repairing all steam traps such that all are in working order;*

9. *Installing or upgrading steam system master venting at the ends of mains, large horizontal pipes, and tops of risers, vertical pipes branching off a main;*

10. *Upgrading lighting to comply with the standards for new systems set forth in section 805 of the New York city energy conservation code and/or applicable standards referenced in such energy code on or prior to December 31, 2024. This provision is subject to exception 1 in section 28-310.3, provided that July 1, 2010 is replaced by January 1, 2020 for the purposes of this section;*

11. *Weatherizing and air sealing where appropriate, including windows and ductwork, with focus on whole-building insulation;*

12. *Installing timers on exhaust fans; and*

13. Installing radiant barriers behind all radiators.

§ 28-321.3 Reports. *By May 1, 2025, an owner of a covered building shall submit a report to the department to demonstrate compliance with this section in accordance with section 28-321.3.1 or section 28-321.3.2.*

§ 28-321.3.1 Energy compliant buildings reports. *The owner of a covered building shall file with the department a report, certified by a registered design professional, prepared in a form and manner and containing such information as specified in rules of the department, that for calendar year 2024 such building was in compliance with the applicable building emissions limit established pursuant to section 28-320.3.2.*

§ 28-321.3.2 Prescriptive energy conservation measures reports. *A retro-commissioning agent, as defined in article 308, shall prepare and certify a report in a form and manner determined by the department. The report shall include such information relating to the completion of the prescriptive energy conservation measures as shall be set forth in the rules of the department including, at a minimum:*

1. Project and team information:

1.1. Building address.

1.2. Experience and certification of persons performing the prescriptive energy conservation measures and any staff involved in the project.

1.3. Name, affiliation, and contact information for persons performing the prescriptive energy conservation measures, owner of building, and facility manager of building.

2. Building information:

2.1. List of all HVAC, domestic hot water, electrical equipment, lighting, and conveyance equipment types serving the covered building.

§ 28-321.4 Penalties. *Penalties that may be assessed for violations of section 28-321.2 shall be determined by department rule.*

§ 7. This local law takes effect 180 days after it becomes law, except that prior to such effective date the department of buildings and the office of long term planning and sustainability may take such measures as are necessary for the implementation of this local law, including the promulgation of rules.

THE CITY OF NEW YORK, OFFICE OF THE CITY CLERK, s.s.:

I hereby certify that the foregoing is a true copy of a local law of The City of New York, passed by the Council on April 18, 2019 and returned unsigned by the Mayor on May 20, 2019.

MICHAEL M. McSWEENEY, City Clerk, Clerk of the Council.

CERTIFICATION OF CORPORATION COUNSEL

I hereby certify that the form of the enclosed local law (Local Law No. 97 of 2019, Council Int. No. 1253-C of 2018) to be filed with the Secretary of State contains the correct text of the local law passed by the New York City Council, presented to the Mayor and neither approved nor disapproved within thirty days thereafter.

STEVEN LOUIS, Acting Corporation Counsel.

E-CAPITAL
INSURANCE SERVICES

Overview of Energy
Project Performance Insurance (PPI)

Project Performance Insurance (PPI) policies are written to reduce the risk that the Return on Investment (ROI) promised by a Contractor Developer Team (CDT) to a building owner or financier investing in an energy-efficiency or renewable energy project (an Energy Conservation Measure or ECM), fails to materialize or doesn't live up to expectations.

By agreeing to pay for any performance shortfalls over the policy term, a PPI insurer mitigates the two principal barriers to investments in energy projects: (1) the risk of underperformance; and (2) disputes over project performance.

Highlights & Benefits

- PPI policies cover performance shortfalls that result from: improper ECM design; improper ECM installation; improper baseline energy consumption calculations; and improper "savings" (or "output") calculations. They can be tailored to fit a wide variety of technologies and complex projects with different performance metrics (e.g. kWhs, Gals, therms, BTU's etc.). "Soft savings" (e.g. reduced maintenance costs, renewable energy credits, etc.) may also be included within the limits.

- The PPI underwriting process is about validating and bulletproofing a project's internal economics, from an engineering and financial perspective. It forces the criteria for defining baseline energy-use levels and the amounts of "savings" (or "output") to be transparent and explicit for all of the stakeholders in the project, and provides important third-party review of: the engineering design, the consistency and accuracy of energy data and projections, and the methodologies and protocols for ongoing Measurement and Verification of the energy "savings" (or "output").

- PPI policies typically run for terms of five (5) to ten (10) years. Premiums are 3.0%-6.0% of the total amount of energy "savings" (or "output") to be insured during the policy period. Rates will vary for each project, depending upon: the experience level and performance history of the CDT; the types of ECM's to be installed; the *insured amount vs. the total expected amount* of energy "savings" (or "output) for the project; and the policy structure (i.e. the level of Self-Insured Retention or SIR, deductible, coinsurance percentage, etc.).

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Claims Process and Policy Exclusions

- PPI carriers employ engineering experts to analyze the actual energy performance data (through Measurement and Verification) during the covered performance period in order to pre-empt and remediate any claims that may arise.

- Typically, the project's performance is "trued-up" on an annual basis, and potential claims are reviewed to determine the actual cause(s) of loss and if such loss is covered under the PPI policy.

- Measured performance may be subject to adjustments for excluded events that may have caused or contributed to reduced levels of "savings" (or "output"), such as: changes in weather or commodity pricing, physical damage to ECM's or building systems, improper maintenance, changes in building occupancies or operations, etc.

Underwriting and Marketing Considerations

- PPI carriers provide important screening and validation of CDT's. Their underwriting process is similar to qualifying for a conventional Construction Bonding line.

- Once a CDT has been fully qualified by a PPI carrier, it is in a position to market investment-grade "Guaranteed Outcomes" and "Insured Services" to its customers, while transferring most of the liabilities for such guarantees to the insurer.

- CDT's should attempt to limit the amount of performance that they are willing to guarantee to customers to the amount (or some fraction of the amount) that the PPI carrier is willing to insure. This both reduces the CDT's exposure, and also helps to set the customer's expectations as to what levels of performance should be considered "realistic", "achievable", and "safe".

- With a PPI policy in place, a CDT does not have to engage outside counsel or engineers to defend itself against real or perceived claims from a customer for disputed energy performance.

- PPI policy costs are usually minimal as compared to a project's total return over the life-cycle of the ECM's. If a CDT properly prices all of the PPI policy costs into the project's economics, then it is the *customer* that will ultimately be paying for the coverage to backstop the project's income projections.

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Using PPI to Enhance Project Development

Sample Solar Lease Project:

Equipment life-expectancy of 25 yrs.; 10-yr. "Simple Payback"; Estimated "output" of 25 yrs. @ $172k/yr. = $4.3M. [This assumes that panel degradation and utility rate increases more or less offset each other.]
7 yrs. lease payments @ $164k/yr., then 3 yrs. buyout @ $150k/yr. ($1.6M in total cash outlays over 10-yrs.). Project cash-flow is positive from day one; large savings to begin in 11th year. Net gain is $2.5M+ over the 25-yr. system life. Annual Return of 15%+.
Customer needs a production guarantee to cover all cash outlays. A PPI policy was structured to backstop 10-yrs. of "output" @ $1.6M. This project's internal economics support the $65k PPI policy premiums and/or a reserve fund to cover SIRs/deductibles. The CDT's SIR exposures under the PPI policy could range from zero to $160k, as negotiated between the parties.

Sample LED Project:
Cash Price $105k; equipment life-expectancy of 10 yrs. 3-yr. "Simple Payback"; Estimated "savings" of 10 yrs. @ $37k/yr. = $374k;

- Funding Option 1: Cash (Self-funded): The net gain to customer over 10 yrs. = $270k. Annual Return of 25%+:
- Funding Option 2: Debt (Loan or Leasing): Depending upon interest rates, net gain to customer over 10 yrs. = $230k to $250k; Annual Return of 15% - 20%;
- Funding Option 3: ESA (Shared-Savings): Customer pays $26k/yr. (or 70% of the annual "savings") to an investor for 7 yrs. (total of $182k). Net gain to customer over the life cycle of the system is $150k to $175k, *plus* free lighting for 10 yrs., off-balance sheet, and no up-front capital outlay.

Attaching an investment-grade performance guarantee to the project adds important security in all of the above funding situations. A PPI policy can be written to cover:

a) 10-yr. total "savings" of $374k for a premium of $12k; or
b) "savings" of $120k to $140k during repayment of a loan or lease, for a premium of $6k; or
c) "savings" of $105k over the "Simple Payback" period, for a premium of $4k.

This project's internal economics support the PPI premiums and/or a reserve fund to cover SIRs/deductibles. The CDT's SIR exposures under the PPI policy could range from zero to $37k, as negotiated between the parties.

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E-CAPITAL
INSURANCE SERVICES
A DIVISON OF E-CAPITAL DEVELOPMENT INC.

Project Risks and Available Coverage

Equipment Exposures

Policy	Coverage	Estimated Cost
Manufacturer's Product Warranty	Manufacturer's warranty risk of product repair or replacement.	Provided by each Manufacturer.
Manufacturer's Output Performance Warranty	Insures against Project's underperformance from Manufacturer's design, and calculation errors.	4.0% to 6.0% of the Project's Guaranteed Energy Output.

Contractor/Construction Exposures

Policy	Coverage	Estimated Cost
Construction Bond	Guarantees satisfactory completion of a project by a Contractor.	0.5% to 2.0% of Contract Cost.
General Liability	Insures (and defends) against claims or third-party suits arising from construction or ongoing operations.	1.0% to 3.0% of field payroll. Varies with trade type and operating location.
Builders Risk	Insures against physical damage or losses to the materials, fixtures and/or equipment used during construction/renovation.	0.1% to 0.3% of Final Construction Cost.
Workers' Compensation and Employer's Liability Insurance	Insures against injuries to employees during ongoing construction or operations	0.5% to 1.5% of field payroll. Varies with trade type and operating location.
Professional Liability / Errors & Omissions	Insures (and defends) against claims or third-party suits arising from negligent acts, errors, or omissions in design or professional services.	0.1% to 0.3% of Sales. Included in Energy Savings Performance Insurance coverage.
Automobile Liability Insurance	Insures (and defends) against claims or third-party suits arising from ownership, maintenance or use of motor vehicles.	Varies with vehicle types and operating location.

Contractor's Pollution Liability Insurance	Insures (and defends) against claims or third-party suits arising from the release, discharge, or dispersal of pollutants.	0.1% to 0.3% of Contract Cost.

Project Owner/Operator Exposures

Policy	Coverage	Estimated Cost
Property Insurance	Insures against physical damage or loss to the premises or business equipment.	0.5% to 1.0% of the Total Property limits to be insured.
Business Interruption / Equipment Breakdown Insurance	Insures against loss or delay of income from physical damage to the premises or breakdown of the business equipment.	0.1% to 0.3% of the Business Interruption / Equipment Breakdown limits to be insured.
Energy Savings Performance Insurance	Insures against Project's underperformance from Contractor's design, or the implementation of energy saving measures and does not require physical damage to have occurred to the equipment.	2.0% to 5.0% of the Project's Guaranteed Energy Savings.
General Liability	Insures (and defends) against claims or third-party suits arising from construction and/or ongoing operations.	Varies with site operation, type and location.
Site Pollution Liability Insurance	Insures (and defends) against claims or third-party suits arising from the release, discharge, or dispersal of pollutants.	Varies with site operation, type and location.

If you have any questions, please feel free to give me a call at any time.

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Quantifying the Financial Value of Insurance for Energy Savings Projects

Richard B. Jones and David R. Tine, Hartford Steam Boiler Inspection & Insurance Co.

ABSTRACT

Insurance is often viewed as an expense applied solely to meet investor, bank lending or regulatory requirements. In the energy savings performance contracting industry, engineers manage performance risk by providing comprehensive investment grade audits, robust designs, project implementation best practices, measurement and verification (M&V) plans, and reasonable energy savings deductible levels. Historically, insuring energy savings has not been widely adopted as a cost effective practice considering the guarantees offered by energy service companies (ESCOs). And from a lender's or investor's risk analytic perspective, the financial value of insurance has not been previously quantified.

This paper combines the financial-risk engineering of lending institutions with the energy-risk engineering of an insurer. It describes three models: a graphical/visual method, a theoretical solution and also a practical stochastic model that computes the credit risk reduction offered by insuring a fraction of the projected savings revenue stream. The work demonstrates the credit enhancement from the projected energy savings stream with and without insurance. An actual building retrofit project is used as an example to demonstrate the analysis model and the value created by energy savings insurance. The paper also demonstrates a methodology that connects the reduction in credit risk to an improvement in credit quality. For example, energy savings insurance can be applied to make a sub-investment grade loan appear, from an equivalent credit risk perspective, as an investment grade transaction.

Introduction

With about 49% of all energy used and 75% of all electricity consumed in the United States in buildings (EIA) the energy profiles of these structures represent a significant opportunity to increase grid reliability and reduce emissions, energy production, and costs. There are four basic pathways to achieve these goals as our economy and population grows:

- Building owners can retrofit the structures with new materials, windows, energy efficient equipment, and distributed generation
- Legacy energy production can be replaced or supplemented with cleaner or renewable sources.
- Building users can change their energy use behaviors.
- Ensure that newly constructed buildings incorporate best practices in energy efficiency design and are integrated with power production.

The diverse building marketplace of residential, commercial and institutional structures is composed of several underlying markets and segments and there is no one-size-fits-all approach. However, there are several options available to building owners to improve energy efficiency. The materials, equipment, and energy engineering knowledge are available today. And also due to the rapid increase in internet supported control, monitoring and operational systems, there is a

rich selection of affordable aggregation and reporting tools to support dynamic energy management (US DOE Smart Grid). In other words, the practical engineering solutions to radically reduce building energy demand and consumption exist today.

New building construction provides a significantly improved level of energy efficiency over older structures simply because contemporary equipment and materials are manufactured to higher energy efficiency standards. However, the real potential for energy efficiency is in upgrading pre-existing buildings to contemporary standards. For example, Figure 1 shows, in part, the magnitude of this opportunity in the US and UK (US DOE 2010 and DECC 2012):

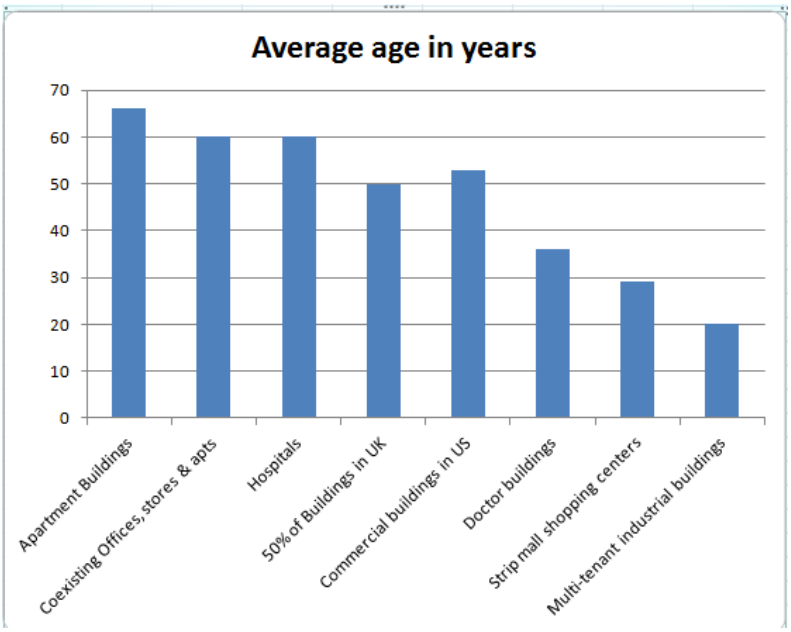

Figure 1. Average age in years of US and UK buildings.

So it is not surprising see that the global building retrofit market valued at $80.3 billion in 2011, is forecasted to grow to $151.8 billion by 2020(Navigant Research). Most of the new investments will be made by ESCOs and other energy engineering companies through the sale of equipment and technical services.

Yet, in spite of the purported long and short term money saving benefits and the proven engineering means to radically improve building energy efficiency, there still remains formidable barriers to the widespread deployment and implementation of actual programs. Regardless of the estimated annual energy savings, building retrofits are capital intensive projects that are executed in a relatively short period, usually less than a year. It is impractical to do these types projects gradually over several years; a compressed schedule is typically required in order that buildings and services remain functional throughout. Consequently, a significant capital expense is incurred by the building owner at the beginning of the project. The sources of this funding, for both the public and private sectors, generally fall into the following categories (ACEEE 2011):

Cash Flows

If the cash flows from the building are large enough, the project can be funded directly from this source. While this option is certainly convenient it implies that the cash flows can be

diverted from their previous destination. In some structured finance situations, cash flow allocations are not discretionary, but in others this may be a viable option.

Parent Company Debt

A corporate owned building can borrow funds from internal sources for better than market interest terms. While this approach clearly streamlines the acquisition of capital, the corporation's financial data must reflect this debt which can influence trading values and company valuations.

Acquire Debt

If the building is completely owned, then this option is viable. However, for building owners with mortgages, there are often mortgage covenants that restrict debt accumulation and overriding these agreements can be difficult. Also many mortgages are part of larger security structures which complicates the approval process even further.

Utilize ESCOs & Energy Service Agreements (ESAs)

There are two major versions of a model where the project's capital expense will not be placed on the building owner's balance sheet: (1) The ESCO can create a Special Purpose Vehicle that will own and operate the energy-related equipment in the building. Essentially, the building owner outsources all energy-related operations. The reduction in energy costs pays for the O & M costs plus the ESCO's profit in addition to providing the building owner with lower energy expenses. (2) In the second model, the ESCO funds the project and is paid back over time through the energy savings.

These models have been used in specific market segments and there are many variations in how ESCOs can work. Generally ESCOs are not a source of funding as much as a way of structuring the financial arrangements of projects and whose direct loans and packaged capital are seen as expensive in some segments.

Rebates & Subsidized Capital Resources

Utilities have special programs and equipment rebates that can offset some of the equipment upgrade capital expense but their value does not offset all project costs. State, municipal, and federal programs offer tax incentives for renewable energy investments. But it is our belief that these programs are highly regionalized and are not necessarily long-term benefits, since they are subject to political factors.

Yet, even with the many positive accomplishments (ACEEE 1980-2012) of the building retrofit industry; there still remain several barriers to achieving the anticipated scale and demand for projects. These barriers reflect primarily the complexity of the residential, commercial and industrial building marketplace. On the demand (buyer) side (McKinsey & Company 2009):

- Retrofit projects usually require large upfront costs to achieve the savings annuity
- Savings incentives of energy consumption can be structured differently for tenants and owners, causing confusion.

- Building owners may not fully comprehend (or believe) the retrofit financial benefits.
- Sales cycle for retrofit projects of 9-12 months is too long to keep owner interest.

And on the supply (seller) side, the diversity and large size of the marketplace brings its own challenges. For in order to acquire the scale that is suggested by the overall technical and financial opportunities, the project development and financing need to become more standardized, simplified, and designed to directly address balance sheet requirements.

To deal with these issues, new financial structures have been created and others have been streamlined. Each of the major types listed below have advantages and disadvantages, but together they provide a solid basis to develop a list of financial options that can, hopefully in the near future, begin to penetrate the scale barriers (World Economic Forum 2011):

- Property Accessed Clean Energy (PACE) – regional & regulatory
- Energy Service Agreements (ESA) –special purpose vehicle
- On-Bill Loan – utility
- Government-owned development bank – some non-US markets
- Equipment Lease Finance
- ESCO business model
- Endowment and revolving funds

These finance structures are designed to manage the expense of building retrofits projects relative to the efficiency savings over time. They all involve the transfer for funds (or loans) for project implementation and include accounting of accumulated energy savings. These types of transactions possess two major forms of risk: loan default and asset performance. Default (or credit risk) is assessed and underwritten by the lending institution but the valuation or credit enhancement of insurance related to asset performance is not included in aforementioned financing models. The exception to this statement is the credit enhancement association with government-owned developmental banks.

Credit Enhancement of Asset Performance Insurance

Credit enhancement of a project loan transaction is protection in the form of financial support to cover loan losses under default or other adverse conditions. For energy efficiency projects there are two levels of financial support that generally can be interpreted as credit benefits:

- the new effective revenue stream from the efficiency improvements, and,
- insurance that some or all of the calculated reduction in energy use will be realized.

Many projects require property, casualty, and builder's risk insurances as part of the structured financial arrangement so these products are already being used as standard requirements for project lending. However, the financial benefits of insuring asset performance are just beginning to be explored.

Asset performance insurance is financial support, subject to the terms and conditions of the policy, to insure that the annual savings for a project will not fall below some prescribed

level. From one perspective this provides a valuable benefit to mitigate risk in that the lenders (and the credit rating agency) will be assured of a minimum cash flow at the credit rating of the insurer.

For this analysis we define credit risk as the expected loss or recovery due to default for a loan of principal $\hat{P}$, for a term of 'n' years at an interest rate 'i.' These calculations are standard in lending activities but for energy efficiency loans there is another variable that also needs to be considered. This is the anticipated savings from lower energy demand and consumption costs. There may be additional savings (or costs) in maintenance and operations but generally these values are not considered when developing loans for efficiency projects.

Insuring a part of the annual savings provides a key benefit in that the total amount insured is backed by the credit rating of the insurer rather than the credit rating of the borrower. Credit rating enhancement insurance for energy efficiency needs to conform to three basic tenets (Puccia 2004):

- If a shortfall in aggregate savings occurs, the insurance company pays the claim within a pre-set period of time regardless of the cause. Any claim-related legal issues are secondary to claim payment.
- Claims settlement follows an approved formula known at the beginning of the policy.
- No additional legal or administrative charges will be assessed to the insured party.

In other words, if there is a claim for a given year, the insurer must quickly pay the claim amount to the policy holder and then pursue recovery or other subrogation measures independent of the insured. The major exception is fraud.

Given that asset performance insurance prescribes to these tenets, the question remains, "how to quantify the credit enhancements of this type of risk transfer"? Energy savings can be viewed as a new revenue stream that offsets the legacy expenses and improves cash flows that are necessary for loan repayment. From this perspective the certainty and size of the energy savings relative to the periodic loan payments should change the default probability for a given loan.

For example, consider the credit worthiness of two loans each for $1,000,000 for 5 years at an interest rate of 6%. The annual payment for this loan is $230,974.80. Each borrower is required to pay this amount each year. However, if borrower #1 is using the money for property improvements (e.g. a new roof) there probably are no annual savings. However, if borrower #2 is using the loan for an energy efficiency project with an annual savings of $100,000 per year, the financial stress to repay the loan is less, suggesting borrower #2 should have a lower default probability and therefore a higher effective credit rating.

Traditionally, lending companies or banks cover default risk and specialty insurers cover asset performance risk (related in this case to energy efficiency). To determine a project rating, analysts consider many project variables associated with default and asset performance, (Mandel, Morgan, and Wei 2012) including sovereign, business & legal, and force majeure risks. At a project level, rating analysis is divided into contract design, technology, construction, operation, competitiveness, legal structure, financial strength, and others. For energy efficiency projects, the major risks usually rest in the adequacy of the engineering design, performance of the technology to achieve the targeted efficiencies, the measurement and verification plan, and whether operational best practices are followed to maintain the saving levels. These risks can be

addressed by energy efficiency insurance. Subsequently, as rating agencies begin to study these specialized projects types, more rating benefits of asset performance insurance may emerge.

In this paper we present a qualitative, theoretical, and numerical simulation examples, of methods designed to measure the credit rating enhancement potential for energy efficiency projects. The work does not replace a credit rating analysis done by a rating agency, lender, or investor but it does supply some insights on the amount of credit enhancement that is possible under certain conditions. A secondary application of this paper is to provide a framework that hopefully can be developed to provide a level of uniformity and standardization to financing and rating energy efficiency project loans.

Graphical Depiction of Credit Enhancement with Asset Performance Insurance

To understand how insurance can enhance a loan transaction credit rating, we begin by showing the results of a standard credit risk model. The multi-year default probabilities are taken from S&P's CDO Evaluator Code (CDO Evaluator Engine) and annual interest rates by rating category are estimated from S&P's 2013 literature (Rigby 2013). Since interest rates vary over time and default probabilities are re-published periodically, the objectives of this analysis are to:

- Demonstrate the methodologies that can be applied to value asset performance insurance in structured finance and
- Provide approximate estimates of how risk transfer through insurance can create savings for building energy-efficiency projects.

Figure 2 shows the average default loss or average credit risk associated with borrowing $1,000,000 and $500,000 (each paid back in five annual payments) as a function of the credit rating of the borrower.

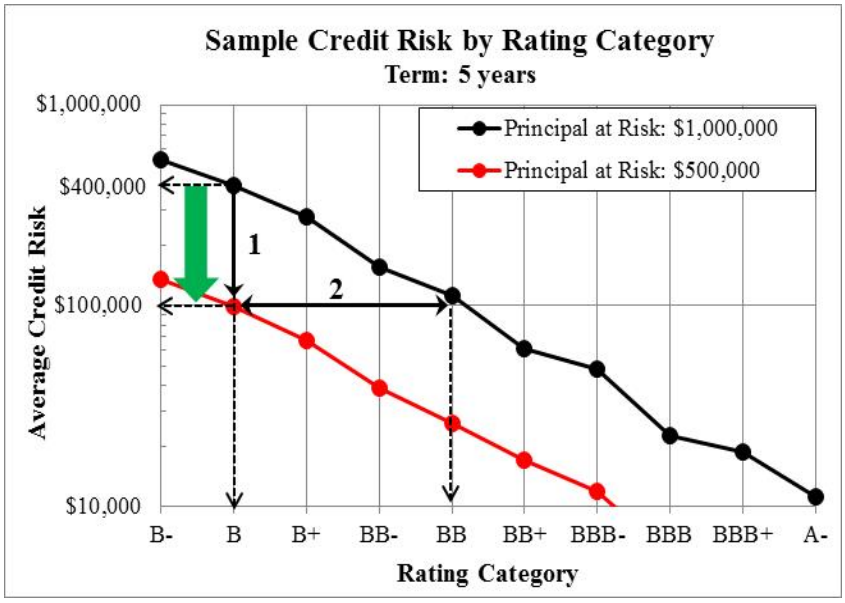

Figure 2. Credit risk enhancement from risk transfer conceptual description.

Both lines show how the default loss decreases as the borrower's credit rating improves. The only difference between the two lines is the principal at risk. The dotted horizontal line shows that the B rated company borrowing $1M has an average credit risk of $400,000. However, if $500,000 is insured, the principal at risk is reduced to $500,000, and the red curve (following the direction indicated by "1" in Fig. 2) applies. However, following "2" horizontally to the right, we see that this value is approximately equal to the credit risk of $1M for a BB rated borrower. Therefore from a credit risk perspective, a $1M loan to a B-rated borrower with $500,000 insured, is equivalent to a $1M transaction over the same time period to a BB rated borrower. In other words, the $500,000 insured value decreases the loan credit risk and therefore increases the loan credit rating; technically in this case from a "B" to a "BB." The difference in credit risk (shown by the green arrow) depicts about a $300,000 credit risk savings associated with insuring $500,000.

This methodology illustrates how asset performance insurance applied to the risk transfer of building energy efficiency savings can be used as a credit enhancement tool by investors, lenders, and rating agencies. There are several assumptions that are inherent in the method as described in Figure 2 that will be explored in the following theoretical and stochastic models.

Theoretical Model Credit Enhancement with Asset Performance Insurance

In this analysis, we describe a model for computing the credit enhancement from insuring a fraction of the loan principal associated with energy efficiency projects. The major approximations or assumptions are in the actual insurance coverages relative to what is needed by rating agencies and lenders to quantify the financial value of energy efficiency insurance in practice.

The situation being modeled is a building energy efficiency project where the implementation time is relatively short compared to the loan period so we ignore implementation delays relative to the loan payment period.

Let

Q_x	(x=1) - the credit rating of the borrower (x=2) - the achieved equivalent rate
L_x	the total amount loan including principal and interest (x = 1, 2)
M_x:	the annual (or periodic) loan payment (x = 1, 2)
$\hat{P}$	loan principal
$P_d(k, Q_x)$	the default probability in year k for a borrower with credit rating Q_x, (x = 1, 2)

For this model we repay the loan with interest in 'n' years with annual payments. The credit risk or default loss recovery for a loan, C_1, for 'n' years at an interest rate i_1 for a borrower with credit rating 1 (say "B") is:

$$C_1 = \sum_{k=1}^{n} P_d\,(k, Q_1)(L_1 - k * M_1) \qquad (1)$$

The annual loan payment M_1 can be written in terms of the loan principal, $\hat{P}$, interest rate, i_1, and loan term, n, as:

$$M_1 = \hat{P} * \frac{i_1}{(1-(1+i_1)^{-n})} = \hat{P} * I_1 \quad (2A)$$

$$\text{and} \qquad L_1 = n * M_1 = n * \hat{P} * I_1 \quad (2B)$$

The basic descriptions of M_1 and L_1 in terms of the interest, principal and loan term are helpful in simplifying the final equations.

Let's assume that the principal and interest required for loan repayment are determined for the borrower at their initial credit rating taking into consideration the insured energy efficiency savings amount, *S*. And the credit risk of *S* is measured at the insurer's credit rating. The resulting total credit risk is the sum of the reduced borrower's credit risk for (L_1-*S*) and the insurer's credit risk for *S*:

$$\sum_{k=1}^{n} P_d(k, Q_1)(n-k)(\hat{P} - S)I_1 + \sum_{k=1}^{n} P_d(k, Q_I)(n-k)SI_I \quad (3)$$

We now need to find the new state (denoted by the subscript 2) where this amount of credit risk is equal to a higher credit rating and lower interest rate for the full loan amount $\hat{P}$.

$$\sum_{k=1}^{n} P_d(k, Q_1)(n-k)(\hat{P} - S)I_1 + \sum_{k=1}^{n} P_d(k, Q_I)(n-k)SI_I = \sum_{k=1}^{n} P_d(k, Q_2)(n-k)\hat{P}I_2 \quad (4)$$

The left-hand side of Equation 4 describes the situation where the lender gives the borrower full benefit of the energy efficiency insurance. The insurance covers the asset performance or energy efficiency savings designed to produce at least *S* dollars of savings over the policy term and the default risk for this portion of the principal is rated at the insurer's credit rating.

This scenario implies that default and energy efficiency savings risk associated with the amount, *S*, is completely transferred to the insurer. In general, default risk coverage is not included in the same policies that cover asset performance. However, the effective new revenue stream from the efficiency savings, the insurer's additional technical project review, and the additional oversight through the policy term intuitively decrease default risk.

Also there is a basic difference between default and energy efficiency insurance that is a significant issue from the lender's perspective. If a borrower defaults the bank can lose the outstanding repayments. However, financial support for energy efficiency insurance is not a strict guarantee. There are terms and conditions that must be satisfied in order for the policy to respond to any revenue shortfall. So lenders cannot be 100% confident that the insurance will provide the needed financial support. Insurance is generally not an unconditional financial guarantee and rating agencies have indicated that energy efficiency policies must respond quickly and unilaterally if any credit enhancement is to be achieved(9). To address this important

issue, new energy efficiency policy language is being developed in cooperation with interested investors, contractors, and building owners to ensure that the policy language provides the maximum credit enhancement benefits from this type of insurance.

Using Equation 4, it can be shown that the maximum credit enhancement possible is equal to the insurer's credit rating. If for example, an insurer covers the entire principal in its performance-related coverage then S = $\hat{P}$ which mathematically states this result. Solving Eqn. 4 for ($S/\hat{P}$) we compute a formula than can be used to determine how much credit enhancement is obtained by insuring a given percentage of the principal, $\hat{P}$.

$$\frac{S}{\hat{P}} = \frac{I_1 \sum_{k=1}^{n} P_d(k, Q_1)(n-k) - I_2 \sum_{k=1}^{n} P_d(k, Q_2)(n-k)}{I_1 \sum_{k=1}^{n} P_d(k, Q_1)(n-k) - I_I \sum_{k=1}^{n} P_d(k, Q_I)(n-k)} \quad (5)$$

Equation 5 has several variables that need to be known before the ratio can be computed: loan term, n, credit rating of the insurer, and the enabled credit enhancement '2.' To demonstrate the results that can be computed from Eqn. (5), we consider the example used in the previous section with the additional piece of data required being the credit rating of the insurer. For this example we will assume the insurer is 'A' rated by S&P.

Table 1. Maximum credit rating enhancement from insuring percentage of loan amount (S / $\hat{P}$)

		Achieved Credit Rating								
		B	**B+**	**BB-**	**BB**	**BB+**	**BBB-**	**BBB**	**BBB+**	**A-**
Initial Credit Rating	**B-**	22%	47%	58%	67%	80%	88%	94%	96%	98%
	B		32%	46%	58%	74%	85%	92%	95%	98%
	B+			21%	39%	62%	77%	88%	93%	97%
	BB-				23%	52%	71%	85%	92%	96%
	BB					39%	63%	80%	89%	95%
	BB+						40%	68%	82%	93%
	BBB-							47%	71%	88%
	BBB								45%	77%
	BBB+									58%

Table 1 is interpreted as follows: if the borrower was rated at a B-, then insuring 22% of the loan principal is required in order for the loan to have the same credit risk as a B rated loan for the total principal $\hat{P}$. In other words, insuring 22% of the principal has the potential to improve the credit rating of the loan transaction from a B- to a B. The biggest credit improvement comes for the non-investment grade rating categories (< BBB-) where the default probabilities and interest rates are considerable higher relative to the highly rated insurance company. As the borrower credit rating improves, the difference in credit risk between the borrower and the insurer decreases thereby diminishing the value of the insurance.

Stochastic Model for Energy Efficiency Insurance Valuation

In Figure 2 the credit benefit of insurance was demonstrated by reducing the principal at risk by a fixed amount – namely the insured amount of the project total efficiency savings. Yet, in building energy efficiency projects the actual amount of annual of savings is a stochastic variable subject to variation from a large number of internal and external factors. Energy efficiency loans are generally paid off by project cash flows where savings is seen effectively as new revenue stream compared to pre-retrofit operations. Therefore from an insurance and lending perspective there are two components that reduce the principal at risk: (1) the stochastic new revenue stream created by the efficiency upgrades and (2) the deterministic efficiency insurance which supports a minimum level of savings.

Intuitively, a company with an energy efficiency savings revenue stream is more likely not to default than an equivalent company that does not have this benefit. Yet rating agencies and lenders do not generally consider savings cash flows as a new revenue stream for providing credit enhancement benefits. Insurance, depending on the coverage details, can be considered a credit enhancement instrument.

There are several factors that can influence loan default rate. For example, a corporation which owns many buildings can be forced into loan default due to external factors related to their business that have nothing to do with local project cash flows. Yet for the single building owner where energy efficiency projects are viable, the efficiency savings stream can have direct revenue value in the long term project cash flows. To provide some insight on how these cash flows can influence the credit risk of loans, a stochastic model was developed that incorporates the stochastic distribution of potential efficiency savings with the additional option of augmenting this distribution with insurance.

To demonstrate the application of the model, consider an energy efficiency retro-fit project for an office building located in Connecticut. The project is composed of 12 energy conservation measures (ECMs) related to HVAC, building envelope, and control system upgrades. The total project costs are $2.5M with an expected annual energy savings of $185,000.

Performing a risk analysis from the audit reports, baseline, and engineering data, a range of possible ECM outcomes are computed and correlations between ECMs are assessed. From this data a project level savings distribution is computed as shown in Figure 3.

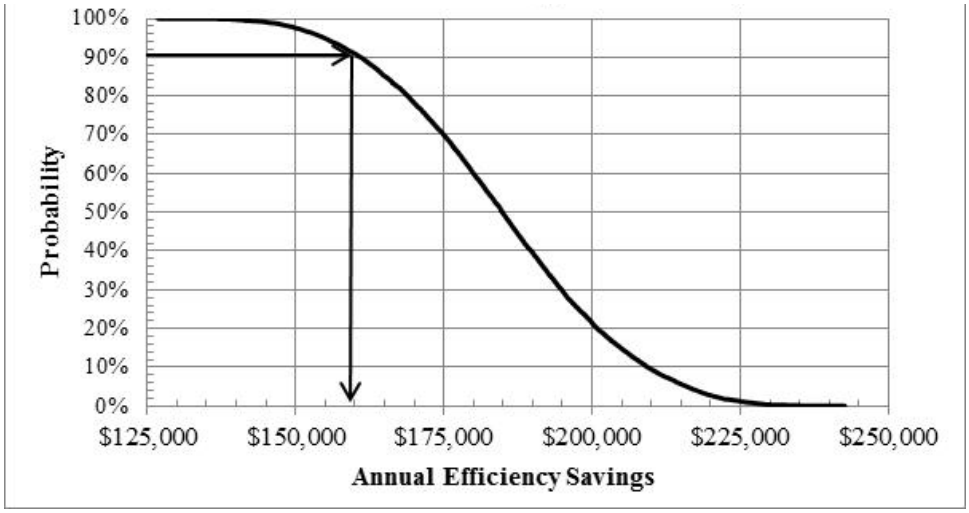

Figure 3. Distribution of annual efficiency savings for Connecticut Office Building Retrofit Project.

According to Figure 3, there is a 90% chance of the annual efficiency savings will exceed about $160,000 and a 20% chance that the savings amount will exceed $200,000. This curve represents valuable quantitative information that can be used to reduce the real income required to repay the loan. Let's consider a 10 year loan for the full project costs of $2.5M. To measure the credit enhancement value of the efficiency revenue stream and the additional value of insurance, we set the insured annual savings at the 10% deductible level from the expected savings estimate of $185,000 which corresponds to $166,500. The insurance company is assumed to be AA rated. Table 2 shows the credit enhancement potential that is obtained from:

- insuring $1,665,000 (10x$166,500) at the insurer's credit rating with the remaining part of the principal financed at the borrower's credit level, and
- the stochastic new revenue stream from the annual efficiency savings distribution shown in Figure 3

Table 2. Credit enhancement potential

		Achieved Credit Rating								
Initial Credit Rating	**Insurance?**	**B**	**B+**	**BB-**	**BB**	**BB+**	**BBB-**	**BBB**	**BBB+**	**A-**
B-	**No**	**98%**	**98%**	**35%**	**20%**	**---**	**---**	**---**	**---**	**---**
	Yes	**98%**	**98%**	**98%**	**35%**	**---**	**---**	**---**	**---**	**---**
B+	**No**	**---**	**---**	**98%**	**98%**	**40%**	**2%**	**---**	**---**	**---**
	Yes	**---**	**---**	**99%**	**98%**	**98%**	**10%**	**---**	**---**	**---**
BB+	**No**	**---**	**---**	**---**	**---**	**---**	**98%**	**12%**	**5%**	**---**
	Yes	**---**	**---**	**---**	**---**	**---**	**98%**	**98%**	**28%**	**6%**

In Table 2, three initial credit rating examples are shown with and without the energy efficiency insurance. The percentages refer to the probability of exceeding a level of credit enhancement. Notice the new revenue stream from the energy efficiency savings alone is

sufficient to reduce the credit risk to gain two credit rating improvement in two cases and a single level of improvement for the highest initial credit rating, BB+. The value of the insurance is shown in all three examples by comparing the probability of exceeding the credit rating level as shown in the three circles. For example the B- borrower has only a 35% chance of exceeding the BB- level but with insurance this confidence is improved to 98%.

The value created by insuring a minimum level of savings provides a marginal increase in credit enhancement that is difficult to quantify in general. It is the lender's decision as to how much influence will be given to the effective revenue stream and to the insurance since all models contain assumptions and limitations. The revenue, while very real, is difficult for a lender to value because:

- From a securitization perspective there are no accounting rules as to how to value a stochastic energy efficiency savings distribution,
- Lenders generally do not have the engineering knowledge to assess the financial risk of the proposed energy efficiency revenue stream, and
- Energy price market risk over the loan term can influence the financial results.

Insurance is a financial risk transfer instrument that is well understood from a coverage perspective, but as this paper discusses, there can be additional project value created by reducing the effective credit risk which can be realized as a credit enhancement. The value created from this process is project dependent but the general categories are:

- Lower interest rate for the borrower: A credit enhancement can be translated into a basis point reduction in loan interest. This calculation and judgment is a function of the lender's view of the project. Mills (2003) describes the interest cost savings of energy-savings insurance versus a traditional savings guarantee. Our analysis shows the cost of the insurance is small in comparison to the financial benefit associated with the credit enhancement. Figure 4 shows a case study example, based on data from an energy efficiency project in Connecticut that highlights the lower interest rate for borrower, 4.0% versus 5.5%, due to insurance.

Loan Amount:	$1,992,683		**With Energy Efficiency Insurance: Years 1-5**	
Rate:	5.50%		Annual Insured Energy Efficiency Amt:	$164,489
Term (mo)	240		*(Insured Amt = Annual Debt Service)*	
			5 Year Insured Total:	$822,445
Without Energy Efficiency Insurance				
Monthly Payment	$13,707		Monthly Payment for first 5 years@ 4.0%:	$15,147
	x240		Monthly Payment for remaining 15 years@ 5.5%:	$9,562
Total Term Payout	$3,289,779		Time averaged monthly payment:	$10,958
			Total Term Payout:	*$2,629,922*
			Insurance Value = (Payout w/o ins - Payout w/ins)	***$659,857***

Figure 4. Lower interest payment for borrower because of insurance.

- Lower reserves for the lender: The quantification of the reduction in credit risk as shown in the stochastic model can be applied to reduce loan loss reserves which can enable the lender to make more loans.
- Intangible borrower assistance: It is possible that the insurance can improve a loan to make the loan appear as an investment grade transaction. This fact can help the borrower improve its marketplace perception, for example in the acquisition of capital funding, bond development, and stock performance.

Summary

The Introduction discussed the large potential for the building retrofit industry and that the financial community and building owners have yet to develop a systematic and standardized approach to streamline financing. While the technical and business justifications for these types of projects do exist, there are still roadblocks to large scale implementation. The authors speculate that as energy prices, emissions, and grid reliability become more important issues, retrofit projects will become more prolific. And the need to include insurance as a viable risk management instrument can be an important component of the financing equation – not just for better loan terms but also to possibly make more project capital available. The availability of insurance will increase the number of energy efficiency projects in two ways. First, level the playing field for contractors that are unable to provide a guarantee of energy savings due to constrained balance sheets. This will increase the selection pool for owners and increase competitiveness in the market. Second, as discussed in this paper, reducing credit terms will free up capital and in turn make projects more affordable and increase the likelihood of implementation.

Three methods of how insurance and energy efficiency savings can improve the credit worthiness of building retrofit projects have been discussed. The visual method provides a qualitative description regarding how insurance can reduce the effective principal at risk and how the net credit risk of this transaction is equivalent to the full principal loan credit risk at a higher credit rating. The principal of equivalent credit risk is the basis for credit enhancement. The theoretical approach shows that the limiting credit enhancement possible is the credit rating of the insurer. The method also assumes that project risk and default risk are covered by the insurance company. This is generally not currently the case in that insurers provide project performance protection and not default coverage. Project performance risk is generally the highest risk in retrofit projects in that lenders have good experience and expertise in assessing default risk but little to no experience in assessing performance risk which is exactly the cover that is being added by the insurance discussed here.

The stochastic model uses the basic visual model approach but instead of considering a fixed decrease in the principal at risk, the decrease is a probability distribution corresponding to the annual building efficiency savings distribution computed from a risk analysis of the energy efficiency project. In the stochastic model this distribution is modified to include a minimum level of savings. This patented methodology (Jones and Barats 2012) provides a practical method to assess project specific credit rating enhancement benefits as a function of the credit rating of the borrower and the other loan terms.

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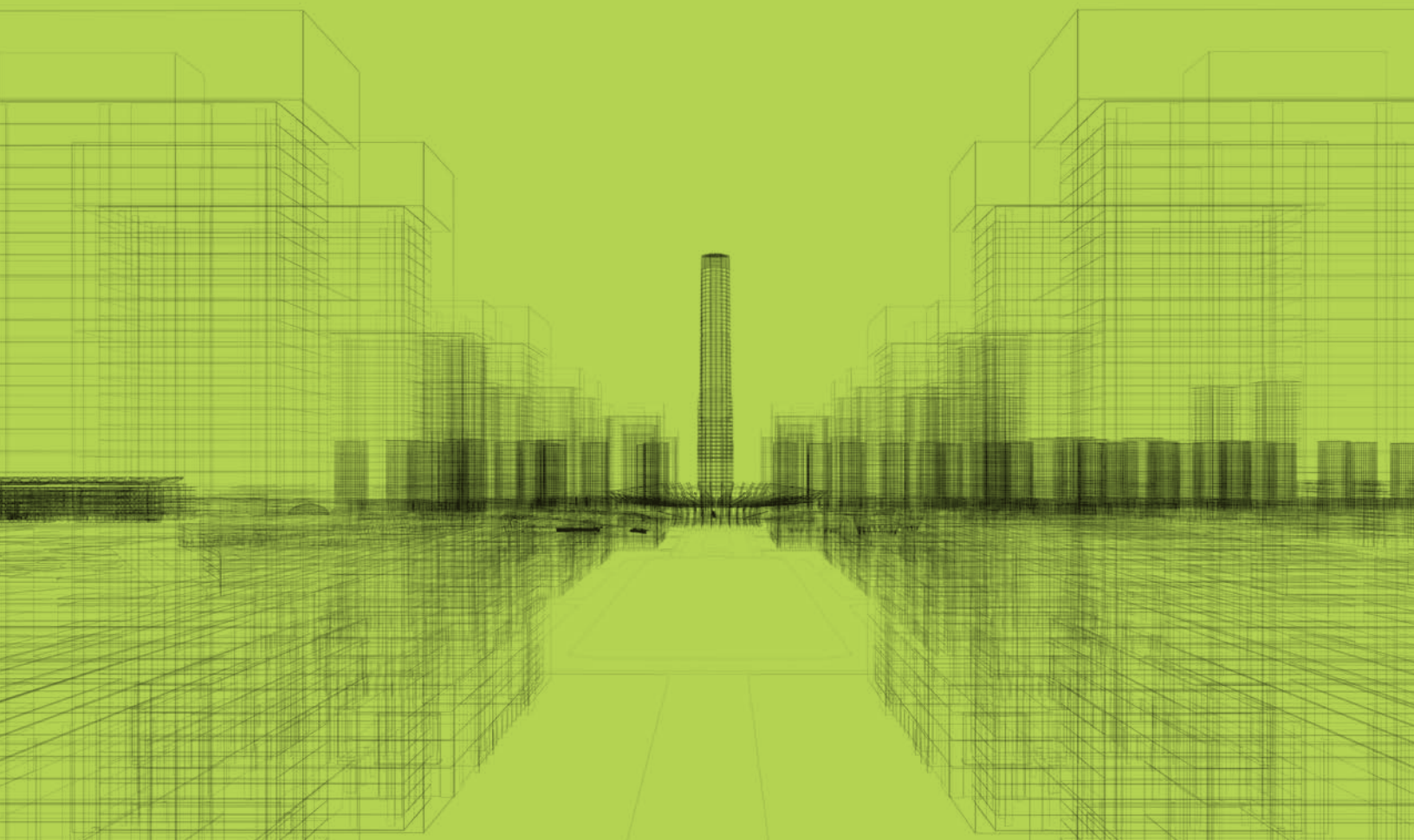

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Buildings over 25,000 square feet account for nearly 60 percent of the city's building area. With the right planning and support, upgrades over the next 10 years will put them on track for 80 percent carbon savings by 2050.

ABOUT THIS REPORT

We know how to dramatically reduce carbon pollution in New York City. We'll need to make major efficiency upgrades to our buildings. We'll eventually need to transition our heating and hot water systems from burning fossil fuels to using electricity. And we'll need to develop a greener electrical grid, with much more solar, wind and other sources of carbon-free electricity.

The stakes couldn't be higher: Sea levels along the coast have risen a foot in the past century. Spring begins a week earlier. Heat waves and superstorms—like Sandy and Irene—are becoming more frequent. And scientists project increasing impacts in the decades ahead, bringing enormous costs, heat waves, blackouts and floods that put vulnerable populations at greater risk.

Fortunately, New York City has made great progress. The green skyscraper was conceived by NYC developers, born on NYC drafting boards, and built with NYC labor. So much innovative policy was born here. New York was the first city to legislate LEED for city-funded construction, and now requires that new city-owned buildings be designed to use 50 percent less energy than used today. The city also recognized the importance of large buildings in solving climate change and developed groundbreaking policies for lighting upgrades, building tune-ups, and data-gathering under the Greener Greater Buildings Plan. Our energy codes continue to break new ground. The result? Even while the city's population has grown, emissions from large buildings have dropped 14 percent since 2010.

But the pace of these efforts must accelerate to achieve the city's goal of reducing greenhouse gas emissions 80 percent by 2050 (80x50). Getting there will require more than what existing regulations and voluntary, market-driven decisions will deliver. We need a bigger down payment on this transformation: a world-leading energy performance policy to drive efficiency in our large buildings.

Collaboration is key for a policy of this scale, with a multi-decade horizon and far-reaching implications for about 50,000 buildings. Mayor de Blasio laid a thoughtful climate planning foundation in *One City Built to Last* (2014) and *New York City's Roadmap to 80x50* (2016). The City Council galvanized action with Local Law 66 of 2014, committing NYC to 80x50. The vision took further shape with a bold efficiency proposal in fall 2017 for NYC's large buildings, carried forward by legislation sponsored by

Environmental Protection Committee Chair Costa Constantinides. And it continues with the 80x50 Buildings Partnership, an unparalleled collaboration of building and energy stakeholders convened by Urban Green.

This report is the result of a consensus-based process involving more than 70 participants from the real estate, labor, energy efficiency, nonprofit and government sectors. The varied knowledge and experience—and, ultimately, the buy-in—of these stakeholders was crucial to creating *Blueprint for Efficiency*.

This plan addresses New York City's large buildings (those over 25,000 square feet), which represent 57 percent of the city's built area. Upgrading these buildings takes time and money, but it also brings great opportunity. With the right financing and schedule, many efficiency improvements are highly cost effective. And this transformation will usher in new jobs, industry expertise and building technology to make New York City a healthier, more sustainable city in the years ahead.

Blueprint for Efficiency provides a workable policy **framework** to reduce emissions by 2030 and keep us on the path to reaching 80x50. It addresses **special cases**, like affordable housing and nonprofits, that will require unique treatment. It explores ways to allow **flexibility** for building owners to find the lowest-cost path to compliance. And it outlines the need for a major expansion of support services and financing to **make efficiency easier**.

The result is an ambitious but achievable plan to deliver 20 percent energy savings in large buildings from 2020 to 2030, with recommendations to guide future phases. Together with reductions made to date, this strategy will take NYC buildings a third of the way to 80x50. Equally important, New York City will have an infrastructure to deliver building energy improvements at scale. Finally, the hard work of the Partnership shows that consensus climate solutions are within reach, paving the way for other cities.

Note: This report contains brief summaries of the proposals. Additional details on each are available at ***urbangreencouncil.org/BlueprintForEfficiency.***

STATEMENT OF SUPPORT

The organizations listed below participated in a collaborative stakeholder process leading to the recommendations in this summary report. These organizations accept the core ideas expressed here, even though some may not agree with the specifics of certain recommendations. For many, consent to certain recommendations is contingent on other recommendations. Whether an organization will ultimately support a new law depends on many issues that will be determined during the legislative process.

32BJ SEIU

AIA New York

ALIGN: The Alliance for a Greater New York

American Council of Engineering Companies of New York

ASHRAE New York

Bright Power, Inc.

Brookfield Properties

Catholic Community Relations Council

CodeGreen Solutions

The Community Preservation Corporation

Council of New York Cooperatives & Condominiums

The Durst Organization

Edison Energy

Empire State Realty Trust

EnergyWatch Inc.

Enterprise Community Partners

Environmental Defense Fund

JLL

Jewish Community Relations Council of New York

Local Union No. 3 I.B.E.W.

Natural Resources Defense Council

New York League of Conservation Voters

New York University

New York Working Families

New York Communities for Change

Partnership for New York City

Real Estate Board of New York

Realty Operations Group

Related Companies

Rent Stabilization Association

Rudin Management Company, Inc.

SL Green Realty Corp.

Steven Winter Associates

Sustainable Energy Partnerships

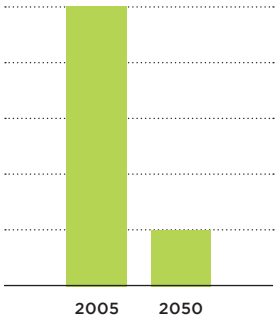
UA Plumbers Local Union No.1

Vornado Realty Trust

What does 80x50 mean for NYC?

Together with other leading world cities, NYC has pledged to cut its greenhouse gas emissions

80%
BY 2050



Two-thirds of citywide carbon emissions come from buildings, so they are central to achieving this goal.

REPORT HIGHLIGHTS

Major Impacts

20%
BUILDING ENERGY REDUCTION BY 2030

Balancing current costs with future uncertainties, these proposals will set large buildings on a realistic path to 80x50.

36%
PROGRESS TO 80x50

NYC buildings will be a third of the way to their 2050 CO_2 goal.

Key Proposal Elements

PROPOSAL 2:
Use a made-in-NYC metric to set realistic emissions targets for individual buildings.

PROPOSAL 5:
Focus fixes where needed most by requiring more of less-efficient buildings.

PROPOSAL 10:
Leading by example, city-owned buildings must hit 20% savings five years earlier.

Government Support

PROPOSAL 16:
Make efficiency easier by expanding services for building owners.

PROPOSAL 18:
To help tenants use just what they need, align energy use with energy bills.

50K BUILDINGS AFFECTED

All buildings over 25,000 square feet will be included.

PROPOSAL 7:
Require less of rent-stabilized housing to limit rent hikes in these buildings.

PROPOSAL 11:
Let owners trade efficiency credits to deliver carbon savings at the lowest cost.

PROPOSAL 13:
Encourage beneficial electrification to reward early adopters of efficient solutions.

PROPOSAL 19:
Shorten the NYC heating season to match warmer spring temperatures.

PROPOSAL 20:
Speed up upgrades by facilitating access to tenant spaces for retrofit work.

PROPOSAL 21:
Lower the burden of façade inspections for buildings with good track records.

What went into creating this report?

42
ORGANIZATIONS
joined together to form the 80x50 Buildings Partnership, a collaboration of key building and energy stakeholders.

70
EXPERTS
contributed time and ideas to these recommendations, lending insight from fields as diverse as real estate, labor, energy efficiency, government and nonprofit.

8
MONTHS
of discussions and over 1,300 meeting hours went into shaping these recommendations.

Steam is used in 80 percent of large multifamily buildings. Many older steam systems are inefficient and offer abundant opportunities for energy savings.

CREATE A SMART FRAMEWORK

Building efficiency policies are becoming the norm. Many cities now have laws directing owners to measure annual energy use. A few, like New York and Los Angeles, mandate building system inventories and tune-ups. The energy code requires better boilers and more insulation when equipment is replaced or a building is renovated. Under NYC's Carbon Challenge, over 100 participants have volunteered to cut building emissions 30 percent over ten years.

But there is no playbook for an efficiency policy of the magnitude proposed here. The right framework must drive cost-effective carbon savings that will ultimately reach the city's 80x50 goal. It needs to align these goals with the practical realities of buildings and their management. It should balance present knowledge with future uncertainty, including changes to technology and the electrical grid. It must be fair to the many owners who have already made efficiency upgrades, while not penalizing buildings for density or other features that cannot or should not be changed. It must work across a great variety of buildings and make sense on a 30-year time horizon.

So, we built a novel policy structure from the ground up.

This chapter outlines the key elements of the policy framework: Start with ambitious but feasible sector-wide energy savings targets, measuring energy from its source in order to deliver the greatest carbon reductions. Develop a new performance metric that gauges the relative efficiency of similar buildings, based on NYC data. Assign building-level reduction targets that get smaller as performance scores increase, so that less-efficient buildings do more. And allow an initial ten-year compliance timeline so upgrades can align with financing, equipment replacement, and tenant turnover.

1
Cut Citywide Building Energy 20 Percent by 2030

ISSUE
Reaching 80x50 means making major reductions in building energy in the coming decades. We must balance the need to act soon with cost, the limits of existing practice and technology, housing affordability, and the uncertainty of more-distant timelines.

RECOMMENDATION
Require large buildings to save 20 percent from 2020 to 2030 in aggregate, with each building sector contributing its proportional share. By 2020, establish default targets for 2040 and 2050 consistent with achieving 80x50, with review and update every 5 years.

2
Use a Made-in-NYC Metric

ISSUE
Buildings use energy differently because of differences in construction, operations and occupancy. To accurately compare buildings, an energy metric must account for these variations.

RECOMMENDATION
Develop a metric based on EPA's Energy Star rating tool that is calibrated with NYC building data and reflects the downstate grid.

3
Measure Energy at its Source

ISSUE
Energy is measured either solely at the building level (site energy) or by also including energy used to generate and transport power to the site (source energy). Site energy is what owners control directly but source energy reflects energy's full environmental impact and is used for benchmarking. Source energy changes as the grid changes, which could mean a shifting metric for owners.

RECOMMENDATION
Use source energy to measure energy consumption. Base the source energy calculation on the local grid composition in 2020 so owners don't face a moving target in 2030. Adjust that calculation for future compliance periods based on the changing grid.

4
Combine All Building Energy in One Requirement

ISSUE
Buildings use many sources of energy, including electricity from the grid and oil and gas burned on site. Separately regulating each source would increase certainty about future emissions but add red tape and reduce flexibility for owners.

RECOMMENDATION
Regulate all energy sources together in a single, whole-building requirement. In the alternative, supplement with a cap on fossil fuels burned by the least-efficient multifamily buildings.

Together, the framework proposals outline a fair and effective approach to setting building energy reduction requirements.

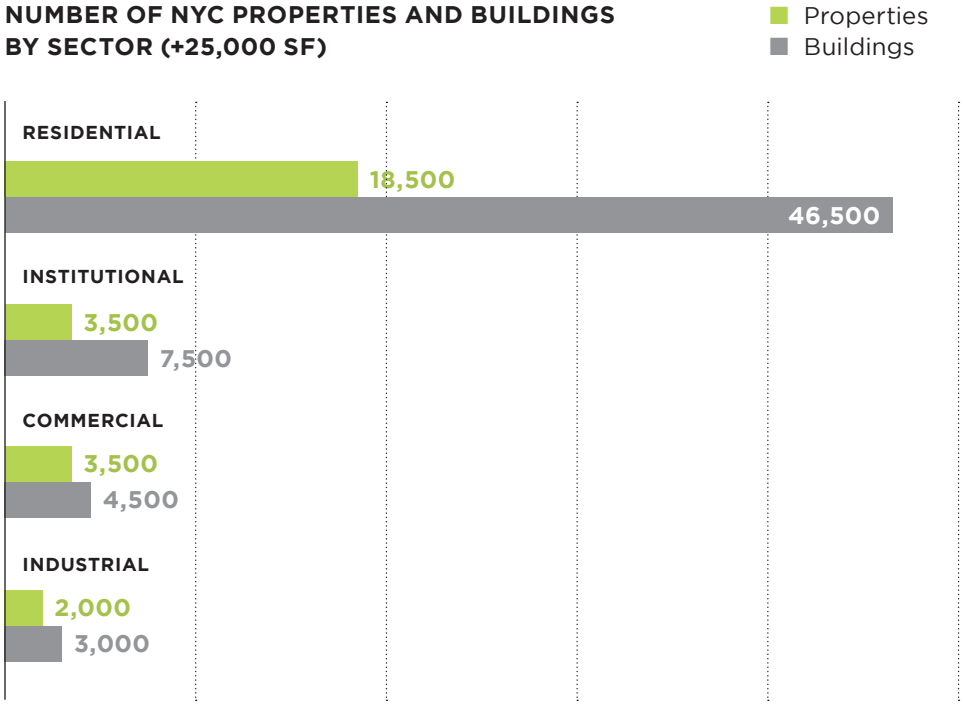
Each building receives a unique relative efficiency score using an NYC-calibrated metric.

Based on this score, each building receives a different reduction target. Lower scores mean larger reductions.

Together, the reductions add up to 20% energy savings in large buildings citywide.

The most efficient buildings, like PS 62, a Net Zero school on Staten Island, would be exempt from compliance in 2030.

NUMBER OF NYC PROPERTIES AND BUILDINGS BY SECTOR (+25,000 SF)



Many NYC properties have more than one building. Some smaller buildings on large properties may not be affected by this policy. Ultimately, the number of buildings covered will depend on legislative definitions.

5

Require Less-Efficient Buildings to Reduce More

ISSUE

Two core reduction strategies were considered for most buildings: cap a building's energy use, or require all buildings to reduce energy by a percentage. A one-cap-fits-all approach doesn't account for how different buildings use energy, while leaving those under the cap untouched. But using the same percentage reduction for all buildings may require too much from top performers and not enough from the least efficient.

RECOMMENDATION

Require most buildings to meet percent reductions that are smaller the more efficient a building is.

6

Avoid a Compliance Pile-up

ISSUE

A distant compliance date could delay upgrades. That means less carbon saved in the interim and a potential rush near 2030 that could overwhelm the workforce.

RECOMMENDATION

Develop a phased timeline to avert a 2030 pile-up. Options include multiple compliance years, an interim capital plan, and incentives for early compliance.

After a recent lighting upgrade, 160 LED bulbs illuminate the sanctuary at Our Lady of Mount Carmel, a Romanesque Revival church in the Bronx.

ADAPT FOR SPECIAL CASES

No two buildings and no two owners are the same. Some sectors face greater challenges than others when implementing efficiency upgrades and will require more support or tailored solutions. Proposals in this chapter focus on identifying these sectors and adapting the framework accordingly.

Perhaps the toughest nut to crack in developing this policy is the rent-stabilized multifamily sector. Housing affordability is a critical issue for NYC. Complicated state rules allow the costs of many major building upgrades to be passed on to tenants through permanent rent increases. Owners need to find a way to pay for upgrades, but efficiency requirements shouldn't drive rent increases on low- and moderate-income tenants. Until state rules are changed, this sizable sector requires a different path, one that spurs action but avoids affordability impacts.

Owners of other affordable housing—and there are many types—often struggle with thin margins and have difficulty accessing financing. So, too, do many nonprofit organizations, like houses of worship and social service organizations, or schools that may have limited staff and no experience with energy management. With a public-interest mission, these sectors warrant a bigger helping hand: dedicated financing, technical support and streamlined access to incentives or subsidies.

On the other hand, city-owned buildings can do more. The city should lead the way by upgrading public buildings sooner rather than later. Doing so will provide a critical place for industry to learn and innovate, encourage the development of a qualified workforce, and drive demand for energy efficiency products and services.

7
Keep Affordable Housing Affordable

ISSUE
The cost of "Major Capital Improvements" (MCIs), like boiler replacements, can often be passed on to tenants in rent-stabilized apartments, who may not be able to afford the resulting permanent rent increases. Nonetheless, owners need a way to pay for efficiency improvements. The rent-stabilized sector accounts for about 40 percent of large multifamily building space, so it's essential to get it right.

RECOMMENDATION
Require low-cost, energy-saving measures that don't qualify as MCIs for the rent-stabilized sector, instead of the percent reductions applicable to other sectors. Require adjustments to this approach if MCI rules or their interpretations change. And provide support and incentives so that the rent-stabilized sector can achieve the same efficiency gains as market-rate buildings.

How are MCIs approved?

Owners apply to New York State to raise rents based on the costs of MCIs. To qualify, an improvement must be building-wide, benefit all tenants, and typically replace an item past its "useful life."

8
Lend a Bigger Hand Where It's Most Needed (Part 1)

ISSUE
Affordable housing owners often face thin margins, financing challenges, and a backlog of upgrades to implement. Without help, they may struggle to achieve required energy savings.

RECOMMENDATION
Help affordable housing owners by expanding support programs, improving access to financing, and coordinating with NY State programs to achieve energy savings on par with market-rate buildings.

9
Lend a Bigger Hand Where It's Most Needed (Part 2)

ISSUE
Efficiency upgrades may be challenging for many nonprofit organizations. They often have constrained finances, limited staff, difficulty accessing available resources, and minimal experience with energy management.

RECOMMENDATION
Provide dedicated financing and technical support for nonprofits and religious organizations, including streamlining access to incentives.

10
Lead the Way with City Buildings

ISSUE
Scaling retrofits in NYC requires a proving ground so designers and contractors can experiment, shedding light on costs, risks, and solutions. City buildings have long paved the way for green building innovations.

RECOMMENDATION
Require city-owned buildings over 10,000 square feet to reduce energy consumption 20 percent by 2025 (twice as fast as private sector buildings) and reduce fossil fuel consumption. Publish case studies with lessons learned on deep retrofits and new technology pilots.

The Samuel Field YM & YWHA in Queens serves 35,000 kids, adults and seniors. Generous city grants made recent efficiency upgrades possible, including replacing a 60-year old oil boiler.

Building management systems can help maximize efficiency. At One Battery Park Plaza, ventilation and cooling automatically adjust to the number of occupants, avoiding energy waste.

ALLOW FLEXIBILITY

The ideal building retrofit policy will deliver the largest carbon savings at the lowest cost. That doesn't just make sense for building owners. It also makes sense for everyone who lives and works in New York City, as we will ultimately benefit when energy efficiency is reflected in real estate prices. Proposals in this chapter explore ways to allow—and place reasonable limits on—flexibility in compliance to achieve that end, including adjustments that advance long-term carbon goals.

The cost of efficiency upgrades varies across sectors, building types and owners. And efficiency work is most cost-effective when aligned with equipment life, tenant turnover and normal financing cycles. Allowing owners to trade efficiency credits and purchase green power to achieve some portion of compliance would introduce flexibility, including some breathing room if retrofits underdeliver. But both options need more analysis and planning to advance.

From a policy perspective, two long-term 80x50 goals require some flexibility.

First, how can we encourage early adopters to replace fossil-fuel based heating and hot water systems with highly efficient electric systems? Doing so will help the market learn what works over the next decade and be ready to scale beyond 2030.

Second, what's the right balance to strike on credit for efficiency achieved through new, gas-fired cogeneration plants? Placing a limit will ensure that this policy drives the on-site efficiency improvements that are critical to reaching 80x50.

11
Let Owners Trade Efficiency

ISSUE
Every building has a different cost for energy savings. Allowing buildings to bundle together or trade efficiency "credits" would give owners flexibility and reduce the cost of cutting carbon.

RECOMMENDATION
Develop an optional efficiency trading program, enabling owners to reach their energy reduction targets by buying energy savings from upgrades in other buildings. Consider providing greater credit for efficiency improvements in the nonprofit and affordable housing sectors.

Tokyo Cap-and-Trade

In 2010, Tokyo became the first city in the world to use a cap-and-trade program to reduce CO_2 emissions. The program covers about 1,300 large buildings and has driven more than 25 percent emissions savings to date. Lessons learned in Tokyo should inform a New York efficiency trading program, including the importance of strict third-party verification and strategies for addressing high credit prices.

12
Include Flexibility to Buy Green Power

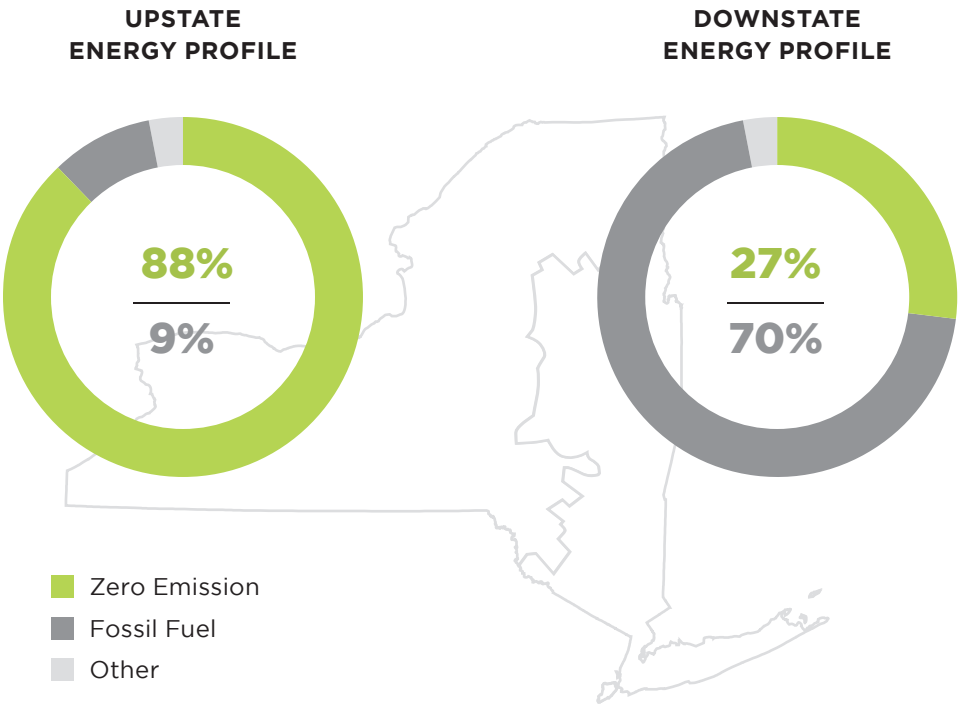
ISSUE
Financing cycles, equipment life and tenant turnover may make 2030 compliance especially challenging for some buildings. Allowing owners to defer some energy savings by buying green electricity would provide helpful flexibility. But not all green power is created equal. If used, it must not undercut efficiency as the top priority.

RECOMMENDATION
Allow owners to buy new, additional green power to defer a small portion of their required energy savings. Limit the option in quantity and duration, and prioritize New York green power.

13
Encourage Beneficial Electrification

ISSUE
To achieve 80x50, buildings must reduce their fossil fuel consumption and eventually begin using electricity for heating and hot water. Electric heat pumps are a likely solution. High electricity prices make them more expensive to operate now, but early adopters can help pave the way for taking them to scale.

RECOMMENDATION
Encourage heat pump pilots and installations by reducing the energy savings requirement for buildings that convert to high-efficiency electric heat or hot water systems.



Although New York state generates a lot of carbon-free electricity, constraints in transmission limit how much clean energy makes it to New York City.

14

Cap the Efficiency Credited to New Cogeneration

ISSUE

Cogen plants generate electricity from natural gas and then use exhaust heat that is normally wasted. It's a carbon benefit whenever the downstate grid is "dirty." Once the grid is clean, burning gas on site will mean more emissions than electricity from the grid. Investment in new cogen should be valued now, but not at the expense of building efficiency.

RECOMMENDATION

Limit the amount of new cogen that counts toward reduction requirements. Develop rules that require metering for new cogen and a transparent calculation for the efficiency credit. If a fossil fuel cap is included, exempt gas burned in cogen plants in the near term. But end that exemption once gas no longer dominates the downstate grid.

15

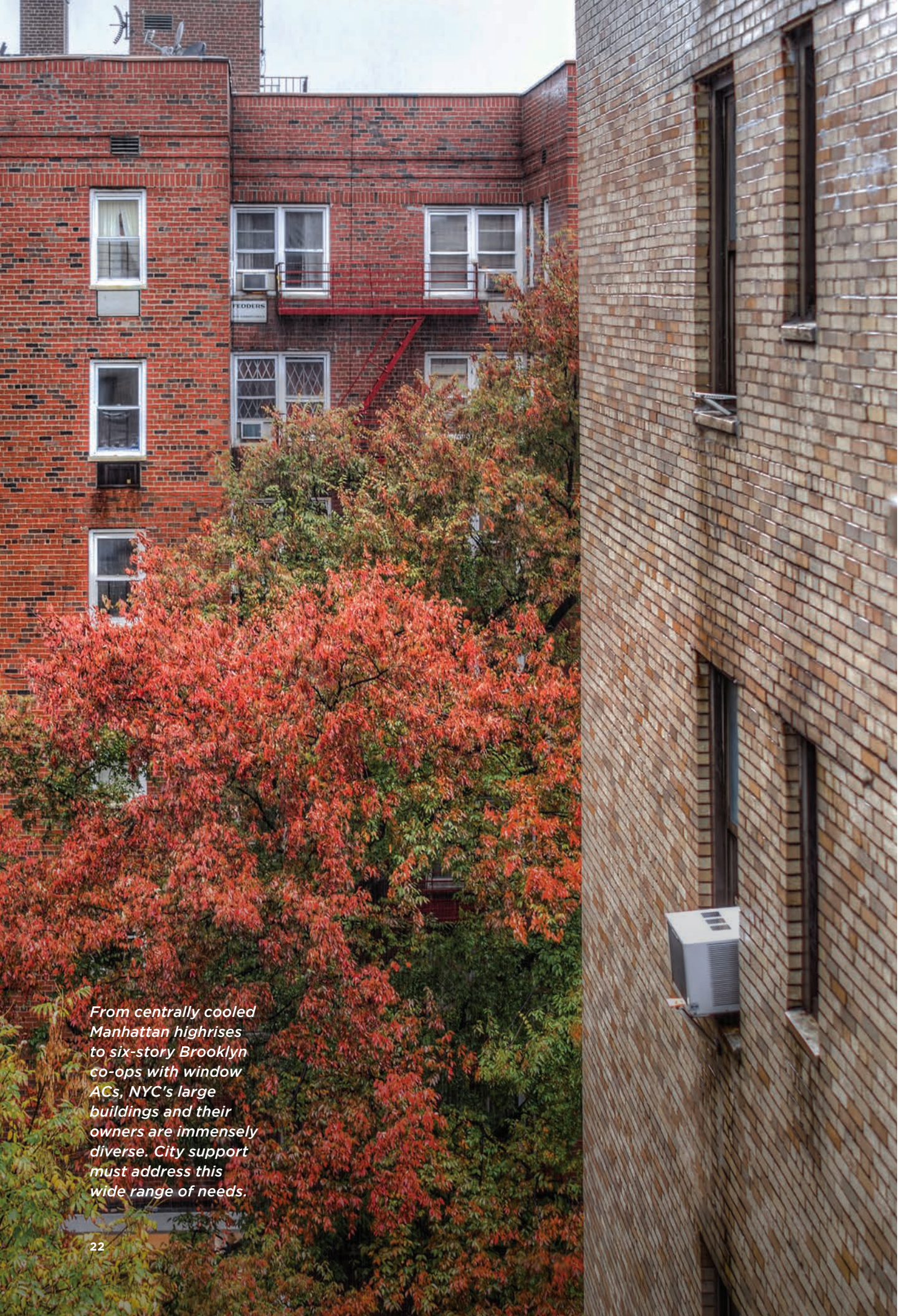
Reward Peak Demand Savings

ISSUE

The electrical grid is sized to meet a very small number of hours of maximum demand each year. A kilowatt-hour saved at 3AM in winter is worth much less for reducing carbon and air pollution than a kilowatt-hour saved at the peak of a hot summer day, when the least efficient power plants are firing.

RECOMMENDATION

Evaluate options to account for the carbon benefits of peak demand savings without undercutting permanent energy reductions.



From centrally cooled Manhattan highrises to six-story Brooklyn co-ops with window ACs, NYC's large buildings and their owners are immensely diverse. City support must address this wide range of needs.

MAKE EFFICIENCY EASIER

Construction in New York City is no cakewalk. It's more expensive to build here than anywhere else: 50 percent above the national average and 20 percent higher than major cities like Chicago, Los Angeles and Boston. In New York City, a typical project may require approvals from half a dozen city agencies, all important but adding time and cost.

Urban density places limits on noise and working schedules and makes it hard to deliver and store materials. And the high cost of living and a tight market for skilled labor translate to higher soft costs.

Given these high costs, building owners need support to comply with this plan. Many buildings—like most co-ops and condos—have minimal experience integrating efficiency upgrades into capital planning. They will need help doing so.

About 50,000 buildings are covered under the policy. Currently, big retrofit consulting firms might complete 50 large-building retrofits annually, while the city's Retrofit Accelerator targets 1,500 "projects" over three years (whether stairway lighting upgrades or full retrofits). We will require a support infrastructure more than ten times larger than what exists now.

Proposals in this chapter focus on providing owners with the technical and financial resources to make implementation easier. We need a huge expansion of programs to help owners with upgrades, prioritizing assistance to those with fewer resources and less technical ability. We also need to streamline existing financing options, better integrate efficiency in conventional lending, and enact new funding streams like commercial PACE. Some proposals also focus on lightening the regulatory burden for owners. As we add expenses through a major new policy, it makes sense to look for feasible ways to reduce costs elsewhere.

16
Make Efficiency Easier through Expanded Services

ISSUE
The proposed policy would impact about 50,000 buildings. Yet, most building owners are not proficient in energy efficiency or accessing financing for retrofits. Owners will require a lot of help for the policy to be successful, including engaging tenants whose energy use drives the energy profile of many buildings.

RECOMMENDATION
Dramatically expand the scope and capacity of the city's Retrofit Accelerator or other entities and approaches to support owners undertaking retrofits. Prioritize assistance to owners with fewer resources and less technical ability, including smaller buildings and nonprofits. Assist owners with strategies to reduce tenant energy use. Align with state and utility efficiency initiatives to maximize impact.

17
Bolster Financing Initiatives

ISSUE
Many buildings will require specialized financing to undertake energy retrofits, including on schedules that don't align with mortgage refinancing. And straightforward efficiency financing is not yet readily available through the traditional lending process.

RECOMMENDATION
Align and streamline existing financing resources. Simultaneously, enact C-PACE financing legislation, opening a new funding stream at attractive terms and rates. Encourage support for efficiency in conventional underwriting, while advancing other financing options to support retrofits.

18
Align Energy Use with Energy Bills

ISSUE
People tend to waste things that are free. When electricity is included in rent, apartment dwellers use about 20 percent more than when the tenant foots the bill. And metering and billing for water has saved 35 percent in some buildings. While more direct billing is possible now, regulatory hurdles mean it's cumbersome. Any change must be equitable for tenants in affordable housing.

RECOMMENDATION
Convene a task force with NY State to implement electric and cold water submetering and simplify regulatory requirements. When metering occurs in rent-stabilized units, ensure it is cost-neutral for tenants through rent reductions. Experiment with heat submetering, and later assess the potential to mandate.

19
Shorten the NYC Heating Season

ISSUE
NYC classifies October 1 to May 31 as the "heating season," when owners must maintain certain indoor temperatures. This means heating systems can only be upgraded or repaired during four months of the year. Over the last 20 years, the temperature has stayed above 50 degrees for 70 percent of days in May.

RECOMMENDATION
Reduce the heating season by four weeks, shifting it to October 1 to April 30.

20
Facilitate Access for Retrofits

ISSUE

Many efficiency improvements require work within tenant apartments, like upgrading radiators or insulating exposed pipes. Owners need predictability, while building service workers need clear access guidelines. Skipping work in just a few apartments can have an outsized impact on the cost, timeline and energy savings of a retrofit. But any changes must continue to protect tenant rights.

RECOMMENDATION

Explore the feasibility of facilitating access to tenant spaces for legitimate efficiency upgrades, while balancing the need to protect tenants. Options include developing a form letter from the city and guidelines for service workers to clarify the rules for access.

21
Lower the Burden of Façade Inspections

ISSUE

Since 1980, the façades of buildings affected by Local Law 11 have been thoroughly inspected eight times. Regulations and industry customs make these inspections the single largest expense for many buildings.

RECOMMENDATION

Require less-frequent inspections for buildings with clear track records. Reduce other cost factors by creating a role for drones or cameras, allowing reports to be filed despite open permits and clarifying rules for site-safety inspectors.

The Partnership held over 85 meetings and will continue to convene during the legislative process to advance our recommendations.

ABOUT THE 80x50 BUILDINGS PARTNERSHIP

The 80x50 Buildings Partnership is a collaboration between NYC's leading building and energy stakeholders to develop smart climate change policies. First convened by Urban Green Council in November 2017, the Partnership included more than 70 individuals from over 40 organizations representing the real estate, labor, energy efficiency, nonprofit and government sectors.

This report is the Buildings Partnership's inaugural project. In developing our recommendations, we followed the successful approaches of Urban Green's prior major convenings, the Green Codes Task Force (2008-2010) and Building Resiliency Task Force (2013).

Buildings Partnership participants were organized into five Working Groups, each led by a chair or co-chairs and focused on a different aspect of the policy: Framework, Requirements, Affordable Housing, Alternate Compliance, and Red Tape & Optimization. The Working Groups identified key issues and questions. Subgroups then analyzed and developed answers and potential solutions, collaborating on detailed proposals. The full Buildings Partnership reconvened throughout to review and comment on high-priority issues and finalize the ultimate recommendations.

Over the course of eight months, we held 85 meetings, with participants donating 1,300 pro bono hours of meeting time—and that doesn't include tremendous additional volunteer time spent drafting and reviewing detailed proposals. The substantial time and effort contributed by partnership members, all experts in their fields, was essential to the outcome. Urban Green is grateful for the knowledge, experience and dedication of all those who made this report possible.

The work of the Buildings Partnership will continue. Details of many proposals must be worked out during the legislative process, and we will continue to convene and help shape the final policy. Then there will be rulemaking. Beyond the legislation, we will work to ensure the development of the support services that will be essential for successful implementation.

In addition, entirely new 80x50 policy challenges await, such as addressing energy use in buildings under 25,000 square feet. Stakeholder input is critical to a successful policy, and the 80x50 Buildings Partnership will continue to drive consensus solutions to NYC's energy and climate challenges.

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NOTES & CREDITS

Notes

Report Highlights

Analysis of CO_2 impact based on NYC energy benchmarking data and Property Land Use Tax Lot Output (PLUTO) data, using Energy Star scores in place of an NYC-calibrated metric. Baseline electric grid fuel mix adapted from New York City's Roadmap to 80x50 with accelerated closure of Indian Point Energy Center.

Analysis of number of buildings affected based on NYC's 2017 Primary Land Use Tax Lot Output (PLUTO) dataset and calculated using the definition of "covered building" from the NYC Benchmarking Law. Analysis excludes buildings likely to be under 25,000 square feet on large properties.

Create a Smart Framework

Analysis of number of NYC properties and buildings based on NYC's 2017 Primary Land Use Tax Lot Output (PLUTO) dataset.

Allow Flexibility

Upstate energy profile and downstate energy profile based on the New York Independent System Operator (NYISO) *2018 Power Trends*.

Photography & Design

8: Claire Taylor Hansen

12: ©James Ewing/OTTO

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Unlock energy savings and convert them into "bankable" income-producing assets.

E-CAPITAL
DEVELOPMENT

Marshall Haimson, President
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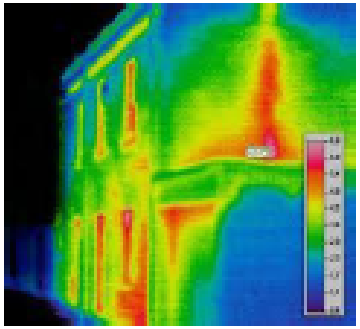
Energy-Efficiency Projects Are Solid Investments with Desirable Characteristics

- **ROI's are high: 10% to 30% (or more);**
- **Payback Periods are relatively short;**
- **Payout Periods are relatively long;**
- **Yields: Predictable, Measureable, Verifiable;**
- **Cash flows: Can be Guaranteed, Insured**
- **Credit Enhancement: The retrofit itself makes it easier to pay for the project, while also raising the value of the underlying Real Estate asset;**

SIZE MATTERS: The largest impact is often from higher-cost ECM's with longer useful life-cycles and paybacks.




Recommended ECM's	Useful Life (yrs)	ECM Cost	Annual Savings*	Simple Payback (yrs)	Life Cycle Savings	Savings / Cost Ratio
Lighting	7.0	$ 80,000	$ 77,500	1.0	$ 542,500	6.78
BMS (Controls)	12.0	$ 125,000	$ 85,000	1.5	$ 1,020,000	8.16
HVAC System	25.0	$ 300,000	$ 78,000	3.8	$ 1,950,000	6.50
Insulation	20.0	$ 95,000	$ 9,500	10.0	$ 190,000	2.00
Boiler / Heating	30.0	$ 400,000	$ 75,000	5.3	$ 2,250,000	5.63
TOTAL "BUNDLE" OF ECM'S:		*$ 1,000,000*	*$ 325,000*	*3.1*	*$ 5,952,500*	*5.95*

Non-Cash Benefits from Retrofits

- Upgrading to the newer technologies
- Increased efficiencies in daily operations
- No disruptions from system breakdowns
- Better working / tenant conditions
- Attracting better tenants / higher rents
- Higher NOI's mean higher RE values

Motivating CEO's & CFO's to do what's best for both themselves and the environment

Sticks and Carrots…

NYC's "Greener, Greater Buildings Plan" (2009)

Local Law 84 – Benchmarking: Requires owners of large buildings (i.e. over 25,000 gross ft.^{2}) to annually measure their energy / water consumption and submit these data to the City.

Local Law 85 - NYC Energy Conservation Code (NYCECC): Requires buildings to meet the most current energy codes for any renovation or alteration project (incl. 2010 Energy Conservation Construction Code of New York State (ECCCNYS), Local Law 85 of 2009, Local Law 48 of 2010 and Local Law 1 of 2011.

Local Law 87: Energy Audits & Retro-Commissioning: Mandates that all large buildings to undergo periodic energy audits, to perform retro-commissioning measures and to submit these data to the City.

Local Law 88 - Lighting Upgrades & Sub-Metering: Requires all large buildings to upgrade their lighting in compliance with NYCECC; to install electrical sub-meters for each non-residential tenant space over 5,000 gross ft.^{2} ; and provide monthly energy statements. The compliance deadline for both the lighting and sub-metering requirements is 2025.

NYC's "Climate Mobilization Act" (2019)

Local Laws 92 & 94 – Green Roofs & Solar PV: Requiring green roofs solar PV systems on certain new construction and renovation projects.

Local Law 95 – Building Labeling: Adjusting metrics used for letter grades assessing building energy performance.

Local Law 96 – PACE: Establishing clean energy financing tools for building owners (more on this below).

Local Law 97 – Emissions Limitations: First-of-its-kind legislation placing emissions limits on NYC's large buildings, both commercial and residential.

Local Law 98 – Wind Energy: Obliging the Department of Buildings to include wind energy generation in its toolbox of renewable energy technologies.

NYC's Local Law 97 – Emissions Limitations

Emissions reduction targets represent a **40% carbon reduction by 2030** and an **80% carbon reduction by 2050** relative to 2005 levels. Limits are assigned according to building occupancy type, with accommodations made for energy-intensive facilities involved in healthcare. Emissions limits for both the first and second compliance periods may be adjusted through the **rulemaking process**. Limits become much more stringent during the second compliance period.

ANNUAL BUILDING EMISSIONS LIMIT 2024-2029		Carbon Limit (KgCO2e/sf)*	
Occupancy Group(s)	Space Use	2024-2029	2030-2034
B- Ambulatory Health	Medical Office, Labs	23.81	11.93
M - Mercantile	Retail	11.81	4.03
I-1 - Facilities	Care & Rehab facilities	11.38	5.98
A - Assembly	Assembly	10.74	4.2
R-1 - Hotel	Hotel	9.87	5.26
B - Business	Office	8.46	4.53
E - Educational & I4 - Custodial Care	School, Daycare	7.58	3.44
R-2 - Residential	Multi family housing	6.75	4.07
F - Factory	Factory	5.74	1.67
S - Storage & U - Utility	Storage/Warehouse	4.26	1.10

*converted from metric tons to kilograms for easier reading

NYC's Local Law 97 – Penalties for Non-Compliance

- Failure to submit an annual report (by a "qualified energy professional") for a covered building will result in a penalty of $.50 per square foot for each month the violation is not corrected.
- False reporting will result in a penalty of $500,000 per violation.
- If your building emissions per square foot in a particular year are higher than the allowable limit set forth in the law, you are subject to a penalty of $268 per square foot multiplied by the difference between the emissions limit and your reported emissions.

  For example, a 1,000,000 square foot commercial office building (group B), has an emissions limit of .00846 tCO2e/sf/yr in 2024. If the actual reported emissions is .009729 (15% higher), then the annual penalty is $340,092.

NYC's "Climate Mobilization Act" (2019)

<u>Queens Chamber of Commerce panel on 'Climate Mobilization Act' (7/31/19):</u>

"If you're a building owner here today, and you're worried about fines, I don't want your money. I want your carbon," Councilmember Costa Constantinides told the audience.

Constantinides, who led the charge on the set of climate bills, has made climate change one of his signature issues, and is chair of the Council's Environmental Protection Committee.

NYC's "Climate Mobilization Act" (2019)

These laws are so ambitious, they're sparking an "Energy Gold Rush" and exposing clients to lots of new risks.

Legal and risk management professionals will play a key role in implementing these new laws effectively and safely.

Mitigating Risks and Maximizing Returns

Clients and advisors must focus on:

- **Upgrading Equipment** (paid for through savings)
- **Solid Projects** (hard numbers - not "Gut Feel Factor")
- **Large Life-Cycle Savings** (vs. Simple Payback)
- **Investment Returns** (not just the incentives)
- **Guarantees / Insurance** (protecting the cash flows)
- **Strong Teams** (Professionals, Contractors, Financiers)

ENERGY PROJECT PERFORMANCE INSURANCE

Hartford Steam Boiler

Munich RE

STARR COMPANIES

LLOYD'S

hannover re®

Swiss Re

AIG

"This is Physics, not Metaphysics"

BENCHMARKING / ASSESSMENTS:
ASTM is an international standards organization that develops and publishes voluntary consensus technical standards for a wide range of materials, products, systems, and services.

METHODS FOR AUDITING / SAVINGS CALCULATIONS:
A.S.H.R.E.A. (American Society of Heating, Refrigeration and Air-Conditioning Engineers)

PERFORMANCE MEASUREMENT & VERIFICATION:
International Performance Measurement and Verification Protocol ("IPMVP")

"An Insurable Project is an Investable Project"

- ✓ **Insurer validates project's economics and engineering**
- ✓ **Large balance sheet to backstop savings guarantees**
- ✓ **Performance shortfalls resolved as insurance claims**
- ✓ **Economic analysis becomes a "Line-Item" Decision**

Potential Project **Insured Project** **Implemented Project**

SOLAR SHORTFALL INSURANCE

Securing a Solar Future for 930 Families

Georgetown Mews Co-op (Flushing, NY) - 1.55 MW
Backstopped by 5-Year Solar Shortfall Policy

SOL ALLIANCE

Energy Services Agreements (ESA's)
Portfolio of Small- to Mid-Sized Business

- Install new Energy Management System, lighting, HVAC.
- Systems are connected to the internet and remotely accessible.
- Includes an operating system that learns from its environment.
- Used to maximize systems' performance, efficiency, productivity.
- ECM installations are paid for by rebates and future savings.
- JouleSmart owns the ECM's until fully repaid.
- No out-of-pocket for owners.
- Future savings are guaranteed and insured.

JouleSmart℠

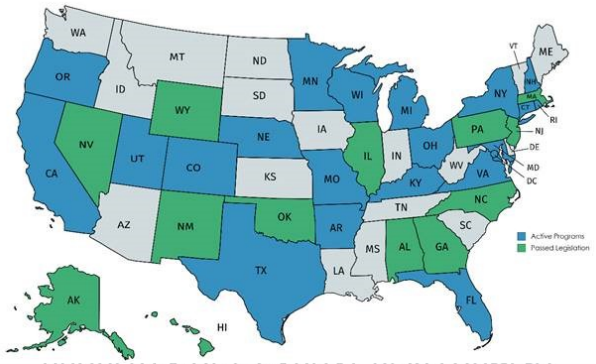
Local Law 96: P.A.C.E. (Property-Assessed Clean Energy)

City or county creates type of land-secured financing district or similar legal mechanism

Property owners voluntarily sign-up for financing and make energy improvements

Proceeds from revenue bond or other financing provided to property owner to pay for energy project

Property owner pays assessment through property tax bill (up to 20 years)



Resources

- https://www1.nyc.gov/site/buildings/codes/local-laws.page
- https://be-exchange.org/insight/the-climate-mobilization-act-int-1253/
- https://dsllp.com/content/pdfs/Climate_Mobilization_Act_White_Paper.pdf
- https://queenseagle.com/all/queens-chamber-of-commerce-hosts-panel-on-climate-mobilization-act
- https://www.tandfonline.com/doi/abs/10.1080/10406026.2017.1415074?scroll=top&needAccess=true&journalCode=becj20
- https://www.pacenation.org/wp-content/uploads/2018/04/CMBS-Article.pdf

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DEVELOPMENT

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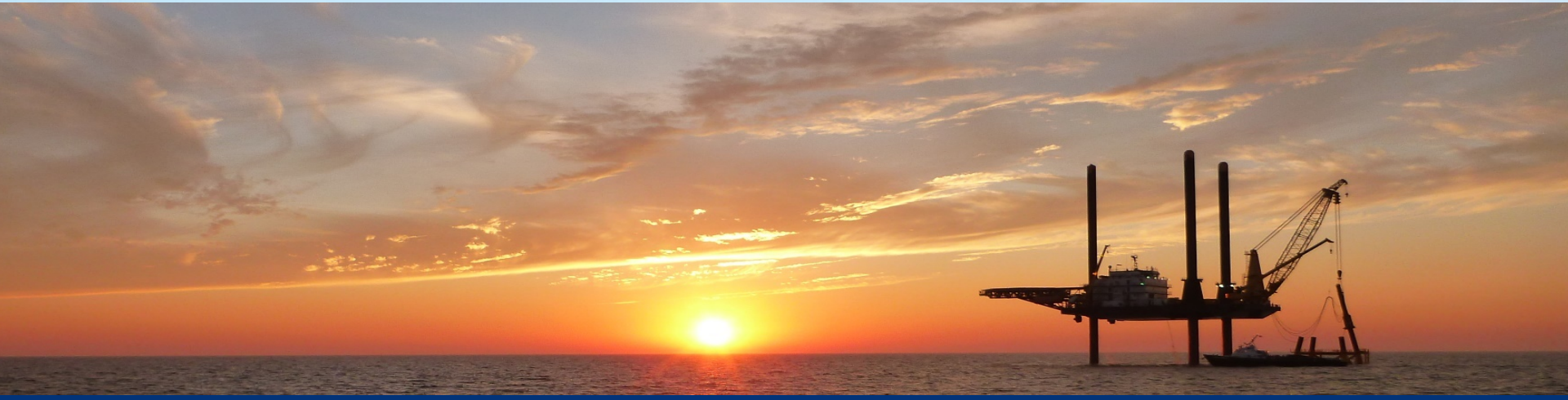
Tetra Tech Offshore Wind Project Support

New York State Bar Association

Environmental and Energy Law Section Fall Meeting

September 23, 2019



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U.S. OFFSHORE WIND POTENTIAL
25,824 MEGAWATTS (MW)

- 30 MW of installed capacity
- 2,043 MW of capacity with site control and offtake pathways
- 19,151 MW of potential capacity (developers have exclusive site control)
- 2,250 MW of potential capacity in unleased wind energy areas (North Carolina)
- 2,350 MW of potential capacity in unsolicited project applications (Pacific region)

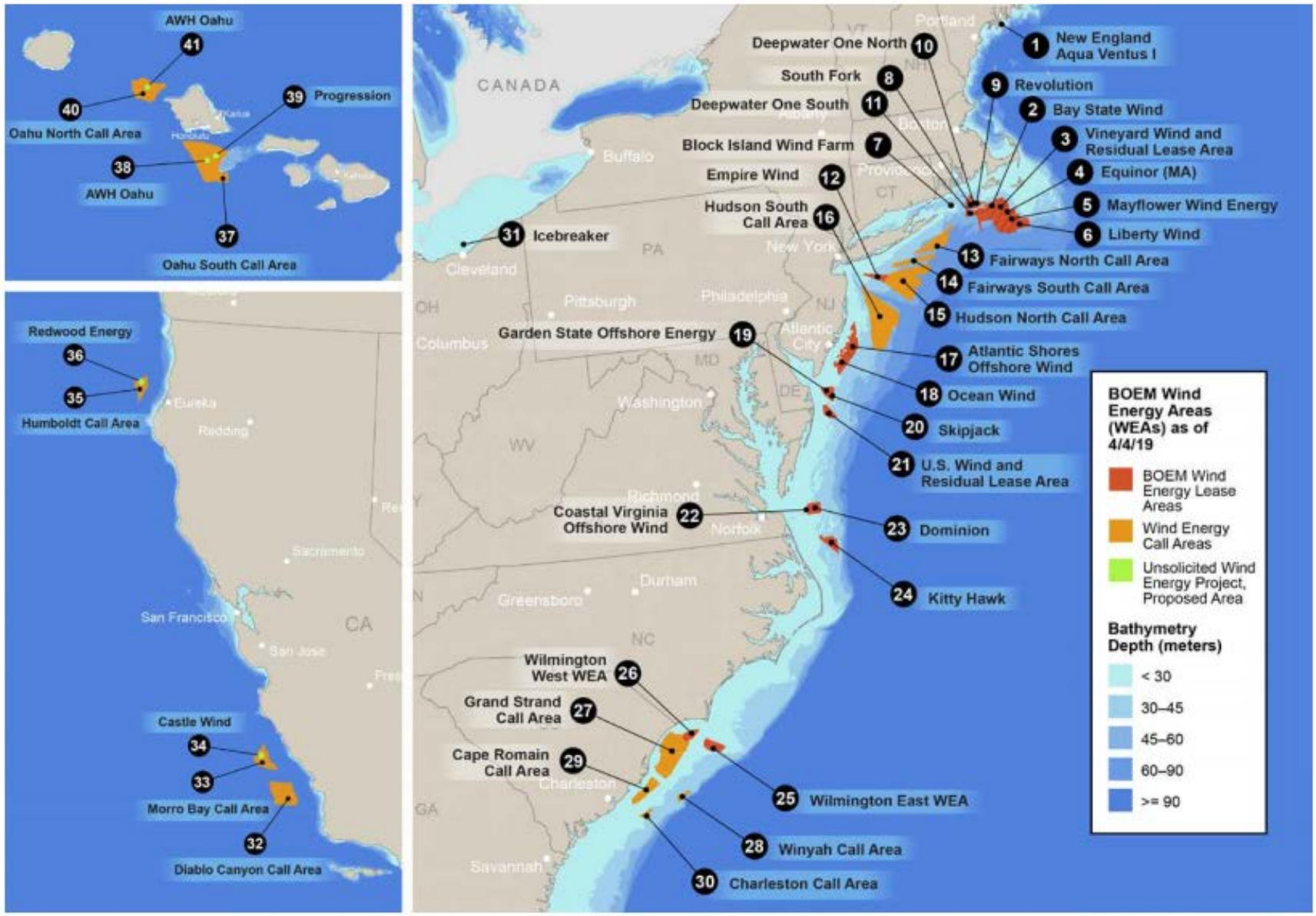
Federal Activities

- DOE released "Offshore Wind Technologies Market Report"
- Increased competition at auctions for new renewable energy lease areas. Three lease areas in Massachusetts were each sold for $135 million, more than tripling the previous highest winning bid.
- Department of Interior's Bureau of Ocean Energy Management (BOEM) considering establishment of an Intergovernmental Task Force for New Hampshire.
- BOEM is examining new "Call Areas" for offshore wind development.
    - Assessed commercial interest in multiple Call Areas in the New York Bight (2018). Final WEA expected in fall 2019. Lease auction expected in 2020.
    - Designated Call Areas along central and northern California coast (2018). Lease auction expected in 2020.

State Activities

- State-level policies continue to drive the U.S. market.
- State offshore wind targets increased to 11,468 MW to be operating in 2030 and 19,968 MW to be operating by 2035 (as of June 2019).
- 4 projects awarded offshore wind renewable energy certificates (US Wind Maryland project, Deepwater Wind Skipjack project) or a power purchase agreement (PPA) (Deepwater Wind South Fork project)

U.S. OFFSHORE WIND DEVELOPMENT ACTIVITY



Source: NREL 2019

NEW YORK AND OFFSHORE WIND

What is the driver?

- Climate Leadership and Community Protection Act
  - 100% zero-carbon electricity by 2040
  - 70% of state's electricity from renewable sources by 2030
  - 9,000 MW of offshore wind by 2035, enough to power up to 6 million homes

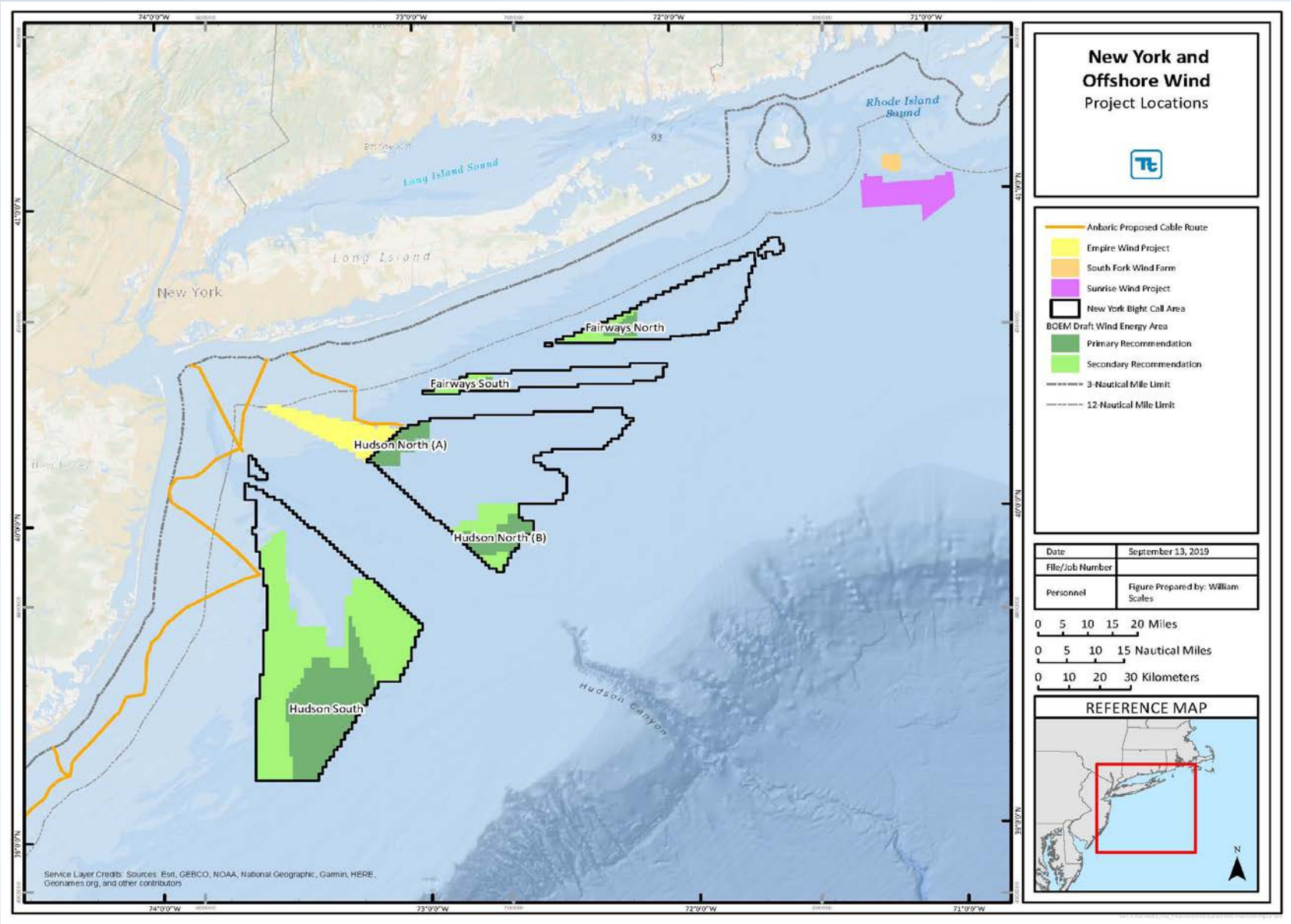
What is the status of projects?

- **South Fork Wind Farm**: Ørsted U.S. Offshore (Deepwater Wind) and Eversource Energy
  - 132 MW, enough to power 70,000 homes
  - 35 miles east of Montauk Point, Long Island
  - Operational by 2022
- July 2019—NYSERDA negotiated 25-year offshore wind RECs for 2 offshore wind farm projects
  - **Empire Wind**: Equinor
    - 816 MW of capacity
    - 14 miles southeast of Manhattan
    - Operational by 2024-2025
  - **Sunrise Wind**: Joint venture between Ørsted U.S. Offshore and Eversource Energy
    - 880-MW project
    - 30 miles east of Montauk Point, Long Island
    - Operational by 2024
  - Combined capacity to produce 1,700 MW of electricity (enough to power 1 million homes), or 20% of Gov Cuomo's goal for offshore wind.
  - 1,600 jobs and $3.2 billion in economic activity

What is next?

- Final NY Bight Wind Energy Areas to be announced by BOEM

NEW YORK AND PROPOSED OFFSHORE WIND PROJECTS



OFFSHORE WIND PROJECT ELEMENTS

Marine Surveys
- Geophysical & Geotechnical
- T&E Species
- Cultural Resources

Permits
- NEPA process through BOEM
- Federal, state, and local permits

Site Control
- Lease from BOEM

Financing
- Investor or bank funding to construct

Offtake Agreement
- Revenue stream for power produced
- Unlocks development funding

Marine Construction and O&M

Subsea Cable Design and Installation
- Technology providers
- Owner's engineer
- Installation contractors

PERMITTING PROCESS IN THE UNITED STATES

- Lead Federal Agency: Bureau of Ocean Energy Management (BOEM)
  - 3 nautical miles to U.S. Exclusive Economic Zone
  - Responsible for NEPA review for all project infrastructure from sea to point of interconnection
- State Lead would be site specific

PROJECT COMPONENT[1]	STATE	FEDERAL
Wind turbine array		X[2]
Offshore substation(s)		X[2]
Submarine transmission cable	X	X
Onshore transmission cable	X	X[3]
Tie-in to existing transmission system (e.g., substation and port upgrades)	X	X[3]

[1]Assumption is that offshore wind energy facilities are located on the Outer Continental Shelf ([OCS] federal waters).
[2] State Coastal Zone Management Agency must, however, issue a Consistency Certification for any project if it will "directly, indirectly, or cumulatively affect any natural resources, land uses, or water uses in the coastal zone."
[3] Depending on existing conditions along proposed route (e.g., wetlands, protected species habitat), federal jurisdiction may apply and require a permit (e.g. U.S. Army Corps of Engineers).




FEDERAL AUTHORITIES

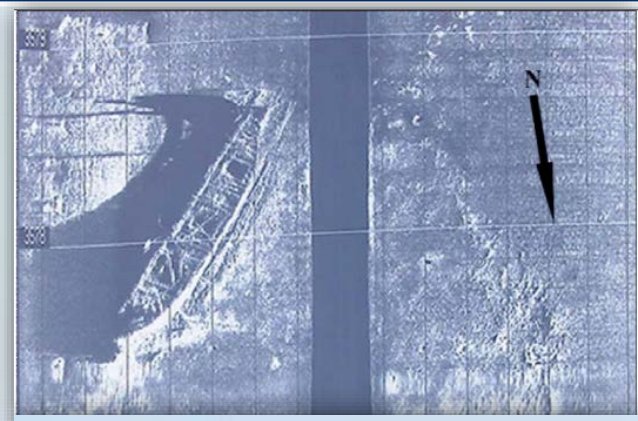
- National Environmental Policy Act
- Endangered Species Act
- Marine Mammal Protection Act
- Magnuson-Stevens Fishery Conservation and Management Act
- Marine Protection, Research, & Sanctuaries Act
- National Marine Sanctuaries Act
- E.O. 13186 (Migratory Birds)
- Coastal Zone Management Act
- Clean Air Act
- Clean Water Act
- Marking of Obstructions
- E.O. 13007 (Indian Sacred Sites)
- E.O. 13547 (Stewardship of the Oceans, Our Coasts and the Great Lakes)
- Ports and Waterways Safety Act
- Rivers and Harbors Appropriation Act
- Resource Conservation and Recovery Act
- National Historic Preservation Act
- Archaeological and Historical Preservation Act
- American Indian Religious Freedom Act
- Federal Aviation Act
- Federal Power Act

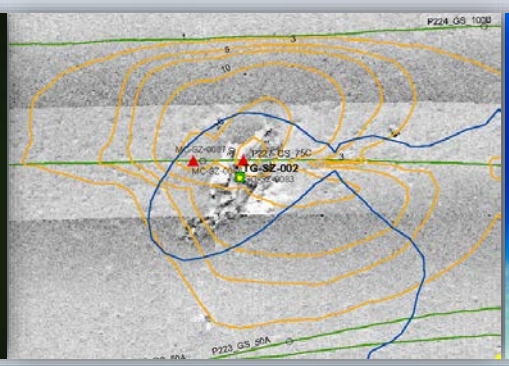
US Army Corps of Engineers

BOEM Bureau of Ocean Energy Management

MARINE ISSUES

- Impacts to marine mammals, fish, and avian species
- Disturbance of benthic habitat
- Suitable substrate (engineering and permitting)/ construction methodology
- Avoidance of sensitive cultural resources
- Avoidance of dumping grounds and UXO
- Minimize impact to Essential Fish Habitat (EFH)
- Water quality and air impacts during construction
- User conflicts especially with fishing interests and commercial shipping interests



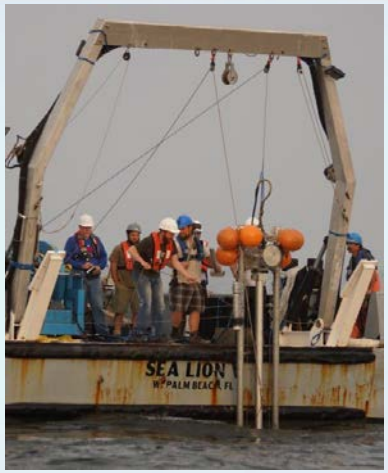


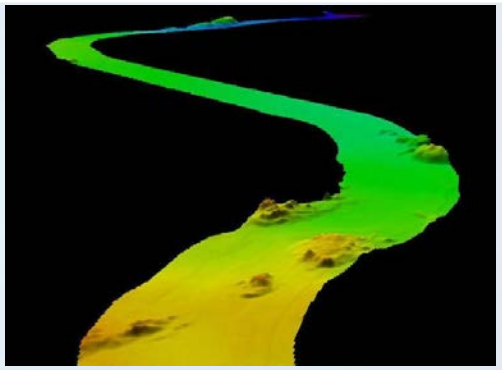
TERRESTRIAL ISSUES

- Sensitive coastal/near shore habitats
- Threatened and endangered (T&E) species
- Wetlands
- Coastal consistency
- Compatibility with existing land use and the power grid (use of existing infrastructure is best whenever possible)
- Submerged aquatic vegetation
- Sensitive cultural resources
- Structures
- Archaeological
- Noise (construction)

SURVEYS AND DESKTOP ANALYSIS

- Marine Geophysical and Shallow Geotechnical Surveys
- Marine Cultural Survey
- Marine Benthic Site Characterization
- In-Air and Underwater Noise Modeling
- Electromagnetic Field Assessment
- Visual Impact Assessment
- Navigational Safety Assessment
- Marine Mammal and Sea Turtle Assessment
- T&E Species Assessment
- Fisheries Assessment
- Air Emissions Analysis
- Sediment Dispersion Modeling
- Historic Properties Surveys





OVERVIEW OF BOEM PERMITTING PROCESS

Wind Energy Area Identification

- Intergovernmental Task Force--BOEM works with federal and state stakeholders to find potential areas with few environmental/user conflicts
- BOEM conducts an Environmental Assessment on lease execution and site assessment
- Request for Information or Call for Information and Nominations

2-3 years

Auction/Lease Execution

- BOEM determines competitive interest in designated wind energy area
- BOEM qualifies interested developers to participate in auction
- Auction winner(s) signs lease(s) including terms and conditions

1-2 years

Where Tetra Tech gets involved

Lease Preliminary Term (1 year)

- Begins on effective date of a lease
- Conduct site characterization surveys for buoy/meteorological tower deployment
- Submit a Site Assessment Plan (SAP) to BOEM for approval

1 year

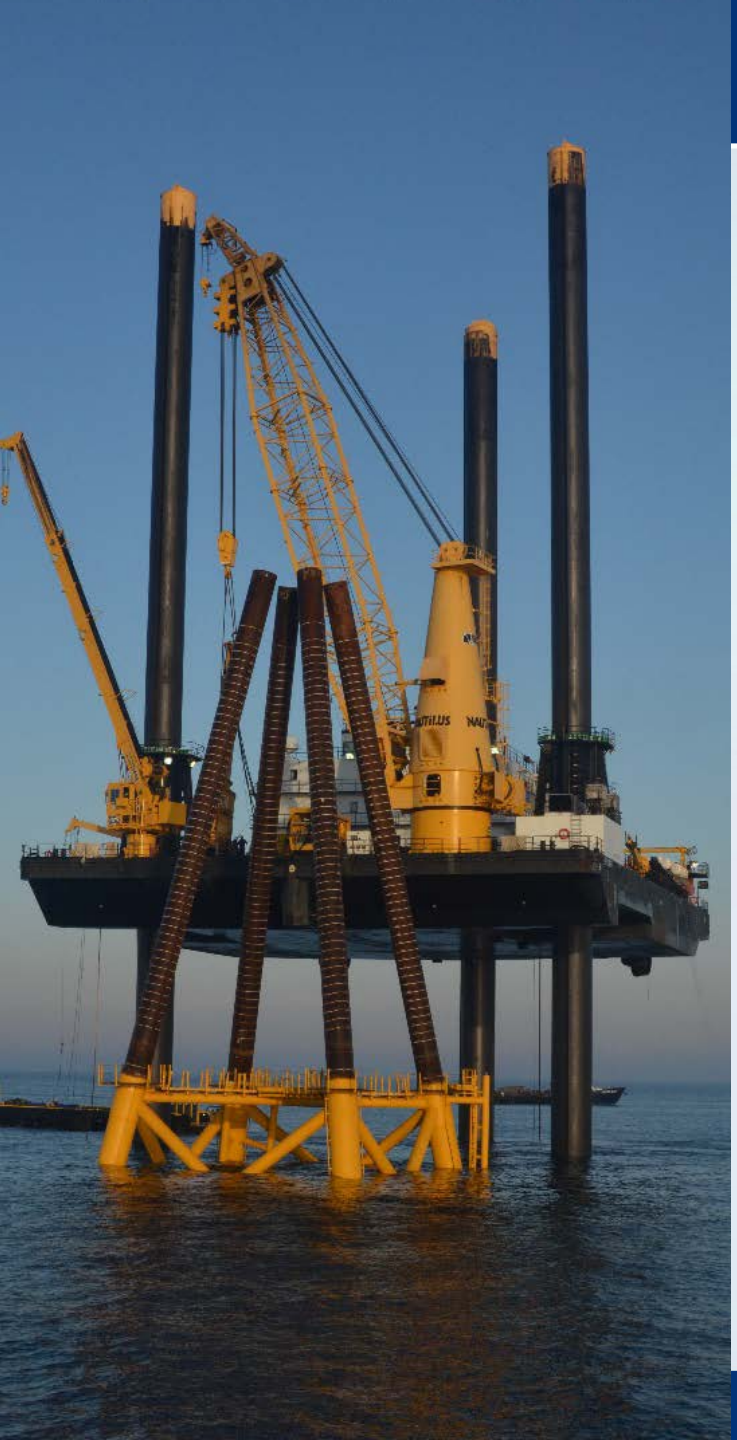
Lease Site Assessment Term (1 to 5 years)

- Begins when SAP approved by BOEM
- Deploy environmental monitoring equipment
- Conduct site surveys for wind project area
- Submit Construction and Operations Plan (COP) to BOEM for approval

2 years

Lease Operations Term (25+ years)

- Begins when COP approved by BOEM
- Construction, commissioning, and operations

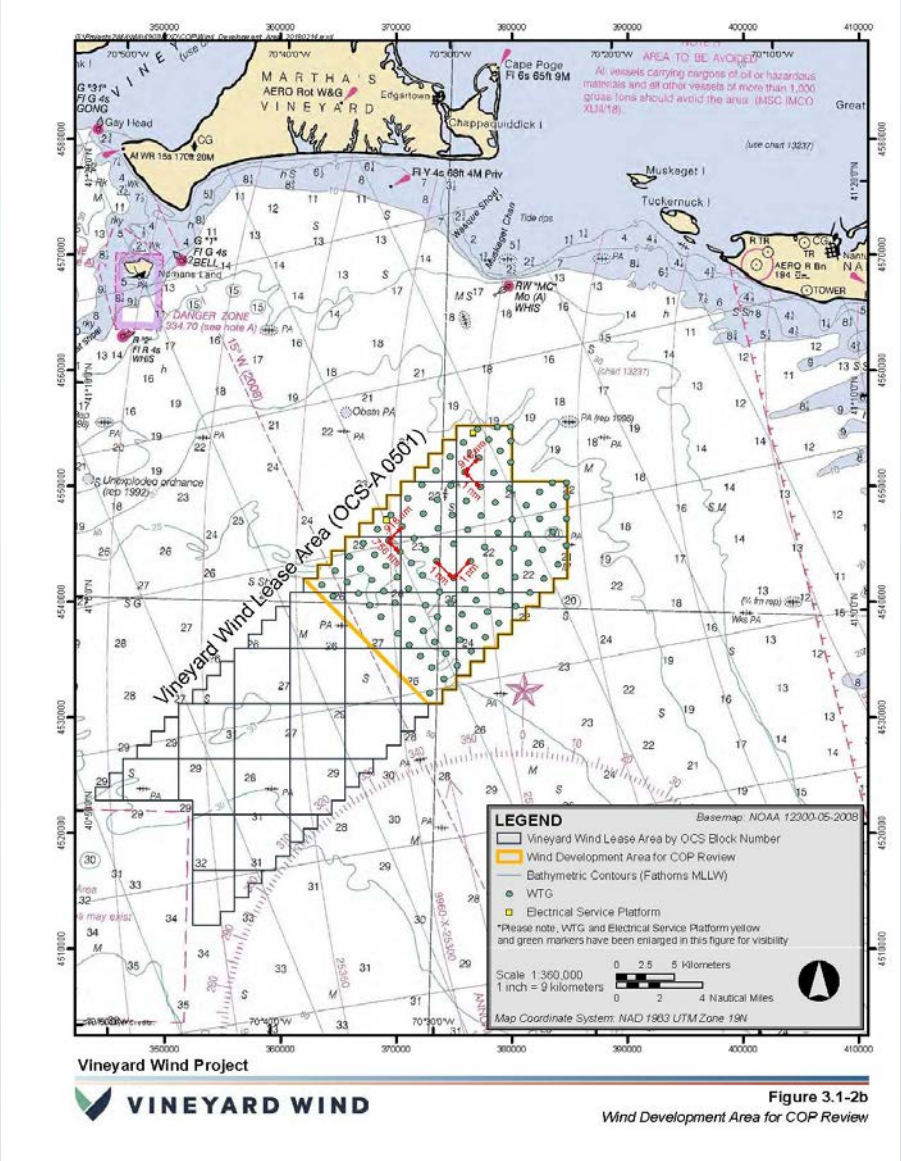


COP – NEPA REVIEW

- Agency scoping meetings (BOEM/USACE/USFWS/NOAA/EPA/USCG)
- Publish Notice of Intent to initiate scoping period in *Federal Register*
- Agencies' public notice, public meetings, and comment period
- Third-party contractor prepares Draft Environmental Impact Statement (EIS) for agency review and public comment period.
- Third-party contractor prepares Final EIS for agency review
- BOEM issues Final EIS
- Issuance of Record of Decision (ROD)

CASE STUDY: VINEYARD WIND PROJECT

- 50-50 partnership between Copenhagen Infrastructure Partners and Avangrid Renewables
- $2.8 billion, 800-MW project (energy for over 400,000 homes) 15 miles south of Martha's Vineyard, MA with a transmission system at the Barnstable 115-kV substation
- 2 400MW Power Purchase Agreements (PPAs) approved by MA Dept of Public Utilities:
  - Phase 1: $74/megawatt-hour (MWh)—COD 2022
  - Phase 2: $65/MWh—COD 2023
  - Utilities have agreed to purchase 100% of energy and RECs generated and delivered by the project over a 20-year term
- Fishing conflicts
  - Vineyard Wind reduced project footprint by 20% and changed wind turbine generator layout to E-W alignment.
- Secretary of the Interior David Bernhardt has ordered additional study due to public comments requesting a more robust **cumulative impacts analysis** of offshore wind capacity buildout.
- BOEM is extending the mandatory environmental review in a **Supplemental EIS** (March 2020).
- Onshore construction expected in 2019; first phase of the project was expected to come online in 2022.
  - Qualification for 12% Investment Tax Credit being called into question



EARTH, WIND & FIRE, "GOT TO GET YOU INTO MY LIFE" – CLEANER AND COST-EFFECTIVE ENERGY

Monday, September 23, 2019
9:50-11:05 AM (ET)
Mohonk Mountain House
New Paltz, NY

NEW YORK STATE BAR ASSOCIATION
ENVIORNMENTAL & ENERGY LAW SECTION

Earth, Wind & Fire, “Got to Get You Into My Life” – Cleaner and Cost-Effective Energy

- Panel Chair:
  - Gregory M. Brown, Esq. Brown Duke & Fogel, P.C
- Panelists:
  - Julia Pettit, Esq. Senior Counsel EDF Renewables

    Large Scale Solar and on-shore Wind
  - Megan Higgins, Director of Offshore Energy, Tetra Tech, Inc. Sciences

    Offshore Wind
  - Marshall Haimson, President, E Capital Development

    Storage, Transmission and Financing Energy Projects

Climate Leadership and Community Protection Act

Statewide Greenhouse Gas Emission Limits

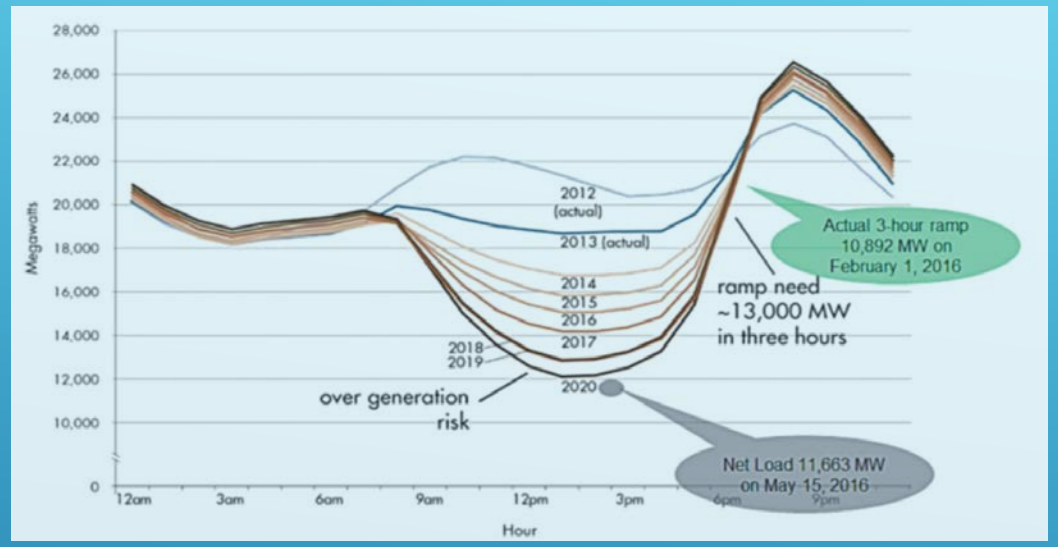
- Limits (ECL 75-0107) Percentage of 1990 emissions:
  - 2030- 60%
  - 2050 – 15%
- Enforceable Regulations no later than 4 years – (ECL 75-0109) shall:
  - Include "*enforceable limits, performance standards, or measures or other requirements*" to control (exception for livestock emissions)
  - Considerations: equitable, minimize cost, maximize total benefits to NY, verifiable, permanent, enforceable
  - Limited use of offset projects as alternative compliance mechanism – electric generation sector not eligible to use offset mechanism.

Climate Leadership and Community Protection Act cont.

Climate Action Council - 22 members – and advisory panels

- Timing:
  - 2021 – draft scoping plan – recommendations for attaining limits and beyond
  - 2022 – final scoping plan – recommendations to be incorporated into state energy plan
  - Updates at least once every five years
- "Just transition Working Group"
- Environmental Justice Advisory Group
- Must include measures to achieve – by 2025:

- 6 Gigawatts distributed solar
- 9 Gigawatts Offshore Wind
- 3 Gigawatts energy storage by 2030
- Displace fossil-fuel fired electricity with renewable or energy efficiency



NEW YORK STATE BAR ASSOCIATION
ENVIORNMENTAL & ENERGY LAW SECTION
September 23, 2019

ENERGY STORAGE

Energy Storage

- “‘[Q]ualified energy storage system’ shall mean commercially available technology that is capable of absorbing energy, storing it for a period of time, and thereafter dispatching the energy using mechanical, chemical, or thermal processes to store energy that was generated at one time for use at a later time” (PSL § 74).
- Electric Storage Resource: “a resource capable of receiving electric energy from the grid and storing it for later injection of electric energy back to the grid” (18 C.F.R. § 35.28; Order No. 841, 162 FERC ¶ 61,127 at P 29).

Public Service Commission to establish an energy storage goal and policy by end of 2018 (PSL § 74.2)

- 3,000 MW of qualified storage energy systems by 2030,
- interim objective of deploying 1,500 MW of energy storage systems by 2025

Case 18-E-0130 *Matter of Energy Storage Deployment Program*, Order Establishing Energy Storage Goal and Deployment Policy, Dec. 13, 2018.

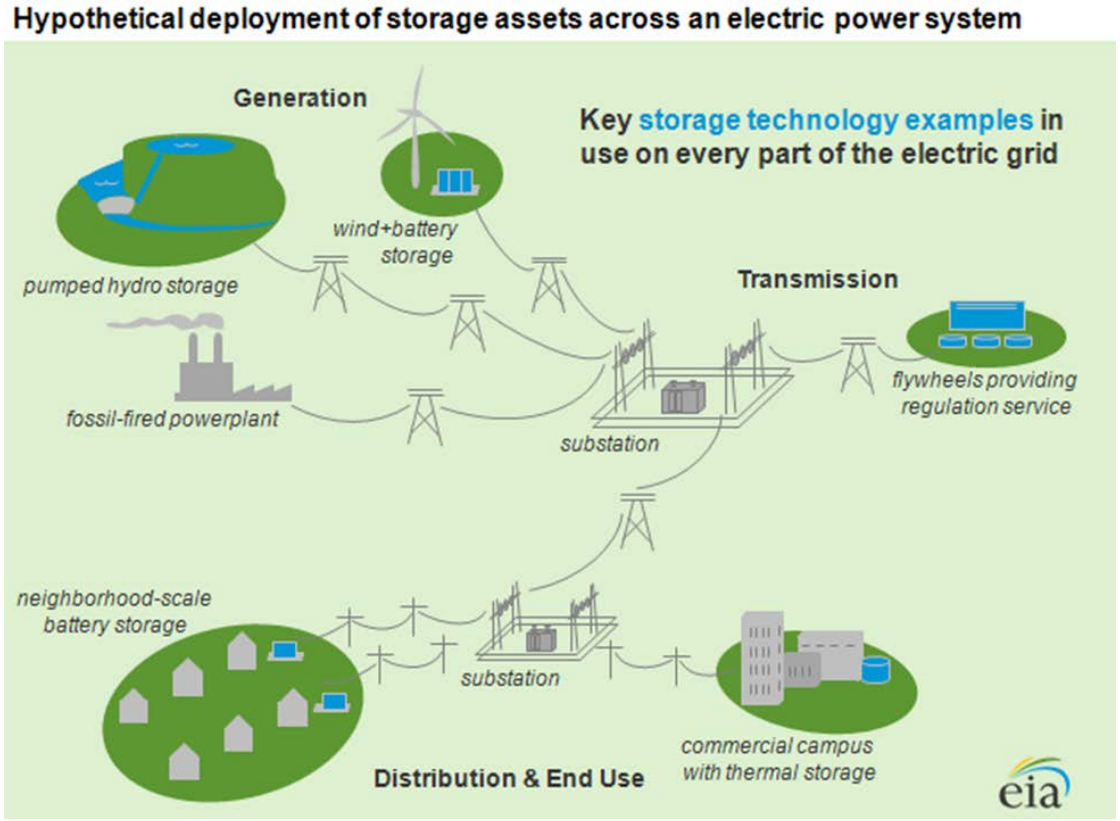
Energy Storage

NYSERDA Announces Completion of Largest Battery Installation in the State – 20MW - September 12, 2019

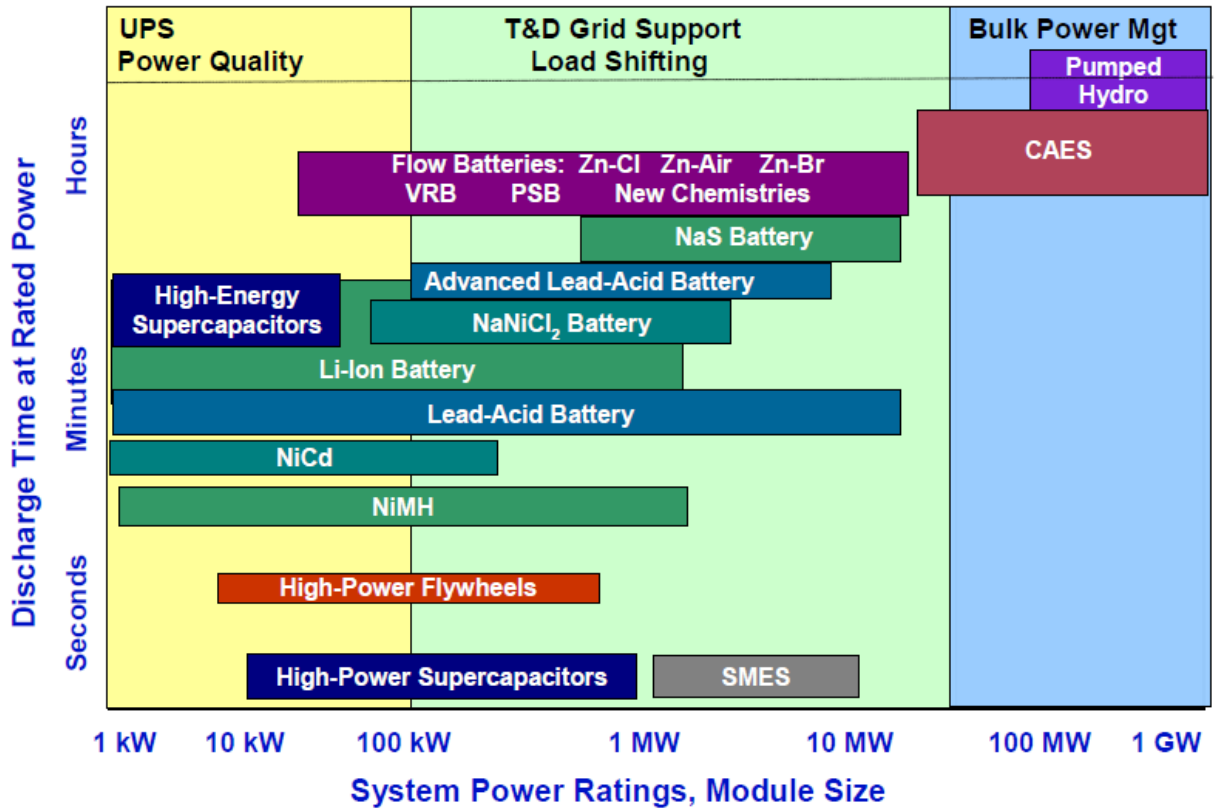
NY Power Authority - Blenheim-Gilboa Pumped Storage Project -1,400MW

Energy Storage

Technologies



Characteristics



Energy Storage

Resources:

- U.S. Energy Information Administration (https://www.eia.gov/todayinenergy/detail.php?id=6910)
- International Energy Agency, Technology Roadmap, Energy Storage (https://www.iea.org/publications/freepublications/publication/TechnologyRoadmapEnergystorage.pdf)
- Sandia National Laboratories, DOE/EPRI 2013 Electricity Storage Handbook in Collaboration with NRECA (https://www.sandia.gov/ess-ssl/lab_pubs/doeepri-electricity-storage-handbook/

Energy Storage

Public Service Commission

- Bulk Storage Dispatch Rights Contracts - investor owned utilities required to competitively bid specified quantity to provide fixed revenue stream for up to seven years. (ConEd 300MW, other IOU's 10MW each)
- Market Acceleration Incentives - NYSERDA to develop incentives
- Wholesale and Retail Market Reforms - DPS to study and make proposals (VDER docket)
- Evaluate storage in connection with Peaker Rule

Case No. 18-E-0130 – *In the Matter of Energy Storage Deployment Program*, Order Establishing Energy Storage Goal & Deployment Policy (Dec. 13, 2018)

Energy Storage

Public Service Commission

Retail Storage Incentive

(bill savings or credits under IOU tariff - totaling $130 million)

Eligibility Up to 5MW – allocated blocks of MWh by region

- Retail demand metered customers standalone or paired with on site-generation (e.g. solar)
- Standalone or paired connected directly to distribution system compensated under VDER Value Stack Tariff
- Resource operated primarily for electric load management or shifting electric generation to more beneficial time periods while operating in parallel with the utility grid

Energy Storage Market Acceleration Incentives Implementation Plan (NYSERDA August 1, 2019) (filed in Case 18-E-0130)

Retail Energy Storage Incentive Program Manual (August 2019)

Updated amounts available: www.nyserda.ny.gov/All-Programs/Programs/Energy-Storage/Developers-Contractors-and-Vendors/Retail-Incentive-Offer/Incentive-Dashboard

Energy Storage

Public Service Commission

NYSERDA Bulk Storage Block Incentive($150 million)

Eligibility Up to 5MW – allocated blocks of MWh by region

- ❑ Above 5 MW providing wholesale energy, ancillary services, and/or capacity services
- ❑ Commercially available chemical, thermal, or mechanical systems physically located within New York State and interconnected into New York's bulk transmission system or an IOU's transmission or distribution system
- ❑ In Stage 9 in the NYISO interconnection queue or later (see NYISO's OATT 22 Attachment P – Transmission Interconnection Procedures) or have begun the equivalent distribution utility study if connecting directly into the distribution system

- ❑Executed agreement demonstrating site control for the duration of the project's lifespan
- ❑Completed draft Environmental Impact Study with a negative declaration as evidenced by meeting minutes of the local government or written approval
- ❑If applicable (*i.e.*, project includes new or expanded generation =>25MW), proof that the required Article 10 Application has been deemed compliant

ConEd RFP with NYSERDA Incentive Agreement and Storage Services Agreement at https://www.coned.com/en/business-partners/business-opportunities/bulk-energy-storage-request-for-proposals

Energy Storage

NYSDEC/ Public Service Commission

PEAKER RULE

- Renewable energy/storage output averaging as compliance alternative:

Effective Rate= Mass NOx / ∑ MWh(turbine, renewables, storage)

- DPS Evaluated Storage as Substitute for Peaking Units

Proposed Subpart 227-3, Ozone Season Oxides of Nitrogen (NOx) Emission Limits for Simple Cycle and Regenerative Combustion Turbines (comment period extended to Oct. 7, 2019)

The Potential for Energy Storage to Repower or Replace Peaking Units in New York State, filed in Case No. 18-E-0130 Matter of Energy Storage Deployment Program (July 2, 2019)

Energy Storage

FERC Order 841

- FERC held Regional Transmission Organization and Independent System Operator market rules are unjust and unreasonable in erecting barriers to the participation of electric storage resources.
- Directed RTO/ISO to revises tariffs establish a participation model consisting of market rules that, recognizing the physical and operational characteristics of electric storage resources, facilitates their participation in the RTO/ISO markets.

Order 841, 162 FERC ¶ 61,127 (2018) & Order 842, 167 FERC ¶ 61,154 (2019)

Electric storage resources tariff provision requirements at 18 C.F.R. § 35.28(9)

- NYISO Compliance Filing and Intervention and Protests by PSC, NYC, industry, NGOs

Energy Storage

FERC Order 841

- NYISO Request compliance no earlier than May 1, 2020
- Issues Raised by Intervenors
  - ❑ Buyer-Side Mitigation (BSM)
  - ❑ Dual Participation in Wholesale and Retail

- Considerations
  - ❑ BSM assessment done with interconnection class year process – substantially delay entry in NYC
  - ❑ IOU 300MW procurement of dispatch rights and $310 million market acceleration bridge – disputed impact on capacity prices

Energy Storage

Public Service Commission

- Ravenswood 316 MW Energy Storage Project
- Petition for Certificate of Public Convenience and Necessity
- Article 10 Not Applicable Per Prior Declaratory Ruling

- Expanded EAF
  - Existing Generation Site
  - Noise Study
  - Coastal Consistency

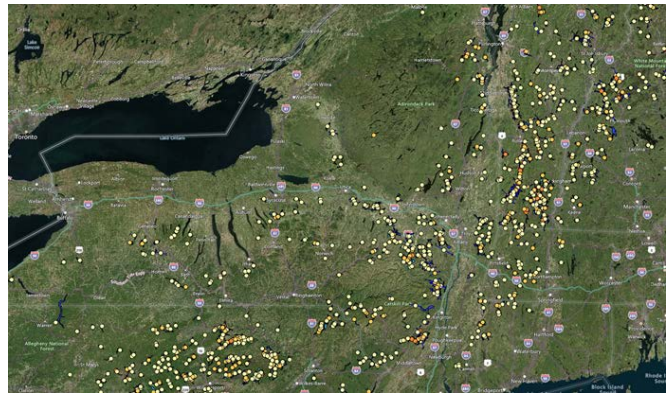
Case No. 19-E-0122, Petition of Ravenswood Development, LLC for Original Certificate of Public Convenience and Necessity (filed Feb. 21, 2019)

Energy Storage

Pumped Storage

Potential

- 530,000 potential pumped hydro storage sites globally(1)
- 100 x more than required for 100% global renewable electricity system(1)
- DOE forecasted new domestic 36 GW of pumped storage(2)



Australia Renewable Energy Mapping Infrastructure Project /https://www.nationalmap.gov.au/renewables/)

1 Australia National University

2. Hydropower Vision (DOE 2016)

Forecasted Pumped Storage

- DOE Energy Vision 2016

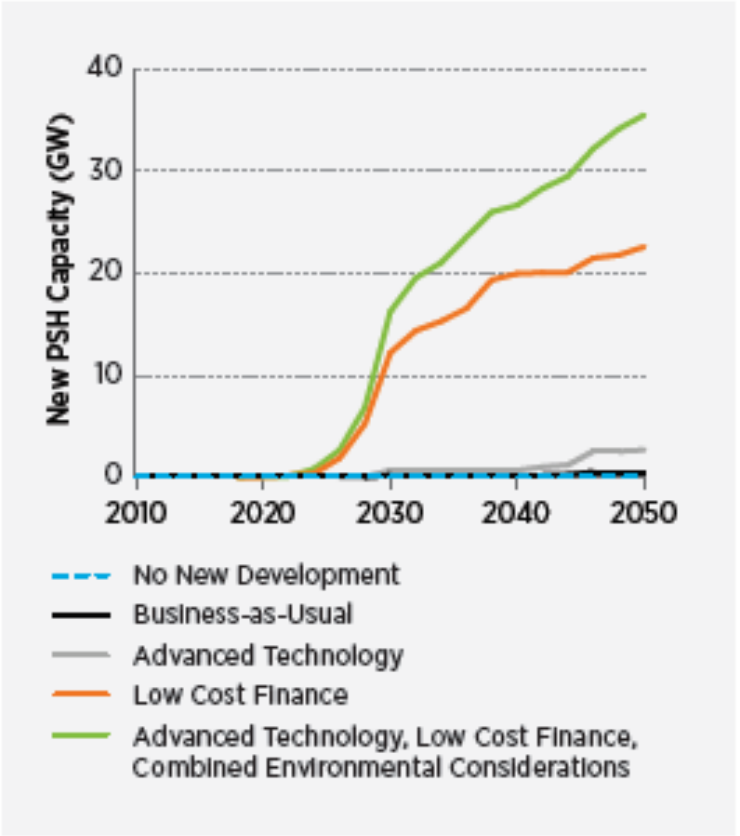


Figure ES-7. ReEDS modeled deployment of new pumped storage hydropower capacity, selected scenarios, 2017–2050 (GW)

Energy Storage

Pumped Storage

➢ Status[1]

- Licensed pumped storage – 19,769MW
- Preliminary Permitted – 20,041MW
- Pending preliminary permit applications – 19,020MW

(1) *https://www.ferc.gov/industries/hydropower/gen-info/licensing/pump-storage.asp*

1 Australia National University

2. Hydropower Vision (DOE 2016)

➢ America's Water Infrastructure Act of 2018

- ❑ FERC to issue rules establishing expedited processes for closed-loop pumped storage projects
- ❑ Goal- final decision no later than two years after receipt of a completed application

16 U.S.C. § 823f Closed-loop pumped storage projects

Energy Storage

Pumped Storage

- Jurisdiction

- "[T]he term waterway as used in the FPA is sufficiently broad to include groundwater." Eagle Crest Energy Co., 153 FERC ¶ 61058 (2015)

- Commission may issue and amend licenses, as appropriate, for closed-loop pumped storage projects. 16 USCA § 823f(a)(1)

- Statutory Criteria for Expedited Treatment[1]

- cause little to no change to existing surface and ground water flows and uses; and

- is unlikely to adversely affect species listed as a threatened species or endangered species under the Endangered Species Act of 1973

16 U.S.C. § 823f(g)

Energy Storage

Pumped Storage

Rulemaking/ Guidance

- **Pumped Storage Eligible for Expedited Treatment Defined:**

  "pumped storage projects that: (1) cause little to no change to existing surface and groundwater flows and uses; (2) are unlikely to adversely affect species listed as a threatened species or endangered species, or designated critical habitat of such species, under the Endangered Species Act of 1973; (3) utilize only reservoirs situated at locations other than natural waterways, lakes, wetlands, and other natural surface water features; and (4) rely only on temporary withdrawals from surface waters or groundwater for the sole purposes of initial fill and periodic recharge needed for project operation."

➢ Procedures

- Application for expedited treatment
- If accepted, order issued establishing schedule

18 C.F.R. § 7.6

➢ Abandoned Mine Sites –

Commission directed to issue guidance to assist applicants for licenses or preliminary permits for closed-loop pumped storage projects at abandoned mine sites

16 USCA § 823f(f)

“We Built This City on Rock and Roll” (with a little help from our friends) – Risk Management & Project Financing R.E. Transaction

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Alert

Brownfields Practice Group

Lawmakers Reach Deal to Reform NYS Brownfield Cleanup Program

Syracuse, New York April 2015

New York State Governor Andrew Cuomo and the New York State Legislature have agreed to extend and modify the financial incentives under New York's Brownfield Cleanup Program (BCP) as part of the 2015-2016 State budget, which was signed into law on April 13, 2015. Important program changes to the BCP are also included in the legislation, along with the creation of a streamlined "BCP-EZ" program without tax incentives. This BCP extension and modification act (referred to below as "BEMA") resolves lingering uncertainty over the future of the statewide program for cleaning up and redeveloping properties blighted by contamination, often referred to as "brownfields."

In January, the Governor proposed changes to the BCP, along with significant curtailment of the tax incentives that have been part of the BCP since its adoption in 2003. Those proposals followed his unsuccessful attempt to modify and extend the program in the 2014-15 budget. Our prior alerts regarding the January proposal and the 2014 proposal can be found on our website at www.bhlawpllc.com/brownfields.

The BCP's tax incentives were to sunset for brownfield sites that do not receive a certificate of completion (*CoC*) from the NYS Department of Environmental Conservation (*DEC*) by December 31, 2015. During the 2014 legislative session, the Legislature passed a 15-month extension of that sunset date, but that extension was ultimately vetoed by the Governor.

Under current law, taxpayers may earn refundable New York State income/franchise tax credits for remediation and redevelopment activities, property taxes and on-site employment, and environmental insurance premiums for their BCP sites. The credit for remediation and redevelopment activities, known as the Brownfield Redevelopment Tax Credit (*BRTC*), is the focus of the proposed changes. BEMA will phase out the other two credits (the credit for real property taxes based on employment and the credit for environmental insurance premiums) for sites which have not been accepted into the BCP by the Effective Date noted below.

The BRTC has three components that are currently calculated based on whether the site was accepted into the BCP before, or after, the BCP credits were overhauled in June 2008. The 2008 law change limited the BRTC component for redevelopment costs (including buildings) to a multiple of eligible cleanup costs and an overall limit of $35 million, or $45 million for sites primarily used in manufacturing. In addition to the 2008 changes, BEMA introduces new eligibility criteria and incentives for sites accepted into the BCP after the effective date noted below.

Effective Dates, Sunsets, and Grandfathering

BEMA makes significant changes to the tax credits for sites accepted into the BCP after the later of July 1, 2015 or the date NYSDEC publishes proposed regulations detailed below (referred to below as the "*Effective Date*"). Most provisions of BEMA take effect on that Effective Date. BEMA exempts, or "grandfathers," sites accepted before the Effective Date from the new tax credit structure.

Sites accepted into the BCP after the Effective Date and on or before **December 31, 2022** will be eligible for the new BEMA tax credit structure described below, provided a CoC is issued on or before **March 31, 2026**. No tax incentives will be available for sites accepted into the BCP after December 31, 2022.

Sites currently in the BCP must receive a CoC before specific deadlines in order to preserve the tax credit structure that they were accepted into (pre-2008 or post-2008):

Continued on next page...

- Sites with a Brownfield Cleanup Agreement (BCA) dated before June 23, 2008 will have until **December 31, 2017** to obtain a CoC; otherwise they will only be eligible for the tax credits as if they entered the BCP after the Effective Date.
- Sites with a BCA dated on or after June 23, 2008 but before BEMA's Effective Date will have until **December 31, 2019** to obtain a CoC; otherwise they will only be eligible for the tax credits as if they entered the BCP after the Effective Date.

Commentary: Overall, BEMA provides a dose of security after the last several years of legislative wrangling. The relatively long windows for the BCP included in BEMA will provide much needed stability for projects considering the program and the grandfathering provisions provide the same to projects already accepted into the program. Additionally, each of the timelines created by BEMA are more reasonable than some of the proposals introduced in 2014 and 2015.

Under BEMA, existing projects will have to complete remediation and obtain a CoC by either 2017 or 2019. Although this introduces new deadlines, they should actually come as relief to developers that were working up against the previous sunset date of December 31, 2015. Moreover, missing the applicable deadline has much less catastrophic consequences than the Governor had proposed in his 2014 Executive Budget. In that proposal, failure to obtain a CoC by the sunset date would mean the project would have been barred from claiming any of the BCP tax credits. Under BEMA, however, the failure to obtain a CoC by the applicable sunset date will only shift the project into the post-2015 paradigm.

As with other sections of BEMA, the measure of whether a project will be considered part of the post-2008/ pre-2015 program or part of the post-2015 program is whether the project is accepted into the BCP as of the later of July 1, 2015 or the date the DEC issues required regulations. We have been told informally that DEC is targeting to have those regulations published by the July 1, 2015 date. As a result, projects that have applied or intend to apply to be eligible for the post-2008/pre-2015 program should do everything in their power to have an acceptance letter issued by July 1, 2015.

BRTC Credit changes affecting sites accepted on and after the Effective Date

BEMA includes several changes that would take effect for sites that receive notice of acceptance from NYSDEC on or after the Effective Date.

1. **NEW: Separate eligibility "gates" for the Tangible Property Credit Component for sites in NYC ONLY.** The Governor's 2014 and 2015 proposals put forth two "gates" of BCP eligibility - one set of criteria for acceptance into the BCP, and a second set of criteria for the site owner(s) to be eligible for the BRTC's tangible property credit component (*TPCC*). BEMA adopts the two-gate approach, but **only for sites located in a city with a population of one million or more persons**. New York City is the only city in New York State that currently exceeds that threshold. All other BCP sites do not have to meet any additional eligibility criteria for the TPCC. For sites located in such a city, applicants must demonstrate to the satisfaction of NYSDEC that the site meets one of three tests (the so-called "*second gates*"):

- *Option 1: ≥ 50% of site area in EnZone.* The applicant must demonstrate that at least half of the site is located in an Environmental Zone ("*EnZone*"), which the bill would also re-define (a brief description of the changes to EnZones is included below).
- *Option 2: Site is "upside down" or "underutilized."* The applicant would need to demonstrate that the site is either:
  - economically "upside down," meaning that, as of the date of the BCP application, the projected cost of the investigation and remediation exceeds the 75% of the appraised value of the site without contamination; or

Continued on next page…

- is "underutilized," which is not defined; however, DEC is instructed to define "underutilized" in regulations after consultation with the business community and the City of New York (again, these gates apply only in NYC). Final regulations are to be adopted no later than October 1, 2015. It is the publication of these regulations on which the Effective Date depends.

- *Option 3: Affordable Housing.* The applicant would need to demonstrate that the site will be developed as an "affordable housing project." The definition of affordable housing was the subject of much debate in the eleventh hour and ultimately was left to be defined in regulations. However, sites that are eligible for the TPCC as "affordable housing projects" will only be eligible for the TPCC based on the affordable housing units, not the costs of the entire project (i.e., the eligible costs will be limited by the ratio of square feet of affordable units to the square feet of the entire building).

  Commentary: The Governor championed a "two-gate" approach in his Executive Budgets for two years in a row. This approach was touted as a response to development on contaminated property that might have otherwise been developed, particularly for sites in the NYC metropolitan area because of the high cost and high demand for land there. Unlike the Governor's proposals, which would have applied state-wide, application of the second gate only to NYC (and, potentially, other large cities) is a much more measured approach and more targeted at the criticisms lodged by the Governor and other critics of the BCP. While NYC sites will have to pass a second gate to be eligible for the TPCC, we expect that many sites will be eligible under the more expansive gates.

2. NEW: Limitations on Eligible Tangible Property. For sites accepted into the BCP after the Effective Date, new limits on costs allowed for the TPCC will apply.

- The following property will be eligible:
  - Depreciable property with a useful life of 15 years or more;
  - "Costs associated with non-portable equipment, machinery, and associated fixtures and appurtenances used exclusively on the site," regardless of whether those items have a useful life of 15 years or more"; and
  - Costs associated with demolition, excavation, and foundation in excess of the amount properly included in the calculation of the site preparation credit component (see below).

    Commentary: Previously, taxpayers were permitted to calculate the TPCC based on the capitalized costs of tangible property with a useful life of four or more years. Items that were previously eligible but will now be ineligible include computers and other office machines, furniture, and decorative items such as artwork. Commercial and residential buildings and depreciable land improvements remain eligible, and most built-in, wired-in, or other items that cannot be regularly moved around should remain eligible. This change appears intended to eliminate credits for easily moved personal property that does not have a long-term life linked to the BCP site.

    The ability to pick up demolition, excavation, and foundation costs should provide some consolation for taxpayers where the amount of such costs exceed the new limits on such costs in the site preparation component. However, a site's 3x/6x cap based on site preparation costs may be affected by the shift in such costs to the tangible property category.

Costs for "related party service fees" may also be included. Previous changes proposed by the Governor sought to totally exclude any payments to related parties from the BRTC calculations.

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The concern appeared to be focused on accrued, but deferred, service fees payable to related businesses, such as development fees. BEMA therefore now requires "related party service fees" to be actually paid in order to be eligible for inclusion in the TPCC calculation, and allows the TPCC for those fees to be claimed only in the year actually paid. This approach is consistent with the recommendations of the Brownfield Task Force of the Environmental Law Section of the NYS Bar Association (the memorandum outlining the recommendation, to which Phil Bousquet and Julia Martin contributed, is available on our website at **http://bhlawpllc.com/publications/nysbarBCP**).

Commentary: This change came out of a perceived abuse by the Tax Department relating to developer fees paid between related parties over a period of time. The Tax Department argued that taxpayers could increase the amount of these developer fees required to be paid to a related party under a contract, and thus boost their credit claims, but ultimately never pay the fee. Early proposals by the Governor would have barred the TPCC on any payments made to a related party. The method taken in BEMA is a significantly more measured approach. Under BEMA, taxpayers may claim the TPCC based on related party service fees only to the extent the fees are actually paid in the taxable year.

It is also important to note that related party service fees can be included in the TPCC, but not in the site preparation credit component or the on-site groundwater remediation credit component.

3. **NEW: Clarification of the timing rule for the Tangible Property Credit Component.** BEMA clarifies that eligible taxpayers may claim the TPCC for up to 120 months after the CoC is issued. BEMA also clarifies that the TPCC will be allowed in the year the CoC is issued for property placed in service prior to the issuance of the CoC - a practice currently approved by the NYS Tax Department in informal advice and in a recent advisory opinion.

Commentary: The previous provisions of the BCP allowed for the TPCC to be claimed for up to ten taxable years after the CoC was issued. The change from ten taxable years to 120 months can be significant. In the course of many projects, changes in ownership as a result of financing or other conditions may result in taxpayers being required to take a short taxable year. In that case, ten taxable years is actually less than ten calendar years or 120 months. Additionally, the 120 month window affords projects more certainty when determining which costs will be eligible; in order to be eligible for the TPCC, costs must be paid or incurred before the tenth anniversary of the CoC date.

4. **Applicable Percentage for Tangible Property Credit Component.** BEMA modifies the "applicable percentage" used to calculate the TPCC. For eligible sites (i.e., sites either outside of NYC or in NYC and meeting one of the second gates described above), the TPCC would have an across-the-board base of **10%** of eligible costs (curtailed as noted below), and new "bump-ups" to the applicable percentage - **not to exceed 24%**, in the aggregate- calculated as follows:

- An additional **5%** for qualified tangible property placed in service on brownfield sites located within and developed in conformance with the goals of a Brownfield Opportunity Area (BOA);
- An additional **5%** for the affordable housing units in an affordable housing project as defined above (based on the proportion of square footage of the units in the overall building);
- An additional **5%** for sites used primarily for manufacturing activities;
- An additional **5%** for qualified tangible property placed in service on a brownfield site having at least fifty percent of its area located in an EnZone. ; and
- **NEW:** An additional **5%** for sites remediated to Track 1 standards (formerly 2%).

Commentary: Compared with the previous TPCC applicable percentage schemes, the applicable percentage calculation under BEMA may be either positive or negative, depending on the characteristics of the site and the redevelopment. In either event, a single base percentage regardless of the type of taxpayer lends welcome predictability to the calculation of the TPCC.

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The bill would not change the applicable percentage for the site preparation (SPCC) and on-site groundwater remediation (OSGRCC) credit components, but the calculation of those components (as well as the TPCC) would change due to the exclusions and adjustments to the credit bases noted below.

5. **NEW: Changes to the Site Preparation and On-Site Groundwater Remediation Credit Components.** BEMA makes several changes to the definitions of "site preparation costs" and "onsite groundwater remediation costs," which form the basis for calculating the respective credit components.

- "Site Preparation Costs" has been redefined to be all capitalized costs that are necessary to implement the site's investigation, remediation, or qualification for a CoC, including: excavation; demolition; activities undertaken under the oversight of the NYS Department of Labor (DOL) or in accordance with standards established by the Department of Health to remediate and dispose of regulated materials including asbestos, lead, or PCBs; environmental consulting; engineering; legal costs; transportation, disposal, treatment, or containment of contaminated soil; remediation measures taken to address contaminated soil vapor; cover systems consistent with applicable regulations; physical support of excavation; dewatering and other work to facilitate or enable remediation activities; sheeting, shoring, and other engineering controls required to prevent off-site migration of contamination from the qualified site or migrating onto the qualified site; and the costs of fencing, temporary electric wiring, scaffolding, and security facilities until the CoC is issued.
- BEMA also indicates that "site preparation costs" includes costs paid or incurred within 60 months after the last day of the tax year in which the CoC is issued "that are necessary for compliance with the [CoC] or subsequent modifications thereof, or the remedial program defined in such [CoC]," including: institutional controls, engineering controls, an approved site management plan, and the site's environmental easement.

  Commentary: The list of enumerated types of costs included in the new definition of site preparation costs provides some clarity to taxpayers about what costs will be eligible. Some commenters have raised a concern that by providing such a list, BEMA will serve to exclude costs that would otherwise have been considered site preparation costs but were not included in the enumerated list (either unintentionally or because of unanticipated changes in technology). However, based on the language making the enumerated list inclusive, not exclusive, we believe the enumerated list is a positive change in the BCP legislation.

  BEMA does not revise the section of the law that deals with the timing of claims for the SPCC. Currently, SPCC claims based on post-CoC costs are allowed "for the taxable year in which the improvement to which the applicable costs apply is placed in service for up to five taxable years after the issuance [of the CoC]." This existing timing rule may be unworkable or unclear because BEMA indicates that appropriate post-CoC costs are compliance-type costs that may not relate to a particular improvement to be placed in service. In contrast, OSGWCC claims based on post-CoC costs are allowed in the taxable year such costs are paid or incurred. It is our expectation that the incongruous provisions of the existing SPCC timing rule will be addressed in technical corrections and the result will be similar to the timing rule for post-CoC OSGWCC claims. We will provide a future alert when and if this correction is made.

- BEMA makes clear that "site preparation costs" includes foundation costs, but only to the extent of the costs of the cover system required for the site

  Commentary: We recommend that developers obtain a quote for a site cover that meets the requirements of the applicable regulations. The quote will serve as the basis for determining the amount of foundation costs that are eligible to be included in the SPCC. As indicated above, any costs in excess of the comparable site cover is eligible to be included in the TPCC calculation.
- BEMA includes a list of potential enumerated costs that would be eligible for the on-site groundwater remediation credit component.

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Other changes to the BCP

The proposed budget includes many other non-tax BCP changes not discussed above, including:

1. **Elimination of Section 22 and 23 credits**. Consistent with the Governor's proposal, BEMA eliminates the BCP credits based on property taxes and environmental insurance premiums for all sites accepted into the BCP after the Effective Date.
2. **New definition of EnZone.** BEMA transfers the authority for designating EnZones to the Commissioner of the DOL and would base the determination of EnZone status on the characteristics of each census tract determined in the most recent five year American Community Survey (ACS). Currently, EnZones are based upon data from the 2000 Census. DOL must redraw EnZones based on the 2009-13 ACS within 90 days of enactment of BAM. At the request of DEC, EnZone designations may be updated based on the most recent five-year ACS. The determination of whether a site is located in an EnZone will be made based upon EnZone designations in effect as of the date DEC notifies an applicant that its application to participate in the BCP is complete.
3. **BCP-EZ Program**. BEMA creates a BCP-EZ Program that will allow volunteer applicants to waive their right to all BCP tax credits and enter into a modified remedial program exempt from procedural requirements (as specified by DEC) relating to investigation and remediation. The BCP-EZ Program has been proposed consistently in both the 2014 legislative session as well as the proposals set forth earlier this year.
4. **CoC transfers**. BEMA clarifies that a CoC can be transferred to a successor to a real property interest in all or a portion of a brownfield site, including legal title, equitable title, or leaseholds. BEMA also provides that the CoC could not be transferred to a responsible party.
5. **DEC oversight costs**. BEMA permits negotiation of flat-fee arrangements with participants.

Next Steps

BEMA was passed into law on April 13, 2015. The final Effective Date will be determined once DEC issues proposed regulations on the definition of "underutilized." Bousquet Holstein's Brownfield Practice Group is closely monitoring developments in this area and we intend to issue an additional alert once the regulations are released. Please do not hesitate to **contact us** with any questions you may have regarding these BCP developments and how they may impact your brownfield projects.

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Alert

Brownfields Practice Group

DEC Issues Revised Regulations Defining Terms for Purposes of the Brownfield Cleanup Program

Syracuse, New York March 2016

On **March 9, 2016**, the New York State Department of Environmental Conservation (DEC) issued revised proposed regulations defining terms relating to the Brownfield Cleanup Program (BCP) tax credits for sites located in New York City. The revisions modify proposed regulations issued last June and discussed in our prior alert. The revised proposed regulations apparently reflect the DEC's consideration of comments to the initial proposed regulations released in **June 2015.**

Significance of the Definitions

The regulations will affect sites located in cities with a population of 1,000,000 or more people (i.e., New York City) that are accepted into the BCP on or after July 1, 2015. Under the 2015-16 NYS Budget provisions, sites located in New York City will be eligible for the tangible property credit component only if:

- at least 50% of the site area is in an Environmental Zone; or
- the site is "upside down"; or
- is "underutilized"; or
- the site will be developed as an "affordable housing project."

The 2015 statutory revisions reviewed in our **April 2015 Alert** included definitions for Environmental Zones and "upside down," but left the definitions of "underutilized" and "affordable housing project" to regulations. Those terms were the subject of the June 2015 proposed regulations, now revised by NYSDEC[1].

"Underutilized"

According to the DEC, the revised definition of "underutilized" is intended to expand the number of eligible sites. The revised proposed definition of "underutilized" includes any real property that meets the following characteristics:

1. No more than 50% of the permissible floor area of the building or buildings is certified by the applicant to have been used under the applicable base zoning for at least three years prior to the application, **and**

2. The proposed use for the site is either:
   a. At least 75% for industrial use, **or**
   b. The site meets the following set of conditions:
      i. At least 75% for commercial uses or commercial and industrial uses, **and**
      ii. The proposed development could not take place without substantial government assistance, as certified by the municipality in which the site is located, **and**

[1] Both the June 2015 and March 2016 regulations also included a definition of "Brownfield site." The June 2015 regulation revised the regulatory definition of a Brownfield site to be consistent with the change in that definition that was included in the Budget legislation. The March 2016 regulations make no changes to the definition proposed in the June 2015 regulations

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iii. At least one of the following conditions exists, as certified by the applicant:

1. Property tax payments have been in arrears for at least five years immediately prior to the application; **or**
2. The site contains a building that is condemned, or has documents structural deficiencies, as certified by a professional engineer, which present a public health or safety hazard; **or**
3. There are no structures on the site.

Any site seeking "underutilized" status must demonstrate that no more than 50% of the permissible floor area has been used in the preceding three-year period.

Sites with proposed uses that are not at least 75% "industrial" or 75% "commercial and industrial" cannot be "underutilized" under this definition. That means, for example, that any site with a proposed use that is more than 25% residential use cannot be "underutilized"

Once the proposed use threshold has been met, sites that intend to be at least 75% industrial need not show anything further. Sites that intend to be at least 75% commercial or commercial/industrial, however, must demonstrate that it needs substantial government assistance and has had tax arrearages, has been condemned, is structurally unsound, or has no structures.

Whether a site meets this definition of "underutilized" is determined as of the date of the BCP application. A chart showing the changes from the June 2015 proposed regulations is available on the next page.

"Affordable Housing Project"

The June 2015 proposed regulations erroneously used the term "tenant" when defining affordable home ownership programs. The March 2016 proposed regulations correct that error.

The definition of an "affordable housing project" is now any project developed for residential or mixed residential use that is subject to a federal, state, or local government housing agency's affordable housing program, subject to a local government's regulatory agreement, to provide either (1) a percentage of rental units dedicated to tenants at a defined maximum percentage of the area median income, or (2) affordable units for homeowners at a defined maximum percentage of area median income.

Comments: The new "underutilized" definition would remove the requirement to obtain municipal certification of certain conditions. Instead, applicants will need to certify to certain conditions. This approach still allows for accountability, while not providing municipal government with an effective veto over a project's eligibility for the tangible property credit component.

Notwithstanding those improvements, the definition is still complex and may prove difficult to attain.. The revised regulations clearly favor "industrial" uses for remediated brownfield sites. The emphasis on industrial use seems anomalous for New York City sites, where so much development is being directed to residential and commercial use. As we noted in our prior alert, the definition would effectively bar market-rate housing development from obtaining the tangible property credit component unless at least half of the site is in an Environmental Zone or the site is "upside down," as that term is defined in the statute.

Continued on next page...

June 2015 Proposed Regulations	March 2016 Revised Proposed Regulations
As of the date of application, no more than 50% of the permissible floor area of the building or buildings on the site is **certified by the municipality** to have been used under the applicable base zoning in effect for **at least the** prior **five years**.	As of the date of the application, no more than 50% of the permissible floor area of the building or buildings on the site is **certified by the applicant** to have been used under the applicable base zoning in effect for at least the prior **three years**.
The proposed development is solely for a use ***other than* residential or restricted residential**.	The proposed used is **at least 75% for industrial uses, commercial uses, or commercial and industrial uses**
The property could not be developed without substantial government assistance, as certified by the municipality in which the site is located.	**If the proposed use is ≥75% commercial or commercial/industrial**, the proposed development could not take place without substantial government assistance, as certified by the municipality in which the site is located.
At least *one* of the following conditions exists, as **certified by the municipal department responsible for such determinations** of the municipality in which the site is located: property tax payments have been in arrears for at least five years immediately prior to the application; the site contains a building that is condemned, or has documents structural deficiencies, as certified by a professional engineer, which present a public health or safety hazard; *or* **the proposed use is in whole or substantial part for industrial uses**.	**If the proposed use is ≥75% commercial or commercial/industrial**, at least *one* of the following conditions exists, as **certified by the applicant**: property tax payments have been in arrears for at least five years immediately prior to the application; the site contains a building that is condemned, or has documents structural deficiencies, as certified by a professional engineer, which present a public health or safety hazard; *or* **there are no structures on the site**.

Bousquet Holstein's Brownfield Practice Group works extensively with investors, developers, consultants, and other stakeholder in connection with New York's Brownfield Cleanup Program. Please do not hesitate to contact us with questions you have regarding these developments and your brownfield projects.

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Tax Credits Available Under the Brownfield Cleanup Program

June 2018

BOUSQUET HOLSTEIN PLLC

Overview of NYS BCP Tax Credits

BCP tax credit structure:	Accepted into BCP:	Must receive a CoC by:
BCP 1.0	Before 6/23/2008	December 31, 2017
BCP 2.0	6/23/2008 to 6/30/2015	December 31, 2019
BCP 3.0	7/1/2015 and after	March 31, 2026

- BCP 1.0 sites that did not receive a CoC by 12/31/2017 are now subject to BCP 3.0 credit structure

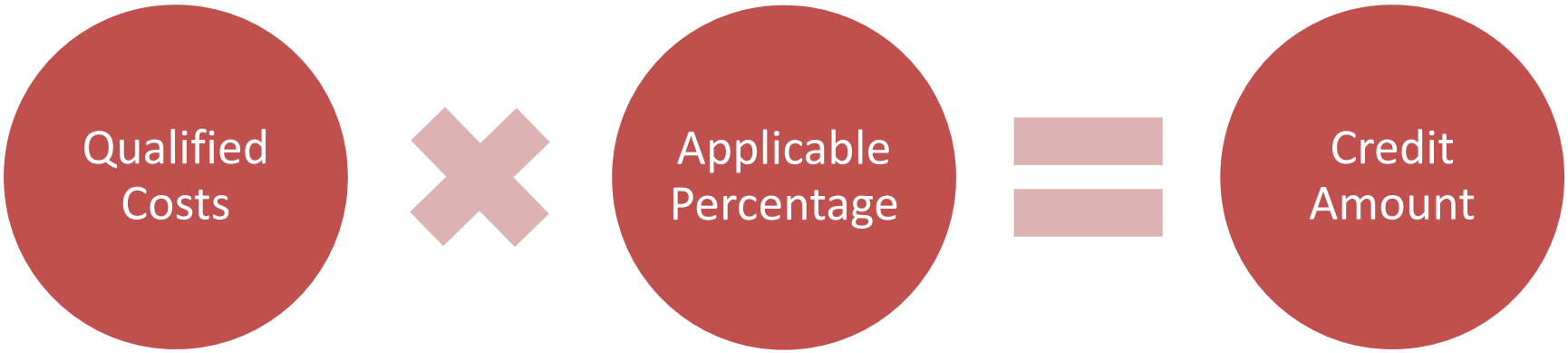
Overview of NYS BCP

Three tax credits:

- Brownfield Redevelopment Tax Credit (BRTC) (Tax Law § 21)
  - Site Preparation credit component
  - On-site groundwater remediation credit component
  - Tangible property credit component
- Credit based on real property taxes (Tax Law § 22)
  - **BCP 1.0/2.0** only
- Credit based on qualified policies of environmental remediation insurance (Tax Law § 23)
  - **BCP 1.0/2.0** only

Overview of NYS BCP Tax Credits

- **Refundable** – treated like an overpayment of tax
- Brownfield Redevelopment Tax Credit components are product of certain **qualified costs** and **applicable percentage**



Site Preparation Credit Component under **BCP 1.0 and 2.0**

- Eligible costs: costs paid or incurred **in connection with** (1) qualification for CoC, AND (2) preparing site for construction of building
- Applicable Percentage:
  - **BCP 1.0**: 10% (individuals) or 12% (corporations) plus 2% for Track 1 and 8% for En-Zones
  - **BCP 2.0**: varies from 22% (track 4, industrial) to 50% (track 1, unrestricted), based on intended use of site and level of cleanup
- Timing: First claimed in year CoC is issued, then up to 5 taxable years after CoC

Site Preparation Credit Component under BCP 3.0

- Eligible costs:
  - Capitalized costs **necessary** to implement the site's investigation, remediation, or qualification for a CoC
  - Post-CoC costs that are "**necessary** for compliance with the [CoC] or the remedial program defined in such [CoC]"
  - Limits site preparation costs foundations to the cost of a cover system pursuant to DEC regulations
- Applicable Percentage: same as BCP 2.0
- Timing: First claimed in year CoC is issued, then up to 60 months after the year the CoC is issued

Tangible Property Credit Component under **BCP 1.0 and 2.0**

- Eligible costs: cost or other basis of depreciable property with useful life of **4 years** or more with situs on brownfield site
- Applicable Percentage: max of 20% (**BCP 1.0**) or 22% (**BCP 2.0**)
  - **BCP 1.0**: 10% (individuals) or 12% (corporations) plus 2% for Track 1 and 8% for En-Zones
  - **BCP 2.0**: additional 2% for sites in BOA and developed in conformance with BOA plan
- Timing: claimed in year property is placed in service, for up to 10 taxable years after CoC is issued
- Cap (**BCP 2.0**):
  - Non-manufacturing sites: *lesser* of $35M or 3 x site preparation costs
  - Manufacturing sites: *lesser* of $45M or 6 x site preparation costs

Tangible Property Credit Component under BCP 3.0

- Eligible costs:
  - Cost or other basis of depreciable property with a useful life of **15 years** or more with a situs on the brownfield site; plus
  - Costs associated with non-portable equipment, machinery, associated fixtures and appurtenances used exclusively on the site, regardless of length of useful life
  - Costs associated with demolition, excavation, and foundation in excess of amount allowable for the *site preparation credit component*
  - "Related party service fees" includable only in year actually paid (related party service fees cannot be included in SPCC at any time)

Tangible Property Credit Component under BCP 3.0

- Applicable Percentage: 10% base plus, up to max of 24%:
  - +5% for BOA sites developed in conformance with BOA plan
  - +5% for affordable housing
  - +5% for manufacturing sites
  - +5% for sites within an En-Zone
  - +5% for sites remediated to Track 1
- Timing: claimed in year property is placed in service, for up to 120 months after date CoC is issued
- Cap: same as BCP 2.0, but can include IRC § 198 costs cap

Tangible Property Credit Component under BCP 3.0

- Additional Changes:
  - Sites are not eligible for the TPCC if either:
    - Contamination is "solely emanating" from property other than the site itself, OR
    - DEC has determined that the property has previously been remediated under other programs such that it may be developed for its then intended use, including: RCRA Corrective Action Program, Inactive Hazardous Waste Disposal Site Program (State Superfund), BCP, Environmental Restoration Program, and Navigation Law
  - Separate "gates" for sites in NYC only in order to be eligible to claim TPCC:
    - At least 50% in En-Zone (newly defined areas for BCP 3.0 sites based on updated census data)
    - "Upside down" (the projected cost of investigation and remediation exceeds 75% of the appraised value of the site without contamination)
    - "Underutilized" (defined in DEC regulations)
    - Developed as an "affordable housing project" (defined in DEC regulations)

BRTC Credit Illustrations

Component	Costs	App. %	Preliminary	Credit Cap	TOTAL
Site Preparation	$2,000,000	50%	$1,000,000		$1,000,000
Tangible Property	$35,000,000	(10%+2%+8%) 20%	$7,000,000	$6,000,000	$6,000,000
BRTC UNDER BCP 2.0			$8,000,000		**$7,000,000**

Component	Costs	App. %	Preliminary	Credit Cap	TOTAL
Site Preparation	$1,800,000	50%	$900,000		$900,000
Tangible Property	$35,100,000	(10%+5%+5%) 20%	$7,020,000	$5,400,000	$5,400,000
BRTC UNDER BCP 3.0			$7,920,000		**$6,300,000**

How BCP Credits Are Claimed

- Claimed on a NYS income or franchise tax return
- Claim is calculated at project entity; if passthrough, flows to upper-tier members to claim on their returns
- Credits are first applied to any tax due, then can be carried forward or refunded to taxpayer
- Return requires only minimal information (i.e., CoC, costs by broad categories, applicable percentage)
- BCP credit claims are routinely audited by NYS Tax Department
- On audit, NYS Tax Department will require detailed information about project costs and BCP credit calculations, including invoices

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THANK YOU!


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The BCP – a Quick Overview

By: Philip S. Bousquet

The Brownfield Cleanup Program (BCP) was designed to foster two goals: (1) to encourage and expedite remediation of "brownfields" -- sites with contamination in excess of regulatory levels allowable for site-specific re-use; and (2) to foster economic development through private sector capital investment in the redevelopment of brownfield sites for productive use. To accomplish these goals, the BCP has two essential elements: (1) broad liability protection (in the form of a statutory covenant not to sue) from the State upon completion of a regulated cleanup under the BCP; and (2) a package of refundable New York State income tax credits available to those who successfully complete remedial activities under the BCP.

The BCP process starts with submission of an application to the NYS Department of Environmental Conservation (DEC) to determine whether the property and applicant entity are eligible for the BCP. If the application is approved, the Applicant must enter into a Brownfield Cleanup Agreement (BCA) with DEC. Under a BCA an Applicant assesses the nature and extent of contamination at the brownfield site and devises and implements a remedial program approved by DEC. Upon successful completion of the remediation of the site, DEC issues a written Certificate of Completion (COC) to the applicant. The COC confirms that that cleanup is complete, recites the liability protection, refers to ongoing restrictions applicable to the site (if any), and sets forth the "applicable percentages" used to calculate NYS tax credits allowable with respect to the site. The COC is the threshold requirement for BCP tax credit eligibility for a brownfield site.

For sites accepted into the BCP after June 30, 2015, BCP tax credits are available through the Brownfield Redevelopment Tax Credit (BRTC), a New York State income/franchise tax credit described in Section 21 of the New York State Tax Law. The BRTC is claimed by filing a New York State income (or franchise) tax return with credit forms attached.

The BRTC is allowed in three components, all of which are "refundable," meaning that the credit must first be used by the taxpayer to reduce income or franchise tax liability on a dollar-for-dollar basis (to zero, for individuals, or to the statutory minimum tax, for corporate taxpayers), and then any excess amount of the BRTC is treated by statute as an overpayment of tax for the year in which the BRTC is allowable, and may therefore refunded to the taxpayer (without interest).

The three "credit components" of the BRTC are: (1) the site preparation credit component (based on remediation costs); (2) the on-site groundwater remediation credit component (specific to groundwater remediation); and (3) the tangible property credit component (based on the cost basis for federal tax purposes of certain tangible property (including buildings) placed in service on the site). Each BRTC component is calculated by multiplying an "applicable percentage" by certain allowable capital costs paid or incurred by the taxpayer. Each credit component may be earned in the same or different years, beginning with the taxable year in which the COC is issued. The tangible property credit component is earned in the year in which the qualified tangible property is placed in service on the site.

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The Evolving "Nature" of Environmental Risk: A Responsible Approach for Residential and Commercial Real Estate

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The Evolving "Nature" of Environmental Risk: A Responsible Approach for Residential and Commercial Real Estate

FRANK PICCININNI

Environmental losses suffered by commercial and residential real estate owners are becoming more frequent and severe due to evolving regulatory regimes and the changing global climate. This article reviews the nature of environmental risk, specifically within the context of a changing climate, and proposes the large-scale installation of green infrastructure as both a business opportunity for insurers and a responsible approach.

INTRODUCTION

Owners of commercial and residential real estate face a myriad of hard-to-predict environmental risks such as bodily injury due to asbestos exposure,[1] mold contamination,[2] fuel spills,[3] on- and off-site hazardous waste disposal,[4]

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[1] See e.g., *Kosich v. Metro. Prop. & Cas. Ins. Co.*, 626 N.Y.S.2d 618,618 (N.Y. App. Div. 1995) (affirming the finding that "plaintiffs' losses were caused by asbestos contamination, coverage for which [wa]s specifically excluded under the insurance policy issued by defendant").

[2] See e.g., *American Western Home Ins. Co. v. Utopia Acquisition L.P.,* 2009 WL 792483 (W.D. Mo. 2009) (finding that mold contamination in an apartment building was not covered by a commercial general liability policy).

[3] *Watson v. Travelers Indem, Co.*, 2005 WL 839504 (Mich. Ct. App. 2005) (holding that diesel fuel, accidentally spilled during a roofing project, was a pollutant that was excluded from a commercial general liability insurance policy).

[4] See e.g., *Vermont Mut. Ins. Co. v. Parsons Hill P'Ship*, 1 A.3d 1016 (Vt. 2010) (unsafe levels of perchloroethylene (PCE) in an apartment complex's water system was outside the scope of a comprehensive liability insurance policy).

and indoor air quality issues.[5] These risks have the potential to cause catastrophic financial losses and public relations disasters. To help mitigate exposures of commercial and residential real estate owners, insurers have begun to develop comprehensive environmental coverage such as the General Real Estate Environmental Enterprises Net (GREEN) Program.[6] Despite the effectiveness of these programs, insuring against environmental losses is likely to become increasingly complex due to the imminent impacts of climate change.[7]

A recent report by the United Nations Intergovernmental Panel on Climate Change presented multiple lines of empirical support for climate change, largely due to anthropogenic activities.[8] This evidence included warming ocean temperatures, rising sea levels, changing ocean salinity, acidifying oceans, increasing frequency of warm days, lessening frost days, decreasing snow cover in most regions, degrading permafrost, increasing heavy precipitation events, and retreating sea ice and glaciers.[9] The impact of climate change, coupled with increasingly stringent regulatory policy, will increase the frequency and intensity of loss events. Furthermore, spatial and temporal variability of losses, nonlinear loss functions and single events with multiple correlated consequences will increasingly occur.[10] This article: (1) reviews the emergence and role of environmental insurance; (2) explores the changing nature of risk management for commercial and residential real estate owners in the face of the changing global climate; and (3) suggests that insurers, as proactive risk managers, are well-suited to lead by promoting adaptation to and mitigation of climate change by encouraging the installation of green infrastructure.

I. ENVIRONMENTAL RISKS

The late 1960s and early 1970s gave rise to the U.S. environmental movement, which was marked by the passage of fundamental environmental statutes such as the Comprehensive Environmental Response, Compensation, and Liability

[5] See e.g., *Clipper Mill Fed., LLC v. Cincinnati Ins. Co.* 2010 U.S. Dist. LEXIS 112172 (D. Md. 2010) (ruling that the "plain terms" of the pollution exclusion would be enforced in connection with the indoor airborne contaminants that resulted from a faulty HVAC system).

[6] See e.g., *Environmental Services*, SterlingRisk Insurance, http://www.sterlingrisk.com/business-insurance/specialties-by-industry/environmental-services/green/ (accessed June 27, 2014).

[7] See Sean B. Hecht, Insurance, in *The Law of Adaptation to Climate Change, U.S. and International Aspects,* Michael B. Gerrard and Katrina F. Kuh, eds. (Chicago: American Bar Association Publishing, 2012), 514–515 (describing the challenges that climate change poses for predicting risks and setting appropriate premiums).

[8] *Int'l Governmental Panel On Climate Change, Climate Change 2013: The Physical Science Basis*, http://www.climatechange2013.org/images/report/WG1AR5_ALL_FINAL.pdf

[9] *Id.*

[10] Evan Mills, "Insurance in a Climate of Change," *Science* 309 (2005): 1040, 1040.

Act (CERCLA)[11] and the Clean Water Act (CWA).[12] Increased regulation has created both the beginnings of protecting our natural resources and the potential for major financial liabilities from environmental contamination. These liabilities are routinely excluded from commercial general liability insurance policies.[13] To fill the coverage gap related to pollution exclusions, the insurance industry has manuscripted environmental insurance policies, such as GREEN, to manage these risks for residential and commercial real estate owners.

Environmental losses are generally classified as either first-party or third-party losses.[14] First-party losses are those suffered by the insured, whereas third-party losses include legal action arising out of bodily injury or property damage to a third party for which the insured is allegedly responsible.[15] The two common policy forms available to cover environmental losses are cost cap and pollution liability insurance.[16] Cost cap policies insure against cost overruns associated with known liabilities such as implementing a remedial action plan.[17] Pollution liability insurance insures against new environmental conditions such as newly discovered contamination.[18] Environmental claims are relatively infrequent, but, when they occur, severe and catastrophic losses can result.[19]

One environmental risk commonly faced by commercial and residential real estate owners is CERCLA liability. The act is a necessary way to manage and remediate hazardous contamination and real public threat. Liability under CERCLA is strict, joint, and several[20] and attaches to: (1) the current owner of the property contaminated with hazardous waste; (2) the owner at the time of the release of hazardous waste; (3) any person who disposes of, or arranges for, the disposal of hazardous wastes; and (4) any person who accepts hazardous

[11] 42 USC §§ 9601 et seq.

[12] 33 USC §§ 1251 et seq.; see also Jonathan H. Alder, "Fables of the Cuyahoga: Reconstructing a History of Environmental Protection," *Fordham Environmental Law Journal* 14 (2002): 89 (describing joint state and federal efforts to respond to a "clean water crisis").

[13] T. McRoy Shelly III, "Insurance Coverage for Environmental Claims: Current Litigation Issues in the United States," *Environmental Claims Journal* 26 (2014): 4, 4–5.

[14] Rodney J. Taylor and Howard M. Tollin, "Insurance Market for Global Warming Heats up: Old Products and New Policies Respond to Climate Change Risks," *Environmental Claims Journal* 21 (2009): 247, 249–250.

[15] *Id.*

[16] Howard M. Tollin, "Environmental Insurance for a New Wave of Claims," *Environmental Claims Journal* 16 (2004): 203, 210–211.

[17] *Id.*

[18] *Id.*

[19] Howard M. Tollin and Boris F. Strogach, "Defining "Pollutant": What You Don't Know Can Hurt You," *Environmental Claims Journal* 21 (2009): 156, 157.

[20] Notably, the terms *strict, joint*, and *several* are not referenced in CERCLA, but have been routinely applied by the judiciary in CERCLA litigation. See e.g., *Burlington Northern & Santa Fe Railway Co. v. United State*s 129 S. Ct. 1870, 1882–1883 (2009) ("...conclud[ing] that the facts contained in the record reasonably supported the apportionment of liability").

substances for disposal.[21] The term *hazardous substance* is defined extremely broadly under CERCLA,[22] and includes many substances commonly used by residential and commercial real estate owners.

The original defenses to liability under CERCLA, which must be proven through a preponderance of the evidence, included claiming that the release was an act of God, an act of war, or an act or omission of a third party not the agent or employee of the potentially responsible party.[23] Subsequently, amendments to CERCLA allow purchasers of property to potentially qualify for the innocent landowner, bona fide potential purchaser, or contiguous property owner defenses to liability if the party conducts "all appropriate inquiries" before acquiring the property.[24] Due, in part, to the deleterious consequences of hazardous waste on human and environmental health, the defenses to CERCLA liability are difficult to successfully prevail upon.[25] Thus, many unknowing real estate owners are found to be potentially responsible parties, resulting in substantial and unforeseen financial loss. For example, in *New York v. Shore Realty Corp.*,[26] the court imposed liability on Shore Realty, despite the fact that the past owners of the property actually caused the release of hazardous waste.

Access to clean water is critical to the survival of all life. Accordingly, the CWA highlights further potential for residential and commercial real estate owners to fall subject to environmental risk.[27] For example, section 303 of the act regulates the discharge of pollutants, including sediment, nitrogen, and phosphorus, into regulated water bodies.[28] These contaminants can impair local ecosystem structure and function jeopardizing the health of local inhabitants. The U.S. Environmental Protection Agency promulgates, or reviews state-promulgated, numerical or narrative water quality standards that "tak[e] into consideration their use and value for public water supplies, propagation of fish and wildlife, recreational purposes, and also tak[e] into consideration their use and value for navigation."[29] Accordingly, the federal or state

[21] 42 USC § 9607 (a).
[22] 42 USC § 9601 (14).
[23] 42 USC § 9607 (b).
[24] 42 USC § 9601 (35) (innocent landowner defense); § 9601 (40) (bonafide potential purchaser); § 9607 (q) (contiguous property owner). The guidelines for conducting all appropriate inquires are governed by regulation and require, inter alia, interviews with current and past owners, a record search for cleanup liens, and searches of government databases (40 CFR §312).
[25] See J. M. Moss, "Impact of CERCLA on Real Estate Transactions: What Every Owner, Operator, Buyer, Lender,. . .Should Know," *Brigham Young University Journal of Public Law* 6 (1992): 365, 375 (noting that courts typically construe the provisions of CERCLA liberally).
[26] 759 F.2d 1032, 1043–44 (2d Cir. 1985).
[27] 33 USC §§1251 et seq.
[28] 33 USC § 1313.
[29] 33 USC § 1313 (c)(2); see also *Pronsolino v. Nastri*, 291 F.3d 1123 (9th Cir. 2002) (upholding the Environmental Protection Agency's authority to force states to set water quality standards sufficient to protect the designated use even if pollution originated entirely from nonpoint pollution).

administrators require municipalities and industrial point source discharges to adopt best pollution control technologies and obtain a discharge permit through the National Pollution Discharge Elimination System to meet and maintain water quality standards.[30] To comply with federal or state standards, municipalities often enact local ordinances, such as stormwater management laws, that may result in enforcement actions against commercial and residential real estate owners.[31] Although federal, state, and local antidegradation jurisprudence continues to evolve[32] and enforcement is highly site-specific, regulation of water pollution is a notable environmental risk facing commercial and residential real estate owners.

Prior to the enactment of U.S. environmental law, private citizens relied on common law causes of action such as private nuisance to combat pollution from neighboring landowners.[33] Liability in private nuisance suits is found when the defendant intentionally causes a substantial and unreasonable interference with the use and enjoyment of another's land in a continuous or recurring manner.[34] These causes of action remain today and represent a risk to residential and commercial real estate owners.

Significant costs and claims against real estate owners can also result from installed and applied building materials, indoor air quality, and biological contaminates.[35] Common examples of losses include bodily injury resulting from exposure to lead paint[36] and asbestos,[37] as well as losses incurred in connection with removal and disposal of these materials. Furthermore, prior industrial use of the site or migrating irritants can leave buildings' interiors at risk of vapor intrusion and indoor contamination with hazardous wastes.[38]

[30] 33 USC § 1342. States that assume the authority to administer the CWA enact similar state level permitting regimes. See e.g., N.Y. Environmental Conservation Law § 17-0808 (McKinney).

[31] See e.g., Roslyn, N.Y., Code §400 (setting forth stormwater management and erosion control measures).

[32] See Sandi Zellmer and Robert L. Glicksman, "Improving Water Quality Antidegradation Policies," *Journal of Energy and Environmental Law* 4 (2013): 1, 1, (recommending various reforms to antidegradation policy in order to ". . .provid[e] a margin of safety, protect[] high-value natural resources, prevent[] the development of pollution havens, and balance[e] environmental goals and economic growth opportunities").

[33] See e.g., *Madison v. Ducktown Sulphur, Copper & Iron Co.,* 83 S.W. 658, 664 (1904) (finding that damages are properly granted against a copper smelting plant where injury is proven).

[34] *Berenger v. 261 W. LLC*, 93 AD 3d 175, 182(NY Appellate Div. 2012).

[35] Catherine E. Bostock, "Environmental Liabilities of Property Owners: Examples of Common Risks and Strategies to Anticipate and Avoid Them," *Environmental Claims Journal* 26 (2014): 27, 32–35.

[36] See Christine L. Hansen, "Lead Astray and Back Again: Alternative Solutions to the Lead Paint Poisoning Problem in Wisconsin's Rental Housing," *Wisconsin Law Review* (2000): 1073, 1073 (noting the prevalence of lead paint poisoning and its severe effects on young victims).

[37] See James A. Henderson Jr. and Aaron Twerski, "Asbestos Litigation Gone Mad: Exposure-Based Recover for Increased Risk, Mental Distress and Medical Monitoring," *South Carolina Law Review* 58 (2002): 816 (calling asbestos litigation "a blight on the American judicial system").

[38] See Chuck Wah Francis Yu and Jeong Tai Kim, "Building Pathology, Investigation of Sick Buildings-VOC Emissions," *Indoor and Built Environment* 19 (2010): 40 (reviewing some of the causes of indoor air quality issues).

Finally, biological agents, such as mold, can lead to catastrophic losses associated with remediation and bodily injury.[39]

GREEN coverage is a comprehensive environmental insurance policy offered on a "claims made" basis. The coverage is designed to insure new environmental conditions that result in first- and third-party pollution claims such as cleanup costs, associated property damage, claims for bodily injury associated with pollution, and legal defense costs.[40] In addition, coverage extends to indoor contaminates such as mold and bodily injury claims related to installed and applied materials such as lead paint and asbestos. GREEN also insures third-party claims resulting from off-site disposal of hazardous materials. Although GREEN is an innovative insurance coverage that mitigates environmental exposure to residential and commercial real estate owners, climate change is likely to impede the insurability of many environmental risks.[41] Fortunately, because of insurers' financial capacity and ability to influence private individuals and corporations more effectively than the public sector, they are in the position to act as proactive risk managers by endorsing or requiring sustainable practices and loss-prevention measures.[42] Development of such measures requires an understanding of the risks correlated with climate change.[43]

II. ENVIRONMENTAL RISKS IN A CHANGING CLIMATE

The changing climate has already begun to reveal vulnerability in natural and human systems, albeit with high amounts of spatial and temporal variability.[44] Further warming portends pervasive and irreversible effects including more frequent and intense rainfall events such as hurricanes, associated flooding, drought, sea-level rise, and heat waves. Climate risks to commercial and residential real estate owners extend well beyond the initial impact of these disasters; there are potential long-term environmental liabilities resulting from the recovery, the reconstruction, and the resumption of habitation of storm- and flood-impacted areas.

[39] Thelma Jarman-Felstiner, "Mold is Gold: But Will it be the Next Asbestos?" *Pepperdine Law Review* 30 (2002).

[40] GREEN does not automatically cover underground storage tanks, or the abatement of lead or asbestos. Underground storage tanks that are not too old can, however, be added to the policy, although the premium will be adjusted to reflect the increased risk.

[41] Cf. Evan Mills, "Synergisms Between Climate Change Mitigation and Adaptation: An Insurance Perspective," *Mitigation and Adaptation Strategies for Global Change* 12 (2007): 809–810.

[42] *Id.*

[43] See Mills supra, note 10, 1043 ("Insurance is a form of adaptive capacity for the impacts of climate change, although the sector itself must adapt in order to remain viable. It is incumbent on insurers, their regulators, and the policy community to develop a better grasp of the physical and business risks").

[44] See *Intergovernmental Panel On Climate Change*, supra note 8, 7.

Although not explicitly linked to climate change, Superstorm Sandy is thought to be indicative of the frequent and extreme weather expected as our climate changes.[45] The storm pummeled the New York metropolitan area with wind gusts up to 90–100 mph, fourteen feet of storm surge during high tide, and a deluge of rainfall exceeding five inches in many places.[46] The destructive force of the storm was apparent immediately—the storm damaged more than 375,000 housing units and caused an estimated $50 billion worth of damage.[47] The true breadth of the damage, however, only began to emerge as the floodwaters receded. Hazardous materials, swept from destroyed homes and businesses, were deposited throughout the environment; raw sewage from overwhelmed water treatment facilities stood in flooded homes; and mold began to proliferate within floodwater-affected structures.[48]

As disasters such as Superstorm Sandy become more common, U.S. environmental regulatory policy and jurisprudence will likely responsibly evolve to protect health and safety. This, in turn, however, will create a number of new environmental risks to commercial and residential real estate owners.[49] For example, the way in which federal and state governments remedy the release of hazardous wastes may become more stringent, reflecting the greater risk of disturbance to contaminated sites.[50] Under the current regulatory regime, regulators often allow contamination to be remediated through monitored natural recovery or in situ capping.[51] Monitored natural recovery involves utilizing natural processes to reduce the bioavailability of sediments; in situ capping refers to the placement of clean material over contaminated sediments to prevent exposure and stabilize contaminates.[52] Climate change is likely to decrease the efficacy of such measures, as erosion, flooding, and high winds are more likely to affect those sites.[53] Accordingly, regulators are increasingly more likely to require more elaborate remedies that ultimately create greater financial liability for the responsible parties.

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[45] See Kim Knowlton et al., "Post-Sandy Preparedness Policies Lag as Sea Levels Rise," *Environmental Health Prospectives* 121 (2013): 208 (finding that lessons learned from the impacts of Sandy should be translated into adaptive policies).

[46] Jeffery B. Halverson and Thomas Rabenhorst, "Hurricane Sandy: The Science and Impacts of a Superstorm," *Weatherwise* 66 (2013): 14.

[47] John Manuel, "The Long Road to Recovery: Environmental Health Impacts of Sandy," *Environmental Health Prospectives* 131 (2013): 152.

[48] *Id.*

[49] See e.g., Keneth T. Kristl, "Diminishing the Divine: Climate Change and the Act of God Defense," *Widener Law Review* 15 (2010): 325 (finding that the Act of God defense in tort, admiralty, and environmental law will lose significance as the risk of climate change related weather becomes more foreseeable).

[50] Katrina F. Kuh, "Climate Change and CERCLA Remedies: Adaptation Strategies for Contaminated Sediment Sites," *Seattle Journal of Environmental Law* 2 (2012): 61.

[51] Environmental Protection Agency, *Contaminated Sediment Remediation Guidance For Hazardous Waste Sites* (Dec. 2005).

[52] *Id.,* iii–iv.

[53] Katrina F. Kuh, supra note 50, 71–75.

Similarly, regulation under the CWA is likely to become more stringent in order to deal with the impacts of climate change. Climate change is expected to contribute to the degradation of waters by increasing stormwater runoff and altering temperatures and rainfall patterns.[54] In addition, climate change is expected to alter the composition, diversity, and stability of aquatic biological communities.[55] These effects of climate change will exacerbate other anthropogenic impacts on waters such as combined sewer overflows[56] and nonpoint pollution.[57] Currently, section 208 of the CWA provides financial incentives for polluters to adopt best management practices that reduce stormwater runoff and nonpoint pollution, but does not penalize those that decline to do so.[58] In the future, regulation of point sources will likely be insufficient for maintaining quality standards, and command and control regulation of nonpoint sources will likely be enacted. Commercial and residential real estate owners will, therefore, be subject to an ever-increasing degree of liability associated with the CWA.

In addition to evolving regulatory regimes, commercial and residential real estate owners may face environmental liability from private and public common law nuisance claims due to pollution from climate change impacts. Although climate change effects on any given locality are exceedingly hard to predict, it would be prudent for both insurers and the insured to reduce exposures and increase resilience.[59]

III. INSURERS AS PROACTIVE RISK MANAGERS

Insurers have a long history of addressing root causes of risk through proactive risk management—noted examples include fostering the development of fire departments, building codes, and auto safety testing protocols.[60] Climate

[54] Margaret A. Palmer et al., "Climate Change and River Ecosystems: Protection and Adaptation Options," *Environmental Management* 44 (2009): 1053.

[55] *Id.*

[56] Combined sewers collect stormwater, industrial wastewater, and residential wastewater in one pipe and typically direct water to a wastewater treatment facility for treatment and eventual discharge. During major storm events, however, runoff overwhelms the capacity of the system, causing the discharge of untreated wastewater directly into a water body. See Maria R. C. De Sousa et al., "Using Life Cycle Assessment to Evaluate Green and Grey Combined Sewer Overflow Control Strategies," *Journal of Industrial Ecology* 16 (2012): 901, 901 (describing combined sewer overflows as a "public health and environmental liability"). Researchers anticipate that climate change is likely to increase the frequency and intensity of such overflow events. See Annette Semadeni-Davies et al., "The Impacts of Climate Change and Urbanisation on Drainage in Helsingborg, Sweden: Combined Sewer System," *Journal of Hydrology* 350 (2008): 100, 100.

[57] J. S. Baron et al., "The Interactive Effects of Excess Reactive Nitrogen and Climate Change on Aquatic Ecosystems and Water Resources of the United States," *Biogeochemistry* 114 (2013): 71.

[58] *Natural Resources Defense Council v. USEPA*, 915 F.2d 1314, 1317 (9th Circuit 1990).

[59] Cf. Mark E. Keim, "Building Human Resilience: The Role of Public Health Preparedness and Response as an Adaptation to Climate Change," *American Journal of Preventive Medicine* 35 (2008): 508, 508.

[60] Mills, supra note 10, 1043.

change presents the insurance industry the opportunity to lead adaptation and mitigation efforts by promoting it to commercial and residential real estate owners.[61] Insurers can reward such efforts by reducing self-insured retentions, decreasing premiums, or increasing aggregate limits. This responsible approach represents a business opportunity for insurance companies; insurers and brokers can provide risk management advisory services and develop innovative loss mitigation products.[62]

One climate loss prevention strategy that can be employed by residential and commercial real estate owners is the installation of green infrastructure.[63] The definition of *green infrastructure* is somewhat amorphous. It has been described broadly as an interconnected network of green spaces that conserves ecosystem structure and function among human land use.[64] Green infrastructure includes blue roofs,[65] green roofs,[66] rain gardens or planter boxes,[67] bioswales,[68] and permeable pavement.[69] The large-scale development of networks of green infrastructure will boost the resilience of the built environment—a critical first step in preparing for the imminent threat of climate change (Table 1).[70]

In addition to engineered green infrastructure, residential and commercial real estate owners can restore native ecosystems on portions of their parcels where possible.[71] Restoration will enable habitats to respond to change

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[61] See *id.* (noting that public-private partnerships for adaptation and mitigation are essential for spreading risk and developing loss mitigation strategies).

[62] *Id.*

[63] See S.E. Gill et al., "Adapting Cities for Climate Change: The Role of the Green Infrastructure," *Built Environment* 33 (2007): 115.

[64] Mark A. Benedict and Edward T. McMahon, "Green Infrastructure: Smart Conservation for the 21st Century," *Renewable Resources Journal* 20 (2002): 12, 12.

[65] Nonvegetated roofing materials that retains and gradually releases runoff. As a cobenefit, blue roofs provide the sustainable benefit of reducing heating costs. See *Blue Roof and Green Roof*, NYC Department of Environmental Protection, http://www.nyc.gov/html/dep/html/stormwater/green_pilot_project_ps118.shtml http://water.epa.gov/infrastructure/greeninfrastructure/gi_what.cfm*Id* (accessed August 25, 2014).

[66] Roofs covered with growing media and vegetation designed to retain runoff. Green roofs also provide a myriad of cobenefits such as reducing noise pollution and cooling cost, increasing air quality, and providing wildlife habitat. *Id.*

[67] Shallow, vegetated basins designed to collect water from rooftops. *What is Green Infrastructure*, U.S. Environmental Protection Agency, http://water.epa.gov/infrastructure/greeninfrastructure/gi_what.cfmId (accessed August 25, 2014). *Id.*

[68] A vegetated channel designed to move water while promoting bioretention of runoff, nutrients, and other types of pollution. *Id.*

[69] Porous pavement allows for infiltration of water, thereby reducing overland flow and runoff. *Id.*

[70] See S. E. Gill, supra note 63; see also "The Executive Office of the President, The President's Climate Action Plan," 13, http://www.whitehouse.gov/sites/default/files/image/president27sclimateactionplan.pdf (outlining the importance of building "stronger and safer communities" to deal with the exigencies of climate change).

[71] See Constance I. Millar et al., "Climate Change and Forests of the Future: Managing in the Face of Uncertainty," *Ecological Applications* 17 (2007): 2145, 2147–2149 (discussing a need for adaptive

TABLE 1. A hypothesized tabular model of the succession of anthropogenic ecosystem factors varying along a spatiotemporal gradient of green infrastructure network complexity. This tabular model is based on Eugene Odum's famous tabular model of ecological succession. See Eugene P. Odum, "The Strategy of Ecosystem Development," *Science* 164 (1969): 262, 265. The steepness of each gradient is likely to increase as the Earth's climate continues to warm. Note that natural or human disturbances are likely to reset the successional processes.

	Intensive Human Land Use with Little Green Infrastructure	Moderately Developed Networks of Green Infrastructure	Complex Networks of Green Infrastructure
Community Energetics			
Energy Demand for Cooling	High	Medium-High	Low
Vulnerability of Energy Infrastructure	High	Medium-High	Low
Urban Heat Island Effect	High	Medium	Low
Community Structure and Function			
Air Quality	Low	Medium	High
Water Pollution, Stormwater Runoff, Erosion	High	Medium-Low	Low
Resistance and Resilience to Flooding	Low	Medium-High	High
Aquifer Recharge	Low	Medium	High
Electric and Magnetic Field Shielding	Low	Medium-Low	High
Noise Reduction	Low	Medium	High
Overall Homeostasis			
Stability (resistance to external perturbations)	Low	Medium-High	High
Human Health and Well-Being	Low	Medium	High
Environmental Awareness and Prosocial Behavior	Low	High	High

by increasing ecological resistance and resilience.[72] Native forests help to buffer storm waters; lower the water table, which decreases the likelihood of flooding; and act as a mechanical filter to trap pollutants and particulate matter.[73] As our climate continues to warm, the energy demand for indoor cooling is projected to increase.[74] Native forests can help to reduce this demand, and ultimately energy consumption, by moderating the maximum

forest management); James P. Collins et al., "A New Urban Ecology: Modeling Human Communities as Integral Parts of Ecosystems Poses Special Problems for the Development and Testing of Ecological Theory," *American Scientist* 88 (2000): 416, 424 (discussing how standard ecological theory such as successional dynamics can be applied to human dominated ecosystems); Mark J. McDonnell and Steward T. A. Pickett, "Ecosystem Structure and Function Along Urban-Rural Gradient: An Unexploited Opportunity for Ecology," *Ecology* 71 (1990): 1232 ("Urbanization is a massive, unplanned experiment that already affects large acreages and is spreading in many areas of the United States").

[72] See Constance I. Millar et al., supra note 71.

[73] See Frank Piccininni, "Adaptation to Climate Change and the Everglades Ecosystem," *Environmental Claims Journal* 26 (2014): 63, 80–82 (discussing the stabilizing affect of native vegetation in a dynamic ecosystem).

[74] Danny H. W. Li et al., "Impact of Climate Change on Energy Use in the Built Environment in Different Climate Zones—A Review," *Energy* 42 (2012): 103, 103.

surface temperatures and the urban heat island effect (Table 1).[75] Finally, planting trees, shrubs, and herbaceous flora would provide the invaluable ecosystem service of carbon sequestration to mitigate climate change.[76]

Green infrastructure provides redundancy and modularization of ecosystem services, which helps to defuse risk throughout the built environment.[77] In this way, real estate owners have to rely less on centralized infrastructure (e.g., wastewater treatment facilities), which are relatively vulnerable to failure.[78] Moreover, the benefits of green infrastructure (Table 1) are likely to reduce environmental losses associated with regulatory liabilities and common law lawsuits. Finally, and perhaps most importantly, the installation of complex networks of green infrastructure will increase environmental awareness, thereby promoting a responsible stewardship approach to real estate.[79]

CONCLUSION

Environmental law is critical for the maintenance and protection of innocent life, including our own. Yet, it also creates significant liability for residential and commercial real estate owners, which is likely to be exacerbated by the impacts of climate change. Fortunately, the insurance industry is poised to provide leadership in promoting adaptation to and mitigation of climate risk.[80] It is, therefore, incumbent upon insurers to rise to the challenge of developing novel and innovative products designed to cope with the evolving "nature" of environmental risk.

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[75] See S.E. Gill, supra note 63, 116–124 (modeling the effects of "green cover" on surface temperatures under projected climate change scenarios).

[76] See Kathryn R. Kirby and Catherine Potvin, "Variation in Carbon Storage Among Tree species: Implications for the Management of a Small-Scale Carbon Sink Project," *Forest Ecology and Management* 246 (2007): 208, 214.

[77] Jack Ahern, "From Fail-Safe to Safe-to-Fail: Sustainability and Resilience in the New Urban World," *Landscape and Urban Planning* 100 (2011): 341, 342–343.

[78] *Id.*

[79] Cf. R. Edward Grumbine, "What is Ecosystem Management?," *Conservation Biology* 8 (1994): 27 ("Ecosystem management is not just about science nor is it simply an extension of traditional resource management; it offers a fundamental reframing of how humans may work with nature."); David S. Wilson, "Human Prosociality from an Evolutionary Perspective: Variation and Correlations at a City-Wide Scale," *Evolution and Human Behavior* 30 (2009): 190 (using field observations of prosocial behavior, multivariate analysis, and spatial interpolation to demonstrate that prosocial behavior is correlated with neighborhood social support).

[80] Sean B. Hecht, "Climate Change and the Transformation of Risk: Insurance Matters," *UCLA Law Review* 55 (2008): 1559, 1618.

Developments in Federal and State Law

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If You BUILD It, Will They Come? A Look at the 2018 Congressional Reauthorization of the Federal Brownfields Program and Other Amendments to CERCLA

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IN THIS ISSUE

Introduction

It is possible that no federal environmental law has been criticized as much the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA).[1] Yet perhaps even more than the National Environmental Policy Act,[2] CERCLA has been the cornerstone of much of environmental law practice in this country. It not only governs how liability is allocated at actual Superfund sites but also regulates how private parties resolve their disputes about adjacent property sources of contamination, as well as how liability is allocated between present and past owners and operators of facilities. Some critics have opined that the law "has been an utter failure,"[3] while others have somewhat more kindly noted that "CERCLA has been an exercise in trial and error."[4] Despite its faults, CERCLA is still regarded by some environmental practitioners as an important and progressive piece of legislation. As we approach CERCLA's fortieth anniversary, it is notable that the law has been significantly revised just three times since the 1986 amendments reauthorizing the Superfund.

This article will explore the BUILD Act of 2018—the most recent amendments to CERCLA—which was passed as part of the 2018 federal appropriations bill,[5] and will touch upon the missed opportunity to truly enhance CERCLA.

[1] 42 U.S.C. §§ 9601–9675.
[2] 42 U.S.C. §§ 4321–4347.
[3] Frona M. Powell, *Amending CERCLA to Encourage the Redevelopment of Brownfields: Issues, Concerns, and Recommendations*, 53 WASH. U. J. URB. & CONTEMP. L. 113, 121 (1998).
[4] Garry A. Gabison, *The Problems With The Private Enforcement of CERCLA: An Empirical Analysis*, 7 GEO. WASH. J. ENERGY & ENVTL. L. 189 (2016).
[5] Pub. L. No. 115-141, 132 Stat. 1147.

Prior Significant Amendments to CERCLA[6]

In the aftermath of CERCLA's enactment in 1980, litigation was plentiful, beginning—though not ending—with challenges to the constitutionality of CERCLA's imposition of retroactive liability.[7] The statute was controversial from its inception on various fronts.[8] District courts across the country had to grapple with this new piece of legislation that has been described by federal courts as "hastily-drawn,"[9] "marred by vague terminology,"[10] and "fragmented."[11] The Supreme Court has remarked that the law is "not a model of legislative draftsmanship."[12]

More than six years passed before Congress took its first shot at addressing some of the flagrant problems with CERCLA by passing the Superfund Amendments and Reauthorization Act of 1986 (SARA).[13] With SARA, Congress addressed several glaring fairness issues, including by creating the "innocent landowner" defense[14] to liability for owners who unknowingly purchase contaminated land, so long as they conducted all appropriate inquiries (AAI) into the past history of the property consistent with customary commercial practice and are able to establish other aspects of the defense such as exercising due care.[15] SARA also formalized the right of contribution among potentially responsible parties (PRPs)[16] and added the statutory authority for private suits under CERCLA.[17] In addition to addressing the foregoing liability issues, SARA also reauthorized the Superfund tax and created the National Priorities List—a collection of contaminated sites the EPA should consider the most important, based on certain criteria.

More than 10 years passed before Congress acted on CERCLA again, by passing the Asset Conservation, Lender Liability, and Deposit Insurance Protection Act of 1996.[18] With these amendments, Congress created "safe harbor" provisions that exempted lenders and trustees—which had been left exposed after *United States v. Fleet Factors Corp.*[19]—from CERCLA liability by clarifying the definitions of "owner and operator" and "participation in management." Just three years later, Congress amended CERCLA again by passing the Superfund Recycling Equity Act of 1999 (SREA).[20] With SREA, Congress focused its efforts on shielding the solid waste industry by creating a defense to CERCLA liability for persons who send otherwise hazardous materials to a site for recycling purposes.[21]

Then, three years after SREA, Congress passed arguably the most significant improvements to CERCLA since SARA, namely, the Small Business Liability Relief and Brownfields Revitalization Act of 2002 (the Brownfields Act).[22] The Brownfields Act gave us liability protection for "bona fide prospective purchasers" (BFPPs),[23] which was rather more sweeping than the existing innocent landowner defense. The Brownfields Act also created an exemption from CERCLA liability for persons who contribute *de micromis* amounts of waste to sites.[24]

In addition to addressing a number of liability issues, the Brownfields Act amendments created the federal Brownfields

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[6] There have been other amendments to CERCLA not referenced here, including Title VI and Title XI of the Omnibus Budget Reconciliation Act of 1990, Pub. L. No. 101-508, 104 Stat. 1388, which extended the authorization of appropriations for the U.S. Environmental Protection Agency's (EPA's) Superfund program through fiscal year 1994, and extended the authority to collect the special Superfund taxes on industry through December 31, 1995, respectively. There were also other minor amendments to the law in 1990 and 1996 concerning the transfer of surplus federal property. These amendments are not discussed in this article.

[7] A search in LexisNexis yielded more than 300 reported cases that referenced the statute from the date of enactment until the first amendments in 1986. An almost book-length exhaustive compendium of reported and unreported cases published by BNA in 1990 and entitled "Ten Years of CERCLA Litigation" was an early reference work for litigators. It was jokingly referred to by some as "100 Years of CERCLA Litigation," a reference to Gabriel García Márquez's magical realism novel, *One Hundred Years of Solitude*.

[8] MICHAEL B. GERRARD & JOEL M. GROSS, AMENDING CERCLA: THE POST-SARA AMENDMENTS TO THE COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT, at xi (2006).

[9] *See, e.g.*, United States v. Davis, 882 F. Supp. 1217, 1220 n.1 (D.R.I. 1995); O'Neil v. Picillo, 682 F. Supp. 706, 719 n.2 (D.R.I. 1988); United States v. Ne. Pharm. & Chem. Co., 579 F. Supp. 823, 844 (W.D. Mich. 1984).

[10] *See In re* Sundance Corp., 149 B.R. 641, 660 (Bankr. E.D. Wash. 1993).

[11] *See* Ninth Ave. Remedial Grp. v. Chalmers, 946 F. Supp. 651, 660 (N.D. Ind. 1996).

[12] *See* United States v. Bestfoods, 524 U.S. 51, 56 (1998).

[13] Pub. L. No. 99-499, 100 Stat. 1613.

[14] "The 'innocent landowner defense,' while not titled as such, is a term of art that has been coined by commentators and practitioners. The innocent landowner defense is actually a type of third party defense under CERCLA section 107(b)(3) read in combination with the SARA-added CERCLA section 101(35)." Paul C. Quinn, *The EPA Guidance on Landowner Liability and the Innocent Landowner Defense: The All Appropriate Inquiry Standard: Fact or Fiction?*, 2 VILL. ENVTL. L.J. 143, 144 n.11 (1991); *see also* CERCLA §§ 101(35) and 107(b)(3), 42 U.S.C. §§ 9601(35) and 9607(b)(3).

[15] CERCLA §§ 101(35)(A)–(B), 107(b)(3), 42 U.S.C. §§ 9601(35)(A)–(B), 9607(b)(3).

[16] CERCLA § 113(f), 42 U.S.C. § 9613(f).

[17] David W. Marczely, Note, *Superfund Liability Alternatives for the Innocent Purchaser*, 39 CLEV. ST. L. REV. 79, 88 (1991).

[18] Pub. L. No. 104-208, 110 Stat. 3009, 3009–462 (Sept. 30, 1996).

[19] 901 F.2d 1550 (11th Cir. 1990).

[20] Pub. L. No. 106-113, 113 Stat. 1501, 1501A-598 (Nov. 29, 1999).

[21] *See* GERRARD & GROSS, *supra* note 8, at 20.

[22] Pub. L. No. 107-118, 115 Stat. 2356 (Jan. 11, 2002).

[23] *See* GERRARD & GROSS, *supra* note 8, at 46; *see also* CERCLA § 101(40), 42 U.S.C. § 9601(40).

[24] *See* GERRARD & GROSS, *supra* note 8, at 41; *see also* CERCLA § 107(o), 42 U.S.C. § 9607(o).

Program found in CERCLA Section 104(k), providing for redevelopment and assessment grants and loans to qualifying applicants. (These provisions were among the most important to undergo significant revision in the 2018 BUILD Act.)

Since 2002, we have seen CERCLA continue to be a thorn in the sides of the regulated community, state and local governments, EPA, and the environmental practitioners who represent them. In the absence of congressional action, CERCLA has instead evolved through federal court litigation and EPA policy over the past 17 years.

Then, in 2018, Congress passed the BUILD Act. As with other minor amendments to CERCLA since 2002,[25] the BUILD Act takes the "low-hanging fruit."

Legislative History of the BUILD Act of 2018

In the 115th Congress, the original version of the BUILD Act (S. 822) was a bipartisan bill introduced by Senator James Inhofe (R-OK) in 2017 that was initially cosponsored by Democratic Senators Markey (MA) and Booker (NJ), as well as other Republican senators. Within a few months, the bill garnered additional bipartisan support, including New York's Kirsten Gillibrand and Massachusetts's Elizabeth Warren. In all, one Independent senator, six Democratic senators, and two Republican senators cosponsored the bill, clearly signaling a bipartisan desire to make at least some revisions to CERCLA.

In September 2017, the Senate Committee on Environment and Public Works (CEPW) issued a report (Senate Report 115-148) on the bill, reporting favorably on it and recommending that the bill be passed. In its report, the CEPW noted the importance of CERCLA, and cited the fact that more than 1,300 contaminated sites remain on the Superfund National Priorities List. The report also noted that EPA estimates there are more than 450,000 brownfield sites across the country.[26] The report highlighted that in 2001, the Senate passed the bill that ultimately turned out to be the Brownfields Act, by a vote of 99-0.[27] The report said the BUILD Act would authorize the appropriation of $250 million annually for brownfields grants and loans.[28] The Senate bill was never scheduled for a Senate vote.

In the House, Representative Elizabeth Esty (D-CT) introduced H.R. 1758, the House version of the BUILD Act, referred to as the "Brownfields Reauthorization Act of 2017," on March 28, 2017, the same day that the House Committee on Transportation and Infrastructure Subcommittee on Water Resources and Environment held an oversight hearing on "Building a 21st Century Infrastructure for America: Revitalizing American Communities through the Brownfields Program." The Subcommittee received testimony from a state brownfields agency, two mayors, a city councilman, a county chairman, a real estate investment expert, an EPA representative, and environmental engineering firms, among other interested stakeholders.[29] Like the Senate CEPW, the Committee on Transportation and Infrastructure recommended that the bill pass.

A similar bill (H.R. 3017) was introduced in the U.S. House of Representatives on June 22, 2017 by Representative David McKinley (R-WV), with four cosponsors. After Representative Esty and another member were added as cosponsors, the House ultimately passed that bill by a vote of 409-8 on November 30, 2017. The major difference between the two stand-alone bills (H.R. 1758 and H.R. 3017) was in the amount of funds to be made available for remediation grants under CERCLA Section 104(k)(3)(A)(ii). The earlier bill (H.R. 1758) provided for a higher cap—up to $600,000 for each site to be remediated—as the maximum grant award, and allowed for the EPA to increase that amount to $950,000 by application, while the later bill (H.R. 3017) restricted EPA's authority to increase grants to $750,000. H.R. 3017 also increased the amount of new "multipurpose" grant awards by $50,000 (up to $1 million). Substantively, both bills were virtually identical.

The Senate did not take up the House bill, but on March 23, 2018, Congress passed the Consolidated Appropriations Act of 2018—a thrilling 878-page omnibus bill, which was enacted into law upon signature by the President.[30] Buried deep in this spending directive, beginning on page 705, is Division N, the Brownfields Utilization, Investment, and Local Development Act of 2018, the BUILD Act. With the BUILD Act, Congress sought to clarify Superfund liability for state and local governmental entities, extend liability protections to tenants and certain Alaska Native villages and corporations, and formally reauthorize funding for the federal Brownfields Program, as its prior authorization had expired in 2006.[31]

BUILD Act: Section-by-Section Analysis

Section 1 – *Short Title*: As is the case with most congressional bills, the first section simply provides the short title.

[25] For example, in 2005, CERCLA § 104(k)—the Brownfields Program—was slightly amended by the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users, Pub. L. No. 109-59, § 1956, 119 Stat. 1144, 1515.

[26] S. REP. NO. 115-148, at 1 (2017).

[27] S. REP. NO. 115-148 at 2.

[28] S. REP. NO. 115-148 at 2.

[29] *See* H.R. REP. NO. 115-419, pt. 1, at 7 (2017).

[30] Pub. L. No. 115-141, 132 Stat. 1147.

[31] It should be noted that although the Brownfields Program's authorization expired in 2006, Congress continued to provide funding. In fiscal year 2016 and 2017, for example, the Program received $162.1 million and $153 million, respectively. *See* H.R. REP. NO. 115-419 at 6. The President's fiscal year 2018 request for the Brownfields Program was just $118.4 million, *see id.*; as noted above and discussed below, the Senate bill proposed to more than double that allotment with the appropriation of $250 million annually for the Program, and the BUILD Act ultimately provided for an annual appropriation of $200 million through fiscal year 2023. *See* discussion accompanying *supra* note 28 and *infra* note 62.

Section 2 – *Redevelopment Certainty for Governmental Entities*: This section provides additional CERCLA liability protection to local and state governments. With these amendments, Congress revised the "owner or operator" exclusion for state or local governments found in CERCLA Section 101(20)(D).[32] Before this amendment, the exclusion provided that state or local governments that acquired ownership or control of a property "involuntarily"—mainly through tax foreclosure—would be exempted from liability. This appeared to leave a gap for potential state or local government liability for property acquired *voluntarily*, namely through asset forfeiture or otherwise as a result of law enforcement activities. To address this issue, Congress struck "involuntarily" from the provision and added language providing that state or local government entities that acquire ownership or control "through seizure or otherwise in connection with law enforcement activity" will now be excluded from being considered owners or operators.

The House Committee on Transportation and Infrastructure Report (House Report) notes that this amendment simply builds on the existing statutory third-party defense for state and local governments found in CERCLA Section 101(35)(A)(ii).[33] Local or state governments that acquire contaminated property pursuant to Section 101(20)(D) are still required to comply with the due care, cooperation, and other requirements of the third-party defense.[34]

One wonders if this amendment was really necessary—do law enforcement agencies ever acquire significantly contaminated property as a result of criminal investigations? Is someone really going to file a CERCLA Section 113(f) contribution suit against a local police department? Nevertheless, local or state law enforcement agencies are now free to obtain property as a result of criminal investigations without fear of facing CERCLA liability.

Section 3 – *Alaska Native Village and Native Corporation Relief*: These amendments add a new exclusion to the definition of "owner or operator" in CERCLA Section 101(20) for Alaska Native villages or Alaska Native corporations that received contaminated property from the U.S. government under the Alaska Native Claims Settlement Act.[35] Without this new exclusion, these Alaska Native villages and corporations could be held liable for contamination caused by the U.S. government and would not be eligible for federal brownfield grants; the amendment corrects the unfortunate imposition of liability by the statute's strict liability scheme. As with most "owner or operator" exclusions in CERCLA, the Alaska Native villages or Alaska Native corporations seeking Superfund liability protection must not have actually caused or contributed to a release or threatened release of a hazardous substance from the property.[36]

Section 4 – *Petroleum Brownfield Enhancement*: With this section of the BUILD Act, Congress updated the definition of "brownfield site," which establishes the scope of sites that qualify for funds under the Brownfields Program in CERCLA Section 104(k).[37] The amendments make it easier for petroleum-contaminated sites to receive funding under the Brownfields Program. The BUILD Act deleted language that previously required EPA or a state to first conduct a risk analysis evaluating whether potential petroleum-contaminated brownfield sites are of "relatively low risk, as compared to other petroleum-only sites in the State" before they are eligible to receive funding under the Brownfields Program. Deletion of the foregoing language should, in theory, accelerate the assessment and cleanup of some petroleum-contaminated brownfield sites.

However, the requirement that EPA find no viable responsible party associated with the petroleum-contaminated brownfield sites still remains.[38] The House Committee on Transportation and Infrastructure apparently received stakeholder input related to this provision and, as a result, has urged EPA to consider whether this requirement is truly necessary and does not unreasonably delay the assessment and cleanup of petroleum-contaminated sites.[39]

Section 5 – *Prospective Purchasers and Lessees*: From the perspective of a CERCLA practitioner, these are probably the most significant amendments to the law because Superfund liability protection has now been formally extended to tenants.

As most environmental practitioners know (or should know), the BFPP provision shields prospective owners from Superfund liability by allowing them to purchase property even though they learn of hazardous substances on the property prior to closing. It therefore differs from the innocent landowner defense to liability, which protects purchasers of property who conducted all appropriate inquiries into the past uses of the property (typically via Phase I Environmental Site Assessments (ESAs) but not exclusively so[40]), but only discovered the presence of hazardous

[32] CERCLA § 101(20)(D), 42 U.S.C. § 9601(20)(D).
[33] *See* H.R. REP. NO. 115-419 at 11; *see also* CERCLA § 101(35)(A)(ii), 42 U.S.C. § 9601(35)(A)(ii).
[34] *See* H.R. REP. NO. 115-419 at 12.
[35] *See* CERCLA § 101(20)(E), 42 U.S.C. § 9601(20)(E).
[36] *See* CERCLA § 101(20)(E)(ii), 42 U.S.C. § 9601(20)(E)(ii).
[37] *See* CERCLA § 101(39)(D)(ii)(II)(bb), 42 U.S.C. § 9601(39)(D)(ii)(II)(bb).
[38] CERCLA § 101(39)(D)(ii)(II)(bb), 42 U.S.C. § 9601(39)(D)(ii)(II)(bb).
[39] *See* H.R. REP. NO. 115-419 at 12.
[40] "At least one court has determined that a Phase I assessment is not the exclusive means by which a purchaser of land can make all appropriate inquiries. . . . The . . . court determined that the Senate Report on the amendment adding the 'shall satisfy' language to CERCLA read that a Phase I assessment '*can* satisfy' the 'all appropriate inquiries' requirement. . . . That court also noted that 'Congress could have provided that a Phase I site assessment was required or was the exclusive procedure to satisfy the 'all appropriate inquiries' standard; however, Congress made no such mandate.'" Von Duprin LLC v. Moran Elec. Serv., 2019 U.S. Dist. LEXIS 21305, at *47–48 (S.D. Ind. Feb. 11, 2019) (citing R.E. Goodson Constr. Co., Inc. v. Int'l Paper Co., 2006 U.S. Dist. LEXIS 39850, at *6 (D.S.C. June 14, 2006)).

substances after purchase. The benefits of the BFPP exemption are clear—no longer would such prospective purchasers fail to close on property once they discovered hazardous substances—but until now its application was expressly limited to prospective owners. As a result, in the early years of the BFPP provision, tenants could be classified as CERCLA operators (and sometimes as owners) subject to liability for the cleanup of a contaminated site if they entered into a lease with knowledge of the contaminated condition of the property without being able to benefit from the BFPP liability shield.

To address this unfortunate result, EPA issued guidance in December 2012 that broadened the BFPP exemption to include tenants. With this new policy, "Revised Enforcement Guidance Regarding the Treatment of Tenants under the CERCLA Bona Fide Prospective Purchaser Provision," EPA extended this critical CERCLA liability protection to tenants.[41] The policy change was rather narrow, however, and was just policy, always subject to change. As a result, tenants were provided no assurances of this important exemption from CERCLA liability.

In the BUILD Act, Congress provided that tenants can qualify for the BFPP exemption from CERCLA liability regardless of the owner's status as a BFPP. This change is generally consistent with, but even broader than, the EPA enforcement policy from 2012.

A person with a leasehold interest can qualify as a BFPP if (i) he/she acquires a leasehold interest after January 11, 2002; (ii) he/she establishes that the leasehold interest is not designed just to avoid liability; and (iii) one of the following three conditions applies:

1. the owner him/herself is a BFPP;
2. the owner him/herself *was* a BFPP when the leasehold interest was acquired *but* due to circumstances unrelated to the tenant, has somehow lost BFPP status;[42] or
3. the tenant conforms with all of the statutory requirements of BFPPs, including conducting all appropriate inquiries.[43]

Congress also revised the "No Affiliation" requirement for BFPP status to provide that a tenant can still qualify as a BFPP. The amended requirement provides that "the instruments by which a leasehold interest in the facility is created" (e.g., the lease) will not be considered a direct contractual or financial relationship that would otherwise destroy the BFPP exception.[44]

The BUILD Act therefore broadens, as well as codifies, the BFPP liability protection previously afforded to lessees under EPA's policy. Courts, of course, treat administrative agency policy as persuasive authority but not controlling law. Now that CERCLA provides that tenants do not have to rely on their landlords to attain BFPP status, parties and courts will have greater certainty when the issue arises in litigation (as it does from time to time).[45]

This change provides additional incentives for commercial and industrial tenants to perform Phase I ESAs before leasing property to ensure they meet the baseline AAI requirements.

Sections 6 to 13 – *Reauthorization of the Brownfields Program and Amendments Thereto:* The bulk of the BUILD Act consists of various amendments to the federal Brownfields Program created by CERCLA Section 104(k). The summary below touches on some of the more significant or otherwise interesting amendments:

- The amendments first add non-profit organizations and qualified "community development entities," as well as limited liability corporations and limited partnerships in which all managing members or sole members or general partners are nonprofit organizations, to the list of entities eligible for brownfield grants or loans.[46] This should, in theory, broaden the pool of Brownfields Program grant applicants and encourage participation by organizations that serve diverse communities.
- Congress also amended the Brownfields Program by allowing governmental entities to receive grant money for brownfield site characterization, assessment, or remediation for properties acquired by the governmental entities prior to January 11, 2002 (the date BFPP exemption from Superfund liability was added to CERCLA).[47] With these amendments, Congress intended to provide explicit authorization to governmental entities to apply for and use Brownfields Program grant money "even if the eligible entity does not qualify as a [BFPP]," provided such entities have not actually caused or contributed to the release or threatened release of a hazardous substance at the site.[48] While these amendments do not affect the

[41] EPA, Revised Enforcement Guidance Regarding the Treatment of Tenants Under the CERCLA Bona Fide Prospective Purchaser Provision (Dec. 5, 2012), https://www.epa.gov/sites/production/files/documents/tenants-bfpp-2012_0.pdf.

[42] For example, this condition might apply where an owner did not exercise appropriate care at the property, failed to cooperate with EPA or a state agency, or did not provide legally required notices with respect to discovery or release of any hazardous substances at the facility.

[43] CERCLA § 101(40)(A)(ii), 42 U.S.C. § 9601(40)(A)(ii).

[44] CERCLA § 101(40)(B)(viii), 42 U.S.C. § 9601(40)(B)(viii).

[45] *See, e.g.*, Commander Oil Corp. v. Barlo Equip. Corp., 215 F.3d 321 (2d Cir. 2000) ("Although we conclude that a lessee may, under some circumstances, be held liable under CERCLA as an 'owner,' we conclude that, under the circumstances of this case, Barlo was not an 'owner' within the meaning of CERCLA. Accordingly, we reverse the judgment of the district court in substantial part [and hold the lessee not liable under CERCLA].").

[46] CERCLA § 104(k)(1)(I)–(L), 42 U.S.C. § 9604(k)(1)(I)–(L).

[47] CERCLA § 104(k)(2)(C), 42 U.S.C. § 9604(k)(2)(C).

[48] CERCLA § 104(k)(2)(C), 42 U.S.C. § 9604(k)(2)(C).

potential Superfund liability of a governmental entity for properties acquired prior to January 11, 2002, it allows these non-BFPP governmental entities to apply for brownfield grants and loans without restrictions.

- The BUILD Act also increases the amount of money that can be awarded by EPA for remediation grants from $200,000 to $500,000, and allows EPA to increase that amount to $650,000 by waiver.[49] According to the 2017 House Report,[50] multiple stakeholders commented that due to inflation and the increasing complexity of some brownfield sites, the prior maximum cleanup grant level of $200,000 was insufficient. Some would argue that even $500,000 (or $650,000) is insufficient to clean up most significantly contaminated brownfields sites.

- In addition to increasing the amount of money that could be awarded for remediation grants, the BUILD Act adds a new grant provision for "multipurpose grants."[51] The previous Brownfields Program provided grants only for site characterization and assessment, or for remediation. These multipurpose grants, however, expressly encourage applicants to also seek funds for inventory and planning activities at brownfield sites—activities for which grant funds were previously unavailable under the previous version of the Program. Under this new authority, EPA may provide a maximum of $1 million in funding per grant to eligible entities.[52] While EPA has authority to award multipurpose grants of up to $1 million, the agency has determined that it will provide grants of no more than $800,000, and anticipates selecting just 10 proposals for these types of grants.[53] The statute requires that a recipient own the brownfield property prior to spending grant money for remediation purposes.[54] Additionally, grant recipients have five years to spend funds, unless EPA grants an extension.[55]

- Congress also decided to remove the statutory prohibition on grantees using funds for reasonable administrative costs.[56] Apparently, the House Committee on Transportation and Infrastructure Subcommittee on Water Resources and Environment heard from several stakeholders that this prohibition made it difficult for local governments and community organizations, among others, to effectively implement their cleanup programs and projects.[57] This prohibition also served as a barrier to local organizations using brownfields funding in small, rural, or disadvantaged areas.[58]

- In an attempt to encourage "green" brownfields projects, the BUILD Act expanded the list of grant ranking criteria to include the extent to which projects would address sites adjacent to a waterbody or federally designated flood plain,[59] or the extent to which the grant would facilitate the siting of renewable energy projects (i.e., wind, solar, geothermal) or an energy efficiency improvement project.[60]

- The BUILD Act also repealed a provision that required 25% of annual site characterization, assessment, and remediation grant funds to be allocated to sites contaminated by petroleum or petroleum product.[61]

- Finally, Congress reauthorized the funding of the federal Brownfields Program for $200 million in federal appropriations for fiscal years 2019 through 2023.[62]

Section 14 – *Small Community Technical Assistance Grants*: Congress added a new authority for EPA to make grants of up to $20,000 to states and tribes to provide training, technical assistance, or research assistance to support small communities, Indian tribes, rural areas, or disadvantaged areas.[63]

Section 15 – *State Response Program Funding*: The final section of the BUILD Act amends CERCLA Section 128 to authorize $50 million in federal funds for fiscal years 2019 through 2023. This is the pool of money that can be awarded to states for the implementation of states' own brownfields programs.

Missed Opportunities

As we approach the fortieth anniversary of CERCLA, environmental practitioners across the country would agree the law is ripe for significant changes across several areas. This is not to say that CERCLA has been a failure—but it has been an ambitious

[49] CERCLA § 104(k)(3)(A)(ii), 42 U.S.C. § 9604(k)(3)(A)(ii).
[50] *See* H.R. REP. NO. 115-419, pt. 1, at 14 (2017).
[51] CERCLA § 104(k)(4), 42 U.S.C. § 9604(k)(4).
[52] CERCLA § 104(k)(4)(B)(i), 42 U.S.C. § 9604(k)(4)(B)(i).
[53] *Multipurpose, Assessment, RLF, and Cleanup (MARC) Grant Application Resources*, EPA, https://www.epa.gov/brownfields/multipurpose-assessment-rlf-and-cleanup-marc-grant-application-resources (last updated Feb. 1, 2019).
[54] CERCLA § 104(k)(4)(E), 42 U.S.C. § 9604(k)(4)(E).
[55] CERCLA § 104(k)(4)(D), 42 U.S.C. § 9604(k)(4)(D).
[56] CERCLA § 104(k)(5)(E), 42 U.S.C. § 9604(k)(5)(E).
[57] *See* H.R. REP. NO. 115-419, pt. 1, at 15 (2017).
[58] H.R. REP. NO. 115-419 at 15.
[59] CERCLA § 104(k)(6)(C)(xi), 42 U.S.C. § 9604(k)(6)(C)(xi).
[60] CERCLA § 104(k)(6)(C)(xii), 42 U.S.C. § 9604(k)(6)(C)(xii).
[61] *See* H.R. REP. NO. 115-419 at 5, 16.
[62] CERCLA § 104(k)(13), 42 U.S.C. § 9604(k)(13).
[63] CERCLA § 128(a)(1)(B)(iii), 42 U.S.C. § 9628(a)(1)(B)(iii).

experiment that is in need of seriously overdue fine-tuning. Even if some consider the law an utter failure, we need to be reminded that "failure isn't fatal, but failure to change might be."[64]

We have learned many lessons since CERCLA's enactment and since the post-SARA amendments. With those lessons in hand, I firmly believe that the 115th Congress could have done more to improve the law in several respects. For instance, Congress could have clarified certain aspects of the statute to avoid unnecessary litigation and could have provided additional incentives for the cleanup of brownfield sites by private developers.

Below are just a handful of items that Congress could have addressed and that should be considered for future CERCLA revisions:[65]

1. **Applicable or Relevant and Appropriate Requirements (ARARs) should be updated.** Issues with ARARs must be addressed on several fronts. Rather than specifying standards for contaminants, CERCLA functions as an "umbrella" statute that relies on other statutes or regulations for site remediation standards. Section 121(d) broadly requires that cleanup comply with ARARs to protect human health and the environment.[66] ARARs can include a variety of standards, requirements, or other criteria, creating a complex web of demands for those interested in remediating a site.

   Indeed, members of the Association of State and Territorial Solid Waste Management Officials (ASTSWMO) testified before Congress in 2016 and 2017 that their main areas of concern included "[EPA's] inconsistent application of ARARs from site to site"[67] and the lack of written documentation on the rational [sic] used to determine ARARs."[68]

2. **NCP process is outdated and should be revised.** The National Contingency Plan (NCP) should be updated to reflect important lessons learned from almost 40 years of site remediation by EPA, states, and private parties under CERCLA, the Resource Conservation and Recovery Act (RCRA),[69] and state cleanup programs. For example, it is time serious consideration is given to whether every PRP-led and PRP-funded cleanup should go through a complete NCP process. As practitioners may know, the NCP requires a site-specific baseline risk assessment for specific contaminants of concern at the site—this endeavor is typically costly and extremely time-consuming. Instead of this process, Congress should mandate that EPA develop soil and groundwater cleanup standards for the most common contaminants found at Superfund sites, and those standards should vary based on the anticipated future use of the site. This would emulate the model used across the country for various state voluntary cleanup and Superfund programs, including New York's. CERCLA pretends that every contaminated site might someday be put to residential use, which is unrealistic and creates inefficiencies. There are ways to streamline the Superfund cleanup process, and this is one of them.

3. **RCRA and CERCLA should be integrated.** Although RCRA and CERCLA address different purposes and programs,[70] they ultimately serve the same primary goal: ensuring that soil and groundwater at contaminated properties are properly remediated for the protection of human health and the environment. By integrating RCRA and CERCLA, Congress would allow PRPs, EPA, and state government entities the flexibility to select remedial goals and actions that would lead to more efficient cleanups. For example, in the early 2000s, the RCRA Corrective Action Program was transformed into a much more effective cleanup program, allowing states and EPA to speed up investigations and cleanup process while maintaining stringent standards for remediation.[71]

4. **Arranger liability should be clarified.** The Supreme Court's landmark decision in *Burlington Northern*,[72] which settled rather narrow issues with respect to arranger

[64] JOHN WOODEN WITH STEVE JAMISON, WOODEN: A LIFETIME OF OBSERVATIONS AND REFLECTIONS ON AND OFF THE COURT (1997).

[65] It should be noted that some of these suggestions are not entirely new. For example, CERCLA critics have noted for years that the National Contingency Plan process is outdated and due for an update. Additionally, many environmental law practitioners think it is time that CERCLA and the Resource Conservation and Recovery Act (RCRA) be integrated in order to streamline the remediation of contaminated sites. Nevertheless, until Congress decides to actually enact significant amendments to the law, these existing suggestions are worth re-exploring.

[66] CERCLA § 121(d), 42 U.S.C. § 9621(d).

[67] *Oversight of the U.S. Environmental Protection Agency's Superfund Program: Hearing Before the Senate Subcomm. on Superfund, Waste Mgmt., and Regulatory Oversight of the Comm. on Env't and Pub. Works*, 115th Cong. 49 (2017) (testimony of Jeffrey A. Steers, Former President and Vice-Chair CERCLA Post Construction Focus Group, Association of State and Territorial Solid Waste Management Officials (ASTSWMO)).

[68] *Oversight of CERCLA Implementation: Hearing Before the House Subcomm. on Env't and the Econ. of the Comm. on Energy and Commerce*, 114th Cong. 67 (2016) (testimony of Amy Brittain, Remedial Action Focus Group Chair, ASTSWMO).

[69] 42 U.S.C. §§ 6901–6992k.

[70] RCRA provides EPA with the statutory authority to "control hazardous waste from the 'cradle-to-grave' [including] the generation, transportation, treatment, storage, and disposal of hazardous waste. RCRA also set forth a framework for the management of non-hazardous solid wastes." *Summary of the Resource Conservation and Recovery Act*, EPA, https://www.epa.gov/laws-regulations/summary-resource-conservation-and-recovery-act (last updated Aug. 15, 2018).

[71] *Modernizing the Superfund Cleanup Program: Hearing Before the House Subcomm. on the Env't of the Comm. on Energy and Commerce*, 115th Cong. (2018) (testimony of Stephen A. Cobb, ASTSWMO), *available at* https://docs.house.gov/meetings/IF/IF18/20180118/106783/HHRG-115-IF18-Wstate-CobbS-20180118.pdf.

[72] Burlington N. & Santa Fe Ry. v. United States, 556 U.S. 599 (2009).

liability, appears to have opened a Pandora's box of issues. Circuit and district courts are still struggling to determine what constitutes an "arranger." For example, some courts are now grappling with the question of whether "intent to dispose" requires that the alleged arranger knew that materials being disposed of contained hazardous substances.[73] These and other similar issues[74] could be resolved through congressional action.

5. **EPA should be provided more latitude and flexibility in settling cases.** Cost recovery claims brought by EPA that have not been referred to the U.S. Department of Justice (DOJ) and are settled currently require DOJ approval if total response costs are more than $500,000.[75] Given the complexity of most Superfund sites and the fact that EPA response costs can easily run into the millions of dollars, this rather low threshold creates an unnecessary hurdle for settlement. Furthermore, sometimes the need for DOJ approval creates a disincentive for regional EPA counsel to settle quickly. Due to the $500,000 threshold, EPA may prefer to issue consent decrees for *de minimis* settlements to avoid DOJ involvement, which must be sought when administrative orders are used (though orders may be deemed approved if DOJ does not act within 30 days of referral).[76] The threshold could also be increased to encourage EPA to use arbitration for cost recovery settlements.[77]

6. **Federal income tax credits to encourage low- and moderate-income housing.** Grants issued under the federal Brownfields Program are limited in number. Although EPA receives hundreds of applications, EPA typically awards fewer than 200 grants per year. For example, for fiscal year 2018, EPA awarded 149 grants under the Brownfields Program.[78] The vast majority of these grants were awarded to state and municipal entities, with some going to non-profit organizations.

   Amending CERCLA to provide for federal income tax credits would incentivize private developers to pursue brownfield redevelopment. This concept can be taken a step further and bonuses can be issued for the development of low- or moderate-income housing in urban or suburban areas. This type of program has worked well in New York State. There is no reason why it cannot be implemented on a federal level.

Conclusion

The BUILD Act was, at its core, a basic effort by the 115th Congress to reauthorize the Brownfields Program. While the amendments included a handful of useful but relatively minor changes—such as expanding CERCLA liability protection to governmental entities that acquire property as a result of law enforcement activities, excluding certain Alaska Native villages and corporations from "owner or operator" status, and extending BFPP liability protection to tenants—Congress could have done a lot more to advance the underlying goals of the Superfund program and to update parts of CERCLA that have not been touched in decades.[79] Until that does happen, EPA, state and local governmental entities, and private parties—and the environmental practitioners who represent them all—must continue navigating unnecessary hurdles in the complex web of the federal Superfund statute to achieve the central national cleanup goals.

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[73] *See, e.g.*, Town of Islip v. Datre, 245 F. Supp. 3d 397, 424 (E.D.N.Y. 2017) ("Thus, just as the term 'arrange' implies a specific intent to dispose of the substance, . . . so too does it imply knowledge that the substance is hazardous." (citation omitted)).

[74] Another recent CERCLA case explores the meaning of the term "all costs" in Section 107(a)(1) and considers whether a potentially responsible party should also be responsible for reimbursing the government for costs incurred prior to ownership. *See* Pa. Dept. of Envtl. Prot. v. Trainer Custom Chem., LLC, 906 F.3d 85, 91–94 (3d Cir. 2018).

[75] CERCLA § 122(h)(1), 42 U.S.C. § 9622(h)(1).

[76] CERCLA § 122(g)(4), 42 U.S.C. § 9622(g)(4).

[77] *See* CERCLA § 122(h)(2), 42 U.S.C. § 9622(h)(2).

[78] *See Brownfields Grant Fact Sheet Search*, EPA, https://cfpub.epa.gov/bf_factsheets/ (last visited Mar. 8, 2019) (select "2018" for "Grant Announcement Year" filter and "ALL" for other filters).

[79] It should be noted that the 115th Congress made another set of amendments to CERCLA in the Consolidated Appropriations Act of 2018. Buried even deeper in the spending bill—on page 800 of 878—one will find Title XI of Division S, the "Fair Agricultural Reporting Method Act" or "FARM Act." The FARM Act amended CERCLA Section 103(e) to exempt air emissions from animal waste at a farm from reporting under CERCLA. Pub. L. No. 115-141, div. S, tit. XI, § 1101, 132 Stat. 1147. This is hardly a significant update to Section 103 and arguably does nothing to further CERCLA's underlying goals.

“I Walk the Line” – Ethics & Environmental Law

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NYSBA

Staff Memorandum

HOUSE OF DELEGATES
Agenda Item #7

REQUESTED ACTION: Approval of the report and recommendations of the Committee on Attorney Professionalism.

In 1997, the New York court system adopted Standards of Civility as an appendix to the then-Code of Professional Responsibility, 22 NYCRR Part 1200 (now the Rules of Professional Conduct). The Standards are intended to be "principles of behavior to which the bar, the bench and court employees should aspire" and are not intended to be used for sanctioning or disciplining attorneys. The adoption of standards originally was proposed in a November 1995 report by the Chief Judge's Committee on the Profession and the Courts; in a report presented to the House of Delegates in January 1996 and approved in principle, the NYSBA Review Committee on the Profession and the Courts endorsed the adoption of civility standards.

Last year, the Committee on Attorney Professionalism undertook a review of the Standards with a view toward updating and modernizing them. Attached is the committee's proposed revision of the Standards; as the committee notes, the tone and format of the revision is unchanged, but the Standards are modernized, particularly with respect to communication. In a change, however, the committee proposes the addition of a second section, applicable to non-litigation settings. The committee notes that this section is intended to be read in conjunction with the existing Standards.

The report was presented to the Executive Committee on an informational basis at the January 2019 meeting and was posted in the Reports Community on February 11. No comments have been received with respect to this report, although as noted in the report the Committee on Professional Ethics commented on an earlier draft of the revised standards.

Andrew L. Oringer, chair of the Committee on Attorney Professionalism, together with committee member Robert I. Kantowitz, will present the report at the April 13 meeting.

Report of the
NewYork State Bar Association ("NYSBA")
Committee on Attorney Professionalism

on

Revision of the N.Y. Standards of Civility

February 8, 2019

This Report of the Committee on Attorney Professionalism (the "CAP") relates to proposed changes to the N.Y. Standards of Civility (the "Standards").[*]

I. Introduction

Approximately 20 years ago, the Chief Judge of the N.Y. Court of Appeals promulgated the Standards for the legal profession. As stated in the Preamble of the Standards:

> The New York State Standards of Civility for the legal profession set forth principles of behavior to which the bar, the bench and court employees should aspire. They are not intended as rules to be enforced by sanction or disciplinary action, nor are they intended to supplement or modify the Rules Governing Judicial Conduct, the Code of Professional Responsibility and its Disciplinary Rules [as then known], or any other applicable rule or requirement governing conduct. Instead they are a set of guidelines intended to encourage lawyers, judges and court personnel to observe principles of civility and decorum, and to confirm the legal profession's rightful status as an honorable and respected profession where courtesy and civility are observed as a matter of course.

In 2016, the Chief Judge and the then-chair of the CAP, Lillian Moy, had discussions regarding whether the Standards should be updated, modernized or amended in any way. Those discussions led to the establishment of the Subcommittee on Civility of the CAP and, more generally, the CAP's consideration of possible revisions to the Standards. Attached hereto is a proposed revision of the Standards (the "Proposed Revision"), and a second copy thereof marked to show changes from the existing Standards.

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[*] The primary authors of this Report are Andrew L. Oringer, chair of the CAP, and Robert Kantowitz, chair of the Subcommittee on Civility of the CAP. Helpful comments were received from Richard Rifkin.

II. The Proposed Revision

A. In General

The CAP is aware of the considerable negotiation and effort that resulted in the existing Standards. Thus, the tone, format and content of the Proposed Revision generally are essentially unchanged from the existing Standards. However, much has changed in the over 20 years since the initial adoption of the standards, and efforts have been made to modernize the Standards in several places - in particular regarding communications, where technological advances have been substantial.

B. Application to Non-Litigation Settings

There is a significant addition, which appears towards the end of the Proposed Revision. The new section addresses transactional and other non-litigation work. The new section is intended to be read in conjunction with the Standards as a whole such that all the provisions of the Standards are to be used both together as a source of guidance in the non-litigation context.

In deciding to address the non-litigation context, the CAP had become aware of efforts by certain other bar associations to cause civility (or civility-type) standards to be applicable outside of the litigation process. In addition, it is noted that the President of the NYSBA has expressed support for the expansion of the Standards to non-litigation settings, and, indeed, has advocated for the effectuation of that expansion in a manner that is contained directly within the text of the Standards (rather than, for example, by attaching a supplement to the Standards).

III. Process

It would seem worthwhile to discuss briefly the process that resulted in the Proposed Revision. The Proposed Revision is the product of the work that the Civility Subcommittee of CAP undertook over the past two years. The process was a rigorous one. The drafting involved numerous drafts and evolved substantially over the course of the CAP's robust discussions. As a general matter, the CAP ultimately chose to pursue surgically a series of minor refinements rather than a course of major change, essentially to tweak and modernize the standards.

When the draft got to the initial vote within the Committee, there were three dissenting votes. We proceeded to solicit comments from a variety of other NYSBA committees, and reflected those comments in the drafting to varying degrees. As a result of changes made during that phase, a revised draft received the unanimous approval of the Committee (among those voting), with one express abstention. Thus, the draft was not produced lightly, and eventually consensus was achieved.

An exception to the CAP's narrow approach involves the expansion of the standards to the non-litigation setting, noted above. It is acknowledged that this proposed expansion has drawn a negative comment from the Committee on Professional Ethics (the "CPE"). The CPE notes that there are rules that cover the kinds of aspirational standards we have here. The CAP's view is

that the CPE's comments argue against having civility standards at all. In this regard, it is noted that the Court of Appeals has already approved the existing Standards.

The final draft of the Proposed Revision was presented to the Executive Committee by CAP representatives on January 17, 2019 at the NYSBA's 2019 annual meeting.

IV. Conclusion

The CAP is grateful to have the opportunity to participate in this important project. Representatives of the CAP are to be available at the April 2019 meeting of the House of Delegates to present the Proposed Revision and answer any questions.

DRAFT – 10/15/18

STANDARDS OF CIVILITY

PREAMBLE

The New York State Standards of Civility for the legal profession set forth principles of behavior to which the bar, the bench and court employees should aspire. (The term "court" as used herein also may refer to any other tribunal, as appropriate.) They are not intended as rules to be enforced by sanction or disciplinary action, nor are they intended to supplement or modify the Rules Governing Judicial Conduct, the Rules of Professional Conduct or any other applicable rule or requirement governing conduct. Instead they are a set of guidelines intended to encourage lawyers, judges and court personnel to observe principles of civility and decorum, and to confirm the legal profession's rightful status as an honorable and respected profession where courtesy and civility are observed as a matter of course.

The Standards of Civility are divided into two main sections, one that is generally applicable but also contains a number of items specifically directed to the litigation setting, and one that is more specifically directed to transactional and other non-litigation settings. The first section, in turn, is divided into four parts: lawyers' duties to other lawyers, litigants, witnesses and others; lawyers' duties to the court and court personnel; court's duties to lawyers, parties and witnesses; and court personnel's duties to lawyers and litigants. There is also a Statement of Client's Rights appended to the Standards of Civility.

As lawyers, judges, court employees and officers of the court, and as attorneys generally, we are all essential participants in the judicial process. That process cannot work effectively to serve the public unless we first treat each other with courtesy, respect and civility.

SECTION 1 – GENERAL STANDARDS

LAWYERS' DUTIES TO OTHER LAWYERS, LITIGANTS WITNESSES AND CERTAIN OTHERS

I. Lawyers should be courteous and civil in all professional dealings with other persons.

A. Lawyers should act in a civil manner regardless of the ill feelings that their clients may have toward others.

B. Lawyers can disagree without being disagreeable. Effective representation does not require antagonistic or acrimonious behavior. Whether orally or in writing, lawyers should avoid vulgar language, disparaging personal remarks or acrimony toward other counsel, parties or witnesses.

C. Lawyers should not engage in conduct intended primarily to harass or humiliate witnesses.

D. Lawyers should require that persons under their supervision conduct themselves with courtesy and civility.

II. When consistent with their clients' interests, lawyers should cooperate with opposing counsel in an effort to avoid litigation and to resolve litigation that has already commenced.

A. Lawyers should avoid unnecessary motion practice or other judicial intervention by negotiating and agreeing with other counsel whenever it is practicable to do so.

B. Lawyers should allow themselves sufficient time to resolve any dispute or disagreement by communicating with one another and imposing reasonable and meaningful deadlines in light of the nature and status of the case.

III. A lawyer should respect the schedule and commitments of opposing counsel, consistent with protection of the client's interests.

A. In the absence of a court order, a lawyer should agree to reasonable requests for extensions of time or for waiver of procedural formalities when the legitimate interests of the client will not be adversely affected.

B. Upon request coupled with the simple representation by counsel that more time is required, the first request for an extension to respond to pleadings ordinarily should be granted as a matter of courtesy.

C. A lawyer should not attach unfair or extraneous conditions to extensions of time. A lawyer is entitled to impose conditions appropriate to preserve rights that an extension might otherwise jeopardize, and may request, but should not unreasonably insist on, reciprocal scheduling concessions.

D. A lawyer should endeavor to consult with other counsel regarding scheduling matters in a good faith effort to avoid scheduling conflicts. A lawyer should likewise cooperate with opposing counsel when scheduling changes are requested, provided the interests of his or her client will not be jeopardized.

E. A lawyer should notify other counsel and, if appropriate, the court and other persons at the earliest possible time when hearings, depositions, meetings or conferences are to be canceled or postponed.

IV. Responding to communications.

A lawyer should promptly return telephone calls and electronic communications and answer correspondence reasonably requiring a response, as appropriate. (For the avoidance of doubt, the foregoing refers to communications in connection with matters in which the lawyer is engaged, not to unsolicited communications.) A lawyer has broad discretion as to the manner and time in which to respond and need not necessarily follow the same means or format as the original communication or the manner requested in the original communication.

V. The timing and manner of service of papers should not be designed to cause disadvantage to the party receiving the papers.

A. Papers should not be served in a manner designed to take advantage of an opponent's known absence from the office.

B. Papers should not be served at a time or in a manner designed to inconvenience an adversary.

C. Unless specifically authorized by law or rule, a lawyer should not submit papers to the court without serving copies of all such papers upon opposing counsel in such a manner that opposing counsel will receive them before or contemporaneously with the submission to the court.

VI. A lawyer should not use any aspect of the litigation process, including discovery and motion practice, as a means of harassment or for the purpose of unnecessarily prolonging litigation or increasing litigation expenses.

A. A lawyer should avoid discovery that is not necessary to obtain facts or perpetuate testimony or that is designed to place an undue burden or expense on a party.

B. A lawyer should respond to discovery requests reasonably and not strain to interpret the request so as to avoid disclosure of relevant and non-privileged information.

VII. In depositions and other proceedings, and in negotiations, lawyers should conduct themselves with dignity and refrain from engaging in acts of rudeness and disrespect.

A. Lawyers should not engage in any conduct during a deposition that would not be appropriate in the presence of a judge.

B. Lawyers should advise their clients and witnesses of the proper conduct expected of them in court, depositions and conferences, and make reasonable efforts to prevent clients and witnesses from causing disorder or disruption.

C. A lawyer should not obstruct questioning during a deposition or object to deposition questions unless necessary.

D. Lawyers should ask only those questions they reasonably believe are necessary for the prosecution or defense of an action. Lawyers should refrain from asking repetitive or argumentative questions and from making self-serving statements.

VIII. A lawyer should adhere to all express promises and agreements with other counsel, whether oral or in writing, and to agreements implied by the circumstances or by local customs.

IX. Lawyers should not mislead.

A. A lawyer should not falsely hold out the possibility of settlement as a means for adjourning discovery or delaying trial.

B. A lawyer should not ascribe a position to another counsel that counsel has not taken or otherwise seek to create an unjustified inference based on counsel's statements or conduct.

C. In preparing written versions of agreements and court orders, a lawyer should attempt to correctly reflect the agreement of the parties or the direction of the court.

X. Lawyers should be mindful of the need to protect the standing of the legal profession in the eyes of the public. Accordingly, lawyers should bring the New York State Standards of Civility to the attention of other lawyers when appropriate.

LAWYERS' DUTIES TO THE COURT AND COURT PERSONNEL

I. A lawyer is both an officer of the court and an advocate. As such, the lawyer should always strive to uphold the honor and dignity of the profession, avoid disorder and disruption in the courtroom, and maintain a respectful attitude toward the court.

A. Lawyers should speak and write civilly and respectfully in all communications with the court and court personnel.

B. Lawyers should use their best efforts to dissuade clients and witnesses from causing disorder or disruption in the courtroom.

C. Lawyers should be punctual and prepared for all court appearances; if delayed, the lawyer should notify the court and counsel whenever possible.

II. Court personnel are an integral part of the justice system and should be treated with courtesy and respect at all times.

JUDGES' DUTIES TO LAWYERS, PARTIES AND WITNESSES

I. A Judge should be patient, courteous and civil to lawyers, parties and witnesses.

A. A Judge should maintain control over the proceedings and insure that they are conducted in a civil manner.

B. Judges should not employ hostile, demeaning or humiliating words in opinions or in written or oral communications with lawyers, parties or witnesses

C. Judges should, to the extent consistent with the efficient conduct of litigation and other demands on the court, be considerate of the schedules of lawyers, parties and witnesses when scheduling hearings, meetings or conferences.

D. Judges should be punctual in convening all trials, hearings, meetings and conferences; if delayed, they should notify counsel when possible.

E. Judges should make all reasonable efforts to decide promptly all matters presented to them for decision.

F. Judges should use their best efforts to insure that court personnel under their direction act civilly toward lawyers, parties and witnesses.

DUTIES OF COURT PERSONNEL TO THE COURT, LAWYERS AND LITIGANTS

I. Court personnel should be courteous, patient and respectful while providing prompt, efficient and helpful service to all persons having business with the courts.

A. Court employees should respond promptly and helpfully to requests for assistance or information.

B. Court employees should respect the judge's directions concerning the procedures and atmosphere that the judge wishes to maintain in his or her courtroom.

SECTION 2 - STANDARDS FOR TRANSACTIONAL/NON-LITIGATION SETTINGS

INTRODUCTION

Section 1 of the Standards of Civility, while in many respects applicable to attorney conduct generally, in certain respects addresses the practice of law in the setting of litigation and other formal adversary proceedings, where conduct is governed by a variety of specific procedural rules of order and may be supervised by a judge or other similar official. This Section 2, which is more directed to transactional and other non-litigation settings, should be read with Section 1 as one integrated whole for a profession that has multiple facets and spheres of activity.

The differences in practice between lawyers' roles and the expectations in litigation and other settings can sometimes be significant. Although fewer formal rules of conduct and decorum apply outside of the litigation setting, lawyers conducting transactional work should keep Section 1 of Standards of Civility in mind, along with the following additional items.

ADDITIONAL TRANSACTIONAL/NON-LITIGATION STANDARDS

I. A lawyer should balance the requirements and directions of the client in terms of timing with a reasonable solicitude for other parties. Unless the client specifically instructs to the contrary, a lawyer should not impose deadlines that are more onerous than necessary or appropriate to achieve legitimate commercial and other client-related outcomes.

II. A lawyer should focus on the importance of politeness and decorum, taking into account all relevant facts and circumstances, including such elements as the formality of the setting, the sensitivities of those present and the interests of the client.

III. Where an agreement or proposal is tentative or is subject to approval or to further review by a lawyer or by a client, the lawyer should be careful not to proceed without proper authorization or otherwise imply that authority from the client has been obtained when such is not the case.

STATEMENT OF CLIENT'S RIGHTS

1. You are entitled to be treated with courtesy and consideration at all times by your lawyer and the other lawyers and personnel in your lawyer's office.

2. You are entitled to an attorney capable of handling your legal matter competently and diligently, in accordance with the highest standards of the profession. If you are not satisfied with how your matter is being handled, you have the right to withdraw from the attorney-client relationship at any time (court approval may be required in some matters and your attorney may have a claim against you for the value of services rendered to you up to the point of discharge).

3. You are entitled to your lawyer's independent professional judgment and undivided loyalty uncompromised by conflicts of interest.

4. You are entitled to be charged a reasonable fee and to have your lawyer explain at the outset how the fee will be computed and the manner and frequency of billing. You are entitled to request and receive a written itemized bill from your attorney at reasonable intervals. You may refuse to enter into any fee arrangement that you find unsatisfactory.

5. You are entitled to have your questions and concerns addressed in a prompt manner and to have your telephone calls returned promptly.

6. You are entitled to be kept informed as to the status of your matter and to request and receive copies of papers. You are entitled to sufficient information to allow you to participate meaningfully in the development of your matter.

7. You are entitled to have your legitimate objectives respected by your attorney, including whether or not to settle your matter (court approval of a settlement is required in some matters).

8. You have the right to privacy in your dealings with your lawyer and to have your secrets and confidences preserved to the extent permitted by law.

9. You are entitled to have your attorney conduct himself or herself ethically in accordance with the Rules of Professional Conduct.

10. You may not be refused representation on the basis of race, creed, color, religion, sex, sexual orientation, age, national origin or disability.

AMY K. KENDALL, ESQ.
September 23, 2019
New York State Bar Association
Environmental & Energy Law Section
Fall Meeting

I WALK THE LINE

SCENARIO 1

I KEEP MY EYES WIDE OPEN ALL THE TIME

You represent a user of aqueous film-forming foam (AFFF) in federal multi-district litigation. Discovery is ongoing and you have submitted a response to document demands stating that your client has no documents demonstrating that its use of AFFF has impacted local drinking water supplies. Your client wanted to fund scientific research concerning the fate and transport of PFAS in the watershed and asked you to hire the consultant. You did, and the research proceeds. The research concludes that your client's use of AFFF resulted in contamination of local drinking water sources.

QUESTIONS FOR CONSIDERATION

(1) You just received the report from the expert. You are aware of the scientific research linking PFAS to certain types of cancer and other health impacts. **What is the first thing you do? Review the relevant information and state of the law.**

> **RULE 1.1: COMPETENCE**[1] (a) A lawyer should provide competent representation to a client. Competent representation requires the legal knowledge, skill, thoroughness and preparation reasonably necessary for the representation. (b) A lawyer shall not handle a legal matter that the lawyer knows or should know that the lawyer is not competent to handle, without associating with a lawyer who is competent to handle it.
>
> **Relevant Comments (NYSBA)**
>
> [5] Competent handling of a particular matter includes inquiry into and analysis of the factual and legal elements of the problem, and use of methods and procedures meeting the standards of competent practitioners. It also includes adequate preparation. The required attention and preparation are determined in part by what is at stake; major litigation and complex transactions ordinarily require more extensive treatment than matters of lesser complexity and consequence. An

[1] References to New York Rules of Professional Conduct, 22 NYCRR § 1200 with comments: http://www.nysba.org/WorkArea/DownloadAsset.aspx?id=50671

agreement between the lawyer and the client may limit the scope of the representation if the agreement complies with Rule 1.2(c).

[8] To maintain the requisite knowledge and skill, a lawyer should (i) keep abreast of changes in substantive and procedural law relevant to the lawyer's practice, (ii) keep abreast of the benefits and risks associated with technology the lawyer uses to provide services to clients or to store or transmit confidential information, and (iii) engage in continuing study and education and comply with all applicable continuing legal education requirements under 22 N.Y.C.R.R. Part 1500.

(2) What is the second thing you do? Tell your client.

RULE 1.4: COMMUNICATION (a) A lawyer shall: (1) promptly inform the client of: (i) any decision or circumstance with respect to which the client's informed consent, as defined in Rule 1.0(j), is required by these Rules; (ii) any information required by court rule or other law to be communicated to a client; and (iii) material developments in the matter including settlement or plea offers. (2) reasonably consult with the client about the means by which the client's objectives are to be accomplished; (3) keep the client reasonably informed about the status of the matter; (4) promptly comply with a client's reasonable requests for information; and (5) consult with the client about any relevant limitation on the lawyer's conduct when the lawyer knows that the client expects assistance not permitted by these Rules or other law. (b) A lawyer shall explain a matter to the extent reasonably necessary to permit the client to make informed decisions regarding the representation.

(3) The client says not to reveal the information. What is your obligation in the litigation? Does your analysis change if your client is scheduled to be deposed?

RULE 1.2: SCOPE OF REPRESENTATION AND ALLOCATION OF AUTHORITY BETWEEN CLIENT AND LAWYER

(d) A lawyer shall not counsel a client to engage, or assist a client, in conduct that the lawyer knows is illegal or fraudulent, except that the lawyer may discuss the legal consequences of any proposed course of conduct with a client.

* * *

(f) A lawyer may refuse to aid or participate in conduct that the lawyer believes to be unlawful, even though there is some support for an argument that the conduct is legal.

Relevant Comment:

Illegal and Fraudulent Transactions

[9] Paragraph (d) prohibits a lawyer from counseling or assisting a client in conduct that the lawyer knows is illegal or fraudulent. This prohibition, however, does not preclude the lawyer from giving an honest opinion about the consequences that appear likely to result from a client's conduct. Nor does the fact that a client uses advice in a course of action that is illegal or fraudulent of itself make a lawyer a party to the course of action. There is a critical distinction between presenting an analysis of legal aspects of questionable conduct and recommending the means by which a crime or fraud might be committed with impunity.

[10] When the client's course of action has already begun and is continuing, the lawyer's responsibility is especially delicate. The lawyer is required to avoid assisting the client, for example, by drafting or delivering documents that the lawyer knows are fraudulent or by suggesting how the wrongdoing might be concealed. When the representation will result in violation of the Rules of Professional Conduct or other law, the lawyer must advise the client of any relevant limitation on the lawyer's conduct and remonstrate with the client. *See* Rules 1.4(a)(5) and 1.16(b)(1). Persuading a client to take necessary preventive or corrective action that will bring the client's conduct within the bounds of the law is a challenging but appropriate endeavor. If the client fails to take necessary corrective action and the lawyer's continued representation would assist client conduct that is illegal or fraudulent, the lawyer is required to withdraw. *See* Rule 1.16(b)(1). In some circumstances, withdrawal alone might be insufficient. In those cases the lawyer may be required to give notice of the fact of withdrawal and to disaffirm any opinion, document, affirmation or the like. *See* Rule 1.6(b)(3); Rule 4.1, Comment [3].

RULE 3.3: CONDUCT BEFORE A TRIBUNAL (a) A lawyer shall not knowingly: (1) make a false statement of fact or law to a tribunal or fail to correct a false statement of material fact or law previously made to the tribunal by the lawyer; (2) fail to disclose to the tribunal controlling legal authority known to the lawyer to be directly adverse to the position of the client and not disclosed by opposing counsel; or (3) offer or use evidence that the lawyer knows to be false. If a lawyer, the lawyer's client, or a witness called by the lawyer has offered material evidence and the lawyer comes to know of its falsity, the lawyer shall take reasonable remedial measures, including, if necessary, disclosure to the tribunal. A lawyer may refuse to offer evidence, other than the testimony of a defendant in a criminal matter, that the lawyer reasonably believes is false. (b) A lawyer who represents a client before a tribunal and who knows that a person intends to engage, is engaging or has engaged in criminal or fraudulent conduct related to the proceeding shall take reasonable remedial measures, including, if necessary, disclosure to the tribunal. (c) The duties stated in paragraphs (a) and (b) apply even if compliance requires disclosure of information otherwise protected by Rule 1.6. (d) In an ex parte proceeding, a lawyer shall inform the tribunal of all material facts known to the lawyer that will enable the tribunal to make an informed decision, whether or not the facts are adverse.

Relevant Comment

There are circumstances where failure to make a disclosure is the equivalent of an affirmative misrepresentation. The obligation prescribed in Rule 1.2(d) not to counsel a client to commit or assist the client in committing a fraud applies in litigation. See also Rule 8.4(b), Comments [2]- [3].

RULE 3.4: FAIRNESS TO OPPOSING PARTY AND COUNSEL A lawyer shall not: (a) (1) suppress any evidence that the lawyer or the client has a legal obligation to reveal or produce; (2) advise or cause a person to hide or leave the jurisdiction of a tribunal for the purpose of making the person unavailable as a witness therein; (3) conceal or knowingly fail to disclose that which the lawyer is required by law to reveal;

Comment

[1] The procedure of the adversary system contemplates that the evidence in a case is to be marshaled competitively by the contending parties. Fair competition in the adversary system is secured by prohibitions against destruction or concealment of evidence, improperly influencing witnesses, obstructionist tactics in discovery procedure, and the like. The Rule applies to any conduct that falls within its general terms (for example, "obstruct another party's access to evidence") that is a crime, an intentional tort or prohibited by rules or a ruling of a tribunal. An example is "advis[ing] or caus[ing] a person to hide or leave the jurisdiction of a tribunal for the purpose of making the person unavailable as a witness therein."

[2] Documents and other evidence are often essential to establish a claim or defense. Subject to evidentiary privileges, the right of an opposing party, including the government, to obtain evidence through discovery or subpoena is an important procedural right. The exercise of that right can be frustrated if relevant material is altered, concealed or destroyed. Paragraph (a) protects that right. Evidence that has been properly requested must be produced unless there is a good-faith basis for not doing so. Applicable state and federal law may make it an offense to destroy material for the purpose of impairing its availability in a pending or reasonably foreseeable proceeding, even though no specific request to reveal or produce evidence has been made. Paragraph (a) applies to evidentiary material generally, including computerized information.

(3) What is your obligation regarding the contamination?

RULE 1.4: COMMUNICATION

(a) A lawyer shall:

(5) consult with the client about any relevant limitation on the lawyer's conduct when the lawyer knows that the client expects assistance not permitted by these Rules or other law.

RULE 1.6: CONFIDENTIALITY OF INFORMATION.

(a) A lawyer shall not knowingly reveal confidential information, as defined in this Part, or use such information to the disadvantage of a client or for the advantage of the lawyer or a third person, unless:

(1) the client gives informed consent, as defined in Rule 1.0(j);

(2) the disclosure is impliedly authorized to advance the best interests of the client and is either reasonable under the circumstances or customary in the professional community; or

(3) the disclosure is permitted by paragraph (b).

"Confidential information" consists of information gained during or relating to the representation of a client, whatever its source, that is (a) protected by the attorney-client privilege, (b) likely to be embarrassing or detrimental to the client if disclosed, or (c) information that the client has requested be kept confidential. "Confidential information" does not ordinarily include (i) a lawyer's legal knowledge or legal research or (ii) information that is generally known in the local community or in the trade, field or profession to which the information relates.

(b) A lawyer may reveal or use confidential information to the extent that the lawyer reasonably believes necessary:

(1) to prevent reasonably certain death or substantial bodily harm;

(2) to prevent the client from committing a crime;

(3) to withdraw a written or oral opinion or representation previously given by the lawyer and reasonably believed by the lawyer still to be relied upon by a third person, where the lawyer has discovered that the opinion or representation was based on materially inaccurate information or is being used to further a crime or fraud;

(4) to secure legal advice about compliance with these Rules or other law by the lawyer, another lawyer associated with the lawyer's firm or the law firm;

(5)

(i) to defend the lawyer or the lawyer's employees and associates against an accusation of wrongful conduct; or

(ii) to establish or collect a fee; or

(6) when permitted or required under these Rules or to comply with other law or court order.

(c) A lawyer shall make reasonable efforts to prevent the inadvertent or unauthorized disclosure or use of, or unauthorized access to, information protected by Rule 1.6, 1.9(c), or 1.18(b).

"Thus, a lawyer who knows that a client has accidentally discharged toxic waste into a town's water supply may reveal this information to the authorities if there is a present and substantial risk that a person who drinks the water

> **will contract a life-threatening or debilitating disease and the lawyer's disclosure is necessary to eliminate the threat or reduce the number of victims." Comment 6 to ABA's Model Rules of Professional Conduct[2]; Simon's Rules of Professional Conduct Annotated (2017 Edition), Comment 6A on Rule 1.6, p. 239.**

ABA Comm. on Ethics and Professional Responsibility, Formal Op. 366 (1992) (authorizing a lawyer to withdraw from a representation and to "disaffirm documents prepared in the course of the representation" where the lawyer "knows or with reason believes that her services or work product are being used or are intended to be used by a client to perpetrate a fraud")[3].

SCENARIO 2[4]

AS SURE AS NIGHT IS DARK AND DAY IS LIGHT

You represent a very large oil company. It's 2014. The company's shareholders have just won a lawsuit requiring the company to analyze and disclose financial risks to the company associated with greenhouse gas ("GHG") regulation. Your contact with the client (VP) wants you to draft a one-page summary for publication online stating that the company expects no significant regulation of carbon or GHG for the next 40 years. You are not stupid, and aware that (1) the US has put in place regulations mandating gains in fuel economy, (2) the EU has expanded GHG regulations, and (3) California has adopted a cap and trade system, among other things. You also are familiar with the IPCC reports tying specific deaths to impacts of climate change.

Questions for consideration:

(1) How do you advise your client about the proposed one-pager?

> **RULE 1.13: ORGANIZATION AS CLIENT**
>
> (b) If a lawyer for an organization knows that an officer, employee or other person associated with the organization is engaged in action or intends to act or refuses to act in a matter related to the representation that (i) is a violation of a legal obligation to the organization or a violation of law that reasonably might be imputed to the organization,

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[2] *See* https://www.americanbar.org/groups/professional_responsibility/publications/model_rules_of_professional_conduct/rule_1_6_confidentiality_of_information/

[3] *See also,* John Leubsdorf, Using Legal Ethics to Screw Your Enemies and Clients, 11 Geo. J. Legal Ethics 831, 835 (1998)

[4] Victor B. Flatt, Disclosing the Danger: State Attorney Ethics Rules Meet Climate Change (2019) https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3340130

and (ii) is likely to result in substantial injury to the organization, then the lawyer shall proceed as is reasonably necessary in the best interest of the organization. In determining how to proceed, the lawyer shall give due consideration to the seriousness of the violation and its consequences, the scope and nature of the lawyer's representation, the responsibility in the organization and the apparent motivation of the person involved, the policies of the organization concerning such matters and any other relevant considerations. Any measures taken shall be designed to minimize disruption of the organization and the risk of revealing information relating to the representation to persons outside the organization. Such measures may include, among others:

(1) asking reconsideration of the matter;
(2) advising that a separate legal opinion on the matter be sought for presentation to an appropriate authority in the organization; and
(3) referring the matter to higher authority in the organization, including, if warranted by the seriousness of the matter, referral to the highest authority that can act in behalf of the organization as determined by applicable law.

(c) If, despite the lawyer's efforts in accordance with paragraph (b), the highest authority that can act on behalf of the organization insists upon action, or a refusal to act, that is clearly in violation of law and is likely to result in a substantial injury to the organization, the lawyer may reveal confidential information only if permitted by Rule 1.6, and may resign in accordance with Rule 1.16.

RULE 1.2: SCOPE OF REPRESENTATION AND ALLOCATION OF AUTHORITY BETWEEN CLIENT AND LAWYER

(d) A lawyer shall not counsel a client to engage, or assist a client, in conduct that the lawyer knows is illegal or fraudulent, except that the lawyer may discuss the legal consequences of any proposed course of conduct with a client.

* * *

(f) A lawyer may refuse to aid or participate in conduct that the lawyer believes to be unlawful, even though there is some support for an argument that the conduct is legal.

(2) What do you do if your client refuses to take your advice? Can you write it?

RULE 8.4: MISCONDUCT

A lawyer or law firm shall not:

(a) violate or attempt to violate the Rules of Professional Conduct, knowingly assist or induce another to do so, or do so through the acts of another;

(b) engage in illegal conduct that adversely reflects on the lawyer's honesty, trustworthiness or fitness as a lawyer;

(c) engage in conduct involving dishonesty, fraud, deceit or misrepresentation;

> **Rule 1.0(i) :** ''Fraud'' or ''fraudulent'' denotes conduct that is fraudulent under the substantive or procedural law of the applicable jurisdiction or has a purpose to deceive, provided that it does not include conduct that, although characterized as fraudulent by statute or administrative rule, lacks an element of scienter, deceit, intent to mislead, or knowing failure to correct misrepresentations that can be reasonably expected to induce detrimental reliance by another.

RULE 1.16: DECLINING OR TERMINATING REPRESENTATION

(b) Except as stated in paragraph (d), a lawyer **shall** withdraw from the representation of a client when: (1) the lawyer knows or reasonably should know that the representation will result in a violation of these Rules or of law;

SCENARIO 3[5]

I FIND IT VERY, VERY EASY TO BE TRUE
(or not)

You are an employee of a federal environmental agency working in the air policy office. Your politically appointed boss just advised you to work on a new rulemaking regarding the regulation of GHG in which you should assume that the social cost of carbon is only $1 per ton. You are aware of generally accepted economic data and prior guidance estimating the social cost at about $40 per ton.

Questions for consideration:

(1) Who is your client? Does it matter?

(2) Can you write the rulemaking?

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[5] Victor B. Flatt, Disclosing the Danger: State Attorney Ethics Rules Meet Climate Change (2019) https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3340130

RULE 4.1: TRUTHFULNESS IN STATEMENTS TO OTHERS: In the course of representing a client, a lawyer shall not knowingly make a false statement of fact or law to a third person.

Comment

Misrepresentation

[1] A lawyer is required to be truthful when dealing with others on a client's behalf, but generally has no affirmative duty to inform an opposing party of relevant facts. A misrepresentation can occur if the lawyer incorporates or affirms a statement of another person that the lawyer knows is false. Misrepresentations can also occur by partially true but misleading statements or omissions that are the equivalent of affirmative false statements. As to dishonest conduct that does not amount to a false statement or for misrepresentations by a lawyer other than in the course of representing a client, see Rule 8.4.

Statements of Fact

[2] This Rule refers to statements of fact. Whether a particular statement should be regarded as one of fact can depend on the circumstances. Under generally accepted conventions in negotiation, certain types of statements ordinarily are not taken as statements of fact. Estimates of price or value placed on the subject of a transaction and a party's intentions as to an acceptable settlement of a claim are ordinarily in this category; so is the existence of an undisclosed principal, except where nondisclosure of the principal would constitute fraud. Lawyers should be mindful of their obligations under applicable law to avoid criminal and tortious misrepresentation.

Illegal or Fraudulent Conduct by Client

[3] Under Rule 1.2(d), a lawyer is prohibited from counseling or assisting a client as to conduct that the lawyer knows is illegal or fraudulent. Ordinarily, a lawyer can avoid assisting a client's illegality or fraud by withdrawing from the representation. *See* Rule 1.16(c)(2). Sometimes it may be necessary for the lawyer to give notice of the fact of withdrawal and to disaffirm an opinion, document, affirmation or the like. *See* Rules 1.2(d), 1.6(b)(3).

RULE 8.4: MISCONDUCT A lawyer or law firm shall not:
(a) violate or attempt to violate the Rules of Professional Conduct, knowingly assist or induce another to do so, or do so through the acts of another;
(b) engage in illegal conduct that adversely reflects on the lawyer's honesty, trustworthiness or fitness as a lawyer;
(c) engage in conduct involving dishonesty, fraud, deceit or misrepresentation;
(d) engage in conduct that is prejudicial to the administration of justice;

(3) Should you withdraw from representation? What does that mean?

RULE 1.16: DECLINING OR TERMINATING REPRESENTATION

(b) Except as stated in paragraph (d), a lawyer **shall** withdraw from the representation of a client when: (1) the lawyer knows or reasonably should know that the representation will result in a violation of these Rules or of law….

2019 NYSBA ETHICS OPINIONS
http://www.nysba.org/CustomTemplates/EthicsOpinionList.aspx?id=27987

***Digests quoted directly**

Opinion No. 1160

Digest: Not proper for a New York attorney to affiliate and share fees with a lawyer who, though resident in New York, is not admitted to practice in New York, if the solicitation of clients, sharing of fees, and any other services performed, would as a matter of law constitute the unauthorized practice of law.

Opinion No. 1161

Digest: When a lawyer rather than a broker prepares a real estate contract, the lawyer may not disclose the contract to the broker without the client's informed consent, which must include disclosure of any personal, financial, or business interest of the lawyer in responding to the broker's request for disclosure of the information.

Opinion No. 1162

Digest: A lawyer who forms a tax credit business may not pay referral fees to other lawyers unless the lawyer or his law firm could pay such referral fees under Rule 1.5(g) or 7.2. A lawyer who is an employee of a tax credit business owned by non-lawyers may receive a referral fee from the business if none of the lawyer's activities as an employee constitute the practice of law. A lawyer who is a non-employee consultant to a tax credit business may receive a referral fee if the lawyer is not involved in the underlying transaction, obtains informed client consent, and satisfies Rule 1.8(f); if the lawyer is involved in the underlying transaction, then the lawyer must advise the client of the referral fee and credit the client with that fee.

Opinion No. 1163

Digest: A lawyer represented a defendant who later defaulted in making payments under a settlement agreement, who cannot be now located by the lawyer, and who is facing a motion before a court based on the failure to make such payments, may inform the court that the lawyer no longer represents the defendant if the prior representation ended and the prior action before the court had ended. If the representation of the client had not concluded or the prior matter before the court had not been closed, the lawyer will have to seek permission from the court to withdraw from the representation, after using reasonable efforts to locate the client.

Opinion No. 1164

Digest: A lawyer has an interest in maintaining a copy of client-owned documents provided to the lawyer during a representation, but in certain instances that interest must yield to a client's legitimate request to destroy those copies. To protect the lawyer's exposure to later suit, the lawyer may condition compliance on the client's request on receipt of certain protections that are reasonable in light of all the facts and circumstances attending the client's request.

Opinion No. 1165

Digest: Lawyer may not remove amounts from client's trust account if in dispute. Lawyer may only charge reasonable interest if provided for in the engagement letter.

Opinion No. 1166

Digest: A New York lawyer who operates both a law firm and a consulting firm on intellectual property matters in multiple jurisdictions must determine the applicable ethical rules on a matter-by-matter basis, is not engaged in work distinct from the practice of law, may associate and share fees with a non-U.S. lawyer if certain criteria are met, may not share ownership or share fees with a person not thus qualified as a lawyer, and may not delegate the duty to supervise the work of a non-lawyer.

Opinion No. 1167

Digest: A lawyer who practices under the lawyer's full surname name may use a law firm name that omits a first name and includes only the lawyer's middle name and last name.

Opinion No. 1168

Digest: A lawyer affiliated with firm wholly owned by another lawyer may purchase the firm consistent with Rule 1.17 and may use the name of the seller's firm provided that doing so is not misleading. The meaning of "retired" for purpose of such a sale is as set out in Rule 1.17.

Opinion No. 1169

Digest: Subject to any law or regulation governing the office, a public official may engage in the private practice of law, provided that the public official does not represent any private client in a matter involving the official's jurisdiction, does not participate in any matter in which the lawyer participated personally and substantially while in private practice; does not negotiate for private representation on matters with the jurisdiction in which the official

would have a role; avoids the use of public office to obtain special treatment for a private client, to influence a tribunal in favor of a client, or to receive consideration from anyone in the guise of legal fees in order to influence official conduct; and does not represent a private client with interests adverse to a person about whom the official acquired confidential government information in a matter in which the information could be used to that person's material disadvantage.

Opinion No. 1170

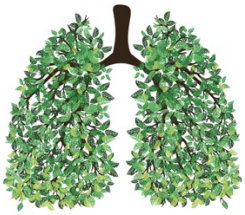
Digest: A Village Attorney who does not represent the Village in court or in criminal matters, may represent private clients in defense of traffic violations, criminal proceedings, or Town Ordinance violation cases brought in the same Town Court that adjudicates such matters arising from summonses issued and arrests that occurred within the Village boundaries, provided that the lawyer adheres to rules governing conflicts and current government employees.

Opinion No. 1171

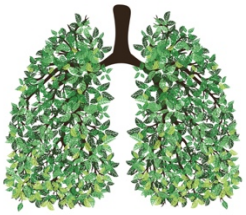
Digest: A lawyer may not engage in deceptive conduct to help clients in foreign countries circumvent currency controls of that country.

Mindfulness Program: “Mohonk State of Mind” (with thanks to Billy Joel)

Lynn Bogin, JD, Ph.D.
Astor Services for Children and Families | Blue Lotus Mental Health Counseling



4-7-8 Breathing Exercise



For optimal results, it is recommended that you sit up straight with your shoulders back.

Upon Inhalation you will breathe through your nose and exhale out of your mouth

During this exercise give all your attention to your breath and bodily sensations. Notice the air passing through your nasal passages and out through your mouth, notice the rise and fall of your abdomen.

Instructions

1. Close your mouth and inhale into your diaphragm and through the nose to a count of 4.
2. Hold your breath for a count of 7.
3. Exhale through your mouth to a count of 8.
4. Complete three repetitions, twice daily.

*if holding your breath for this long is difficult, shorten the exercise but keep the same ratio eg. 2-3.5-4

MINDFULNESS IN LAW: A PATH TO WELL-BEING AND BALANCE FOR LAWYERS AND LAW STUDENTS

Charity Scott*

The National Task Force on Lawyer Well-Being has raised strong concerns about the poor state of the mental health and well-being of lawyers and law students across the country. The co-chairs of the Task Force concluded that recent studies' findings of professional ill health and lack of well-being were incompatible with a sustainable legal profession and raised troubling implications for many lawyers' basic competence. This Article takes an in-depth look at the relevance of mindfulness for the legal profession and legal education and offers mindfulness as one way to begin to respond effectively to the Task Force's concerns. After first reviewing studies demonstrating high rates of depression, anxiety, and substance abuse among lawyers and law students, it reviews personal and professional options that have been used to date, with limited success, to address these problems, and it offers that developing a routine mindfulness practice could be one potential, effective solution to promoting the mental health and well-being of lawyers and law students. This Article explains what mindfulness is, describes a few of its most common meditation practices, and explores the benefits that can ensue from regular mindful practices, which have been scientifically supported in the clinical literature. It analyzes how the Author's law school has incorporated mindfulness and other wellness programs into its offerings for law students and offers some recommendations for how other law schools and legal employers might adopt mindfulness programs. This Article concludes by encouraging law schools and legal employers to incorporate mindfulness training and other wellness programs designed to enhance the health and well-being of law students and lawyers.

TABLE OF CONTENTS

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INTRODUCTION

Mindfulness has become a hot topic in the news and on social media.[1] Major corporations—including Google, General Mills, Intel, Aetna, and Goldman Sachs—have adopted mindfulness programs for their employees.[2] Mindfulness

1. Jacob Gershman, *Lawyers Go Zen, With Few Objections*, WALL ST. J. (June 18, 2015), https://www.wsj.com/articles/lawyers-go-zen-with-few-objections-1434586250; *Mindfulness Is Sweeping the Western World 'at a Momentous Rate' Says Its Pioneer*, POSITIVE NEWS (Apr. 20, 2013), https://www.positive.news/2013/lifestyle/wellbeing/12051/mindfulness-sweeping-western-world-at-momentous-rate-pioneer/.

2. Henry Stewart, *Five Big Companies Who Swear by Mindfulness*, LINKEDIN (Aug. 17, 2015), https://www.linkedin.com/pulse/five-big-companies-who-swear-

training has also been introduced in other diverse settings, such as universities,[3] schools,[4] religious institutions,[5] health-care organizations,[6] professional sports,[7] police departments,[8] prisons,[9] and the U.S. military.[10]

This Article explores the relevance of mindfulness to the legal profession and legal education. Part I reviews studies that demonstrate that lawyers and law students have high rates of depression, anxiety, and substance abuse. Part II of this Article reviews professional and personal options that have been used to date, with limited success, to address these problems. In addition, Part II suggests that

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mindfulness-henry-stewart/; Jeanne Meister, *Future of Work: Mindfulness As a Leadership Practice*, FORBES (Apr. 27, 2015, 1:35 PM), http://onforb.es/1FrSfcc.

3. Sally Weale, *Mindfulness Boosts Student Mental Health During Exams, Study Finds*, THE GUARDIAN (Dec. 18, 2017, 6:30 PM), https://www.theguardian.com/lifeandstyle/2017/dec/18/mindfulness-boosts-student-mental-health-during-exams-cambridge-university-study-finds.

4. Kelly Wallace, *Calming the Teenage Mind in the Classroom*, CNN (Feb. 9, 2016), https://www.cnn.com/2016/02/08/health/mindfulness-teenagers-schools-stress/index.html.

5. *See, e.g.*, *Living Life Deliberately: Mindfulness Meditation in Daily Life*, CHURCH HEALTH (Jan. 29, 2018), https://churchhealth.org/event/living-life-deliberately-mindfulness-meditation-in-daily-life-19/; *Mindfulness-Based Stress Reduction*, OLD ST. PATRICK'S CHURCH (July 18, 2017), http://www.oldstpats.org/mbsr/; *Mindfulness Meditation*, THE CATHEDRAL OF HOPE, http://cathedralofhope.org/event/mindfulness-meditation/all/.

6. Pandit Dasa & David Brendel, *Does Mindfulness Training Have Business Benefits*, SOC. FOR HUMAN RESOURCE MGMT. (Mar. 23, 2017), https://www.shrm.org/hr-today/news/hr-magazine/0417/pages/does-mindfulness-training-have-business-benefits.aspx.

7. Gretchen Reynolds, *Does Mindfulness Make for a Better Athlete*, N.Y. TIMES: WELL (Sept. 30, 2015, 5:45 AM), https://well.blogs.nytimes.com/2015/09/30/does-mindfulness-make-for-a-better-athlete/; Christine Yu, *Mindfulness for Athletes: The Secret to Better Performance*, DAILY BURN (June 10, 2014), http://dailyburn.com/life/fitness/mindfulness-techniques-athletes/.

8. Hanna Kozlowska, *U.S. Police Forces are Practicing Mindfulness to Reduce Officers' Stress—and Violence*, QUARTZ (Jul. 10, 2017), https://qz.com/1025231/police-departments-in-the-us-are-practicing-mindfulness-to-reduce-officers-stress-and-violence/; *Richard Goerling: Mindful Policing*, MINDFUL (Mar. 16, 2017), https://www.mindful.org/richard-goerling-mindful-policing.

9. *3 Ways Prisons Are Becoming Mindful*, MINDFUL (Mar. 27, 2017), https://www.mindful.org/3-ways-prisons-becoming-mindful/; Lindsay Holmes, *This 2-Minute Practice Could Make Prisons a Healthier Place*, HUFFPOST (Nov. 7, 2016, 12:33 PM), https://www.huffingtonpost.com/entry/mindfulness-benefits-corrections-officers_us_581a2941e4b08f9841acc5be.

10. Ella Xiong, *Mindfulness in the Military*, DISCOVER: THE CRUX (Apr. 14, 2016, 3:17 PM), http://blogs.discovermagazine.com/crux/2016/04/14/meditation-in-the-military-ptsd/#.WnzFV5M-dmA; Melissa Myers, *Improving Military Resilience Through Mindfulness Training*, U.S. ARMY (June 1, 2015), https://www.army.mil/article/149615/improving_military_resilience_through_mindfulness_training; Tom Jacobs, *Mindfulness Training Produces Less-Stressed Marines*, PAC. STANDARD (May 15, 2014), https://psmag.com/social-justice/mindfulness-training-produces-less-stressed-marines-81633.

developing a routine mindfulness practice could be one potential effective solution to promote the mental health and well-being of lawyers and law students. Parts III and IV explain what mindfulness is and describe a few of its most common meditation practices. Part V explores the benefits, which have been scientifically supported in the clinical literature, that can ensue from regular mindful practices. Part VI reviews some of the neuroscientific evidence suggesting how meditation can positively change brain structure and function. Part VII identifies some challenges to maintaining a mindfulness practice over the long term. Part VIII explores how the Author's law school has incorporated mindfulness and other wellness programs into its offerings for law students, and it offers some recommendations for how other law schools and legal employers might tailor mindfulness and other wellness programs to their institutions. This Article concludes by offering the reflections of a law student who writes about how she has benefitted from mindfulness training, and by encouraging law schools and legal employers to incorporate mindfulness training and other wellness programs into their curriculum and practices to enhance the health and well-being of law students and lawyers.

I. WHAT'S THE PROBLEM?

Anecdotal evidence and the personal experiences of practicing lawyers attest to the high amounts of stress in their daily lives. By nature, lawyers tend to be both perfectionists and pessimists, concerned with zealously protecting their clients' welfare to the best of their abilities and constantly looking out for downsides, risks, and practical and legal problems with alternate courses of action. Coupled with often-overwhelming workloads to be handled under tight time pressures, this continual state of high alertness unrelieved by breaks and downtime can lead to stress, frustration, and burnout.[11]

In August 2017, the National Task Force on Lawyer Well-Being sounded a piercingly loud alarm about the poor state of the mental health and well-being of lawyers and law students.[12] In light of two previous studies on lawyer mental health and substance-use disorders and law-student well-being (whose results are reported below in Part II), the co-chairs of the Task Force bluntly stated:

> To be a good lawyer, one has to be a healthy lawyer. Sadly, our profession is falling short when it comes to well-being. The two studies referenced above reveal that too many lawyers and law students experience chronic stress and high rates of depression and substance use. These findings are incompatible with a sustainable legal profession, and they raise troubling implications for many lawyers' basic competence. This research suggests that the current

11. Leslie A. Gordon, *How Lawyers Can Avoid Burnout and Debilitating Anxiety,* A.B.A. J. (July 2015), http://www.abajournal.com/magazine/article/how_lawyers_can_avoid_burnout_and_debilitating_anxiety.

12. NATIONAL TASK FORCE ON LAWYER WELL-BEING, THE PATH TO LAWYER WELL-BEING: PRACTICAL RECOMMENDATIONS FOR POSITIVE CHANGE 7 (2017), https://www.americanbar.org/content/dam/aba/images/abanews/ThePathToLawyerWellBeingReportFINAL.pdf [hereinafter NATIONAL TASK FORCE REPORT].

> state of lawyers' health cannot support a profession dedicated to client service and dependent on public trust.[13]

A. Attorney Survey

A 2016 survey (the Krill study) of 12,825 licensed, employed attorneys assessed their alcohol use, drug use, and symptoms of depression, anxiety, and stress.[14] The Krill study found substantial rates of behavioral-health problems, which were experienced at the following levels among this population: 28% for depression, 19% for anxiety, 23% for stress, and 20.6% for problematic drinking.[15]

Younger lawyers and men were more at risk for the harmful use of alcohol.[16] Men had higher levels of depression, while women had higher levels of anxiety and stress.[17] These levels were assessed at the time the survey was taken. "In terms of career prevalence, 61% reported concerns with anxiety at some point in their career and 46% reported concerns with depression."[18] While fewer than 1% of the attorneys reported suicide attempts, 2.9% reported self-injurious behaviors, and 11.5% reported suicidal thoughts at some point in their careers.[19]

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13. *Id.* at 1.

14. Patrick Krill, Ryan Johnson & Linda Albert, *The Prevalence of Substance Use and Other Mental Health Concerns Among American Attorneys*, 10 J. ADDICT. MED. 46, 46 (2016) [hereinafter *Krill study*], http://journals.lww.com/journaladdictionmedicine/Fulltext/2016/02000/The_Prevalence_of_Substance_Use_and_Other_Mental.8.aspx. The study was supported by the Hazelden Betty Ford Foundation and the ABA Commission on Lawyer Assistance Programs. *Id.*

15. *Id.* at 51. For comparison, while 20.6% of attorneys in the *Krill study* screened positive for "hazardous, harmful, and potentially alcohol-dependent drinking," other studies using the same measurement scale found that 15% of physicians screened positive for problematic drinking, as did 11.8% of a broad, highly educated workforce. *Id.* Attorneys in their first ten years of practice experienced the highest rate of problematic drinking (28.9%), and those under age 30 had the highest rates of all (32.3%). *Id.* Mental-health concerns often co-occur with alcohol-use disorders, and the *Krill study* showed significantly higher levels of depression, anxiety, and stress among those who screened positive for problematic alcohol use. *Id.* Attorneys working in private law firms had some of the highest levels of problematic alcohol use compared with other work environments—e.g., government, non-profit, in-house counsel. *Id.* In the *Krill study*, 84.1% of surveyed attorneys reported using alcohol in the last year. *Id.* at 47. For comparison, about 65% of the general population drinks alcohol. Eilene Zimmerman, *The Lawyer, The Addict: A high-powered Silicon Valley attorney dies. His ex-wife investigates, and finds a web of drug abuse in his profession*, N.Y. TIMES (July 15, 2017), https://www.nytimes.com/2017/07/15/business/lawyers-addiction-mental-health.html. Whether attorneys are drinking to cope with their psychological or emotional problems, or their drinking is leading to these problems, the *Krill study* noted that "the ubiquity of alcohol in the legal professional culture certainly demonstrates both its ready availability and social acceptability." *Krill study*, *supra* note 14, at 51.

16. *Krill study*, *supra* note 14, at 48.

17. *Id.* at 49.

18. *Id.* at 51.

19. *Id.* at 50.

The Krill study data that were collected on attorneys' drug use (both licit and illicit drugs) did not allow the researchers to draw statistically valid inferences.[20] Only one-quarter of those attorneys in the survey answered questions about their drug use, leading the study's lead author, Patrick Krill, to observe the following: "It's left to speculation what motivated 75% of attorneys to skip over the section on drug use as if it wasn't there," possibly fear of consequences for bar licensing.[21] While alcohol is still the number-one substance-abuse problem for attorneys, the second-most commonly abused substance is prescription drugs.[22] A substance-abuse recovery expert said that:

> [W]e're seeing a significant rate of increase specifically among attorneys using prescription medications that become a gateway to street drugs. [It used to be mostly alcohol] but now almost every attorney that comes in for treatment, even if they drink, they are using drugs too—Xanax, Adderall, opiates, cocaine, and crack.[23]

Just as problematic drinking can be associated with stress, depression, and anxiety, it can also be associated with opioids and stimulants. "In fact, drugs [including cocaine] are sometimes used to combat the symptoms of alcohol withdrawal."[24] With respect to the Krill study participants who acknowledged using a specific substance class in the previous 12 months, the report showed the following rates of highest weekly usage: stimulants (74.1%), sedatives (51.3%), tobacco (46.8%), marijuana (31.0%), and opioids (21.6%).[25]

Only 6.8% of the surveyed attorneys reported past treatment for alcohol or drug use.[26] Attorneys reported that the two largest barriers to seeking treatment were not wanting others to find out that they needed help and concerns regarding privacy or confidentiality.[27]

B. Law-Student Survey

Similar findings were reported in 2016 based on the Survey of Law Student Well-Being (the SLSWB study), in which approximately 3,300 law students at 15 law schools across the country participated.[28] The SLSWB study primarily sought

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20. *Id.* at 49.
21. Zimmerman, *supra* note 15.
22. *Id.*
23. *Id.*
24. *Id.*
25. *Krill study*, *supra* note 14, at 49. Overall, the percentages of attorneys who acknowledged using the following substances in the previous 12 months were: alcohol (84.1%), tobacco (16.9%), sedatives (15.7%), marijuana (10.2%), opioids (5.6%), stimulants (4.8%), and cocaine (0.8%). *Id.*
26. *Id.* at 50.
27. *Id.*
28. Jerome M. Organ, David B. Jaffe & Katherine M. Bender, *Suffering in Silence: The Survey of Law Student Well-Being and the Reluctance of Law Students to Seek Help for Substance Use and Mental Health Concerns*, 66 J. LEGAL EDUC. 116–56 (2016), http://jle.aals.org/home/vol66/iss1/13/ [hereinafter *SLSWB study*]. Study results focusing on law students' help-seeking behaviors were previously published by the same authors in

to determine the extent of alcohol use, drug use, and mental-health issues among law students, and whether law students were reluctant to seek help for these issues and the reasons for such reluctance.[29] The study found the following percentages of law-student respondents engaged in alcohol use: 53% drank enough to get drunk in the prior 30 days, 43% binge drank at least once in the prior two weeks (median number of drinks was seven for men, five for women), and 22% binge drank two or more times in the prior two weeks.[30] The study found the percentages of law students who used street drugs were as follows: 25% used marijuana in the last 12 months, 14% used marijuana in the last 30 days, 6% used cocaine in the last 12 months, and 2% used cocaine in the last 30 days.[31] Fourteen percent of law students reported using prescription drugs without a prescription in the last 12 months, while 9% used stimulants (of these, 79% used Adderall), and 4% used sedatives/ anxiety medication.[32]

The SLSWB study found the following percentages of law-student respondents who screened positive for the following mental-health issues: 17% for depression,[33] 37% for anxiety (of which 23% experienced mild to moderate anxiety

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Helping Law Students Get the Help They Need: An Analysis of Data Regarding Law Students' Reluctance to Seek Help and Policy Recommendations for a Variety of Stakeholders, B. EXAMINER, Dec. 2015, at 8–17, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2815513. The SLSWB study was sponsored by the ABA Commission on Lawyer Assistance Programs, Law Student Division, Solo, Small Firm and General Practice Division, Young Lawyers Division, and Commission on Disability Rights, as well as with support from the Dave Nee Foundation. *SLSWB study*, *supra*, at 118.

29. *SLSWB study*, *supra* note 28, at 118.

30. *Id.* at 128–29. For comparison, other studies that screened other graduate students and undergraduate students for alcohol use reported the percentages as, respectively, 39%, 36%, and 21% (graduate) and 61%, 45%, and 30% (undergraduate). *Id.* at 128. SLSWB study respondents ages 21–30 were approximately twice as likely to report binge-drinking behavior as those over age 30. *Id.* at 129. Twenty-five percent of respondents (27% men, 23% women) screened positive for needing more careful evaluation for alcoholism. *Id.* at 131.

31. *Id.* at 133. For comparison, the percentages for graduate students were 14% and 7% (marijuana) and 2% and 1% (cocaine), and for undergraduate students the percentages were 33% and 18% (marijuana) and 4% and 1% (cocaine). *Id*.

32. *Id.* at 134–35. The most commonly reported reasons for using prescription stimulants without a prescription were to concentrate better while studying (67%) and to increase alertness to study longer (64%). *Id.* Nearly 20% said they used prescription stimulants without a prescription in order to "prevent other students who [use a prescription stimulant] from having an academic edge over me." *Id.* at 135.

33. *Id.* at 136. This percentage of law-student respondents who screened positive for depression compares with 14% of other graduate-student respondents and 20% of undergraduate respondents. *Id.*

and 14% experienced severe anxiety),[34] and 6% for having had serious suicidal thoughts in the past 12 months.[35]

A primary focus of the SLSWB study was on law students' attitudes toward seeking help for substance use or mental-health issues. Of the students who reported that they were likely or very likely to seek help for an alcohol or drug problem, 81% said they would seek help from a health professional, 30% from a lawyer-assistance program, and 14% from a law-school dean of students.[36] Of the students who reported that they were likely or very likely to seek help for a mental-health concern, 79% said they would seek help from a health professional, while 15% said they would seek help from a law-school dean of students.[37] Only 4% reported that they had actually used a health professional for alcohol or drug issues.[38] With respect to mental-health issues, 42% of law-student respondents reported a perceived need for help with emotional or mental-health problems, yet only approximately half of these respondents actually received counseling from a health professional.[39]

The most common factors that discouraged the law-student respondents from seeking help from a health professional with respect to substance-use and mental-health concerns are depicted in Figure 1.[40]

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34. *Id.* at 137. For comparison, the percentage of graduate students who screened positive for anxiety was 15% and for undergraduate students was 21%, of which 5% (graduate) and 8% (undergraduate) was for severe anxiety. *Id.*

35. *Id.* at 139. For comparison, 9% of undergraduate respondents and 5% of graduate-student respondents reported they had thought seriously about suicide in the prior 12 months. *Id.*

36. *Id.* at 140 n.91.

37. *Id.* at 140.

38. *Id.*

39. *Id.* Female respondents (50%) were more likely than male respondents (31%) to report a perceived need for help with mental-health concerns, and of those, female respondents (28%) reported getting help with more frequency than male respondents (19%). *Id.* at 140. Within the subgroup of respondents with three or more of five issues of concern (two or more incidents of binge drinking, use of street drugs, use of prescription drugs without a prescription, positive screening for depression, or positive screening for severe anxiety), the percentages believing that they were better off keeping their problems to themselves were high for alcohol/drug use (72%) and mental health (62%), leading the study authors to suggest that "those who might benefit the most from getting help appear to be among those least inclined to seek help." *Id.* at 142.

40. *Id.* at 141.

Figure 1.

Discouraging Factor	Percentage Regarding Substance Use	Percentage Regarding Mental Health
Potential threat to bar admission	63%	45%
Potential threat to job or academic status[41]	62%	48%
Social stigma[42]	43%	47%
Concerns about privacy	43%	30%
Financial reasons	41%	47%
Belief that they could handle the problem themselves[43]	39%	36%
Not having time	36%	34%

II. SOLUTIONS: WHAT CAN BE DONE?

The National Task Force Report makes a wide range of recommendations for judges, regulators, legal employers, law schools, bar associations, lawyers' professional-liability carriers, and lawyer-assistance programs. The Report incorporates many of the recommendations from the earlier Krill and SLSWB studies, and it suggests reforms in institutional structures, incentives, and behaviors to support their respective constituents' health and well-being.[44] Part II reviews

41. Third-year law students were more likely to express this concern than first-year law students, leading the study authors to suggest that "while in law school, students are getting messages indicating that seeking help for mental health concerns or alcohol/drug concerns may be problematic for their academic or professional careers." *Id.*

42. Male respondents (54%) had a higher concern than female respondents (41%) about the social stigma associated with mental-health issues. *Id.*

43. Male respondents were more likely than female respondents to think they could handle things themselves with respect to substance-use (51% for males; 30% for females) and mental-health concerns (45% for males; 29% for females). *Id.*

44. NATIONAL TASK FORCE REPORT, *supra* note 12, at 35–40 (specific recommendations for law schools); *id.* at 41–42 (specific recommendations for bar associations); *id.* at 45–46 (specific recommendations for lawyer-assistance programs). More generally, the report made broad recommendations for all legal-professional stakeholders, including, *inter alia*, acknowledging the problems and taking responsibility for them, demonstrating that institutional leaders are personally committed to well-being, encouraging help-seeking behaviors, consulting with well-being experts, fostering collegiality and respect throughout the profession, promoting diversity and inclusivity, creating mentoring programs, enhancing lawyers' sense of control, providing educational programs and materials about lawyer well-being, deemphasizing alcohol at social events, utilizing monitoring to support recovery from substance-use disorders, and beginning a dialogue about suicide prevention. *Id.* at 12–21.

some of these recommendations and highlights some individual and professional options for lawyers and law students that, unfortunately, to date have been insufficient by themselves to ensure lawyers' and law students' health and well-being.

A. Personal Options

The usual recommendations for stress relief and the promotion of health and well-being—such as healthy diet, regular exercise, adequate sleep, development of social relationships, and time off for recreational activities and vacations—are well known and have been shown to contribute to well-being.[45] However, all of these activities require the self-discipline to make the time and space for them in one's life, which can seem challenging or impossible in the context of lawyers' and law students' day-to-day, often overwhelmingly busy and demanding work lives.

These recommendations are sound and largely aimed at prevention of serious health problems. Unfortunately, many lawyers and law students neglect these strategies until health disorders arise. Professional counseling and mental-health therapy are options for individual attorneys who are at risk for, or have developed, mental and behavioral issues. However, the stigma and reputational risks perceived to be associated with seeking professional help—particularly in the legal-professional culture of perfectionism, self-sufficiency, and competence—can deter individuals from seeking the help they need (as evidenced by the Krill and SLSWB studies discussed above).

B. Professional Options

Bar associations have developed lawyer-assistance programs to help attorneys cope with behavioral-health issues once they arise, although it is likely that these programs are underutilized. The ABA's Commission on Lawyer Assistance Programs offers a range of resources, including free videos and contact information for organizations that can help address these issues.[46]

To overcome the pervasive stigma associated with substance-use disorders and mental-health issues, the Krill study encouraged more public-awareness campaigns and professional education aimed at prevention.[47] To address privacy

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45. *See* Debra S. Austin, *Killing Them Softly: Neuroscience Reveals How Brain Cells Die from Law School Stress and How Neural Self-Hacking Can Optimize Cognitive Performance*, 59 LOY. L. REV. 791, 828–54 (2013), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2227155 (reviewing the neurobiology of a variety of activities that can improve cognitive performance, including exercise, sleep, and contemplative practices such as mindfulness, meditation, yoga, relaxation training, and gratitude practices, and concluding that "[n]eural self-hacking is likely to be the newest fitness movement and law students, law professors, and lawyers should be among the early adopters of a regimen of cognitive wellness.").

46. *Commission on Lawyer Assistance Studies*, A.B.A.., https://www.americanbar.org/groups/lawyer_assistance.html (last visited July 27, 2018).

47. *Krill study*, *supra* note 14, at 52.

concerns, it recommended that the confidential nature of lawyer-assistance programs be more widely publicized.[48]

The authors of the SLSWB study on law-student well-being addressed many of their recommendations to law-school faculty, staff, and administrators. Law-school applications often have character–and-fitness questions that are similar to those of a state bar, and so admissions officials may have the ability to identify potentially-at-risk students early on and refer them to resources, including the law school's dean of students.[49] However, in light of the SLSWB study's finding that most students are reluctant to seek help from a dean of students, the dean of students must be well informed and able to effectively raise awareness about wellness issues and resources and help students cope with law-school stressors in a caring and productive way.[50] Faculty are often on the conversational front lines with students and should be trained to recognize warning signs of behavioral-health issues and to refer to other professionals for help.[51]

To reduce the stigma associated with alcohol, drug, and mental-health issues, the SLSWB study's authors recommended that law schools actively publicize their alternative wellness resources beyond the dean of students because such publicity normalizes the process of seeking help.[52] They also recommended coordinating law-school efforts with the local Board of Law Examiners and the state bar's lawyer-assistance program to develop a concerted approach to wellness.[53] Coordination with the state bar conveys that these are real-world concerns, and they should be addressed while in school.[54]

C. Mindfulness Options

Mindfulness is both a personal and professional option. While it is practiced on an individual basis, it can be supported easily by employers, bar associations, and law schools, which can make the trainings available to their lawyers or law students and encourage mindfulness practices during the work week.

The National Task Force Report strongly endorsed the benefits of mindfulness meditation for the legal profession:

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48. *Id.*

49. David Jaffe, who is the Associate Dean for Student Affairs at American University Washington College of Law and was the lead author for the law-school section of the National Task Force Report, has advocated for bringing at-risk entering law students "to the attention of someone at the law school for targeted, positive outreach. These students need to know that they are admitted unconditionally and that, should new stressors inherent to law school exacerbate preexisting conditions, they have one or more confidential resources to turn to." David B. Jaffe, *The Key to Law Student Well-Being? We Have to Love Our Law Students*, PD Q. 11, 12 (Feb. 2018), https://www.wcl.american.edu/impact/lawwire/the-key-to-law-student-well-being-we-have-to-love-our-law-students/article/.

50. *SLSWB study*, *supra* note 28, at 147–48.

51. *Id.* at 153.

52. *Id.* at 150.

53. *Id.*

54. *Id.*

> Mindfulness meditation is a practice that can enhance cognitive reframing (and thus resilience) by aiding our ability to monitor our thoughts and avoid becoming emotionally overwhelmed . . . . Research has found that mindfulness can reduce rumination, stress, depression, and anxiety. It also can enhance a host of competencies related to lawyer effectiveness, including increased focus and concentration, working memory, critical cognitive skills, reduced burnout, and ethical and rational decision-making. . . . Evidence also suggests that mindfulness can enhance the sense of work-life balance by reducing workers' preoccupation with work.[55]

Mindfulness is not a substitute for professional counseling when such counseling is needed. It can, however, be an effective practice to maintain personal equanimity and foster resilience in an increasingly stressful profession and distracted world.

III. WHAT IS MINDFULNESS, AND WHAT IS ITS RELEVANCE FOR LAWYERS AND LAW STUDENTS?

According to Jon Kabat-Zinn, professor of medicine emeritus at the University of Massachusetts Medical Center and creator of the highly successful mindfulness-based stress reduction (MBSR) program, mindfulness "is awareness, cultivated by paying attention in a sustained and particular way: on purpose, in the present moment, and non-judgmentally."[56] In typical lawyer fashion, we need to parse each of these phrases to understand their importance and relevance to the legal profession.[57]

Awareness. Lawyers are understandably achievement oriented and spend years of hard work during and after law school to become experts in their fields. However, professional expertise can come at a cost to personal growth if it closes off our natural attributes of open-mindedness and curiosity. We can get stuck as human *doings*, rather than living fully as human *beings*. Despite widespread use of the Socratic method in law-school classrooms to promote learning to "think like a lawyer," legal education and the legal profession too often deemphasize the Socratic principle to "know thyself."[58] Learning to become a self-aware and self-reflective

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55. NATIONAL TASK FORCE REPORT, *supra* note 12, at 52–53 (citations omitted).

56. JON KABAT-ZINN, MINDFULNESS FOR BEGINNERS: RECLAIMING THE PRESENT MOMENT—AND YOUR LIFE 1 (2012). For other books that introduce mindfulness to the general public, see generally BHANTE HENEPOLA GUNARATANA, MINDFULNESS IN PLAIN ENGLISH (2015); DANIEL GOLEMAN, ELLEN LANGER & SUSAN DAVID, HARVARD BUSINESS REVIEW, MINDFULNESS: HBR EMOTIONAL INTELLIGENCE SERIES (2017).

57. This Part III has been adapted from Charity Scott, *Tips for Practitioners/Practicing Mindfulness in Law*, GA. ST. L. ALUMNI MAG., Spring 2016, at 30, and it is incorporated here with permission.

58. The Socratic ideal of self-knowledge goes back to the Delphic inscription on the Temple of Apollo to "know thyself." Donald Phillip Verene, *Vichian Moral Philosophy: Prudence as Jurisprudence*, 83 CHI.-KENT L. REV. 1107, 1110 (2008); *see* Richard K. Neumann Jr., *Donald Schön, The Reflective Practitioner, and the Comparative Failures of Legal Education*, 6 CLINICAL L. REV. 401, 424 (2000) (observing that reflective journaling is

practitioner, continually open and curious about oneself and one's world, is perhaps the most important lawyering skill that someone can develop for effectively navigating a professional life that is increasingly characterized by rapid change, continual uncertainty, and clashing ethical values.[59]

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limited to clinical courses in law schools and that "legal education is far behind all the other professions in providing reflective practica").

59. Professor Donald Schön's work on the reflective practitioner pioneered the view that professionals often must act well in situations of "uncertainty, instability, uniqueness, and value conflict," and that they do so best through a process of "reflection-in-action." DONALD A. SCHÖN, THE REFLECTIVE PRACTITIONER: HOW PROFESSIONALS THINK IN ACTION 50 (1983). In this book, Schön contrasted his view with the more traditional view of professional practice as the exercise of technical expertise. *Id.* at 69. Since this book was published, reformers in legal education have championed the role of self-reflection in legal education and the profession. For example, in Best Practices for Legal Education: A Vision and a Road Map, the authors cite to Schön's works on reflective learning by professionals and state that "[a]ll professionals must be life-long learners. . . . The key skill set of lifelong learners is reflection skills. The entire law school experience should help students become expert in reflecting on their learning process." ROY STUCKEY & OTHERS, BEST PRACTICES FOR LEGAL EDUCATION: A VISION AND A ROAD MAP 48 (2007), http://www.cleaweb.org/Resources/Documents/best_practices-full.pdf. In Educating Lawyers: Preparation for the Profession of Law, a seminal work on legal-education reform, the authors highlighted the importance of self-reflection as a core lawyering skill, observing that:

> [t]he mark of professional expertise is the ability to both act and think well in uncertain situations.
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> . . . .
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> . . . Practical skill is developed through modeling, habituation, experiment, and reflection.
>
> . . . .
>
> . . . In order to become expert in a profession, making good grades with minimal effort has to give way to a complete involvement with learning new ways of thinking, performing, and understanding oneself.

WILLIAM M. SULLIVAN, ANNE COLBY, JUDITH WELCH WEGNER, LLOYD BOND & LEE S. SHULMAN, EDUCATING LAWYERS: PREPARATION FOR THE PROFESSION OF LAW 9, 14, 27 (2007).

While they acknowledged that law students must undergo two other key "apprenticeships" in developing certain cognitive and practice-based lawyering skills, the reformers argued that it is the third apprenticeship, "the ethical-social apprenticeship [,] through which the student's professional self can be most broadly explored and developed . . . . [F]ormative education must enable students to become self-reflective about and self-directing in their own development." *Id.* at 28, 85; *see also* Lee S. Shulman, *Pedagogies of Uncertainty*, LIBERAL EDUC., Spring 2005, https://www.aacu.org/publications-research/periodicals/pedagogies-uncertainty. In the context of the Carnegie Foundation for the Advancement of Teaching's long-term program of research on how professionals are educated (Sullivan et al., EDUCATING LAWYERS, *supra*, was one volume in this series on professional education), Shulman observed that:

> a professional's work . . . is also characterized by conditions of inherent and unavoidable uncertainty. Professionals rarely can employ simple algorithms or protocols of practice in performing their services. How then does a professional adapt to new and uncertain circumstances? She exercises

Paying attention in the present moment. We spend so much of our time living in our own heads, especially as lawyers, that we actually miss a lot of what is happening right now around us. Without even intending to, our minds constantly ruminate on what happened in our past—yesterday, last week, or years ago—which can eventually spiral us down into depression. Or our minds can raise continual fears about the future—deadlines, client or colleague demands, or family worries—so that we live in states of perpetual stress and anxiety. Without realizing it, we can become captive to our "monkey mind"[60] that leaps from thought to thought, sometimes reliving past events or imagining future ones, and resting anywhere but in the present moment. That results in a lot of distracted and wasted energy.

Mindfulness practice is a way to become aware of our life in the present, moment to moment. A lawyer who is not fully present in a client meeting or a negotiation can miss important cues or information relevant to professional representation. A law student distracted by texts while studying or by the Internet in class can miss critical points for success on exams. And if lawyers and law students allow their minds to be distracted by work and school concerns when they are home with friends or family, they have lost real-time opportunities to strengthen some of the most fulfilling relationships in their lives. Although the present moment is sometimes difficult, it is really all we have; if we miss it, we are missing our lives.

Paying attention nonjudgmentally. Law school teaches us to think like lawyers: analyze and critique everything, find flaws in reasoning, and make counterarguments. Those skills feed our naturally judging human mind, which endlessly makes judgments about what we like or don't like in nearly everything: the weather, this person, that food, this music, and so on. Yet our likes and dislikes are simply judgments, not facts. The more negative judgments we accumulate in our minds over time, the unhappier we become—particularly when they are turned inward in negative self-criticism. Mindfulness practice helps us to cultivate curiosity, compassion, and a discerning, rather than judging, mind.

Paying attention on purpose. We tend to become hijacked or captivated by our distracted thoughts and negative judgments, which then drive us crazy, interrupt our sleep, and do not serve much useful purpose. Yet they do contribute deeply to our sense of identity, and thus they can be hard to let go. Mindfulness offers a way to learn to let go of our thoughts, negative judgments, and other self-defeating habits of mind. It substitutes healthy, intentional coping strategies for

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> judgment. One might therefore say that professional education is about developing pedagogies to link ideas, practices, and values under conditions of inherent uncertainty that necessitate not only judgment in order to act, but also cognizance of the consequences of one's action."

Shulman, *supra*.

60. PAUL VERHAEGHEN, PRESENCE: HOW MINDFULNESS AND MEDITATION SHAPE YOUR BRAIN, MIND, AND LIFE 4–5 (2017) (discussing the restless human mind that "flits from association to association" and observing that "Buddhist teachers call this 'monkey mind'—just like a monkey swings from one branch to the next, lets go, then grabs another branch, lets go again and grasps for another branch, and so on, our minds tend to just go with whatever mental flow is flowing." (citation omitted)). Many contemporary, secular mindfulness practices trace their historical roots to Buddhist traditions. *Id.* at 6–7.

maladaptive ones that give only temporary relief and can lead to substance abuse and other destructive behaviors.

Awareness, cultivated in a sustained and particular way. There are many kinds of mindfulness practices that cultivate present-moment awareness. They often use the breath as a focus of concentration. Repeatedly bringing the mind's focus back to the breath when thoughts, emotions, and bodily sensations inevitably arise during meditation promotes the skill of being nonjudgmentally aware of them when they inevitably arise during everyday life. One informal practice fosters the habit to **STOP** in stressful or emotional situations: **S**top; **T**ake a breath; **O**bserve what is happening in your body, your feelings, and your thoughts; and **P**roceed when you have gained the awareness to understand what is going on in your own mind.[61] Learning to STOP allows us to become less automatically and mindlessly reactive to people and events, and instead to be more thoughtfully and appropriately responsive to them. We cannot control other people—we can control only our own attitudes, behaviors, and responses.

IV. HOW DO YOU PRACTICE MINDFULNESS?

Mindfulness can be practiced in many ways: sitting meditations, mindful body scans, mindful yoga, mindful eating, mindful walking, and compassion exercises, to name a few. Mindfulness can be practiced in time intervals of a few minutes or much longer at the choice of the practitioner.

Three common forms of meditation are usually part of mindfulness training and have been scientifically studied to understand their potential benefits and the physiological changes in brain structure and function that occur during and after meditation.[62] Each of these meditation practices begins with the meditator taking a comfortable position, usually a sitting position in a posture that is upright yet relaxed, in a quiet space, with eyes closed or lowered. The following provides a brief introduction to how each kind of meditation is practiced.

A. Focused-Attention Meditation

In focused-attention meditation, the meditator focuses on one thing, usually the breath, observing the process of inhaling and exhaling and the physical sensations that breathing causes in the body (such as the expansion and contraction of the belly, or the flow of air in the nostrils or at the back of the throat). The idea is not to control the breath, but to control the focus. When the mind wanders, as it inevitably and repeatedly will do, the meditator notes that the mind has wandered and gently brings the attention back to the breath. The meditator is encouraged not

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61. Leonard L. Riskin & Rachel Wohl, *Mindfulness in the Heat of Conflict: Taking STOCK*, 21 HARV. NEGOT. L. REV. 121, 144–51 (2015) (describing the STOP tool and elaborating two additional tools: STOPSi (**S**top, **T**ake a breath, **O**bserve (body sensations, emotions, thoughts), **P**roceed to **S**et a clear and simple **I**ntention) and STOCK (**S**top, **T**ake a breath, **O**bserve (body sensations, thoughts, emotions), **C**onsider (have you been following your intention or want to change it? What next?), and **K**eep going)).

62. Matthieu Ricard, Antoine Lutz & Richard J. Davidson, *Mind of the Meditator*, 311 SCI. AM. 38, 40 (2014).

to follow the mind where it wandered or to cast negative self-judgments for having lost focus, but rather to simply note that the mind has wandered and to refocus on the breath. This process is repeated many times throughout the meditation, with the meditator continually, purposefully, and nonjudgmentally returning to the present experience of the breath. This practice allows the meditator to develop the capacity to remain focused while also remaining alert (but nonreactive) to distractions.[63]

B. Open-Monitoring Meditation

In open-monitoring meditation, the meditator engages in detached observation of his or her internal thoughts, emotions, physical sensations in the body, and external surroundings—e.g., sounds, temperature, aromas—in the present moment.[64] The meditator nonjudgmentally observes these things as they naturally come into awareness, whether they are pleasant or unpleasant experiences. The meditator does not focus on any particular object of awareness or try to control, like, dislike, or otherwise react to or engage with the experience: he or she just observes it.[65] When the mind inevitably wanders, the meditator repeatedly and gently brings the attention back to open monitoring. This practice "tries to cultivate a less emotionally reactive awareness to emotions, thoughts, and sensations occurring in the present moment to prevent them from spiraling out of control and creating mental distress."[66]

C. Loving-Kindness (Compassion) Meditation

In loving-kindness meditation, the meditator repeats a series of compassionate wishes for the well-being of oneself and others. A typical loving-kindness sequence might be to bring a well-loved person into one's mind (visualization), and then repeat silently to oneself:

- May you be happy.
- May you be healthy.
- May you be safe.
- May you live your life with ease.[67]

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63. *See generally* GUNARATANA, MINDFULNESS IN PLAIN ENGLISH, *supra* note 56, at 39–55; RICK HANSON WITH RICHARD MENDIUS, BUDDHA'S BRAIN: THE PRACTICAL NEUROSCIENCE OF HAPPINESS, LOVE, AND WISDOM 86–87, 200–03 (2009); JON KABAT-ZINN, FULL CATASTROPHE LIVING: USING THE WISDOM OF YOUR BODY AND MIND TO FACE STRESS, PAIN, AND ILLNESS 44–53 (2015); VERHAEGHEN, *supra* note 60, at 6–8.

64. Ricard et al., *supra* note 62, at 41, 42–43.

65. In the Mindfulness-Based Stress Reduction (MBSR) program founded by Jon Kabat-Zinn, this kind of open-monitoring meditation is known as "choiceless awareness" or "open presence," KABAT-ZINN, FULL CATASTROPHE LIVING, *supra* note 63, at 69, 71, 74, 383.

66. Ricard et al., *supra* note 62, at 42.

67. *See* HANSON WITH MENDIUS, *supra* note 63, at 158–60 (utilizing a slightly different order of these wishes). Meditators may modify these phrasings and the order of the phrasings as suits their needs. For a more extended discussion of compassion meditations, see generally BHANTE GUNARATANA, LOVING-KINDNESS IN PLAIN ENGLISH: THE PRACTICE OF METTA 7–18 (2017).

This sequence is then repeated with visualizing and giving these same well wishes to one's benefactors (for example, mentors or teachers), other family and friends (about whom one feels close and positive emotions), acquaintances and strangers (about whom one feels neutral), people one finds difficult or challenging to deal with, and ultimately all beings.[68] Compassion for oneself is an important trait to develop as well, and a loving-kindness meditation may begin with these well wishes for oneself.

This form of meditation can cultivate stronger feelings of altruism and benevolence to others and less harsh, self-critical judgments. One study found "that teaching loving-kindness to people particularly prone to self-criticism both lessened those harsh thoughts and increased their self-compassion."[69] Just as the previous two meditations train the mind, loving-kindness meditations train the heart.

D. Short Mindfulness Exercises Specifically for Lawyers

University of Miami Law Professor Scott Rogers has written books specifically for lawyers and law students to introduce them to mindfulness and its potential to improve well-being in the legal profession. In his mindfulness primer for lawyers (aptly named the "Six-Minute Solution" for devising meditations that can be done in the canonical six-minute, billable-hour increment), Rogers offers mindfulness insights and tips for greater productivity (22 mindfulness insights to enhance clarity, performance, and well-being), relief from stress (three steps for finding balance during challenging times), and peak performance (four contemplative practices to quiet the mind).[70]

V. WHAT ARE THE BENEFITS OF MINDFULNESS?

There have been a multitude of scientific studies assessing the cognitive, psychological, emotional, and physical benefits of mindfulness.[71] The purported

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68. KABAT-ZINN, FULL CATASTROPHE LIVING, *supra* note 63, at 216.

69. DANIEL GOLEMAN & RICHARD J. DAVIDSON, ALTERED TRAITS: SCIENCE REVEALS HOW MEDITATION CHANGES YOUR MIND, BRAIN, AND BODY 105 (2017).

70. SCOTT L. ROGERS, THE SIX-MINUTE SOLUTION: A MINDFULNESS PRIMER FOR LAWYERS (2009). Rogers has written another book specifically for law students: SCOTT ROGERS, MINDFULNESS FOR LAW STUDENTS: USING THE POWER OF MINDFUL AWARENESS TO ACHIEVE BALANCE AND SUCCESS IN LAW SCHOOL (2009). The website for the mindfulness program at the University of Miami Law School hosts a wealth of resources and information on mindfulness in law. *See* MIAMI L. MINDFULNESS L. PROGRAM, http://www.miamimindfulness.org/ (last visited July 30, 2018). Rogers has also developed websites for specific audiences. *See, e.g.*, MINDFUL L., http://themindfullawyer.com/ (last visited July 27, 2018); MINDFUL JUDGE, http://themindfuljudge.com/ (last visited July 27, 2018); MINDFUL L. STUDENT, http://themindfullawstudent.com/ (last visited July 27, 2018); MINDFUL L. PROFESSOR, http://themindfullawprofessor.com/ (last visited July 27, 2018).

71. *See, e.g.*, Amishi P. Jha, *Being in the Now*, SCI. AM. MIND, March/April 2013, at 26, https://www.scientificamerican.com/article/mindfulness-can-improve-your-attention-health/. For a comprehensive, highly readable, and very well-researched book that collects and reviews many of these studies, including meta-analyses of the studies, see VERHAEGHEN, *supra* note 60. *See also* SHANIDA NATARAJA, THE BLISSFUL BRAIN: NEUROSCIENCE AND PROOF OF THE POWER OF MEDITATION (2008) (additionally reviewing the scientific literature).

benefits include a wide range of improvements in both physical and mental health.[72] Part V explores more deeply several of the key benefits, referred to above in the National Task Force Report, that may be particularly relevant for lawyers and law students.

A. Attention Regulation

Studies have shown that meditators have an enhanced ability to remain vigilant to distractions and return more easily to focused attention after the mind wanders.[73] Results of one meta-analysis of mindfulness meditation suggested that the average mindfulness meditator had stronger attention skills than 73% of nonmeditators.[74] An encouraging conclusion from a review of the studies is that not much meditation practice is needed to increase concentration: "Even 20 to 40 hours or so of practice results in measurable changes in control over attention."[75]

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72. Christina Congleton, Britta K. Hölzel & Sara W. Lazar, *Mindfulness Can Literally Change Your Brain*, *in* MINDFULNESS: HBR EMOTIONAL INTELLIGENCE SERIES 32 (2017) ("Neuroscientists have also shown that practicing mindfulness affects brain areas related to perception, body awareness, pain tolerance, emotion regulation, introspection, complex thinking, and sense of self."); NATARAJA, *supra* note 71, at 207 (concluding that regular meditation produces measurable health benefits, including stress reduction, improved cardiovascular health and immune function, and improved coping strategies in the face of disease, as well as significant cognitive and psychological changes and the personal development of the practitioner); VERHAEGHEN, *supra* note 60, at 160–61 (reviewing studies that show "significant and beneficial effects on control over attention, attentional blink, sustained attention, proprioception for sexual arousal, working memory, perceived stress, immune functioning, general well-being, state anxiety, trait anxiety, depressed mood, negative emotions, positive emotions, emotion regulation, rumination, negative personality traits, trait mindfulness, self-concept, empathy and compassion"); *see also* John Paul Minda, Jeena Cho, Emily Grace Nielsen & Mingxia Zhang, *Mindfulness and Legal Practice: A Preliminary Study of the Effects of Mindfulness Meditation and Stress Reduction in Lawyers* 4 (July 19, 2017), https://psyarxiv.com/6zs5g/ (citing studies that suggest that mindfulness reduces stress and anxiety, boosts immune function, enhances the effectiveness of phototherapy as a treatment for psoriasis, is useful in the management of symptoms associated with depression and post-traumatic stress disorder, and is associated with improved everyday cognitive functioning, improved attention, cognitive flexibility, insight problem-solving ability, and general decision-making).

73. Ricard et al., *supra* note 62; *see* Jha, *supra* note 71.

74. VERHAEGHEN, *supra* note 60, at 96–105 (analyzing range of studies that investigated the effect of meditation on three aspects of attention: (1) noticing and alerting (detecting when the mind wanders); (2) controlling attention (returning focus to where it should be); and (3) sustaining a stabilizing attention (keeping awareness focused on what it needs to be focused on)).

75. *Id.* at 98. This author also observes:

> [o]ne conclusion is that some of the effects of mindfulness and meditation on attention may be due to changes in effort, or the willingness to invest effort, rather than to changes in attention per se. You could also, of course, wonder if this distinction is truly important in day-to-day life: A change in your underlying attitude to life, especially an increased willingness to meet challenges with a bit more energy, seems like a vital part of healthy daily functioning.

One study set out to determine how often people's minds wander.[76] Researchers developed an iPhone app that contacted participants randomly during the day and asked them to rate how happy they were right then, what they were doing (out of 22 activities) right then, whether they were thinking about something other than what they were currently doing, and whether what they were thinking about was pleasant or unpleasant.[77] The researchers found that mind wandering was very common, occurring in approximately 47% of the samples overall and in at least 30% of the samples taken during every activity except making love.[78] They also found that people were less happy when their minds were wandering during all activities, and that what people were thinking was a better predictor of their happiness than what they were doing.[79]

As many know who have spent 15 minutes staring at a page in a book or on a screen and then realized with frustration that they have no idea what it said, a wandering mind is an unhappy mind, which is the title of this published study. The study confirms that people are happier when they can be fully attentive to what they are doing in the present moment and when their minds are fully absorbed by the present-moment experience: "The ability to think about what is not happening is a cognitive achievement that comes at an emotional cost."[80]

For lawyers, improving one's ability to focus attention and ignore distractions, even in the midst of the numerous daily and competing demands for time and attention, can improve one's efficiency and productivity in work and reduce the stress associated with seemingly always having too much to do and too little time to do it. Better control over one's attentional focus can improve the ability to serial-task (prioritize and focus on one thing at a time), and decrease self-defeating attempts to multitask, which research has shown is counterproductive to efficiency.[81] Indeed, compelling research has shown that multitasking is a myth: "[T]he brain does not 'multitask' but rather switches rapidly from one task (*my work*) to others (*all those funny videos, friends' updates, urgent texts* . . .). . . . And following every such switch, when our attention returns to the original task, its

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Id. at 105.

76. Matthew A. Killingsworth & Daniel T. Gilbert, *A Wandering Mind Is an Unhappy Mind*, 330 SCIENCE 932, 932 (Nov. 12, 2010), http://www.danielgilbert.com/KILLINGSWORTH%20&%20GILBERT%20(2010).pdf.

77. *Id.*

78. *Id.*

79. *Id.*

80. *Id.*

81. Shailini Jandial George, *The Cure for the Distracted Mind: Why Law Schools Should Teach Mindfulness*, 53 DUQ. U. L. REV. 215, 218 (2015).

> Students often believe they are master multitaskers. Research shows, however, that "heavy media multitaskers . . . [are] suckers for irrelevancy . . . [because] everything distracts them." While many think they can simultaneously attend to many things at once, research shows this is not true. Rather than simultaneously processing all the information, the brain actually toggles among tasks, "leaking a little mental efficiency with every switch."

Id. (citations omitted).

strength has been appreciably diminished."[82] By contrast, a "serial tasker is present in the moment, listens actively to others, maintains a working flow on projects, and ignores the false sense of urgency that multi-tasking creates."[83]

B. Stress Reduction

A recent review of numerous scientific studies on the effects of mindfulness training concluded, "[m]indfulness training clearly leads to stress reduction."[84] The author (psychology professor Paul Verhaeghen at the Georgia Institute of Technology) suggested that the studies implied that the average mindfulness-trained participant is less stressed than 64% of his or her counterparts who had not undergone training.[85] The author also suggested that there is some evidence that mindfulness training can boost immune functioning, perhaps by making people happier.[86]

C. Emotion Regulation

According to Verhaeghen, many of the published studies on the effects of meditation on psychology are not scientifically rigorous enough to draw valid conclusions.[87] However, based on a range of studies that compares the following measures of well-being between mindfulness-trained participants and nontrained participants, he does suggest that one could fairly conclude that the average mindfulness-trained meditator:

- had a higher perceived quality of life than 70% of the nonmeditators;
- felt less temporary anxiety due to stressful circumstances than 75% of the nontrained study participants;
- experienced less trait (or day-to-day) anxiety than 73% of the general public;
- felt less depressed than 63% of the general public;
- experienced fewer negative emotions than 66% of nonparticipants and more positive emotions than 70% of nonparticipants;
- was better at emotion regulation—i.e., the ability to keep emotions in check as required by one's personal goals or the situation—than 63% of nontrained individuals;

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82. GOLEMAN & DAVIDSON, *supra* note 69, at 137 (italics in original).

83. Debra Austin & Rob Durr, *Emotion Regulation for Lawyers: A Mind Is a Challenging Thing to Tame*, 16 WYO. L. REV. 387, 406 (2016).

84. VERHAEGHEN, *supra* note 60, at 122.

85. *Id.*

86. *Id.* at 124.

87. *Id.* at 126–27 (observing that the largest meta-analysis on the effects of meditation on psychology eliminated most of the published studies due to methodological concerns, and concluding that "[t]hree quarters of the published studies in the filed simply don't meet the basic standard that would allow for scientifically valid conclusions").

- ruminated—i.e., engaged in rehashing the same, usually negative, thoughts over and over, often with a sense of no control over them—less often or less vigorously than 65% of nonmeditators;
- was more emotionally stable—i.e., had the ability to maintain emotional balance and to not be rattled or shaken by events—and less easily ruffled than 60% of the general public.[88]

A common thread in the studies reviewed by Verhaeghen was a lowering of reactivity to the stressors of daily life through an increase in open-mindedness and the ability to take a nonjudgmental stance toward them.[89] By encouraging practitioners to take a nonjudgmental stance toward their thoughts, emotions, physical sensations, and surroundings, mindfulness-meditation training encourages this cultivation of an open mind (sometimes called a "beginner's mind").[90] An open mind allows the practitioner to experience sensations and surroundings—as if for the first time, without preconceived notions as to how things should be—and to explore with curiosity simply how things are. "In this open mind there is space for new ideas, new ways of thinking and behaving; a readiness to see things from a different, less restrictive perspective."[91] Recent research also suggests that mindfulness improves rational decision-making and reduces various cognitive distortions, including implicit bias.[92]

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88. *Id.* at 127–30. It is important to mention that Verhaeghen's review of these various studies led him to draw conclusions about the "average meditator," noting that "there's no guarantee that every meditator will experience each [or even any] of these effects." *Id.* at 135. He also highlights other limitations on the findings of the studies he reviews: most of the studies were small (ranging from 8 to 140 people in the meditator groups, with a mean of 27 people per study); most used a passive rather than an active control group (meaning that the former are useful in seeing how the mindful-meditating life compares to life as usual, but not in comparing how mindfulness compares to another active intervention, such as relaxation training, exercise, counseling, cognitive or behavioral therapy, or even a placebo). *Id.* at 136–37. For example, in meta-analyses of the effects of mindfulness on clinical populations—i.e., people diagnosed as suffering from clinical conditions, such as depression, anxiety, or chronic pain—rather than the general public, the studies show that for many mental-health conditions (except depression) mindfulness does not work better or worse than the standard treatment for the condition. So while mindfulness may not be a therapeutic "magic bullet," it seems to be a viable alternative to traditional therapies without their attendant negative side effects. *Id.* at 146–48. Nataraja also acknowledges the limitations in drawing firm conclusions from the scientific research, observing that study participants may vary in their compliance with the meditation program being studied; recruitment of study participants—i.e., general population vs. clinical populations—can result in diverse study populations that make drawing valid comparisons difficult; the methodologies used in the studies may not be scientifically rigorous; and long-term studies are difficult and costly to run. NATARAJA, *supra* note 71, at 186–87.

89. VERHAEGHEN, *supra* note 60, at 143.

90. KABAT-ZINN, MINDFULNESS FOR BEGINNERS, *supra* note 56, at 9–10.

91. NATARAJA, *supra* note 71, at 196.

92. Peter H. Huang, *Can Practicing Mindfulness Improve Lawyer Decision-Making, Ethics, and Leadership?*, 55 HOUS. L. REV. 63, 79–100 (2017).

By promoting open-mindedness and curiosity, mindfulness training can also promote adaptability and improve resilience. "As awareness of what is happening in one's surroundings grows, normal daily irritants—an angry colleague at work, a worried child at home—become less disruptive, and a sense of psychological well-being develops."[93]

D. Awareness of the Body: Impact on Emotional Awareness and Response to Pain

Engaging in a quiet scan of present-moment sensations throughout one's body is an often-used mindfulness practice. The body can be a treasure trove of physical sensations that can lead to increased awareness of one's emotions and one's world. Tuning into the body and its physical sensations can be a good guide to one's emotional states. In this way, "the body can serve as both a resource and a trustworthy partner in life. Knowing your body more intimately, and in an on-going way, supports your capacity to meet all of your moments with more wisdom and compassion, including the anxious ones."[94]

One study examined self-reported body awareness in daily life and found that mindfulness-trained participants differed from control participants in their awarenesses of what is happening inside their bodies, often with an "emotional tinge."[95] After a three-month mindfulness program, the trained group changed more than the control group in answering a body-awareness questionnaire along several dimensions:

- self-regulation—e.g., "When I feel overwhelmed I can find a calm place inside";
- attention regulation—e.g., "I can refocus my attention from thinking to sensing my body";
- body listening—e.g., "I listen for information from my body about my emotional state";
- body trusting—e.g., "I feel my body is a safe place";
- emotional awareness—e.g., "I notice how my body changes when I am angry."[96]

This connection between body awareness and emotional awareness may suggest an increased integration of the two among meditators. One study led Verhaeghen to conclude that "meditators seem to be particularly good at tapping into the physiological markers of their emotions."[97]

Caring for your body is essential for health and longevity, and mindfulness of the body can help you learn what it needs (or doesn't need) in order to thrive:

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93. Ricard et al., *supra* note 62, at 42–43.

94. BOB STAHL, FLORENCE MELEO-MEYER & LYNN KOERBEL, A MINDFULNESS-BASED STRESS REDUCTION WORKBOOK FOR ANXIETY 58 (2014).

95. VERHAEGHEN, *supra* note 60, at 107.

96. *Id.*

97. *Id.* at 108.

> Through mindfulness of the body, you can begin to understand how stress and anxiety affect you, and also learn how to live better even with physical pain and illness. . . . The body has its own wisdom, and if you listen, it can communicate where physical tension, thoughts, and emotions lie within your body.[98]

Mindfulness has also been shown to alleviate the experience of physical pain. Physical pain and illness are things everyone experiences; how you relate to your pain or illness (even if chronic), however, can affect how much you suffer from these conditions. A review of several studies on the impact of meditation on pain led Verhaeghen to conclude "that meditation makes painful experiences less unpleasant . . . . This suggests that the main effect of the meditative experience on pain is not that it removes or dulls the ache. Rather, meditation makes the experience a tad more bearable."[99] Another author put it this way: "Even in times when you can't change the physical sensations of pain, you can change your emotional responses to them and thereby reduce your suffering. In other words, physical pain is a reality, but suffering is optional. . . . [Y]our emotional response to pain is in your hands."[100]

E. Empathy and Compassion

While there is not a lot of research on the effect of meditation practice on interpersonal skills and attitudes, one study of couples undergoing mindfulness training found that mindfulness had a positive impact on relationship satisfaction and closeness and made the couples more accepting of their partner. This led Verhaeghen to conclude that mindfulness-trained couples had a stronger relationship than 69% of nonmeditating couples.[101]

It is possible that mindfulness could improve interpersonal and professional relationships by fostering empathy and compassion. Research suggests that mindfulness develops "an enhanced ability to share the feelings of others without reporting any sign of becoming emotionally overwhelmed."[102] The results of two studies on empathy led Verhaeghen to infer that the average meditator was more empathetic than 79% of nonmeditators.[103]

Of course, one can experience too much empathy and feel overwhelmed by one's own distress at observing the suffering of others. Some people, particularly lawyers and others in service professions, can eventually suffer from "compassion fatigue."[104] Compassion can be healthy and beneficial when it increases one's

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98. BOB STAHL & ELISHA GOLDSTEIN, A MINDFULNESS-BASED STRESS REDUCTION WORKBOOK 65–66 (2010).

99. VERHAEGHEN, *supra* note 60, at 60.

100. STAHL & GOLDSTEIN, *supra* note 98, at 71.

101. VERHAEGHEN, *supra* note 60, at 131–32.

102. Ricard et al., *supra* note 62, at 44.

103. VERHAEGHEN, *supra* note 60, at 132.

104. *Compassion Fatigue*, A.B.A., https://www.americanbar.org/groups/lawyer_assistance/resources/compassion_fatigue.html (last visited July 28, 2018) ("Compassion fatigue is the cumulative physical, emotional and

motivation to relieve another's suffering without being overwhelmed by it. Some meditation practices are intended specifically to foster healthy compassion, such as the loving-kindness meditation described earlier in this Article. Verhaeghen reviewed several studies looking at the effect of compassion training on measures of compassion, which indicated that the average compassion-trained meditator is more compassionate than 65% of nonmeditators.[105]

F. Change in Perspective on the Self

To a greater or lesser extent, we all have blind spots about ourselves and our behaviors. In the proverbial narrative film that we each run continually in our minds about ourselves, we are the hero or heroine, with everyone else playing supporting roles in our life's story. Mindfulness can counteract this human tendency toward self-focus and thereby improve the capacity for honest self-awareness.

Researchers have termed the areas of the brain that activate during mind wandering as the brain's "default mode network."[106] When the mind wanders, it typically focuses on the self:

> In short, our mind wanders mostly to something about ourselves—*my thoughts, my emotions, my relationships, who liked my new post on my Facebook page*—all the minutiae of our life story. By framing every event in how it impacts ourselves, the default mode makes each of us the center of the universe as we know it. Those reveries knit together our sense of "self" from the fragmentary memories, hopes, dreams, plans, and so on that center on I, me, and mine. Our default mode continually rescripts a movie where each of us stars, replaying particularly favorite or upsetting scenes over and over.[107]

As previously noted, a wandering mind is an unhappy mind.[108] Fully focusing on a task or an object of attention, such as the breath, during meditation can inhibit the default-mode network in the brain, thereby "quieting the monkey mind—the incessant self-focused chatter that so often fills our minds"[109] and putting us in a happier frame of mind. Several studies suggest that mindfulness practices can "shift the mind from a narrative mode of viewing the self, in which the central character in the story is you, to a more experiential view, in which you observe the unfolding of your thoughts, feelings and sensations over time."[110]

Verhaeghen reviewed several studies that looked at meditation and different aspects of self-concept, including self-acceptance, self-compassion, and a sense of being in control of one's life. Together, the studies suggest that the average

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psychological effect of exposure to traumatic stories or events when working in a helping capacity, combined with the strain and stress of everyday life.").

105. VERHAEGHEN, *supra* note 60, at 133.
106. GOLEMAN & DAVIDSON, *supra* note 69, at 150.
107. *Id.* at 151.
108. *See supra* notes 76–80 and accompanying text.
109. GOLEMAN & DAVIDSON, *supra* note 69, at 152.
110. Jha, *supra* note 71, at 33.

meditator has a more positive and stronger self-concept than 75% of nonmeditators.[111]

Nataraja has also written about the impact of meditation on one's perception of oneself. Regular meditators have reported an improved and expanded sense of identity, as well as an increased self-acceptance and decreased tendency to attribute self-blame. "This often also translates into an increased acceptance of other people and their eccentricities, which can improve interpersonal relationships."[112]

By taming the self-critical, judgmental mind that is always (and often unhappily) comparing oneself to others, mindfulness can foster self-awareness of one's core values and priorities. In turn, this can help people to deemphasize extrinsic motivations for their personal effort (like money or grades) and foster their intrinsic motivations by aligning their actions with their values, thus allowing them to bring more passion and personal commitment to their chosen work. A recent study on what makes lawyers happy reported:

> [T]hese data indicate that well-being is substantially impaired when law graduates emphasize external over internal factors in their career choices . . . .
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> . . . .
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> . . . These data consistently indicate that a happy life as a lawyer is much less about grades, affluence, and prestige than about finding work that is interesting, engaging, personally meaningful, and focused on providing needed help to others. . . .
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> . . . Psychological factors related to self, others, meaningful and personally engaging work, and supportive work supervision were far more predictive of well-being than external "success" factors relating to competitive standing, honors, or financial rewards.[113]

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111. VERHAEGHEN, *supra* note 60, at 131.

112. NATARAJA, *supra* note 71, at 178 (also noting that experienced meditators report fewer bouts of irritability and impatience, and fewer emotional outbursts).

113. Lawrence S. Krieger & Kennon M. Sheldon, *What Makes Lawyers Happy? A Data-Driven Prescription to Redefine Professional Success*, 83 GEO. WASH. L. REV. 554, 580, 592, 626 (2015) ("External factors, which are often given the most attention and concern among law students and lawyers (factors oriented towards money and status—such as earnings, partnership in a law firm, law school debt, class rank, law review membership, and *U.S. News & World Report*'s law school rankings), showed nil to small associations with lawyer well-being. . . . Intrinsic values include self-understanding and improvement, positive interpersonal relationships, helping others, and building community."). Similarly, a recent study on stress hardiness among lawyers found that maintaining a sense of control, a sense of purpose, and cognitive flexibility were significantly correlated with stress hardiness. Pamela Bucy Pierson, Ashley Hamilton, Michael Pepper & Megan Root, *Stress Hardiness and Lawyers*, 42 J. LEGAL PROF. 1 (2017).

Two other studies have "found that people who were mindful were more likely to care about such internal rewards as integrity, moral identity, and honesty, instead of such external rewards as monetary gains."[114]

Developing the capacities for self-reflection and self-awareness can improve one's self-confidence and willingness to pursue the careers and life paths that most deeply resonate with the individual. Self-reflection skills are particularly important for law students and young attorneys to learn to develop, as they are faced with a bewildering set of choices of settings and subject-matter fields for their employment. Helping them to tap into their internal resources and values can help develop their professional identities and identify the professional attributes and traits that they most want to adopt and exemplify in the practice of law.

The most thoroughgoing critique of legal education in recent years, often referred to as the *Carnegie Report*, urges the legal academy to be more explicit and intentional in fostering students' development of professional identity and sense of professional purpose during their time in law school.[115] Law professors Scott Rogers and Jan Jacobowitz have written a clear guidebook to help law faculty to do just that—by weaving many mindfulness exercises throughout a course on professional ethics and responsibility.[116] The authors of a recent study on what makes lawyers happy also have suggested that promotion of the intrinsic values that are positive factors for lawyer well-being could have positive implications for attorney professionalism and ethics as well.[117]

G. Application of Benefits to Lawyers and Law Students

As an early advocate of incorporating mindfulness practice in the legal profession, Professor Leonard Riskin has identified the potential benefits for lawyers and law students as first, helping them to feel better (enhancing their

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114. Huang, *supra* note 92, at 107.

115. SULLIVAN ET AL., *supra* note 59, at 126–61.

116. SCOTT L. ROGERS & JAN L. JACOBOWITZ, MINDFULNESS AND PROFESSIONAL RESPONSIBILITY: A GUIDEBOOK FOR INTEGRATING MINDFULNESS INTO THE LAW SCHOOL CURRICULUM (2012); *see also* Scott L. Rogers, *The Role of Mindfulness in the Ongoing Evolution of Legal Education*, 36 U. ARK. L. REV. 387, 403–11 (2014) (discussing the integration of mindfulness, professional responsibility, and ethics in the legal-education curriculum); Scott L. Rogers & Jan L. Jacobowitz, *Mindful Ethics and the Cultivation of Concentration*, 15 NEV. L. J. 730, 731 (2015) (developing "the thesis that mindfulness and ethics enjoy a symbiotic connection, such that an attorney's deliberate attentiveness to the rules of professional conduct as a personal ethic can help cultivate a mindfulness practice").

117. Krieger & Sheldon, *supra* note 113, at 581–82 ("Intrinsic values include self-understanding and improvement, positive interpersonal relationships, helping others, and building community; such values would logically lead to introspection, honesty, cooperation, respect, and altruistic behavior. These values, then, would tend to promote integrity, candor, dedication to a client or cause, and respectful interactions with clients, opposing parties, and others, thus elevating an attorney's ethical and professional conduct."); *see also* Huang, *supra* note 92, at 100–26 (analyzing how practicing mindfulness could improve ethical reasoning and conduct). *See generally* Peter H. Huang, *How Improving Decision-Making and Mindfulness Can Improve Legal Ethics and Professionalism,* 21 J. L., BUS. & ETHICS 35 (2015).

capacities to relax and deal with stress and anxiety) and to perform lawyering tasks better (largely by increasing emotional-intelligence competencies), and second, enabling them to listen and negotiate better (by learning to observe limiting mindsets and habitual reactions without getting attached to them).[118] There is now a growing literature on the benefits of mindfulness practice specifically in the context of the legal profession and legal education,[119] a few aspects of which are explored in this Section.

Increased self-awareness and ability to remain balanced. Before much of the recent scientific research on the effects of mindfulness, attorney and *ABA Journal* editor Steven Keeva advocated mindfulness for lawyers. He conducted numerous interviews with attorneys on various practices they adopted to improve their well-being and balance in their lives, and in 1999 the ABA published his seminal work on finding satisfaction in the practice of law.[120] With respect to mindfulness, he observed that it can foster one's ability to deal with stressful situations with greater calm, to stay balanced, and to be creative and confident in responding: "No longer on autopilot, you can really look at what is important to you and realize that, although much of what happens to you is beyond your control, you have enormous power over how you respond to, and deal with, whatever comes your way."[121] He cited additional benefits from mindfulness for the practice of law by helping lawyers to do the following: (1) be aware of their own biases and prejudices and how they get in the way of effective work; (2) see the potential even in difficult moments, and thereby develop an ability to transform superficial, mindless reactions into opportunities to learn what is going on at a deeper level; and (3) be aware of the

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118. Leonard L. Riskin, *The Contemplative Lawyer: On the Potential Contributions of Mindfulness Meditation to Law Students, Lawyers, and Their Clients*, 7 HARV. NEGOT. L. REV. 1, 45–57 (2002).

119. *See, e.g.*, JEREMY D. FOGEL, MINDFULNESS AND JUDGING (2016), https://www.fjc.gov/sites/default/files/2016/Mindfulness%20and%20Judging.pdf (describing the benefits of mindfulness for the judiciary, including allowing a thoughtful approach to repetitive tasks as a way of limiting unconscious assumptions and maintaining a thoughtful and respectful judicial demeanor); Jan L. Jacobowitz, *The Benefits of Mindfulness for Litigators*, 39 No. 2 LITIG. 27, 27–28 (2013) (observing that "[w]hen attorneys practice mindfulness, the experience they gain by noticing their minds moving off into distraction, and returning their attention to their breath, makes them better equipped to deal with the unexpected—because they catch the thoughts and feelings that are resisting the moment, and are better equipped to stay on task and respond in proportion to the challenge"); Rhonda V. Magee, *Educating Lawyers to Meditate?*, 79 UMKC L. REV. 535, 555–58 (2011) (discussing various benefits for lawyers, including self-support for handling the stresses of legal practice, more effective and ethical lawyering, and better client relations and service). For some recent symposium volumes on mindfulness in the legal profession and legal education, see generally *Special Issue on Mindfulness*, FLA. B. J., April 2016; Symposium, *The Mindful Lawyer,* 61 J. LEGAL EDUC., 634 (2012); Symposium, *Mindfulness, Emotions, and Ethics in Law and Dispute Resolution*, 10 NEV. L.J. 289 (2010).

120. STEVEN KEEVA, TRANSFORMING PRACTICES: FINDING JOY AND SATISFACTION IN THE LEGAL LIFE (1999).

121. *Id.* at 69.

quality of one's own behavior (including how one is communicating in the moment) so that others' responses become more understandable.[122]

Recent empirical study on mindfulness and lawyers. A preliminary investigational study that was recently published online is believed to be the first to examine the possible psychological effects and benefits of a mindfulness and meditation program specifically designed for lawyers.[123] Forty-six attorneys participated in an eight-week, online, modified MBSR-style program that was developed in the book *The Anxious Lawyer*,[124] and they completed preprogram and postprogram questionnaires designed to assess various cognitive, psychological, emotional, and behavioral characteristics.[125] The study reported lower levels of stress, anxiety, and depression among the attorneys after the program: depression scores decreased by 28.84%, anxiety scores decreased by 30.29%, and stress scores decreased by 32.45%.[126]

The attorney participants also reported increased levels of positive mood, resilience, and workplace effectiveness.[127] Based on a comparison of their preprogram and postprogram scores on various measures of "job effectiveness," the study found an overall 6.1% increase in their self-reported job-effectiveness scores.[128] These overall effects did not appear to depend on the amount of time that

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122. *Id.* at 69–70; *see also* Rhonda V. Magee, *The Way of ColorInsight: Understanding Race and Law Effectively Through Mindfulness-Based ColorInsight Practices*, 8 GEO. J.L. & MOD. CRIT. RACE PERSP. 251, 272–78 (2016) (describing the use of mindfulness-based practices to deepen focus and concentration; increase awareness of habits of mind associated with bias; increase capacity for emotion regulation, perspective-taking, and compassion; provide protection from stereotype threat; and offer healing from trauma).

123. Minda et al., *supra* note 72, at 11. The authors acknowledged several other limitations of this preliminary study (including the lack of a control group and the possibility that the self-reported changes were due to "expectancy effects"—participants joined the study because they expected benefits from mindfulness and meditation)—that could be addressed in future research. *Id.* at 12–13.

124. *See generally* JEENA CHO & KAREN GIFFORD, THE ANXIOUS LAWYER: AN 8-WEEK GUIDE TO A HAPPIER, SANER LAW PRACTICE USING MEDITATION (2016).

125. Minda et al., *supra* note 72, at 8–9.

126. *Id.* at 10.

127. *Id.*

128. *Id.* The study's authors candidly acknowledged the limitations of the self-reports on job effectiveness:

> The job effectiveness questions were not designed to assess any specific psychological construct and they are not part of a published psychological test. Instead, these items were included for qualitative insight into how participants perceived their own ability to perform on the job. As such, there is no standard way to interpret the results.

Id.

Notably, many of the measures used to determine job effectiveness in this study (such as creativity, thoroughness, open-mindedness, interpersonal relations, social astuteness, communication, listening, integrity, motivation, independence, dependability, emotional control, assuming responsibility, seeing "the big picture," productivity, and work-life balance; *id.* at 26–28) are similar to and complementary of the characteristics and qualities

the participants meditated each week, leading the study's authors to suggest that "[w]hat mattered was just that they meditated."[129]

Mindfulness can promote highly prized professional qualities. More broadly, mindfulness offers practices that can promote many of the important character and professional traits that have been identified as necessary for successful professional law practice. A recent survey (IAALS study) of over 24,000 lawyers sought to identify the key professional skills, characteristics, and competencies that are considered necessary to have right out of law school, as well as those that are not immediately needed in the short term but must be acquired over time.[130] Many of the top-ten qualities that were considered necessary for a new lawyer's success in the first year of practice (out of the 147 skills, characteristics, and competencies considered as foundations for practice that were surveyed) were ones that can be fostered by mindfulness practices, including the following: honoring commitments, integrity and trustworthiness, treating others with courtesy and respect, listening attentively and respectfully, promptly responding to inquiries and requests, diligence, having a strong work ethic, and putting forth best effort.[131]

Interestingly, specific legal skills typically emphasized in law school were not ranked among the top-ten foundations new lawyers needed for success right out of law school. Other characteristics and competencies that were highly prized (considered either "necessary" in the short term at the outset of practice or "must be acquired" over time) by approximately 90% or more of responding lawyers in the IAALS survey were the following: (1) with respect to emotional and interpersonal intelligence: exhibiting tact and diplomacy; demonstrating tolerance, sensitivity, and compassion; regulating emotions and demonstrating self-control; and understanding and conforming to appropriate appearance and behavior in a range of situations; (2) with respect to passion and ambition: showing initiative and taking ownership; and (3) with respect to professional development: adapting work habits to meet demands and expectations; possessing self-awareness (strengths, weaknesses, boundaries, preferences, sphere of control); and taking individual responsibility for actions and results.[132]

Perhaps most interesting were the rankings of the foundations for practice that were grouped under the "qualities and talents" category in the IAALS study. Some of the characteristics and competencies in this category were noted above as being ranked in the top-ten overall—e.g., integrity and trustworthiness, diligence,

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for professional success that were identified in the IAALS study on the foundations for legal practice, discussed *infra* at notes 130–35 and accompanying text.

129. Minda et al., *supra* note 72, at 12.

130. ALLI GERKMAN & LOGAN CORNETT FOR INS. FOR THE ADVANCEMENT OF THE AM. LEGAL SYS., FOUNDATIONS FOR PRACTICE: THE WHOLE LAWYER AND THE CHARACTER QUOTIENT 1–5 (2016), http://iaals.du.edu/sites/default/files/reports/foundations_for_practice_whole_lawyer_character_quotient.pdf (hereinafter *IAALS study*).

131. *Id.* at 26.

132. *Id.* at 8–9, 13.

and attention to detail.[133] In addition, over 80% of attorney respondents thought the following qualities and talents were necessary in the short term or must be acquired over time for successful professional practice: big-picture thinking, common sense, confidence, conscientiousness, decisiveness, grit, humility, maturity, patience, perceptiveness, prudence, resourcefulness, and a strong moral compass.[134] Happily—and hopefully by this point, not surprisingly—these key qualities for successful professional practice are among those that mindfulness can promote and strengthen.

VI. NEUROSCIENCE AND MINDFULNESS

Studies of meditators have shown that meditation not only can offer the benefits described above that improve one's cognitive and emotional functions, but also seemingly can make alterations in the structure and function of the brain itself. Studies have shown an increase in the volume of certain brain areas (prefrontal cortex and insula) and decrease in the activity of the amygdala, which is the brain region involved in emotional reactivity and processing fear.[135] An increase in the

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133. *Id*. at 16, 26.

134. *Id.* at 16.

135. Ricard et al., *supra* note 62, at 41, 43; *see also* Michael Baime, *This Is Your Brain on Mindfulness,* SHAMBALA SUN 47 (July 2011), http://www.amishi.com/lab/wp-content/uploads/SUN_July11_Baime.pdf (reviewing studies on the cortex—the outermost surface of the brain—and two particular regions of the cortex, the prefrontal cortex and the insula: "The prefrontal cortex manages higher cognitive 'executive' functions like planning, decision making, and judgment, and keeps us out of trouble by facilitating socially acceptable behavior . . . . [A different region of the cortex,] the insula, seems to integrate sensation and emotion, and to process social emotions—such as empathy and love."); HANSON WITH MENDIUS, *supra* note 63, at 49–63 (discussing how the brain, nervous system, endocrine system, and immune system interact under stress conditions and the long-term, adverse physical and mental consequences from continual hyperarousal of the these systems due to stress); *id.* at 85–86 (describing how meditation activates the parasympathetic nervous system and has been shown to result in the following: increases in gray matter in the insula, hippocampus, and prefrontal cortex; reductions in cortical thinning due to aging; improvement in functioning including attention, compassion, and empathy; lifting of mood by increasing activation of the brain's left-front regions; decreases in stress-related cortisol; strengthening of the immune system; helping with a variety of medical conditions (including cardiovascular disease, asthma, type II diabetes, PMS, and chronic pain); and helping with a number of psychological conditions (including insomnia, anxiety, phobias, and eating disorders)); Yi-Yuan Tang, Britta K. Hölzel, and Michael I. Posner, *The Neuroscience of Mindfulness Meditation*, 16 NATURE REVIEWS NEUROSCIENCE, 213, at 215 (observing that scientific studies have found eight brain regions to be consistently altered in meditators, and that future scientific studies "need to replicate the reported findings and begin to unravel how changes in the neural structure relate to changes in well-being and behaviour"); *id.* at 222 (observing that "there is emerging evidence that mindfulness meditation might cause neuroplastic changes in the structure and function of brain regions involved in regulation of attention, emotion, and self-awareness," and concluding that future research needs to "advance the understanding of the mechanisms of mindfulness meditation in regard to the interactions of complex brain networks, and needs to connect neuroscientific findings with behavioural data"); VERHAEGHEN, *supra* note 60, at 71 (decreases in volume in amygdala were associated with decreases in perceived stress); Kristyna Zapletal, *Neuroscience of*

gray-matter density (gray matter is the part of the brain with the most brain cells) may reflect an increase in connectivity between the cells.[136]

Meditation practice is associated with changes in specific brain areas that involve attention, learning, and the regulation of emotion.[137] Scientist Amishi Jha has focused her research on studying the extent to which mindfulness can enhance attentional performance. Her lab has shown that meditation improves working (or short-term) memory and the ability to resist distraction.[138] For high-stress professions, like the legal profession, she and others have proposed that mindfulness can lead to increased resilience—i.e., the ability to bounce back from stressful events or situations—by strengthening the ability to focus attention and increase working-memory capacity.[139] Others have found that practicing mindfulness can result in faster recovery to baseline in the amygdala, which is activated by emotions—particularly negative emotion—stress, and anxiety.[140] They suggest that improving the rapidity of amygdala recovery could be a key attribute of resilience.[141]

Contrary to earlier beliefs that brain growth and development stopped sometime prior to adulthood, scientists have confirmed that the neuroplasticity of the brain never ceases (although for certain skills, like learning languages and musical instruments, the brain is more plastic in early life).[142] In effect, this means that at any age it is possible to rewire the brain and lay down new neural circuits.[143]

Mindfulness: What Happens to Your Brain When You Meditate, OBSERVER (Jun. 26, 2017), http://observer.com/2017/06/neuroscience-mindfulness-brain-when-you-meditate-development/ (reviewing, in an accessible way for the public, numerous studies that report changes in brain structures, functions, and neuroplasticity).

136. Baime, *supra* note 135, at 48; *see also* Congleton et al., *supra* note 72, at 30–32 (reviewing how mindfulness changes two key areas of the brain: the anterior cingulate cortex (associated with self-regulation) and the hippocampus (a part of the limbic system that is associated with emotion and memory)).

137. Baime, *supra* note 135, at 46.

138. *Id.* at 84; s*ee also* VERHAEGHEN, *supra* note 60, at 111 (reviewing Jha's and other studies on working memory and meditation, and concluding that "the average meditator has a better working memory than 62% of nonmeditators").

139. Amishi P. Jha, Scott L. Rogers & Alexandra B. Morrison*, Mindfulness Training in High Stress Professions: Strengthening Attention and Resilience, in* MINDFULNESS-BASED TREATMENT APPROACHES: CLINICIAN'S GUIDE TO EVIDENCE BASE AND APPLICATIONS, at 347–66 (Ruth A. Baer ed., 2014), http://www.amishi.com/lab/wp-content/uploads/2014_MTinHighStressProfessions_Jha-Rogers-Morrison.pdf.

140. Steve Paulson, Richard Davidson, Amishi Jha & Jon Kabat-Zinn, *Becoming Conscious: The Science of Mindfulness*, ANNALS OF N.Y. ACADEMY OF SCIENCES 87, 94 (2013).

141. *Id.*

142. *Id.* at 89.

143. *Id.*

VII. THE CHALLENGES TO STARTING AND MAINTAINING A PRACTICE

A. Finding a Good Training Program

One of the first challenges to adopting a mindfulness practice is to figure out which one to adopt and how to begin. Mindfulness-Based Stress Reduction (MBSR) training—the gold standard for secular mindfulness training—is available in many communities. It is a good idea to ensure that the trainers are actually qualified to engage in authentic MBSR training, for "there is mischief afoot in the marketplace for mindfulness."[144] The extent to which mindfulness has swept across the country threatens to turn the practice into a kind of "McMindfulness": junk food promising immediate rewards with little effort on the individual's part.[145]

MBSR training requires an eight-week commitment to once-a-week classes, daily 45-minute home-meditation practice, and one day-long, largely silent retreat.[146] While it is possible to begin by accessing daily the multitude of shorter, free, online-guided meditations,[147] the MBSR style of immersion training helps enormously in forming a new habit and deepens understanding of mindfulness.[148]

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144. Marc R. Poirier, *Mischief in the Marketplace for Mindfulness, in* WHAT'S WRONG WITH MINDFULNESS (AND WHAT ISN'T): ZEN PERSPECTIVES 14 (Robert Meikyo Rosenbaum & Barry Magid eds., 2016). The author describes how:

> commodification of mindfulness and meditation is increasingly prevalent and . . . obscures the importance of at least three key aspects of traditional Buddhist training: (1) a sustained commitment over time; (2) the usefulness of a community of practice in stabilizing and expanding individual practice; and (3) the importance of guidance from a learned and trusted teacher or elder with whom the student develops a long-term disciple relationship.

Id. at 14. The author is also concerned about the increasingly instrumental view of mindfulness training to achieve specific gains: "Approaching practice as a goal-oriented technique has troubling consequences." *Id.* at 15.

145. Barry Magid & Marc R. Poirier, *The Three Shaky Pillars of Western Buddhism: Deracination, Secularization, and Instrumentalism, in* WHAT'S WRONG WITH MINDFULNESS (AND WHAT ISN'T): ZEN PERSPECTIVES 41 (Robert Meikyo Rosenbaum & Barry Magid eds., 2016) ("'McMindfulness': quick, effortless, inexpensive, available everywhere, anytime.").

146. KABAT-ZINN, FULL CATASTROPHE LIVING, *supra* note 63, at xlvii, lxii-iii, lxv, 132–46.

147. *See, e.g.*, INSIGHT TIMER, https://insighttimer.com/ (last visited July 30, 2018) (free guided meditations); UCLA MINDFUL AWARENESS RES. CTR., http://marc.ucla.edu/mindful-meditations (last visited July 30, 2018) (free guided meditations); *Guided Mediations*, TARABRACH.COM, https://www.tarabrach.com/guided-meditations/ (last visited July 30, 2018); *The Basics of Mindfulness Meditation*, 10% HAPPIER, http://www.10percenthappier.com/mindfulness-meditation-the-basics/ (last visited July 30, 2018) (first seven video lessons are free; thereafter pay by subscription); HEADSPACE, https://www.headspace.com/ (last visited July 30, 2018) (free trial program; subscription fees thereafter).

148. MBSR-certified trainers may be located through http://www.umassmed.edu/cfm/mindfulness-based-programs/mbsr-courses/find-an-mbsr-

Mindfulness training can be introduced in less time-intensive formats at law firms and law schools to acquaint professionals with the practice. Lawyers and law professors trained in mindfulness can offer programs tailored to a law firm's or law school's specific needs and preferences.[149] Defraying the costs of an MBSR program for lawyers and law students who, afterward, may want a deeper dive into the practice can support their practice and be a powerful signal of a law firm's or law school's support for health and well-being as a dimension of professional competence.

B. Making the Time

Another challenge is making the time to regularly engage in the practice and maintain it over time. Like so many New Year's resolutions to eat a healthier diet and get more exercise, any activity that requires an ongoing, daily commitment to achieve its benefits can fall by the wayside in the press of other, more immediate-seeming commitments to clients, employers, classes, family, and community.

A student once asked me: "How long does it take to see the benefits of mindfulness practice?" I responded: "How long does it take to lose weight? How long does it take to build physical endurance?" It all depends on how much time and energy you are willing to commit to healthy dieting or physical exercise. Eating wisely for one day a month or hitting the gym every other month is unlikely to result in visible or lasting benefits. It is the same with mindfulness.

C. Developing the Discipline

Mindfulness is often described as being simple but not easy. It is simple: just sit quietly for a few minutes or longer, observing but not reacting to whatever comes up in the mind. It is not easy: people will do almost anything to avoid being alone with their thoughts or feelings. In one series of experiments, many participants who were asked to sit with just their thoughts alone in a room and do nothing except think for 6–15 minutes found it so unpleasant that they began to administer electric shocks to themselves.[150] Though we call ourselves human beings, it seems we would much rather be *doing* than simply *being*. It can take considerable discipline to stick with a meditation practice that requires daily, silent sitting, as many people find

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program/. For those interested in exploring the Buddhist roots of mindfulness, there may be centers in local communities that offer trainings in Zen practices or other contemplative traditions.

149. Resources can be found at: WARRIOR ONE, MINDFULNESS TRAINING FOR THE LEGAL MIND, https://warriorone.com/ (last visited July 30, 2018); MINDFULNESS L. SOC'Y, http://mindfulnessinlawsociety.com/ (last visited July 30, 2018). The Association of American Law School's Section on Balance in Legal Education sponsors a Mindfulness Affinity Group, which includes a cross-section of national faculty with an interest in mindfulness in legal education. *See Section on Balance in Legal Education*, ASS'N AM. L. SCHS., https://memberaccess.aals.org/eWeb/dynamicpage.aspx?webcode=ChpDetail&chp_cst_key=9fb324e8-e515-4fd3-b6db-a1723feeb799 (last visited July 30, 2018); *see also supra* note 70 (resources collected by Prof. Scott Rogers).

150. Timothy D. Wilson et al., *Just Think: The Challenges of the Disengaged Mind*, 345 SCIENCE 75, 75–77 (July 2014).

"doing nothing" to be an unpleasant activity, at least at first. This kind of initial negative reaction to seemingly "doing nothing" may be especially common for high-achieving, type-A attorneys and law students.

One way to address the "it takes discipline" challenge is to find a community in which to keep up one's mindfulness practice. Law students are beginning to develop student chapters of the Mindfulness in Law Society to support their members' practices.[151] Lawyers can find national resources that allow them to engage in short, sometimes regularly scheduled meditations during the work week. For example, attorney Judi Cohen, who is the founder of Warrior One, LLP, offers a weekly guided meditation by national teleconference call.[152] Attorney Jeena Cho, author of THE ANXIOUS LAWYER, offers a variety of guided meditations online.[153]

D. Potential Adverse Side Effects

Another challenge for some people is that mindful meditation can dredge up such painful thoughts and emotions that their mental well-being worsens. Such adverse effects can include feelings of panic, psychological disorders, and insomnia, particularly for especially vulnerable people (such as those with PTSD).[154] One story recounts how attending a mindfulness retreat triggered memories of childhood trauma, leading to a depressive breakdown.[155] These unintended yet potential consequences are good reasons for ensuring that mindfulness trainers are qualified, experienced teachers who can screen for such potential problems and refer appropriately.

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151. *Law Students*, MINDFULNESS L. SOC'Y, http://mindfulnessinlawsociety.com/divisions/lawstudents/ (last visited Aug. 30, 2018).

152. *See Join the Wake Up Call,* WARRIOR ONE, https://warriorone.com/wake-up-call/ (last visited July 27, 2018). The "Wake-Up Call" is held every Thursday at 8:00 a.m. Pacific time and offers a ten-minute talk followed by ten minutes of guided meditation. *Id.*

153. Guided meditations for lawyers are available at http://theanxiouslawyer.com/category/guided-meditations/.

154. Utpal Dholakia, *The Little-Known Downsides of Mindfulness Practice*, PSYCHOL. TODAY (Apr. 27, 2016), https://www.psychologytoday.com/blog/the-science-behind-behavior/201604/the-little-known-downsides-mindfulness-practice; *see also* William Van Gordon, Edo Shonin, & Javier Garcia-Campayo, *Are There Adverse Effects Associated with Mindfulness?*, 51 AUSTL. & N.Z. J. PSYCHIATRY 977 (2017) (discussing concerns arising from empirical and anecdotal reports that a mindfulness-based intervention "has led to (e.g.) executive memory impairments, depersonalisation, asociality, panic attacks, psychotic episodes, addiction (i.e. to mindfulness) and/or impaired reality testing"); VERHAEGHEN, *supra* note 60, at 154–56 (discussing studies showing different findings on whether there may be negative side effects associated with mindfulness meditation, and it is unclear who may be at risk for them).

155. Dawn Foster, *Is Mindfulness Making Us Ill?*, GUARDIAN (Jan. 23, 2016), https://www.theguardian.com/lifeandstyle/2016/jan/23/is-mindfulness-making-us-ill; *see also* Tomas Rocha, *The Dark Night of the Soul*, ATLANTIC (June 25, 2014), https://www.theatlantic.com/health/archive/2014/06/the-dark-knight-of-the-souls/372766/ (recounting current research into, and the experiences of people who have had, negative psychological or emotional reactions to meditation).

VIII. RECOMMENDATIONS BASED ON ONE LAW SCHOOL'S EXPERIENCE

In recent years, Georgia State University College of Law implemented a mindfulness-training program for law students. After experimenting with four- and eight-week programs adapted from the MBSR format, we have settled on a six-week program in the fall semester every year, usually called *Mindful Mondays*. The Author offers this training with a co-instructor who is certified to teach MBSR programs.[156]

First-year students learn about the program during their orientation period, and it is generally offered in September and October of each year. It is open to all law students and averages about 60 students who attend the weekly one-hour trainings. While it is a voluntary program, students who want to receive the training are asked to commit to attending all six weekly sessions, which are held at noon with a light lunch served, and to undertaking daily 10–15-minute mindfulness meditation practices at other times of their own choosing during the week. The Author has also offered a modified version of this training to the school's part-time evening students.

Students have been very positive in their evaluations of our program. Some have characterized it as a "life saver" or a "game changer" for them because it enhances their resilience and ability to cope with the stresses of law classes and exams.[157] We recognize that our *Mindful Mondays* program, an abbreviated form of MBSR training, can simply plant the seeds of mindfulness—it is up to individual students to decide how extensively to incorporate the practice into their daily lives after the program ends, or whether to go on to deepen their practice with additional trainings or retreats.

The *Mindful Mondays* program is supported by other initiatives at the law school. The law school's student chapter of the Mindfulness in Law Society has in the past offered weekly guided meditations and a one-day retreat for its members as a follow-up to this training.[158] One of the Author's former graduate assistants was a certified yoga instructor, and for over two years he offered twice-weekly yoga

156. Co-instructor Helen B. Vantine, PhD, founded the Atlanta Mindfulness Institute. *See Certified Mindfulness Experts*, ATLANTA MINDFULNESS INST., http://www.atlantamindfulness.com/about/ (last visited July 27, 2018). The Author received mindfulness-in-law teacher training from Warrior One (a ten-month program) and several other mindfulness trainings, and she is pursuing qualification as an MBSR instructor through the Center for Mindfulness at the University of California San Diego.

157. *See, e.g.*, Tatiana Posada, *How Mindfulness Changed My Life: A Law Student's Story*, GA. ST. U. NEWS HUB (April 27, 2018), https://news.gsu.edu/2018/04/27/how-mindfulness-changed-my-life-a-law-students-story/.

158. *Mindfulness in Law Society*, GA. ST. U. C. L., http://sites.gsu.edu/mils/ (last visited Aug. 30, 2018). This student organization has recently expanded its mission to encompass wellness and health for law students more generally, and it has become a Wellness in Law Society that also retains its interests in mindfulness, meditation, and yoga.

classes for the law-school community.[159] This year, the Author has instituted a *Take-Twenty Tuesdays* program, which is designed to provide ongoing support for students interested in continuing a meditation practice in an informal way. Two times a week (once at noon, once at 5:15 p.m. for evening students), the Author offers a ten-minute guided meditation followed by ten minutes of debrief and discussion on any health and wellness topics the students may be interested in.

This year, the law school has also implemented a new seven-week program called *Wellness Wednesdays* through its Center for Law, Health & Society. The Author is the co-convener of this series of noon-time presentations whose theme is "From Busy to Balanced: Designing Your Life to Live It Well."[160] Its weekly sessions encompass the multiple dimensions of well-being, including mental health, physical health, emotional and social well-being, financial health, and professional well-being. Some sessions feature guest speakers who are practicing attorneys and who have struggled with some of the mental-health and substance-use disorders outlined in the studies at the outset of this Article. The other co-convener of the series is a graduate of our law school who has coaching and breath-work expertise, and who is active in the State Bar of Georgia's Wellness Committee.[161]

A new companion initiative that launched with the *Wellness Wednesdays* series this year is a student-sponsored, weekly health challenge. Eight student organizations have sponsored weekly photo competitions for the student body to take pictures of themselves, friends, and families engaging in healthy activities related to each week's wellness theme. Together these wellness programs are designed to foster a culture of health and well-being among law students.

An overarching theme of the *Wellness Wednesdays* series is that students and lawyers need to decide how they want to achieve their own individual sense of balance across the multiple dimensions of well-being in ways that align with their own core values and inner sense of purpose. Our students are the principal architects of their own lives, and they should be thoughtful about how they design their lives to live them well. The program avoids the conventional duality of seeking "work-life balance," as work is simply one part of life. Rather, the series encourages students to think about how to attend to all of the dimensions of well-being and find their own ways of integrating those dimensions into their lives.[162] Our program

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159. *Charles (J.D. '18) Leads National Mindfulness Society's Student Division*, GA. ST. U. C. L., (Jan. 10, 2017), http://law.gsu.edu/2017/01/10/charles-j-d-18-leads-national-mindfulness-societys-student-division/.

160. *What Makes Lawyers Happy? Wellness Program Instructs Students on Well-Being*, GA. ST. U. C. L., (Feb. 2, 2018), http://law.gsu.edu/2018/02/02/what-makes-lawyers-happy/.

161. Plamen Russev, J.D., is a contract attorney with SunTrust in Atlanta, a certified Integral Coach and Breathwork Practitioner, and Chair of the Mental Health Subcommittee of the Attorney Wellness Committee of the State Bar of Georgia.

162. Our multidimensional approach is consistent with the National Task Force Report's definition of "lawyer well-being as a continuous process whereby lawyers seek to thrive in each of the following areas: emotional health, occupational pursuits, creative or intellectual endeavors, sense of spirituality or greater purpose in life, physical health, and social connections with others." NATIONAL TASK FORCE REPORT, *supra* note 12, at 9.

acknowledges that the students' individual senses of balance or integration will be continually changing and evolving as the students and their circumstances change and evolve over a lifetime.

Based on our experiences with these programs, a few preliminary recommendations are in order. First, it is important to begin any mindfulness-training program with qualified, experienced instructors. MBSR programs are the most well-researched mindfulness programs, and their benefits have the strongest support in the clinical-studies literature.[163] An institution should consider affiliating with mindfulness teachers who can offer MBSR or other similarly well-established and high-quality programming.

Second, while adopting mindfulness training is one way to support the mental health and well-being of lawyers and law students, it is not the only way. Some legal professionals and students can be highly skeptical about mindfulness either as too "touchy feely" (and thus irrelevant to the study or practice of law) or as "coddling" lawyers or law students (and thus not within the role and responsibility of law firms or law schools to deliver). The National Task Force Report has squarely put promoting the health and well-being of lawyers and law students on the agenda of the legal profession, so if there are other avenues to address wellness that face less initial resistance from an institution's constituencies and may resonate more with them, there is no harm in beginning elsewhere. The National Task Force Report acknowledges that lawyer well-being is a "continuous process in which lawyers strive for thriving in each dimension of their lives."[164] Creating alternative ways to approach issues of health and well-being was one of the reasons for establishing the *Wellness Wednesdays* series at our law school, despite already having a well-established mindfulness program.

Third, legal employers and law schools should collaborate with their local- or state-bar association to align their mindfulness or other wellness programs with new mindfulness or wellness initiatives and resources that may already be underway at the bar association. For example, our State Bar of Georgia has initiated a program called *Georgia Lawyers Living Well*, which provides resources for the mental, physical, and social well-being of lawyers.[165] Our law school's *Wellness Wednesdays* series collaborates with attorneys on the state bar's Wellness Committee and Lawyer Assistance Program. There is no reason to reinvent the wheel in wellness programming. Also, when law students see practicing lawyers on bar committees taking the time and energy to promote their own health and well-being and that of their colleagues and the profession, it sends a powerful signal to

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163. GOLEMAN & DAVIDSON, *supra* note 69, at 85, 165–66.

164. NATIONAL TASK FORCE REPORT, *supra* note 12, at 9.

165. *Georgia Lawyers Living Well*, ST. B. GA., https://www.gabar.org/wellness/ (last visited July 27, 2018). For an example of bar associations specifically supporting mindfulness practices, see Dade County Bar Association & the Federal Bar Association's South Florida Chapter, Mindfulness in Law Joint Task Force, http://mindfulnessinlawcommittee.com/ (last visited Aug. 30, 2018) (introducing the South Florida legal community to information on mindfulness and mindfulness programming, and supporting the formation of mindfulness-practice groups).

students that ensuring their own health and well-being is an ongoing personal and professional responsibility.

Fourth, it can be helpful to connect with national programs that support mindfulness in the legal profession. The national Mindfulness in Law Society offers resources and opportunities for law students, judges, lawyers, and others in the profession to learn about developments in the field and to network with experienced mindfulness professionals.[166] Warrior One offers mindfulness-in-law teacher-training programs, as well as programs tailored to fit an individual institution's needs.[167] Professor Scott Rogers, director of the mindfulness-in-law program at the University of Miami, gives presentations and offers training programs nationally.[168] A number of recent books are also devoted to fostering mindfulness and a balanced life specifically for lawyers and law students.[169]

Finally, legal employers and law schools should consider how their institutions can support mindfulness practice on an ongoing basis after the initial training period ends. Just as physical exercise improves the body's strength and endurance over time, mindfulness is training for the mind and heart, and it requires ongoing practice to see its benefits endure and increase over time. Whether encouraging friends and colleagues to get together informally to practice, establishing regular formal meditation sessions, or hiring an outsider or training an insider within an institution to provide ongoing support, it is important to commit to fostering mindfulness as a vital part of an institution's culture over the long term.

CONCLUSION

The well-being of lawyers and law students should be a priority of the legal profession. While law firms, other legal workplaces, law schools, and bar associations all have roles to play in supporting legal professionals' mental health and well-being, individual lawyers and law students can also learn healthy strategies for coping with the inevitable stressors of legal practice and law school.

Mindfulness offers one approach that can be undertaken by anyone, anywhere, and at any time—although it does take discipline to undertake the practice consistently over time. You need to develop the intention to set aside purposeful

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166. MINDFULNESS L. SOC'Y, http://mindfulnessinlawsociety.com/ (last visited Aug. 30, 2018).

167. *Mindfulness Training for the Legal Mind,* WARRIOR ONE, LLC, https://warriorone.com/ (last visited Aug. 30, 2018).

168. *See* SCOTT ROGERS, http://scottrogers.com/ (Prof. Roger's website with offerings). For additional resources created by Prof. Rogers, see *supra* note 70.

169. *See, e.g.*, DEBORAH CALLOWAY, BECOMING A JOYFUL LAWYER: CONTEMPLATIVE TRAINING IN NON-DISTRACTION, EMPATHY, AND EMOTIONAL WISDOM (2012); GARY FRIEDMAN, INSIDE OUT: HOW CONFLICT PROFESSIONALS CAN USE SELF-REFLECTION TO HELP THEIR CLIENTS (2015); CHO & GIFFORD, *supra* note 124; GEORGE W. KAUFMAN, THE LAWYER'S GUIDE TO BALANCING LIFE AND WORK: TAKING THE STRESS OUT OF SUCCESS (2d ed. 2006) (while not focused specifically on mindfulness, providing a wide variety of similar and complementary exercises to promote work-life balance); NANCY LEVIT & DOUGLAS O. LINDER, THE HAPPY LAWYER: MAKING A GOOD LIFE IN THE LAW (2010); NATHALIE MARTIN, LAWYERING FROM THE INSIDE OUT: LEARNING PROFESSIONAL DEVELOPMENT THROUGH MINDFULNESS AND EMOTIONAL INTELLIGENCE (2018).

time to quiet your mind and focus your attention in the present moment, whether on your breathing, body, emotional state, eating, walking, or surroundings. Regular practice enhances the ability to deal with distractions, not get caught up in them, and keep your attention focused during the day, resulting in more efficiency, clarity, and productivity in your work. Regular practice can also build the ability to remain calm amid triggers and stressors that otherwise would evoke automatic, unreflective reactions (that you may regret later). By literally taking a breath, you can choose an appropriate response in this mindful pause.

Mindfulness is not just about stress relief, though that can be a benefit of regular practice. Over time, by acquainting yourself intimately with your thoughts, physical sensations, and emotions—which often remain only at the level of the subconscious—mindfulness can deepen your self-awareness and your ability to be self-reflective. Although the scientific research on mindfulness should be interpreted with caution given its limitations, it does suggest that mindfulness practice can positively affect many of the emotional and psychological variables of daily life, such as attention regulation, mood, emotion regulation, anxiety, depression, self-concept, empathy, and compassion.

Students at law schools across the country are increasingly asking for more support for their mental health, and student leaders at 13 top law schools have recently pledged to improve the mental health of their campuses.[170] In light of law students' strongly articulated need and desire for more support from their law schools for their health and well-being, the Author is pleased to have one of her students offer the last words in this Article on the benefits of mindfulness for the legal profession. Tatiana Posada took mindfulness training offered at our law school during her first semester of 1L year in 2015, and has been practicing regularly ever since. Nearly three years later, as she approached graduation and the summer bar exam, she reflected on how mindfulness practice has changed her life:

> I began to see a difference after about three weeks.
>
> . . . .
>
> I noticed changes in my personal life first. Small things, like I was calmer while driving in heavy traffic. Instead of getting frustrated, I was rolling down my windows and enjoying the sunrise. My personal relationships grew and became healthier as I became more patient and less anxious.
>
> I also noticed a difference in my academics. In class, I became less anxious about getting cold called, and I became more comfortable answering questions posed to the class. And when it came time for exams, mindfulness came through for me. With mindfulness, I could own my test anxiety instead of it owning me.
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> . . . .

170. Stephanie Francis Ward, *Students at Top Law Schools Ask for More Mental Health Support*, A.B.A. J. (Jan. 2018), http://www.abajournal.com/news/article/students_at_top_law_schools_ask_for_more_mental_health_supports.

> I saw benefits of practicing mindfulness in my employment as well.
>
> . . . I would take several deep breaths before working on a project. I used mindfulness to keep my focused attention, so I didn't waste time creating more stress for myself about all the other assignments I needed to complete. I took everything one step at a time.
>
> . . . .
>
> . . . [When I was interviewing for jobs], without fail, the first question I got in every interview was: tell me about mindfulness. Interviewers across the board were impressed with the program and my ability to already know the importance of having healthy tools to manage stress and anxiety now.
>
> I had attorneys tell me they wish they had this program when they were in law school because it might have saved relationships or changed career trajectories.
>
> . . . [U]sing mindfulness to create and maintain a healthy lifestyle can help ensure you deliver your best work and your best self for all of your clients throughout your career.[171]

171. Posada, *supra* note 157.

“Take me to the River” – How to identify a WOTUS

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2015 Clean Water Rule Cheat Sheet

WATERS OF THE U.S.: The term "waters of the United States" means:

(a)(1) All waters which are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide;

(a)(2) All interstate waters, including interstate wetlands;

(a)(3) The territorial seas;

(a)(4) All impoundments of waters otherwise identified as waters of the United States under this section;

(a)(5) All tributaries, as defined in paragraph (c)(3) of this section, of waters identified in paragraphs (a)(1) through (3) of this section;

(c)(3) Tributary and tributaries. The terms tributary and tributaries each mean a water that contributes flow, either directly or through another water (including an impoundment identified in paragraph (a)(4) of this section), to a water identified in paragraphs (a)(1) through (3) of this section that is characterized by the presence of the physical indicators of a bed and banks and an ordinary high water mark.

(a)(6) All waters adjacent to a water identified in paragraphs (a)(1) through (5) of this section, including wetlands, ponds, lakes, oxbows, impoundments, and similar waters;

(c)(1) Adjacent. The term adjacent means bordering, contiguous, or neighboring a water identified in paragraphs (a)(1) through (5) of this definition, including waters separated by constructed dikes or barriers, natural river berms, beach dunes, and the like.

(c)(2) Neighboring. The term neighboring means:

(c)(2)(i) All waters located within 100 feet of the ordinary high water mark of a water identified in paragraphs (a)(1) through (5) of this section. The entire water is neighboring if a portion is located within 100 feet of the ordinary high water mark;

(c)(2)(ii) All waters located within the 100-year floodplain of a water identified in paragraphs (a)(1) through (5) of this section and not more than 1,500 feet from the ordinary high water mark of such water. The entire water is neighboring if a portion is located within 1,500 feet of the ordinary high water mark and within the 100-year floodplain;

(c)(2)(iii) All waters located within 1,500 feet of the high tide line of a water identified in paragraphs (a)(1) or (a)(3) of this section, and all waters within 1,500 feet of the ordinary high water mark of the Great Lakes. The entire water is neighboring if a portion is located within 1,500 feet of the high tide line or within 1,500 feet of the ordinary high water mark of the Great Lakes.

(a)(7) All waters in paragraphs (a)(7)(i) through (v) of this section where they are determined, on a case-specific basis, to have a significant nexus to a water identified in paragraphs (a)(1) through (3) of this section.

(a)(7)(i) Prairie potholes.

(a)(7)(ii) Carolina bays and Delmarva bays.

(a)(7)(iii) Pocosins.

(a)(7)(iv) Western vernal pools.

(a)(7)(v) Texas coastal prairie wetlands.

(a)(8) All waters located within the 100- year floodplain of a water identified in paragraphs **(a)**(1) through (3) of this section and all waters located within 4,000 feet of the high tide line or ordinary high water mark of a water identified in paragraphs (a)(1) through (5) of this section where they are determined on a case-specific basis to have a significant nexus to a water identified in paragraphs (a)(1) through (3) of this section.

Not an official document; refer to 33CFR328.3 for official information.

2015 Clean Water Rule Cheat Sheet

EXCLUSIONS: 33CFR328.3(b) The following are not "waters of the United States" even where they otherwise meet the terms of paragraphs (a)(4) through (8) of this section.

(b)(1) Waste treatment systems, including treatment ponds or lagoons designed to meet the requirements of the Clean Water Act.

(b)(2) Prior converted cropland. Notwithstanding the determination of an area's status as prior converted cropland by any other Federal agency, for the purposes of the Clean Water Act, the final authority regarding Clean Water Act jurisdiction remains with EPA.

(b)(3) The following ditches:

- **(b)(3)(i)** Ditches with ephemeral flow that are not a relocated tributary or excavated in a tributary.
- **(b)(3)(ii)** Ditches with intermittent flow that are not a relocated tributary, excavated in a tributary, or drain wetlands.
- **(b)(3)(iii)** Ditches that do not flow, either directly or through another water, into a water identified in paragraphs (a)(1) through (3) of this section.

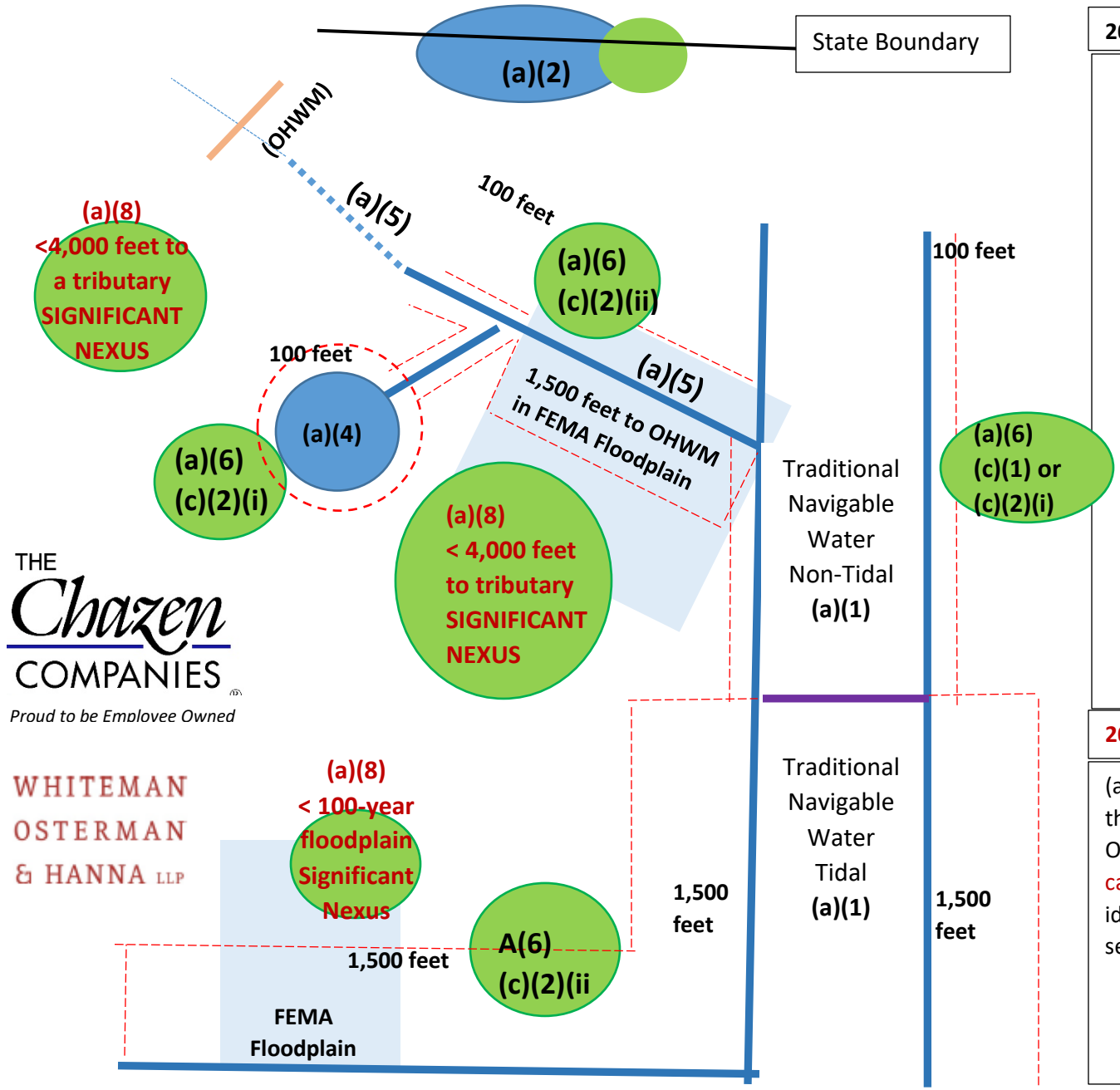
(b)(4) The following features:

- **(b)(4)(i)** Artificially irrigated areas that would revert to dry land should application of water to that area cease;
- **(b)(4)(ii)** Artificial, constructed lakes and ponds created in dry land such as farm and stock watering ponds, irrigation ponds, settling basins, fields flooded for rice growing, log cleaning ponds, or cooling ponds;
- **(b)(4)(iii)** Artificial reflecting pools or swimming pools created in dry land;
- **(b)(4)(iv)** Small ornamental waters created in dry land;
- **(b)(4)(v)** Water-filled depressions created in dry land incidental to mining or construction activity, including pits excavated for obtaining fill, sand, or gravel that fill with water;
- **(b)(4)(vi)** Erosional features, including gullies, rills, and other ephemeral features that do not meet the definition of tributary, non-wetland swales, and lawfully constructed grassed waterways; and
- **(b)(4)(vii)** Puddles.

(b)(5) Groundwater, including groundwater drained through subsurface drainage systems.

(b)(6) Stormwater control features constructed to convey, treat, or store stormwater that are created in dry land.

(b)(7) Wastewater recycling structures constructed in dry land; detention and retention basins built for wastewater recycling; groundwater recharge basins; percolation ponds built for wastewater recycling; and water distributary structures built for wastewater recycling.



The Territorial Sea **(a)(3)**
Or the Great Lakes **(a)(1), (a)(2)**

2015 WOTUS Regulations - Regulated

(a)(1) All waters used or usable for interstate or foreign commerce including those subject to ebb/flow of tide

(a)(2) Interstate waters/wetlands

(a)(3) Territorial seas

(a)(4) All impoundments of WOTUS

(a)(5) All Tributaries of waters (a)(1) –(a)(3)

(a)(6) All waters adjacent to waters (a)(1)-(a)(5)
(c)(1) Adjacent definition including abutting or separated by a barrier
(c)(2) Neighboring definition
(c)(2)(i) - Within 100 feet of OHWM of items (a)(1) – (a)(5)
(c)(2)(ii) Within 100-year floodplain and within 1,500 feet of OHWM of items (a)(1) –(a)(5)
(c)(2)(iii) Within 1,500 feet of High Tide Line of items (a)(1)-(a)(3) or 1,500 feet of Great Lakes.

2015 Regulations – Regulated with Significant Nexus

(a)(8) Waters within 100-year floodplain of items (a)(1) through (a)(3) and all waters within 4,000 feet of HTL or OHWM of waters (a)(1)-(a)(5) where determined on a case-by-case basis to have a significant nexus to a water identified in paragraphs (a)(1) through (a)(3) of this section.

Take me to the River—How to Identify a WOTUS

Presented By:

Chazen Engineering, Land Surveying, and Landscape Architecture Co., DPC
Barbara B. Beall, PWS, LEED® AP
&
Whiteman, Osterman & Hanna, LLP
Terresa Bakner, ESQ

September 24, 2019

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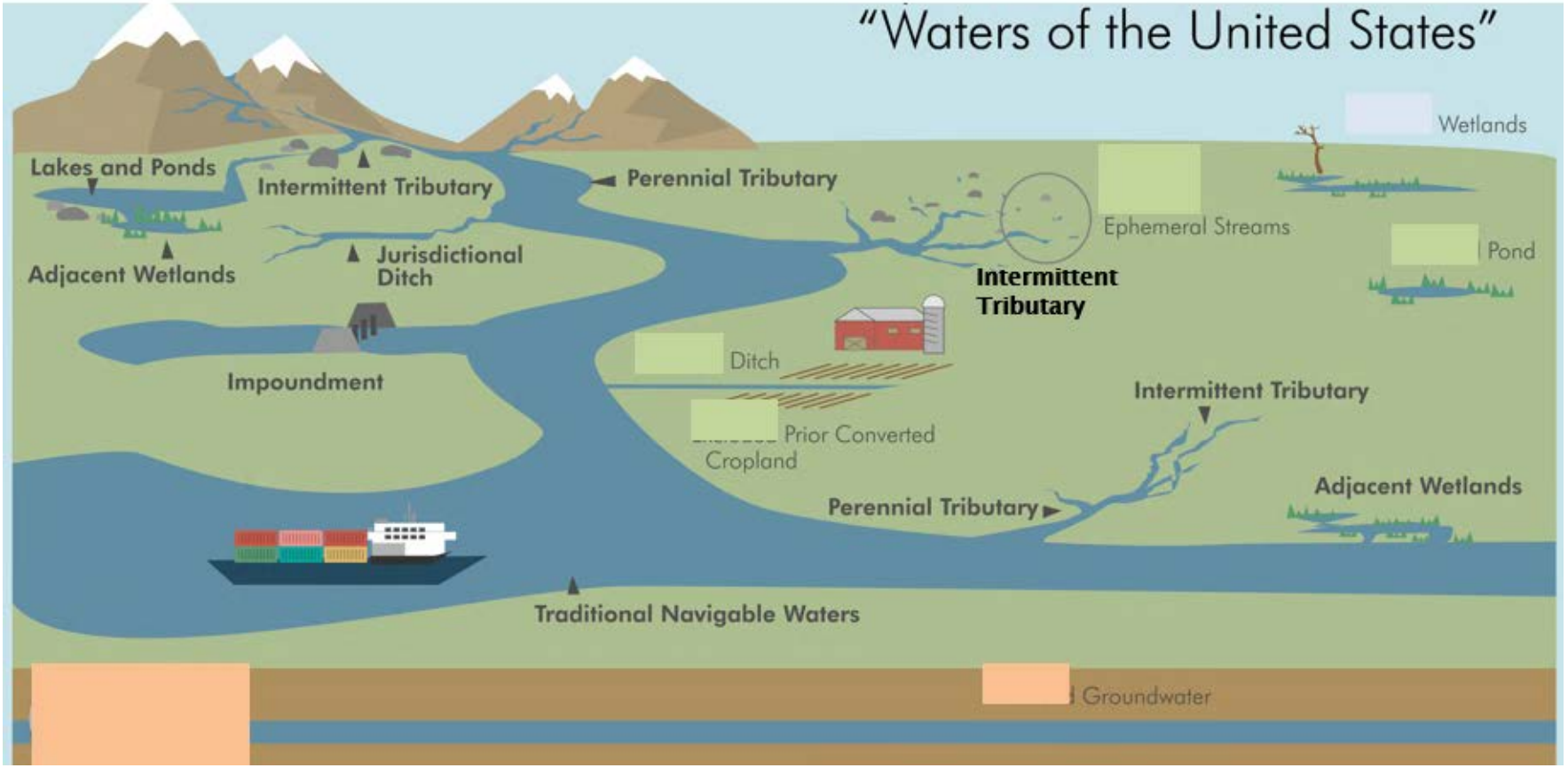
Outline

- Setting the Stage – 1972 to 2007
- 2015 WOTUS regulations
  (Sept – Oct 2015; August 2018 to Present)
- 2018 Proposed WOTUS Regulations
- How to Prepare for Changes

Setting the Stage….. 1972 to 2007

What are……



Setting the Stage….. 1972 to 2007

- 1789 – US Constitution – Federal v. States' Rights
- 1899 – Section 10 Rivers and Harbors Act
  [Traditionally] Navigable Waters (regulates work, structures)
- 1972 – Clean Water Act Section 404
  "Regulates discharge of dredged or fill material into navigable waters of the United States"
- Various lawsuits expand Section 404 jurisdiction
  1985 – US v. Riverside Bayview
- Before 1986, no limit headwater fills, 1986 – NWP 26
- 1995 – Lopez Decision – Commerce Clause Bubble

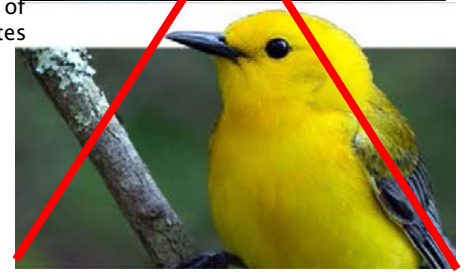
Setting the Stage….. 1972 to 2007

- 1997 – WILSON HOMES

  United States v. Wilson, 133 F. 3d 251 (4th Cir. 1997)

  Isolated wetlands not regulated if commerce connection is migratory birds. People watching birds does not necessarily equate to significant nexus under Commerce Clause. Limited to 4th circuit.

www.doi.gov. Economic impact of waterfowl hunting in United States



- 2001 – SWANCC v. US Army Corps of Engineers

  531 U.S. 159 (2001). US Supreme Court

  Nationally, isolated wetlands not regulated if commerce connection is migratory bird rule.

  Opened door to questions regarding significant nexus to commerce clause

https://www.nps.gov/common/uploads/photogallery/mwr/park/cuva/5B597EEE-155D-4519-3E567FD9C8D29567/5B597EEE-155D-4519-3E567FD9C8D29567-large.JPG

Setting the Stage….. 1972 to 2007

2006 – Rapanos (and Carabell) v. United States

547 U.S. 715 (2006)

- Rapanos – Four Michigan wetlands near ditches or man-made drains eventually running to TNWs. Carabell is denied permit to fill wetlands adjacent to a ditch.
- Plurality decision.
- Waters of the United States "…includes only those relatively permanent, standing or continuously flowing bodies of water "forming geographic features" that are described in ordinary parlance as "streams[,] … oceans, rivers, [and] lakes…" [and their immediately adjacent wetlands.]
- **"Absent more specific regulations…"** Corps must establish significant nexus on a case by case bases when seeking to regulate wetlands based on adjacency to non-navigable tributaries in order to avoid unreasonable application of the Act.
- Significant nexus determination requires demonstration of more than insubstantial or insignificant physical, chemical, biological inputs to TNWs from low volume waters adjacent wetlands.

Setting the Stage….. 1972 to 2007

- Rapanos and Carabell Guidance – 5/30/2007

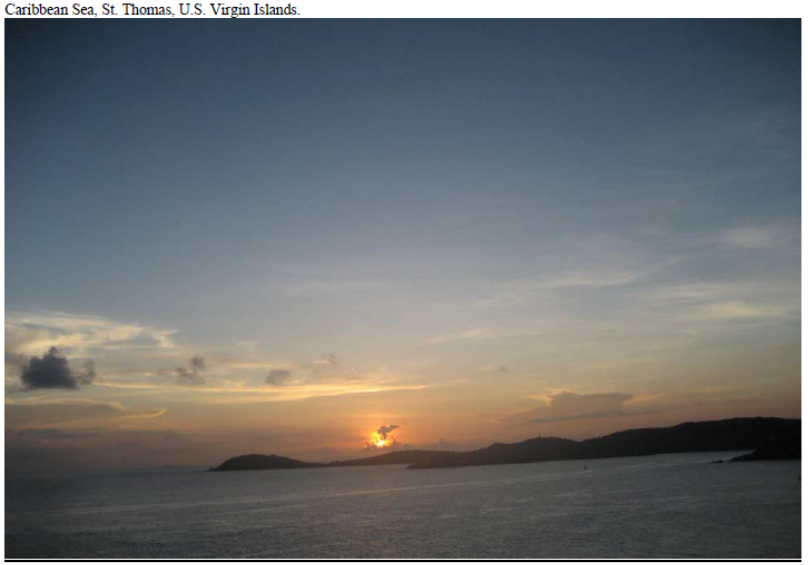
- Approved JD versus Preliminary JD
- When significant nexus needed.
- How to complete JD forms.
- Photos:
- TNW, Wetland adj to TNW.
- RPWs, non-RPWs
- Wetlands directly abutting RPWS
- Wetlands adjacent but not abutting
- Impoundments
- Isolated waters
- Ditches, swales, erosional features

- http://www.usace.army.mil/Portals/2/docs/civilworks/regulatory/cwa_guide/jd_guidebook_051207final.pdf

U.S. ARMY CORPS OF ENGINEERS
JURISDICTIONAL DETERMINATION FORM
INSTRUCTIONAL GUIDEBOOK

This document contains instructions to aid field staff in completing the *Approved Jurisdictional Determination Form* (*"JD form"*). **This document is intended to be used as the U.S. Army Corps of Engineers Regulatory National Standard Operating Procedures for conducting an approved jurisdictional determination (JD) and documenting practices to support an approved JD until this document is further revised and reissued.**[1]

Caribbean Sea, St. Thomas, U.S. Virgin Islands.



This document was prepared jointly by the U.S. Army Corps of Engineers and the Environmental Protection Agency.

The CWA provisions and regulations described in this document contain legally binding requirements. This guidance does not substitute for those provisions or regulations, nor is it a regulation itself. It does not impose legally binding requirements on EPA, the Corps, or the regulated community, and may not apply to a particular situation depending on the circumstances. Any decisions regarding a particular water will be based on the applicable statutes, regulations, and case law. Therefore, interested persons are free to raise questions about the appropriateness of the application of this guidance to a particular situation, and EPA and/or the Corps will consider whether or not the recommendations or interpretations of this guidance are appropriate in that situation based on the statutes, regulations, and case law.

2007 Definition WOTUS Section 404 – 33 CFR 238.3(a)

Traditionally Navigable Waters (TNW)

1. All waters that are currently used, or were used in the past, or which may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide.

- Similar to "Navigable Waters" 33 CFR 329.4 Section 10 Rivers & Harbors Act

https://www.epa.gov/wetlands/coastal-wetlands

https://www.nps.gov/voya/learn/historyculture/the-fur-trade.htm. Artist Frances Anne Hopkins, 1869. National Archives of Canada

www.archives.gov

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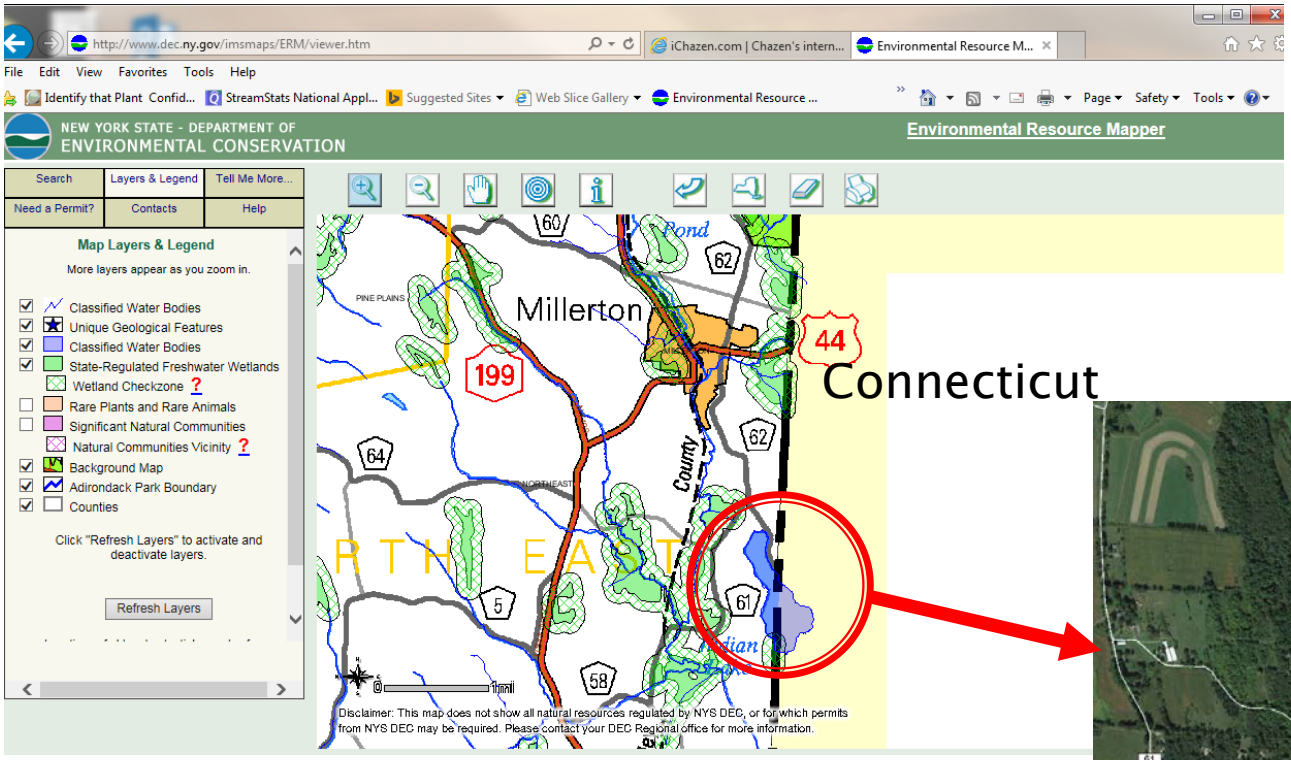
2007 Definition WOTUS Section 404 – 33 CFR 238.3(a)

- 2. All Interstate Waters and Wetlands



http://www.dec.ny.gov/imsmaps/ERM/viewer.htm

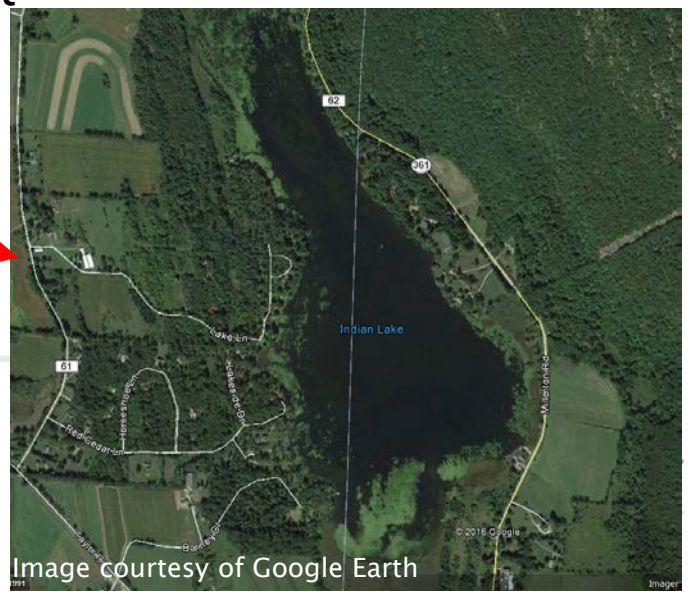


Image courtesy of Google Earth

2007 Definition WOTUS Section 404 – 33 CFR 238.3(a)

COMMERCE CLAUSE CONNECTION

3. All other waters such as intrastate lakes, streams (including intermittent streams) mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation or destruction of which could affect interstate or foreign commerce including any such waters:

(i) Which are or could be used by interstate or foreign travelers for recreational or other purposes

(ii) From which fish or shellfish are or could be taken and sold in interstate or foreign commerce

(iii) Which are/could be used for industrial purposes by industries in interstate commerce

http://www.fda.gov/downloads.food/foodbornelllnessContaminants/UCM239497.pdf

https://www.epa.gov/eg/stream-electric-power-generating-effluent-guidelines

www.danvilleva.gov

http://www.fws.gov/birds/surveys-and-data/harvest-surveys/harvest-information-program.php

www.www.fws.gov/birdhabitat/img/home-hero/impact-07-desktop.png

2007 Definition WOTUS Section 404 – 33 CFR 238.3(a)

THE REST OF THE DEFINITION

4. All impoundments of waters otherwise defined as waters of the U.S.
5. Tributaries of waters identified in paragraphs (a)(1)-(4) [above]
6. The territorial seas
7. Wetlands adjacent to waters (other than wetlands that are themselves wetlands) identified in paragraphs (a)(1)-(6) of this definition

http://www.hoover.archives.gov/research/photos/images/1941-9A.jpg

http://www.fws.gov/mountain-prarie/refuges/images/partnerImages/WY-PFW-UG-Wetlands-and_Sage-MG_1996.jpg

http://www.nesdis.noaa.gov/images/wave_big.jpg

https://www.epa.gov/sites/production/files/styles/large/public/2014-03/san_pedro_2.jpg

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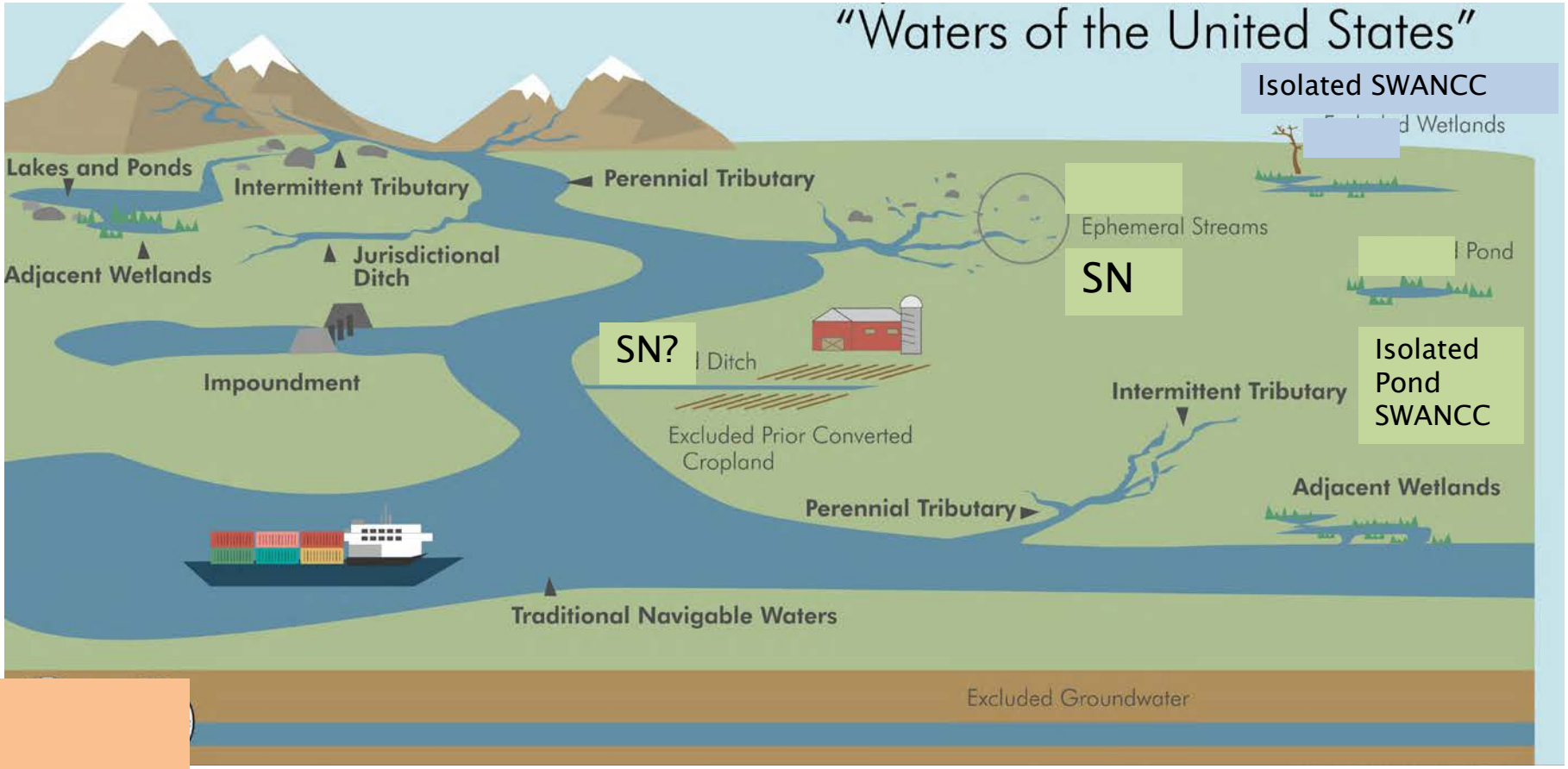
2007 Definition WOTUS

- 2005-05 Regulatory Guidance Letter "Ordinary High Water Mark"
- New Corps Web page dedicated to OHWM
- Focus is on Arid West, Western Mountains, Western Coastal Regions
- OHWM Datasheet
- http://www.erdc.usace.army.mil/Media/FactSheets/FactSheetArticleView/tabid/9254/Article/486085/ordinary-high-water-mark-ohwm-research-development-and-training.aspx

http://media.defense.gov/2014/Aug/04/2000809877/260/200/0/140710-A-DW451-002.JPG

2007 Definition WOTUS (11 years to 2018)



SN=Significant Nexus Test per Rapanos
Isolated per SWANCC (Migratory Birds)

2014 – Proposed WOTUS Regulations

- April 21, 2014 Public Notice
- Draft Connectivity of Streams and Wetlands to Downstream Waters Report

WOUS_ERD2_SEP2013.pdf

FEDERAL REGISTER

Vol. 79 Monday,
No. 76 April 21, 2014

Part II

Department of Defense

Department of the Army, Corps of Engineers
33 CFR Part 328

Environmental Protection Agency

40 CFR Parts 110, 112, 116, et al.
Definition of "Waters of the United States" Under the Clean Water Act; Proposed Rule

DRAFT
DO NOT CITE OR QUOTE

EPA/600/R-11/098B
September 2013
External Review Draft

Connectivity of Streams and Wetlands to Downstream Waters: A Review and Synthesis of the Scientific Evidence

NOTICE

THIS DOCUMENT IS A PRELIMINARY DRAFT. It has not been formally released by the U.S. Environmental Protection Agency and should not be construed to represent Agency policy. It is being circulated for comment on its technical accuracy and policy implications.

Office of Research and Development
U.S. Environmental Protection Agency
Washington, DC

https://www.epa.gov/cleanwaterrule/final-clean-water-rule

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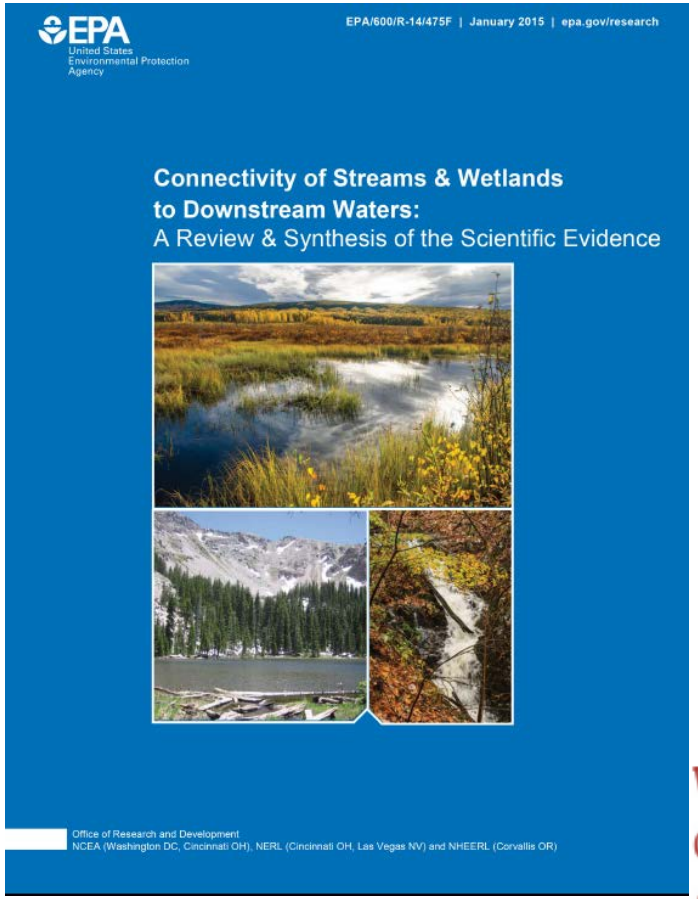
2014 Proposed WOTUS Regulations

- 2014, 2015 Comment period extended
  (July 21, 2014 and October 21, 2015)
- 2015 Final Stream and Wetland Connectivity Report
  (January 15, 2015)

https://www.federalregister.gov/articles/2015/06/29/2015-13435/clean-water-rule-definition-of-waters-of-the-united-states

https://cfpub.epa.gov/ncea/risk/recordisplay.cfm?deid=296414&CFID=62072551&CFTOKEN=98003338



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Proposed 2014 WOTUS Regulations

3 Parts:
What's regulated. What's not regulated. Definitions.

Regulated (paragraphs i-v similar to 2007)

(vi) All waters, including wetlands, adjacent to a water identified in paragraphs (1)(i) through (v) of this definition; and

(vii) On a case-specific basis, other waters, including wetlands, provided that those waters alone, or in combination with other similarly situated waters, including wetlands, located in the same region, have a significant nexus to a water identified in paragraphs (1)(i) through (iii) of this definition.

(3) Definitions—

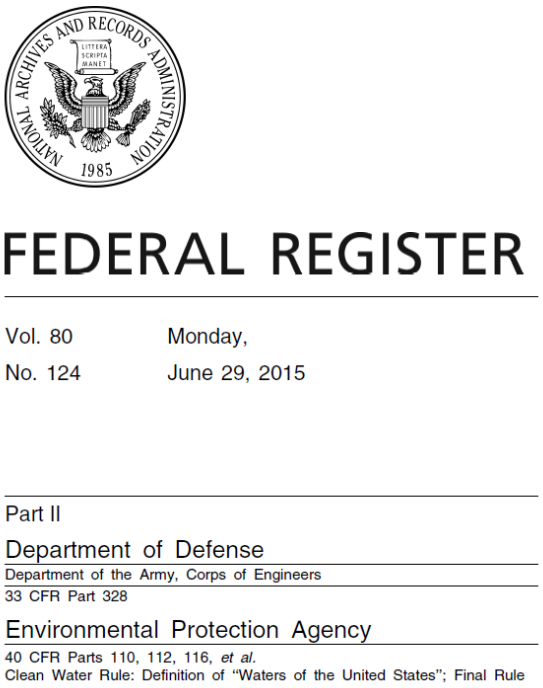
(i) *Adjacent.* The term *adjacent* means bordering, contiguous or neighboring. Waters, including wetlands, separated from other waters of the United States by man-made dikes or barriers, natural river berms, beach dunes and the like are "adjacent waters."

(ii) *Neighboring.* The term *neighboring,* for purposes of the term "adjacent" in this section, includes waters located within the riparian area or floodplain of a water identified in paragraphs (1)(i) through (v) of this definition, or waters with a shallow subsurface hydrologic connection or confined surface hydrologic connection to such a jurisdictional water.

(iii) *Riparian area.* The term *riparian area* means an area bordering a water where surface or subsurface hydrology directly influence the ecological processes and plant and animal community structure in that area. Riparian areas are transitional areas between aquatic and terrestrial ecosystems that influence the exchange of energy and materials between those ecosystems.

2015 WOTUS Regulations (3 mo. – Aug–Oct 2015)

- Published June 29, 2015
- Effective August 28, 2015
- **SIGNIFICANTLY** Different than Proposed Rule



FEDERAL REGISTER

Vol. 80 Monday,
No. 124 June 29, 2015

Part II

Department of Defense
Department of the Army, Corps of Engineers
33 CFR Part 328

Environmental Protection Agency
40 CFR Parts 110, 112, 116, *et al.*
Clean Water Rule: Definition of "Waters of the United States"; Final Rule

https://www.federalregister.gov/articles/2015/06/29/2015-13435/clean-water-rule-definition-of-waters-of-the-united-states

Other information on same page provided in support of the rule

2015 WOTUS Regulations – Stayed

STAYED for 2.5 years OCT. 2015 TO AUG. 2018

- **August 27, 2015** – US District Court for District of North Dakota Southeast Division – Memorandum Opinion and Order Granting Plaintiff's Motion for Preliminary Injunction – Case 3:15-cv-00059-RRE-ARS, Document 70, Filed 08/27/15
- **October 9, 2015** – National stay on rule via court action – 6th Circuit

The Washington Post

The Volokh Conspiracy | Opinion

Sixth Circuit puts controversial 'waters of the United States' (WOTUS) rule on hold

http://www.washingtonpost.com/volokh-conspiracy/wp/2015/10/09/sixth-circuit-puts...

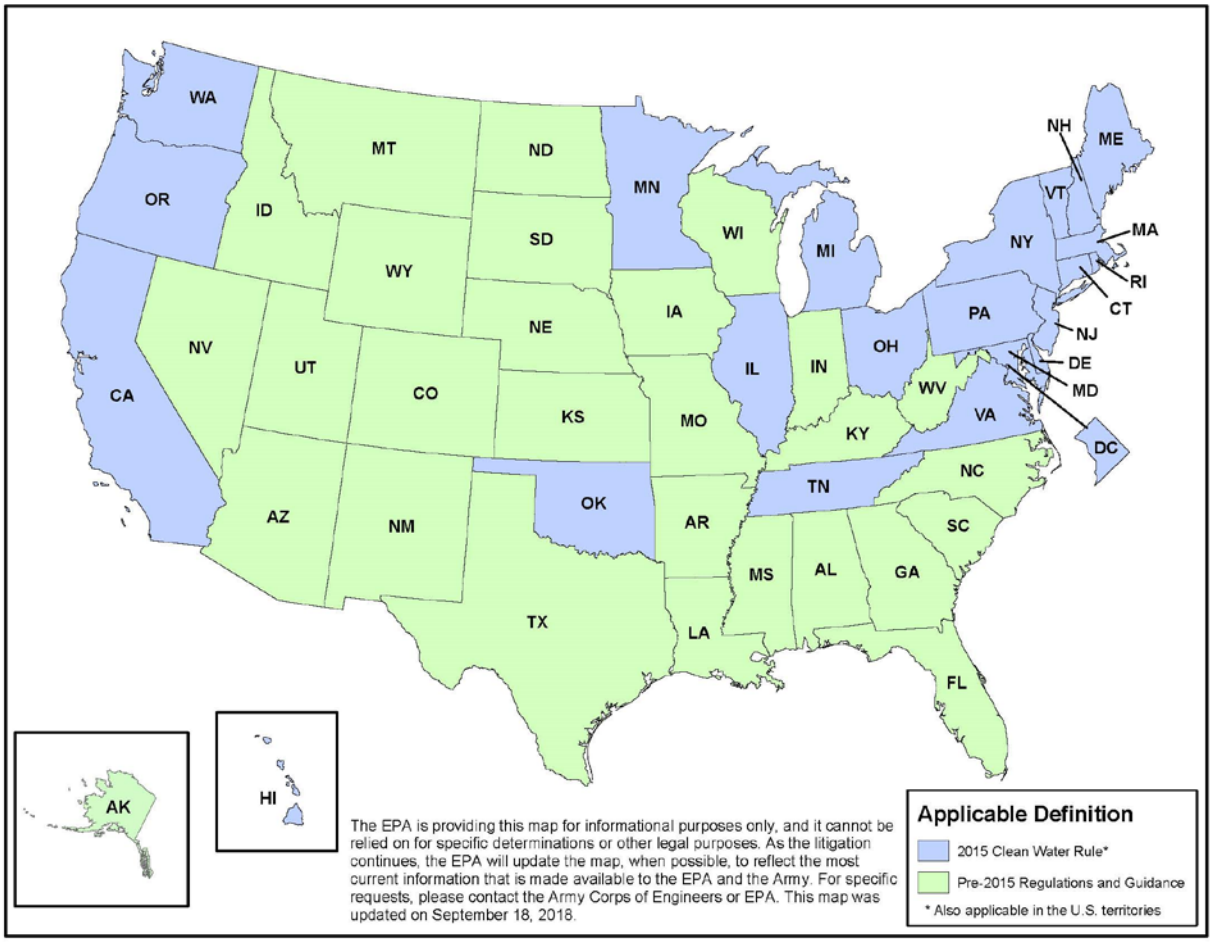
By Jonathan H. Adler October 9, 2015

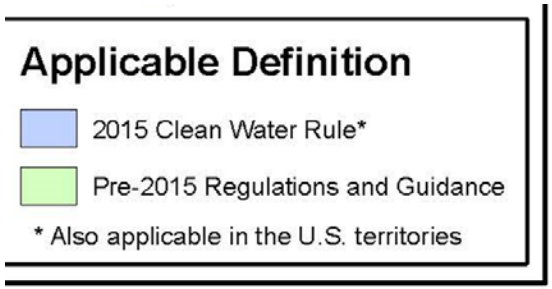
2015 WOTUS Regulations – August 2018

Definition of "Waters of the United States": Rule Status and Litigation Update

The EPA and the Army continue to review the U.S. District Court for the District of South Carolina's decision to nationally enjoin the agencies' final rule that added an applicability date to the 2015 Clean Water Rule. Pursuant to the court's order, the 2015 Clean Water Rule is now in effect in 22 states, the District of Columbia, and the U.S. territories. Parties to the case, including the EPA and the Army, have filed motions appealing the order and seeking a stay of the district court's decision. While the litigation continues, the agencies are complying with the district court's order and implementation issues that arise are being handled on a case-by-case basis. The agencies recognize the uncertainty this decision has created and are committed to working closely with states and stakeholders to provide updated information on an ongoing basis regarding which rules are in place in which states. If a state, tribe, or an entity has specific questions about a pending jurisdictional determination or permit, please contact a local U.S. Army Corps of Engineers District office or the EPA.

2015 WOTUS Regulations – August 2018





https://www.usace.army.mil/missions/civil-works/regulatory-program-and-permits/juris_info/

2015 WOTUS Regulations – CURRENT

3 Parts (along with Preamble)

- Regulations defining Waters of the United States (Paragraphs a1-a8)
- Regulations defining what is not a Water of the United States
- (Paragraphs b1-b7)
- Regulations defining terms (Section c)

Biggest Areas of Concern

- Within 4,000 feet of a tributary
- Significant Nexus "A water has significant nexus when any single function or combination of functions performed by the water, alone or with similarly situated waters in the region contribute significantly to the chemical, physical or biological integrity of the nearest water (a)(1) through (a)(3)
- Similarly situated aquatic resources
- What is a "Tributary" relative to Ditches, Ephemeral Streams (OHWM, contribution of flow, was it previously a stream?)
- "Neighboring" relative to tributaries automatically regulated

2015 WOTUS Regulations – CURRENT

From Buffalo Corps District Consultant Training November 2018
Baker, Susan L CIV USARMY CELRB (US) <susan.l.baker@usace.army.mil>

2015 Clean Water Rule Cheat Sheet

WATERS OF THE U.S.: The term "waters of the United States" means:

(a)(1) All waters which are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide;

(a)(2) All interstate waters, including interstate wetlands;

(a)(3) The territorial seas;

(a)(4) All impoundments of waters otherwise identified as waters of the United States under this section;

(a)(5) All tributaries, as defined in paragraph (c)(3) of this section, of waters identified in paragraphs (a)(1) through (3) of this section;

(c)(3) Tributary and tributaries. The terms tributary and tributaries each mean a water that contributes flow, either directly or through another water (including an impoundment identified in paragraph (a)(4) of this section), to a water identified in paragraphs (a)(1) through (3) of this section that is characterized by the presence of the physical indicators of a bed and banks and an ordinary high water mark.

From Definition Section of Regulations

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2015 WOTUS Regulations – CURRENT

From Buffalo Corps District Consultant Training November 2018

Tributaries

- May be natural, modified, constructed including ditches
- May be ephemeral, intermittent or perennial
- Ditches have additional criteria
- Tributaries must contribute flow
  Flow can be through a jurisdictional or non-jurisdictional feature or impoundment.
- Must have bed/bank & OHWM
- Upper limit where bed/bank and/or OHWM disappear.
- There may be breaks in OHWM but tributary still jurisdictional. Measure and map breaks.
- Ditches are constructed features.
- Ditches are regulated only if they both meet defn of “tributary” and are not excluded under paragraph (b)(3)

2015 WOTUS Regulations – CURRENT

From Buffalo Corps District Consultant Training November 2018

(a)(6) All waters adjacent to a water identified in paragraphs (a)(1) through (5) of this section, including wetlands, ponds, lakes, oxbows, impoundments, and similar waters;

(c)(1) Adjacent. The term adjacent means bordering, contiguous, or neighboring a water identified in paragraphs (a)(1) through (5) of this definition, including waters separated by constructed dikes or barriers, natural river berms, beach dunes, and the like.

(c)(2) Neighboring. The term neighboring means:

(c)(2)(i) All waters located within 100 feet of the ordinary high water mark of a water identified in paragraphs (a)(1) through (5) of this section. The entire water is neighboring if a portion is located within 100 feet of the ordinary high water mark;

(c)(2)(ii) All waters located within the 100-year floodplain of a water identified in paragraphs (a)(1) through (5) of this section and not more than 1,500 feet from the ordinary high water mark of such water. The entire water is neighboring if a portion is located within 1,500 feet of the ordinary high water mark and within the 100-year floodplain;

(c)(2)(iii) All waters located within 1,500 feet of the high tide line of a water identified in paragraphs (a)(1) or (a)(3) of this section, and all waters within 1,500 feet of the ordinary high water mark of the Great Lakes. The entire water is neighboring if a portion is located within 1,500 feet of the high tide line or within 1,500 feet of the ordinary high water mark of the Great Lakes.

From Definition Section of Regulations

2015 WOTUS Regulations – CURRENT

From Buffalo Corps District Consultant Training November 2018

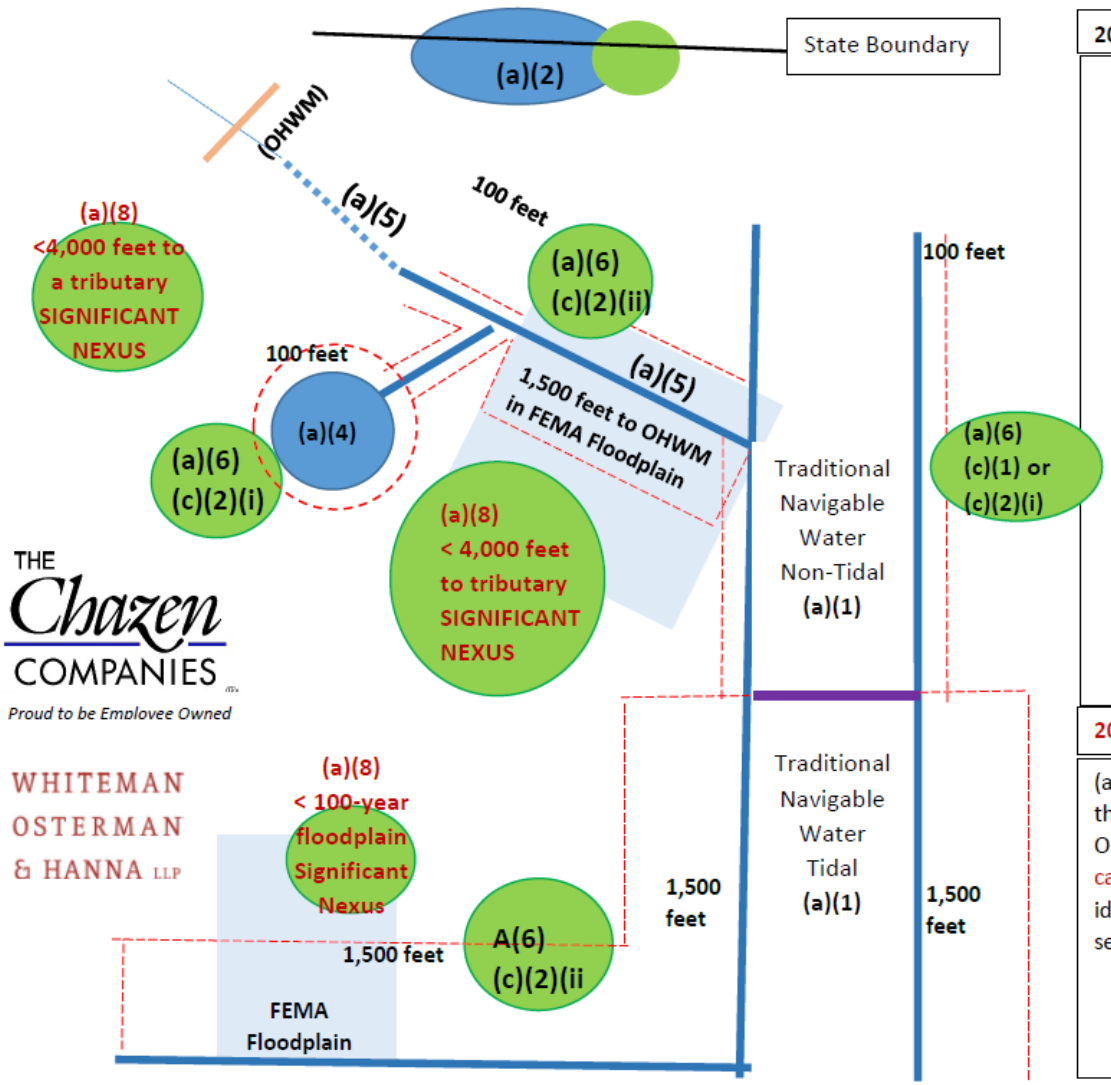
(a)(7) All waters in paragraphs (a)(7)(i) through (v) of this section where they are determined, on a case-specific basis, to have a significant nexus to a water identified in paragraphs (a)(1) through (3) of this section.
(a)(7)(i) Prairie potholes.
(a)(7)(ii) Carolina bays and Delmarva bays.
(a)(7)(iii) Pocosins.
(a)(7)(iv) Western vernal pools.
(a)(7)(v) Texas coastal prairie wetlands.

Not found in NYS

(a)(8) All waters located within the 100- year floodplain of a water identified in paragraphs (a)(1) through (3) of this section and all waters located within 4,000 feet of the high tide line or ordinary high water mark of a water identified in paragraphs (a)(1) through (5) of this section where they are determined on a case-specific basis to have a significant nexus to a water identified in paragraphs (a)(1) through (3) of this section.

Not an official document; refer to 33CFR328.3 for official information.

2015 WOTUS Schematic



2015 WOTUS Regulations - Regulated

(a)(1) All waters used or usable for interstate or foreign commerce including those subject to ebb/flow of tide

(a)(2) Interstate waters/wetlands

(a)(3) Territorial seas

(a)(4) All impoundments of WOTUS

(a)(5) All Tributaries of waters (a)(1) –(a)(3)

(a)(6) All waters adjacent to waters (a)(1)-(a)(5)
(c)(1) Adjacent definition including abutting or separated by a barrier
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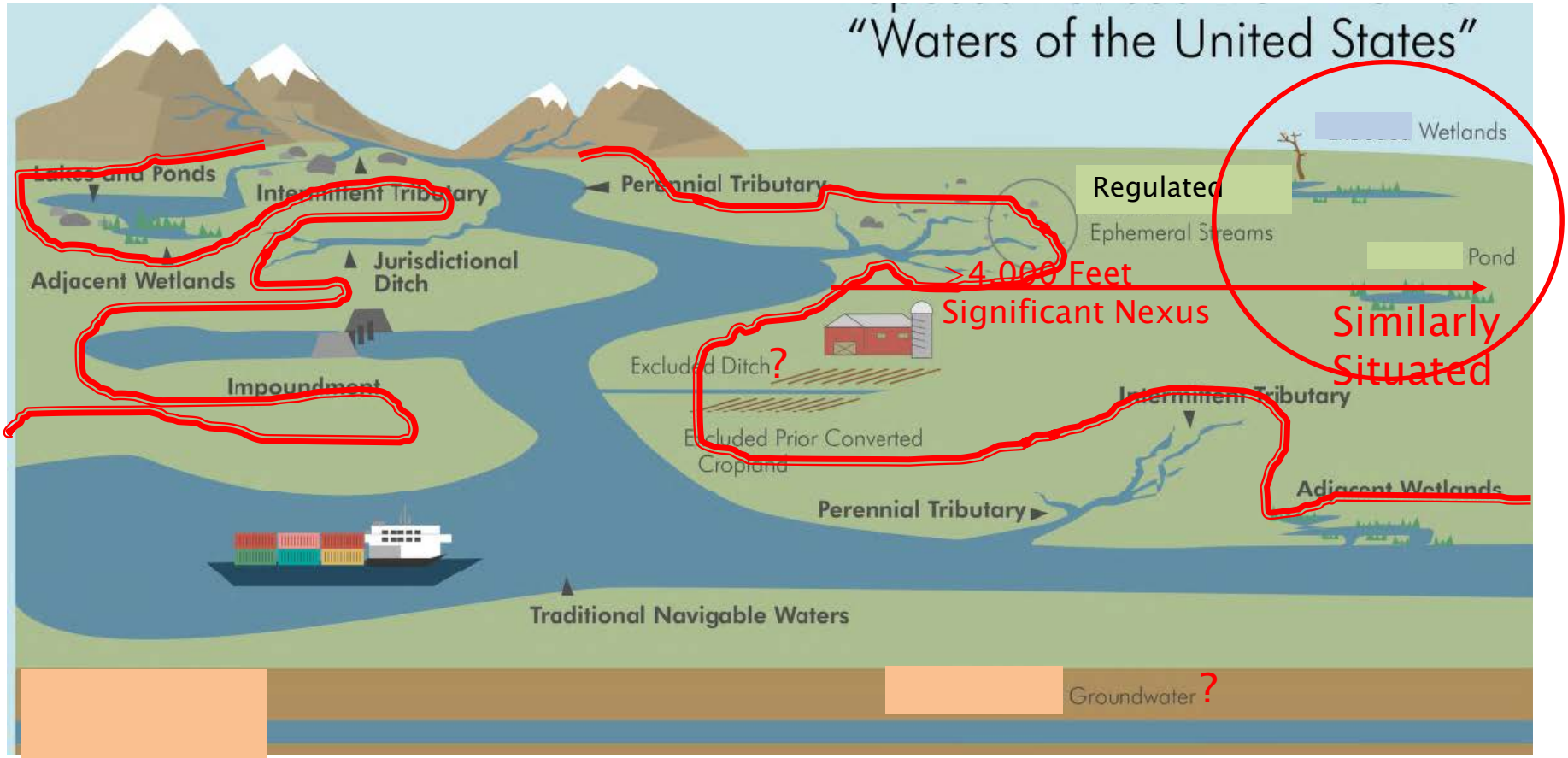
(c)(2)(ii) Within 100-year floodplain and within 1,500 feet of OHWM of items (a)(1) –(a)(5)
(c)(2)(iii) Within 1,500 feet of High Tide Line of items (a)(1)-(a)(3) or 1,500 feet of Great Lakes.

2015 Regulations – Regulated with Significant Nexus

(a)(8) Waters within 100-year floodplain of items (a)(1) through (a)(3) and all waters within 4,000 feet of HTL or OHWM of waters (a)(1)-(a)(5) where determined on a case-by-case basis to have a significant nexus to a water identified in paragraphs (a)(1) through (a)(3) of this section.

2015 WOTUS Regulations



Neighboring – (c)(2) – Automatically Regulated

- W/in 100 feet all tributaries
- W/in 100-year floodplain & w/in 1,500 feet OHWM all tributaries
- W/in 1,500 feet of TNW, Seas, Great Lakes

2015 WOTUS Regulations – CURRENT

From Buffalo Corps District Consultant Training November 2018

2015 Clean Water Rule Cheat Sheet

EXCLUSIONS: 33CFR328.3(b) The following are not "waters of the United States" even where they otherwise meet the terms of paragraphs (a)(4) through (8) of this section.

(b)(1) Waste treatment systems, including treatment ponds or lagoons designed to meet the requirements of the Clean Water Act.

(b)(2) Prior converted cropland. Notwithstanding the determination of an area's status as prior converted cropland by any other Federal agency, for the purposes of the Clean Water Act, the final authority regarding Clean Water Act jurisdiction remains with EPA.

(b)(3) The following ditches:

- **(b)(3)(i)** Ditches with ephemeral flow that are not a relocated tributary or excavated in a tributary.
- **(b)(3)(ii)** Ditches with intermittent flow that are not a relocated tributary, excavated in a tributary, or drain wetlands.
- **(b)(3)(iii)** Ditches that do not flow, either directly or through another water, into a water identified in paragraphs (a)(1) through (3) of this section.

(b)(4) The following features:

- **(b)(4)(i)** Artificially irrigated areas that would revert to dry land should application of water to that area cease;
- **(b)(4)(ii)** Artificial, constructed lakes and ponds created in dry land such as farm and stock watering ponds, irrigation ponds, settling basins, fields flooded for rice growing, log cleaning ponds, or cooling ponds;
- **(b)(4)(iii)** Artificial reflecting pools or swimming pools created in dry land;
- **(b)(4)(iv)** Small ornamental waters created in dry land;
- **(b)(4)(v)** Water-filled depressions created in dry land incidental to mining or construction activity, including pits excavated for obtaining fill, sand, or gravel that fill with water;
- **(b)(4)(vi)** Erosional features, including gullies, rills, and other ephemeral features that do not meet the definition of tributary, non-wetland swales, and lawfully constructed grassed waterways; and

2015 WOTUS Regulations – CURRENT

From Buffalo Corps District Consultant Training November 2018

EXCLUSIONS: 33CFR328.3(b) The following are not "waters of the United States" even where they otherwise meet the terms of paragraphs (a)(4) through (8) of this section.

(b)(5) Groundwater, including groundwater drained through subsurface drainage systems.

(b)(6) Stormwater control features constructed to convey, treat, or store stormwater that are created in dry land.

(b)(7) Wastewater recycling structures constructed in dry land; detention and retention basins built for wastewater recycling; groundwater recharge basins; percolation ponds built for wastewater recycling; and water distributary structures built for wastewater recycling.

Not an official document; refer to 33CFR328.3 for official information.

BBB-TMB Comment

Take care that an Excluded Feature is not actually a regulated water

2015 WOTUS Regulations – CURRENT

Significant nexus. Means that a water, including wetlands, either alone or in combination with similarly situated waters in the region, significantly affects the chemical, physical, or biological integrity of a water identified in paragraphs (1)(i) through (1)(iii) [(a)(1) through (a)(3)] of this definition. For an effect to be significant, it must be more than speculative or insubstantial. Waters are similarly situated when they function alike and are sufficiently close to function together in affecting downstream waters. For purposes of determining whether or not a water has a significant nexus, the water's effect on downstream (1)(i) through 1(iii) waters shall be assessed by evaluating the aquatic functions identified in paragraphs (3)(v)(A) through (I) of this definition. A water has a significant nexus when any single function or combination of functions performed by the water, alone or together with similarly situated waters in the region, contributes to the chemical, physical, or biological integrity of the nearest water identified in paragraphs 1(i) through 1(iii) of this definition. Functions are sediment trapping, nutrient recycling, pollutant trapping, transformation, filtering and transport, retention and attenuation of flood waters, runoff storage, contribution of flows, export of organic matter, export of food resources, life dependent aquatic habitat.

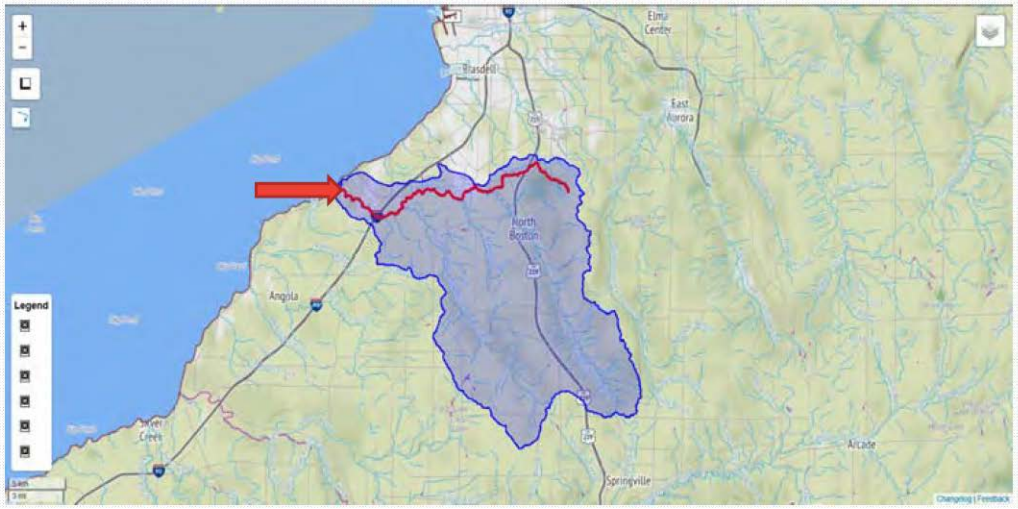
2015 WOTUS Regulations – CURRENT

Significant Nexus Assessment for (a)(8) Waters

From Buffalo Corps District Consultant Training November 2018

Currently no published "step by step" guidance on significant nexus determinations, but ESRI Map Layers identified.

The SPOE watershed is drawn using the ESRI watershed delineation tool.



Identify flowpath from (a)(8) water to nearest (a)1–(a)(5) water

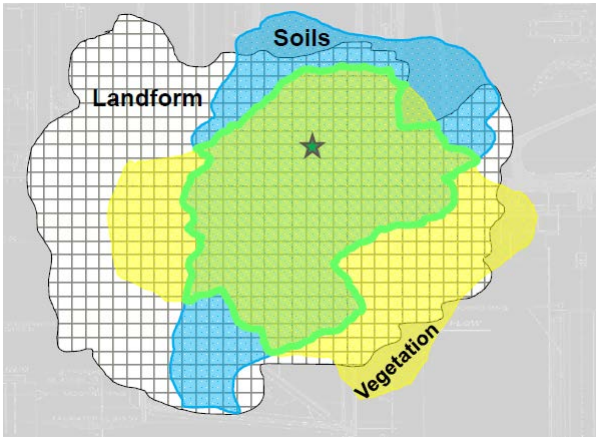
Identify closest TNW

Delineate Single Point of Entry (SPOE) Watershed to TNW.

2015 WOTUS Regulations – Current

Significant Nexus Assessment for (a)(8) Waters

From Buffalo Corps District Consultant Training November 2018



What are similarly situated waters

Similarly Situated Waters – Aggregate #1

GIS "Venn Diagram"

- Waters within (a)(8) limits and waters within (a)(6) limits subject to established normal farming ranching or silvicultural activities that
  - Have similar functions (same Cowardin system) palustrine, lacustrine, riverine) **AND**
- Are located sufficiently close to each other:
  - Within the same uninterrupted, contiguous area of land as the subject water, with relatively homogeneous SOILS, VEGETATION, and LANDFORM

2015 WOTUS Regulations – Current

Significant Nexus Assessment for (a)(8) Waters

From Buffalo Corps District Consultant Training November 2018

What are similarly situated waters

Similarly Situated Waters – Aggregate #2

GIS "Venn Diagram"

- Waters having similar functions (same Cowardin Class) (emergent, forested) **AND**
- Are located sufficiently close to a WOTUS:
  - Waters which lie within (a)(8) water thresholds within the SPOE of subject water & waters within (a)(6) limits that are subject to normal farming, ranching or silvicultural activities.

2015 WOTUS Regulations – CURRENT

(i) Sediment trapping,
(ii) Nutrient recycling,
(iii) Pollutant trapping, transformation, filtering, and transport,
(iv) Retention and attenuation of flood waters,
(v) Runoff storage,
(vi) Contribution of flow,
(vii) Export of organic matter,
(viii) Export of food resources, and
(ix) Provision of life cycle dependent aquatic habitat (such as foraging, feeding, nesting, breeding, spawning, or use as a nursery area) for species located in a water identified in paragraphs (a)(1)-(a)(3)

"Lack of connectivity may be the significant nexus"

What are functions of similarly situated waters
What are functions of TNW
What is connection/nexus
Is it significant?

"Significant is more than speculative or insubstantial"

Similarly situation waters do not need to perform all 9 functions – only 1 function of significance required.

Hydrologic connectivity should be considered but not required.

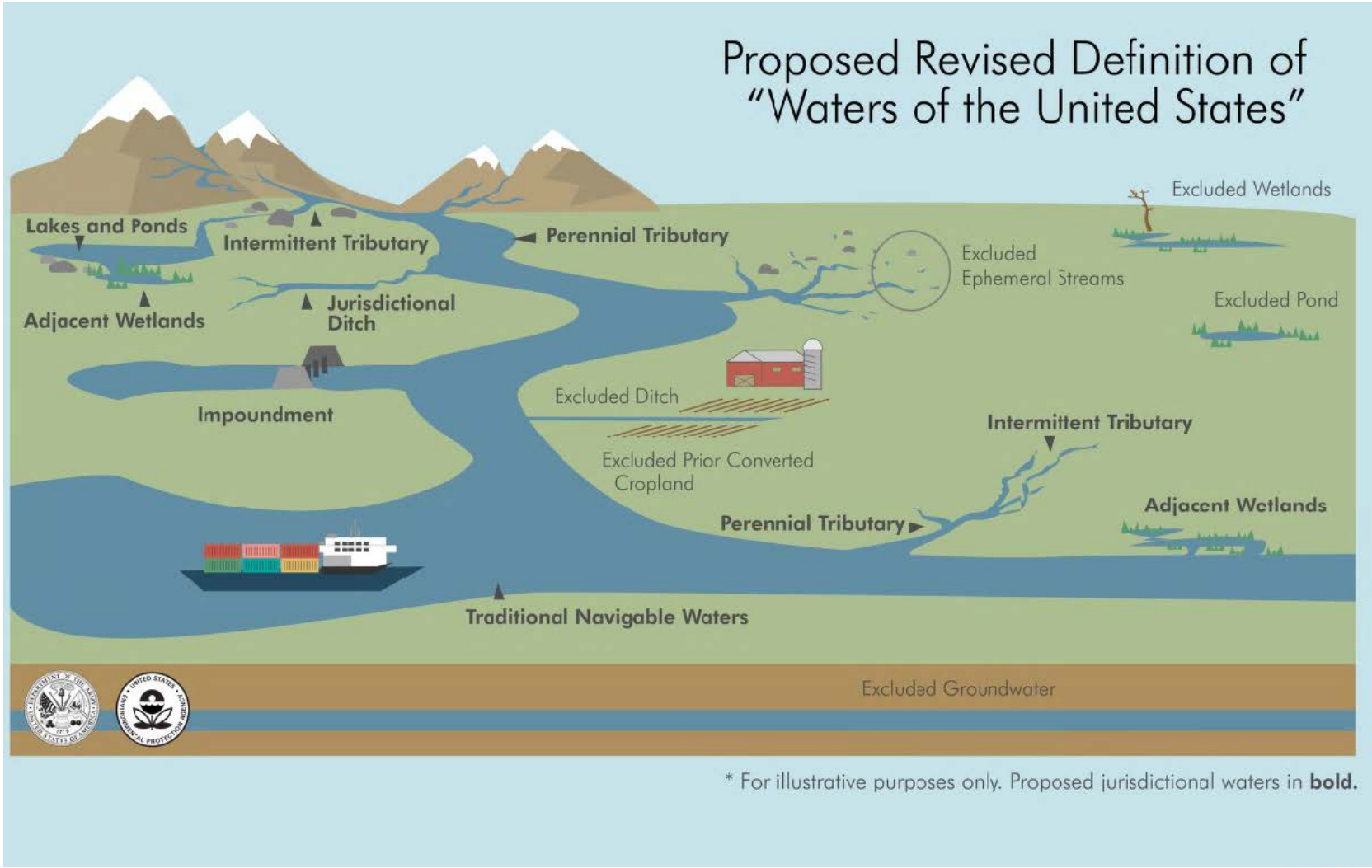
2018 WOTUS Regulations – PROPOSED

December 11, 2018 USEPA and Corps proposed new Definition of WOTUS
See Fact Sheet material in package
Proposed Rule was published in the Federal Register on February 14, 2019
EPA Expects rule to be finalized in 2020
Much more Scalia than Kennedy

BACKGROUND

- On December 11, 2018, the U.S. Environmental Protection Agency (EPA) and the Department of the Army (Army) proposed a revised definition for "waters of the United States," which would establish the scope of federal regulatory authority under the Clean Water Act in a more clear and understandable way.

2018 WOTUS Regulations – PROPOSED



How to Prepare for Continuing Flux

- Review expiration dates for all JD letters, permits, verifications.
- Manage any authorized non-jurisdictional waters **NOW**.
- If possible, let NOTHING LAPSE. Keep permits current – do the work.
- For new Jurisdictional Determinations under 2015 rule –
  - AVOID jurisdictional determinations on potentially "isolated" waters.
  - Obtain JDs for portion of site with no aquatic resources wetlands, or
  - Obtain JD only for those areas with necessary impacts.
- Review impacts to municipal projects – length of time to ramp up and inability to make changes without substantially "redo" of processes for such projects.
- Educate clients about rule & manage expectations.
- Significant nexus process and standards for review will "shake out" with time.

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THE Chazen COMPANIES

WHITEMAN OSTERMAN & HANNA LLP

New York State
Freshwater Wetlands Act

- 12.4 acres or more.
- Unusual Local Importance.
- Located in the Adirondack Park.
- Exceptions for permitting agricultural activities, commercial/recreational fishing, and public health activities.

Freshwater Wetlands Act

- **Statutory Definition of "Freshwater Wetlands" (§ 24-0107(1)):**
  - Lands and submerged lands commonly called marshes, swamps, sloughs, bogs, and flats supporting aquatic or semi-aquatic vegetation;
  - Lands and submerged lands containing remnants of any vegetation that is not aquatic or semi-aquatic that has died because of wet conditions over a sufficiently long period;
  - Lands and waters substantially enclosed by aquatic or semi-aquatic vegetation, the regulation of which is necessary to protect said vegetation.

Freshwater Wetlands: N.Y.S. DEC Regulations

6 N.Y.C.R.R. § 664.7(b): Two or more areas of land and/or water may be considered to be a single wetland for regulatory purposes if

- they are determined by the commissioner to function as a unit, or
- to be dependent upon each other, and;
- if they are no more than 50 meters (approximately 165 ft.) apart.

Freshwater Wetlands Delineation Manual: Sets Hydrological Indicators

Freshwater Wetlands: N.Y.S. DEC Regulations

Unusual Local Importance (6 N.Y.C.R.R. §§ 664.5(a), 664.7(c))

- If it contains any Class I characteristic, or four Class II characteristics, it can be nominated in a ULI petition.
- For any area not containing a Class I characteristic or four Class II characteristics, DEC considers its benefits enumerated in § 24-0105(7) and takes into account expressed local interest.

Freshwater Wetlands: N.Y.S. DEC Regulations

Class I Wetlands: a Class I wetland if it has any of these characteristics (6 N.Y.C.R.R. § 664.5(a)):

- Kettlehole bog;
- Habitat of an endangered/threatened animal species;
- Habitat of an endangered/threatened plant species;
- Supports an unusual animal in abundance or diversity;
- Tributary to a water which could create flooding for an urban area;
- Adjacent to a reservoir used for public water supply, or;
- Contains four or more Class II Characteristics.

Freshwater Wetlands: N.Y.S. DEC Regulations

Class II Wetlands: a Class II wetland if it has any of these characteristics (6 N.Y.C.R.R. § 664.5(b)):

- Purple loosestrife and/or reed constitutes 2/3rds+ of cover;
- Two or more wetland structural groups;
- Contiguous to a tidal wetland;
- Associated with a permanent open water outside the wetland;
- Adjacent or contiguous to streams classified as C(t) or higher;
- A migration habitat of an endangered or threatened animal;
- Habitat of a vulnerable animal species;
- Contains a vulnerable plant species.

Freshwater Wetlands: N.Y.S. DEC Regulations

Class II Criteria Continued:

- Supports an animal unusual in abundance or diversity for the county;
- Demonstrable archaeological or paleontological significance;
- Associated with an unusual geological feature;
- Tributary to a water which could create flooding for an urban area;
- Hydraulically connected to an aquifer;
- Acts in a tertiary treatment capacity for a sewage disposal system;
- Within an urbanized area;
- One of the three largest wetlands within a municipality, or;
- Within a publicly-owned recreation area.

Freshwater Wetlands: N.Y.S. DEC Regulations

- **Patrick Farm, Town of Ramapo**
  - ULI petition filed
  - 2012/2018: DEC declared that wetland area did not meet the criteria to require designation as a Wetland of Unusual Local Importance
    - No Class 1 Characteristics
    - Also failed to have 4 of the Class II Characteristics
    - No significant benefit under § 24-0105(7) of the Freshwater Wetland Act
  - 2015: Two wetland areas, although hydrologically connected, were greater than 50 Meters (164.04 ft.) apart and were considered to be separate wetlands for purposes of mapping.

Freshwater Wetlands: N.Y.S. DEC Regulations

6 N.Y.C.R.R. § 663.5(e)(1): Standards for Freshwater Wetland Permit:

A permit may be issued if it is determined that the activity:

- would be compatible with the conservation of the wetland; and
- would result in no more than insubstantial degradation; and
- would be compatible with public health and welfare.

Freshwater Wetlands: N.Y.S. DEC Regulations

6 N.Y.C.R.R. § 663.5(e)(2): Standards for Permit Issuance Continued:

If the proposed activity cannot meet the three tests for compatibility, then a permit may be issued if:

- For wetland Classes I, II, III and IV, the proposed activity must be compatible with the public health and welfare and be only practicable alternative;
- For wetland Classes I, II, and III, the proposed activity must minimize degradation, or;
- For wetland Class IV, the proposed activity must make a reasonable effort to minimize degradation to wetlands.

Other Items Regulated by the N.Y.S. DEC

Article 15: Water Resources

- **Stream Disturbances**
  - Statutory Authority: § 15-0501
  - N.Y.S. DEC Regulations: 6 N.Y.C.R.R. § 608.2
- **Dams and Impoundment Structures**
  - Statutory Authority: § 15-0503
  - N.Y.S. DEC Regulations: 6 N.Y.C.R.R. § 608.3
- **Docks, Moorings or Platforms**
  - Statutory Authority: § 15-0503
  - N.Y.S. DEC Regulations: 6 N.Y.C.R.R. § 608.4
- **Excavation and Fill in Navigable Waters**
  - Statutory Authority: § 15-0505
  - N.Y.S. DEC Regulations: 6 N.Y.C.R.R. § 608.5

Article 25: Tidal Wetlands Act

- Statutory Authority: Article 25
- N.Y.S. DEC Regulations: 6 N.Y.C.R.R. Pt. 661

Water Quality Certification:

- **Section 401 of the Federal Water Pollution Control Act/Clean Water Act**

  Any applicant for a Federal permit to conduct any activity which may result in any discharge into the navigable waters shall provide the permitting agency a certification from the State in which the discharge originates. In any case where a State or interstate agency has no authority to give such a certification, such certification shall be from the EPA Administrator.

- 6 N.Y.C.R.R. § 608.9
- Park Ridge Neighborhood Ass'n v. Crotty, 38 A.D.3d 903, 832N.Y.S.2d 653 (2d Dept 2002)

Regulations for N.Y.C.’s Drinking Water Sources (“Watershed Regulations”)

Statutory Authority:

Art. 11 of the New York State Public Health Law

§ 24-302 of the New York City Administrative Code

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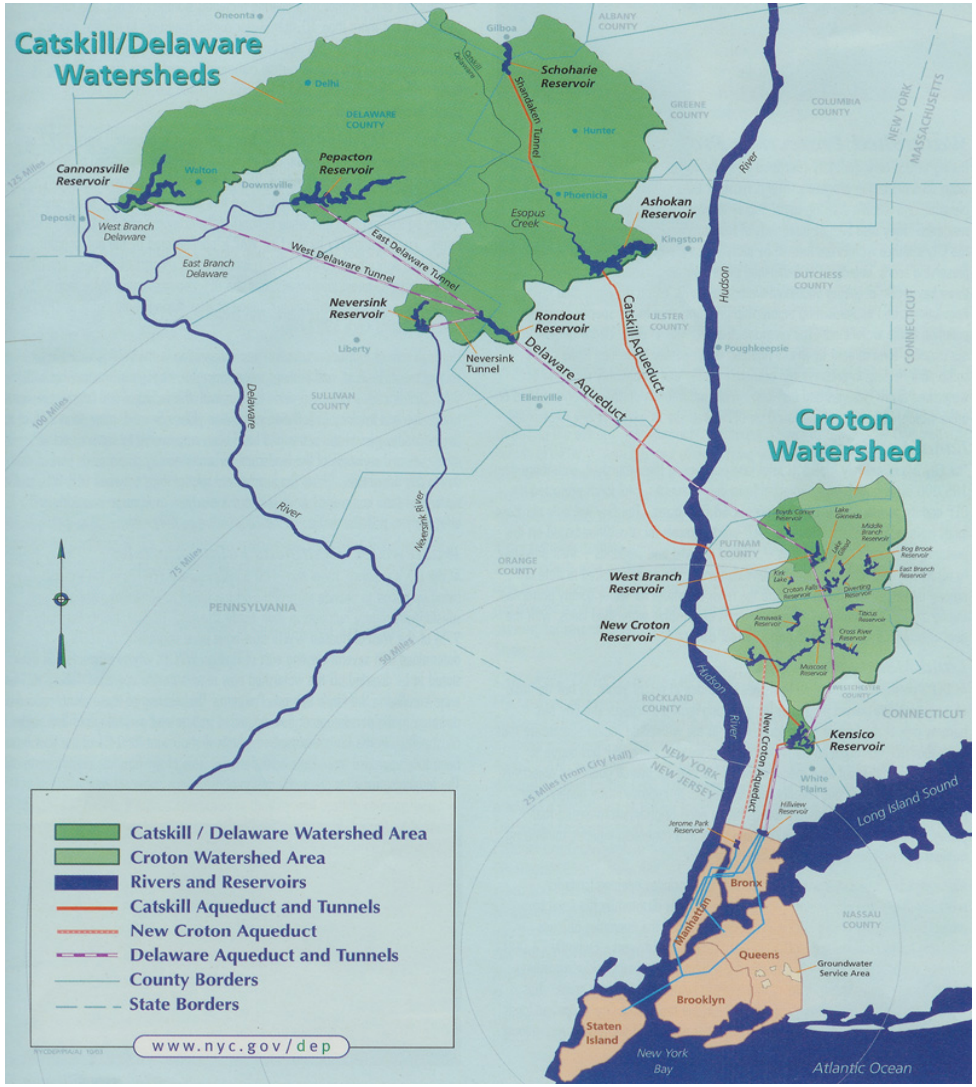

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Regulations for N.Y.C.’s Drinking Water Sources (“Watershed Regulations”)

§ 18-39 of Rules and Regulations for the Contamination, Degradation and Pollution of N.Y.C.’s Water Supply and its Sources:

- The construction of an impervious surface within:
  - the limiting distance of 100 ft. of a watercourse or wetland, or;
  - within the limiting distance of 300 ft. of a reservoir, reservoir stem, or controlled lake, is prohibited.
- Storm Water Pollution Prevention Plans required for most development proposals within certain distances of water bodies.

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LOCAL REGULATIONS OF WETLANDS
Town of Southeast Freshwater Wetlands Law (Ch. 78)

Wetlands shall include:

- Soil types that are poorly drained.
- Lands and submerged lands called marshes, swamps, bogs, and flats supporting aquatic or semi aquatic vegetation.
- Lands and submerged lands containing remnants of vegetation that is not aquatic or semi aquatic because it has died of wet conditions.
- Lands enclosed by aquatic or semi aquatic vegetation and dead vegetation, the regulation of which is necessary to protect the aquatic and semi aquatic vegetation.
- Lands possessing such characteristics less than one acre in size, but are hydrologically connected to and within 50 meters (165 ft.) of other wetlands that, together, exceed one acre.

Town of Southeast Freshwater Wetlands Law

Wetland Buffer by Hydrological Soil Group

HSG		Buffer (feet)
A	High infiltration, transmission deeply drained	100
B	Moderate infiltration and transmission and moderately drained	133
C	Slow infiltration, transmission poor to well drained	166
D	Very slow infiltration, transmission, permanent water	200

Watercourse Buffer by Hydrological Soil Group or Slope Percentage

HSG	Slope%	Buffer (feet)
A or A and B	0-3%; 3-8%	100
B or C	8-15%	100
C or D	15-25%	130
D or E	25-35%	170
F	35-60%	200

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NEWS RELEASE

For Release: January 7, 2019
Immediate

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EPA and Army Postpone Public Hearing on Proposed New "Waters of the United States" Definition

WASHINGTON (January 7, 2019) — Due to the lapse in appropriations for the U.S. Environmental Protection Agency (EPA), EPA and the Department of the Army (Army) announced today they will postpone the planned January 23 public hearing on the proposed new "Waters of the United States" definition until after appropriations have passed to fund the EPA. Publication of the proposed rule in the Federal Register is also postponed.

A notification of public hearing was issued in the Federal Register on December 28, 2018 to hold a hearing in Kansas City, Kansas. EPA and Army will notify the public of the revised date for the public hearing, the start of the public comment period, public webcast and other outreach activities after appropriations have passed. Information on the status of the public hearing will be posted on the EPA website at https://www.epa.gov/wotus-rule/revised-definition-waters-united-states-proposed-rule.

Background: On December 11, 2018, EPA and Army signed a proposed rule that would provide a clear, understandable, and implementable definition of "waters of the United States" that clarifies federal authority under the Clean Water Act while respecting the role of states and tribes in managing their own land and water resources. The agencies have submitted the proposed rule to the Office of the Federal Register for publication. A pre-publication version publication version of the *Federal Register* notice is available at: https://www.epa.gov/wotus-rule/step-two-revise.

EPA and Army will take comments on the proposal for 60 days after publication of the proposed rule in the Federal Register. Comments can be submitted online at https://www.regulations.gov or provided orally at the public hearing once rescheduled. Please follow the instructions for submitting comments to Docket ID No. EPA-HQ-OW-2018-0149. In addition, oral comments and supporting information presented at the public hearing will be considered with the same weight as written statements and supporting information submitted during the public comment period.

-30-

FACT SHEET

Proposed Revised Definition of "Waters of the United States"

BACKGROUND

- On December 11, 2018, the U.S. Environmental Protection Agency (EPA) and the Department of the Army (Army) proposed a revised definition for "waters of the United States," which would establish the scope of federal regulatory authority under the Clean Water Act in a more clear and understandable way.
- The agencies' proposal would be clearer and easier to understand than previous regulations. It would help landowners understand whether a project on his or her property would require a federal permit or not—saving Americans time and money.
- Right now, because of litigation, the 2015 Clean Water Rule (2015 Rule) is in effect in 22 states, the District of Columbia, and the U.S. territories, and previous regulations, issued in the 1980s, are in effect in the remaining 28 states.
- If finalized, the agencies' proposed rule would apply nationwide, replacing the patchwork framework for Clean Water Act jurisdiction that has resulted from litigation challenging the 2015 Rule. The proposal would also re-balance the relationship between the federal government, states, and tribes in managing land and water resources.
- The proposal respects the limited powers that the executive branch has been given under the Constitution and the Clean Water Act to regulate navigable waters. The proposal limits where federal regulations apply and gives states and tribes more flexibility to determine how best to manage waters within their borders. Together, the agencies' proposal and existing state and tribal regulations and programs would provide a network of coverage for the nation's water resources in accordance with the objectives and policies of the Clean Water Act.
- The EPA and the Army reviewed and considered the extensive feedback and recommendations the agencies received from states, tribes, local governments, and stakeholders throughout consultations and pre-proposal meetings and webinars. This input helped highlight the issues that are most important to state and tribal co-regulators and stakeholders, including those directly affected by the scope of Clean Water Act jurisdiction.

THE PROPOSED DEFINITION

- This proposed rule would provide clarity, predictability, and consistency so that regulators and the public can understand where the Clean Water Act applies—and where it does not. Such straightforward regulations would continue to protect the nation's navigable waters, help sustain economic growth, and reduce barriers to business development.
- The agencies' proposal is consistent with the statutory authority granted by Congress, the legal precedent set by key Supreme Court cases, and the February 2017 Executive Order entitled "Restoring the Rule of Law, Federalism, and Economic Growth by Reviewing the 'Waters of the United States' Rule."
- The role of federal government under the Clean Water Act is ultimately derived from Congress' commerce power over navigation. As a result, this proposal clearly limits "waters of the United

States" under the Clean Water Act to those that are physically and meaningfully connected to traditional navigable waters.

- The proposed rule outlines six clear categories of waters that would be considered "waters of the United States:"

    - Traditional navigable waters (TNWs)
        - Under the proposal, traditional navigable waters would be large rivers and lakes, tidal waters, and the territorial seas—such as the Atlantic Ocean, the Mississippi River, the Great Lakes, and tidally influenced waterbodies, including wetlands, along coastlines—used in interstate or foreign commerce.
    - Tributaries
        - In the agencies' proposal, tributaries would be rivers and streams that flow to traditional navigable waters—such as Rock Creek, which feeds to the Potomac River in Washington, D.C.
        - Under the proposal, these naturally occurring surface water channels must flow more often than just when it rains—that is, tributaries as proposed must be perennial or intermittent. Ephemeral features would not be tributaries under the proposal.
        - Tributaries can connect to traditional navigable waters directly, through other "waters of the United States," or through other non-jurisdictional surface waters so long as those waters convey perennial or intermittent flow downstream.
    - Certain ditches
        - A ditch under the proposed rule would be an "artificial channel used to convey water."
        - Under the proposal, ditches would be jurisdictional where they are traditional navigable waters, such as the Erie Canal, or subject to the ebb and flow of the tide.
        - Ditches may also be jurisdictional where they satisfy conditions of the tributary definition as proposed and either 1) were constructed in a tributary or 2) were built in adjacent wetlands.
    - Certain lakes and ponds
        - Lakes and ponds would be jurisdictional where they are traditional navigable waters, such as the Great Salt Lake in Utah or Lake Champlain along the Vermont-New York border.
        - Lakes and ponds would be jurisdictional where they contribute perennial or intermittent flow to a traditional navigable water either directly, through other "waters of the United States," or through other non-jurisdictional surface waters so long as those waters convey perennial or intermittent flow downstream, such as Lake Pepin in Minnesota or Lake Travis in Texas.
        - Lakes and ponds would be jurisdictional where they are flooded by a "water of the United States" in a typical year, such as many oxbow lakes.
    - Impoundments
        - Under the proposal, impoundments of "waters of the United States" would be jurisdictional.
    - Adjacent wetlands
        - Under the proposal, wetlands that physically touch other jurisdictional waters would be "adjacent wetlands," such as Horicon Marsh in Wisconsin.

        - Wetlands with a surface water connection in a typical year that results from 1) inundation from a "water of the United States" to the wetland or 2) perennial or intermittent flow between the wetland and a "water of the United States" would be "adjacent."
        - Wetlands that are near a jurisdictional water but don't physically touch that water because they are separated, for example by a berm, levee, or upland, would be adjacent only where they have a surface water connection described in the previous bullet through or over the barrier, including wetlands flooded by jurisdictional waters in a typical year.

- The proposal also clearly outlines what would not be "waters of the United States," including:

    - Waters that would not be included in the proposed categories of "waters of the United States" listed above—this would provide clarity that if a water or feature is not identified as jurisdictional in the proposal, it would not be a jurisdictional water under the Clean Water Act.
    - Ephemeral features that contain water only during or in response to rainfall.
    - Groundwater.
    - Ditches that do not meet the proposed conditions necessary to be considered jurisdictional, including most farm and roadside ditches.
    - Prior converted cropland.
        - This longstanding exclusion for certain agricultural areas would be continued under the proposal, and the agencies are clarifying that this exclusion would cease to apply when cropland is abandoned (*i.e.,* not used for, or in support of, agricultural purposes in the preceding five years) and has reverted to wetlands.
    - Stormwater control features excavated or constructed in upland to convey, treat, infiltrate, or store stormwater run-off.
    - Wastewater recycling structures such as detention, retention and infiltration basins and ponds, and groundwater recharge basins would be excluded where they are constructed in upland.
    - Waste treatment systems.
        - Waste treatment systems have been excluded from the definition of "waters of the United States" since 1979 and would continue to be excluded under this proposal; however, waste treatment systems are being defined for the first time in this proposed rule.
        - A waste treatment system would include all components, including lagoons and treatment ponds (such as settling or cooling ponds), designed to convey or retain, concentrate, settle, reduce, or remove pollutants, either actively or passively, from wastewater or stormwater prior to discharge (or eliminating any such discharge).

FEDERAL-STATE RELATIONSHIP

- In accordance with section 101(b) of the Clean Water Act, EPA and Army's proposed rule would recognize and respect the primary responsibilities and rights of states and tribes to regulate and manage their land and water resources.
- Under this proposal, there is a clear distinction between federal waters and waters subject to the sole control of the states and tribes.

- The Clean Water Act envisions an approach whereby states, tribes, and the federal government work in partnership to protect the nation's waters from pollution.
- The agencies' proposal is in line with that intent, and appropriately identifies waters that should be subject to federal regulation under the Clean Water Act.
- States and many tribes have existing regulations and programs that apply to waters within their borders, whether or not they are considered "waters of the United States."
- Together, the agencies' proposed definition and existing state and tribal regulations and programs would provide a network of coverage for the nation's water resources in accordance with the objective and policies of the Clean Water Act.

EFFECTS OF THE PROPOSAL

- EPA and the Army developed an illustrative economic analysis for the proposed rule that looks at the potential costs, benefits, and economic impacts of the proposed changes to the definition of "waters of the United States" relative to existing regulations.
- EPA and the Army have identified, where possible, how the proposal would affect categories of water resources across the country and potential effects on Clean Water Act programs. The agencies have also highlighted data limitations that prevent quantitative national estimates for most Clean Water Act programs.
- As a result of these data limitations, the agencies conducted a two-stage analysis of the proposed rule using available data to assess the change from the 2015 Rule to the pre-2015 practice, and then the change from pre-2015 practice to the proposed rule. Additional information is included in the economic analysis fact sheet.

PUBLIC COMMENT SOUGHT

- In addition to seeking comments on the specifics of the proposed "waters of the United States" definition itself, the agencies are requesting comment on the discussion and definition of terms within it, such as whether tributaries should be limited to rivers and streams that flow year-round and whether lakes and ponds should be defined more precisely.
- In response to requests from some states, the agencies will be exploring how to develop a data or mapping system to provide a clearer understanding of the presence or absence of jurisdictional waters that landowners and members of the regulated community could rely on in the future.
- The agencies are also taking comment on the underlying legal interpretations that provide the foundation for the proposed rule.
- Finally, the agencies are requesting comment on how the proposed rule can best be implemented so as to maintain clarity when it is used in the field; examples of such implementation questions include whether to establish specific flooding frequency or magnitude to determine when certain wetland features may be jurisdictional.

HOW TO COMMENT

- The agencies will take comment on the proposal for 60 days after publication in the Federal Register. The agencies will also hold an informational webcast on January 10, 2019, and will host a public listening session on the proposed rule in Kansas City, KS, on January 23, 2019. Additional information on both engagements is available at https://www.epa.gov/wotus-rule.

- Comments on the proposal should be identified by Docket ID No. EPA-HQ-OW-2018-014 and may be submitted online. Go to https://www.regulations.gov and follow the online instructions for submitting comments to Docket ID No. EPA-HQ-OW-2018-0149.
- For additional information, including the full EPA public comment policy, please visit https://www.epa.gov/dockets/commenting-epa-dockets.

FOR MORE INFORMATION

- Additional fact sheets along with copies of the proposed rule and supporting analyses are available on EPA's website at https://www.epa.gov/wotus-rule.

6560-50-P

DEPARTMENT OF DEFENSE

Department of the Army, Corps of Engineers

33 CFR Part 328

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Parts 110, 112, 116, 117, 122, 230, 232, 300, 302 and 401

EPA-HQ-OW-2018-0149; FRL-XXXX-X-OW

RIN 2040–AF75

Revised Definition of "Waters of the United States"

AGENCIES: Department of the Army, Corps of Engineers, Department of Defense; and Environmental Protection Agency (EPA).

ACTION: Proposed rule.

SUMMARY: The Environmental Protection Agency and the Department of the Army ("the agencies") are publishing for public comment a proposed rule defining the scope of waters federally regulated under the Clean Water Act (CWA). This proposal is the second step in a comprehensive, two-step process intended to review and revise the definition of "waters of the United States" consistent with the Executive Order signed on February 28, 2017, "Restoring the Rule of Law, Federalism, and Economic Growth by Reviewing the 'Waters of the United States'

Rule." This proposed rule is intended to increase CWA program predictability and consistency by increasing clarity as to the scope of "waters of the United States" federally regulated under the Act. Today's proposed definition is also intended to clearly implement the overall objective of the CWA to restore and maintain the quality of the nation's waters while respecting State and tribal authority over their own land and water resources.

DATES: Comments must be received on or before *[insert **60** days after publication in the* Federal Register*]*.

ADDRESSES: You may submit comments, identified by Docket ID No. **EPA-HQ-OW-2018-0149**, by any of the following methods:

- Federal eRulemaking Portal: http://www.regulations.gov/ (our preferred method). Follow the online instructions for submitting comments.
- E-mail: OW-Docket@epa.gov. Include Docket ID No. EPA-HQ-OW-2018-0149 in the subject line of the message.
- Mail: U.S. Environmental Protection Agency, EPA Docket Center, Office of Water Docket, Mail Code 28221T, 1200 Pennsylvania Avenue NW, Washington, DC 20460.
- Hand Delivery / Courier: EPA Docket Center, WJC West Building, Room 3334, 1301 Constitution Avenue, NW, Washington, DC 20004. The Docket Center's hours of operations are 8:30 a.m. – 4:30 p.m., Monday – Friday (except Federal Holidays).

Instructions: All submissions received must include the Docket ID No. for this rulemaking. Comments received may be posted without change to https://www.regulations.gov/, including any personal information provided. For detailed instructions on sending comments and additional

information on the rulemaking process, see the "How should I submit comments?" heading of the GENERAL INFORMATION section of this document.

FOR FURTHER INFORMATION CONTACT: Michael McDavit, Oceans, Wetlands, and Communities Division, Office of Water (4504-T), Environmental Protection Agency, 1200 Pennsylvania Avenue, NW, Washington, DC 20460; telephone number: (202) 566-2428; email address: *CWAwotus@epa.gov*; or Jennifer A. Moyer, Regulatory Community of Practice (CECW–CO–R), U.S. Army Corps of Engineers, 441 G Street, NW, Washington, DC 20314; telephone number: (202) 761-5903; e-mail address: *USACE_CWA_Rule@usace.army.mil.*

SUPPLEMENTARY INFORMATION:

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I. General Information

A. *How can I get copies of this document and related information?*

1. *Docket.* An official public docket for this action has been established under Docket ID No. EPA–HQ–OW–2018–0149. The official public docket consists of the documents specifically referenced in this action, and other information related to this action. The official public docket is the collection of materials that is available for public viewing at the OW Docket, EPA West,

Room 3334, 1301 Constitution Ave. NW, Washington, DC 20004. This Docket Facility is open from 8:30 a.m. to 4:30 p.m., Monday through Friday, excluding legal holidays. The OW Docket telephone number is 202–566–2426. A reasonable fee will be charged for copies.

2. *Electronic Access.* You may access this **Federal Register** document electronically under the "**Federal Register**" listings at *http://www.regulations.gov*. An electronic version of the public docket is available through EPA's electronic public docket and comment system, EPA Dockets. You may access EPA Dockets at *http://www.regulations.gov* to view public comments as they are submitted and posted, access the index listing of the contents of the official public docket, and access those documents in the public docket that are available electronically. For additional information about EPA's public docket, visit the EPA Docket Center homepage at https://www.epa.gov/dockets. Although not all docket materials may be available electronically, you may still access any of the publicly available docket materials through the Docket Facility.

B. *Under what legal authority is this proposed rule issued?*

The authority for this action is the Federal Water Pollution Control Act, 33 U.S.C. 1251 *et seq.*, including sections 301, 304, 311, 401, 402, 404, and 501.

C. *How should I submit comments?*

Throughout this notice, the agencies solicit comment on a number of issues related to the proposed rulemaking. Submit your comments, identified by Docket ID No. EPA-HQ-OW-2018-0149, at https://www.regulations.gov (our preferred method), or the other methods identified in the ADDRESSES section. Once submitted, comments cannot be edited or removed from the docket. The EPA may publish any comment received to its public docket. Do not submit electronically any information you consider to be Confidential Business Information (CBI) or other information whose disclosure is restricted by statute. Multimedia submissions (audio,

video, etc.) must be accompanied by a written comment. The written comment is considered the official comment and should include discussion of all points you wish to make. The EPA will generally not consider comments or comment contents located outside of the primary submission (*i.e.,* on the web, cloud, or other file sharing system). For additional submission methods, the full EPA public comment policy, information about CBI or multimedia submissions, and general guidance on making effective comments, please visit https://www.epa.gov/dockets/commenting-epa-dockets.

This rule is the outgrowth of other rulemakings and extensive outreach efforts, including requests for recommendations and comments, and the agencies have taken recommendations and comments received into account in developing this proposal. In developing a final rule, the agencies will be considering comments submitted on this proposal. Persons who wish to provide views or recommendations on this proposal must provide comments to the agencies as part of this comment process. To facilitate the processing of comments, commenters are encouraged to organize their comments in a manner that corresponds to the outline of this proposal.

II. Background

A. Executive Summary

The U.S. Environmental Protection Agency (EPA) and the U.S. Department of the Army (Army) (together, the agencies) are publishing for public comment a proposed rule defining the scope of waters subject to federal regulation under the Clean Water Act (CWA), in light of the U.S. Supreme Court cases in *United States v. Riverside Bayview Homes* (*Riverside Bayview*), *Solid Waste Agency of Northern Cook County v. United States* (*SWANCC*), and *Rapanos v. United States* (*Rapanos*), and consistent with Executive Order 13778, signed on February 28, 2017, entitled "Restoring the Rule of Law, Federalism, and Economic Growth by Reviewing the

'Waters of the United States' Rule."

The agencies propose to interpret the term "waters of the United States" to encompass: traditional navigable waters, including the territorial seas; tributaries that contribute perennial or intermittent flow to such waters; certain ditches; certain lakes and ponds; impoundments of otherwise jurisdictional waters; and wetlands adjacent to other jurisdictional waters.

The agencies propose as a baseline concept that "waters of the United States" are waters within the ordinary meaning of the term, such as oceans, rivers, streams, lakes, ponds, and wetlands, and that not all waters are "waters of the United States." Under this proposed rule, a tributary is defined as a river, stream, or similar naturally occurring surface water channel that contributes perennial or intermittent flow to a traditional navigable water or territorial sea in a typical year either directly or indirectly through other tributaries, jurisdictional ditches, jurisdictional lakes and ponds, jurisdictional impoundments, and adjacent wetlands or through water features identified in paragraph (b) of this proposal so long as those water features convey perennial or intermittent flow downstream. A tributary does not lose its status if it flows through a culvert, dam, or other similar artificial break or through a debris pile, boulder field, or similar natural break so long as the artificial or natural break conveys perennial or intermittent flow to a tributary or other jurisdictional water at the downstream end of the break. Ditches are generally proposed not to be "waters of the United States" unless they meet certain criteria, such as functioning as traditional navigable waters, if they are constructed in a tributary and also satisfy the conditions of the proposed "tributary" definition, or if they are constructed in an adjacent wetland and also satisfy the conditions of the proposed "tributary" definition.

The proposal defines "adjacent wetlands" as wetlands that abut or have a direct hydrological surface connection to other "waters of the United States" in a typical year. "Abut" is proposed to

mean when a wetland touches an otherwise jurisdictional water at either a point or side. A "direct hydrologic surface connection" as proposed occurs as a result of inundation from a jurisdictional water to a wetland or via perennial or intermittent flow between a wetland and jurisdictional water. Wetlands physically separated from other waters of the United States by upland or by dikes, barriers, or similar structures and also lacking a direct hydrologic surface connection to such waters are not adjacent under today's proposal.

The proposal would exclude from the definition of "waters of the United States" waters or water features not mentioned above. The proposed definition specifically clarifies that "waters of the United States" do not include features that flow only in response to precipitation; groundwater, including groundwater drained through subsurface drainage systems; certain ditches; prior converted cropland; artificially irrigated areas that would revert to upland if artificial irrigation ceases; certain artificial lakes and ponds constructed in upland; water-filled depressions created in upland incidental to mining or construction activity; stormwater control features excavated or constructed in upland to convey, treat, infiltrate, or store stormwater run-off; wastewater recycling structures constructed in upland; and waste treatment systems. In addition, the agencies are proposing to clarify and define the terms "prior converted cropland" and "waste treatment system" to improve regulatory predictability and clarity.

In response to the interest expressed by some States in participating in the federal jurisdictional determination process, the agencies are soliciting comment as to how they could establish an approach to authorize States, Tribes, and Federal agencies to establish geospatial datasets of "waters of the United States," as well as waters that the agencies propose to exclude, within their respective borders for approval by the agencies. Under a separate action, the agencies may propose creating a framework under which States, Tribes, and Federal agencies could choose

to develop datasets for approval for all, some, or none of the "waters of the United States" within their boundaries. If the agencies were to pursue such an action, they would do so in coordination with other Federal agencies, State, tribal, and interested stakeholders. This approach would not require State and tribal governments to establish these datasets; it would simply make this process available to those government agencies that would find it useful.

The fundamental basis used by the agencies for the revised definition proposed today is the text and structure of the CWA, as informed by its legislative history and Supreme Court precedent, taking into account agency policy choices and other relevant factors. Today's proposed definition is intended to strike a balance between Federal and State waters and would carry out Congress' overall objective to restore and maintain the integrity of the nation's waters in a manner that preserves the traditional sovereignty of States over their own land and water resources. The agencies believe the proposed definition would also ensure clarity and predictability for Federal agencies, States, Tribes, the regulated community, and the public. Today's proposed rule is intended to ensure that the agencies are operating within the scope of the Federal government's authority over navigable waters under the CWA and the Commerce Clause of the U.S. Constitution.

B. The Clean Water Act and Regulatory Definition of "Waters of the United States"

1. The Clean Water Act

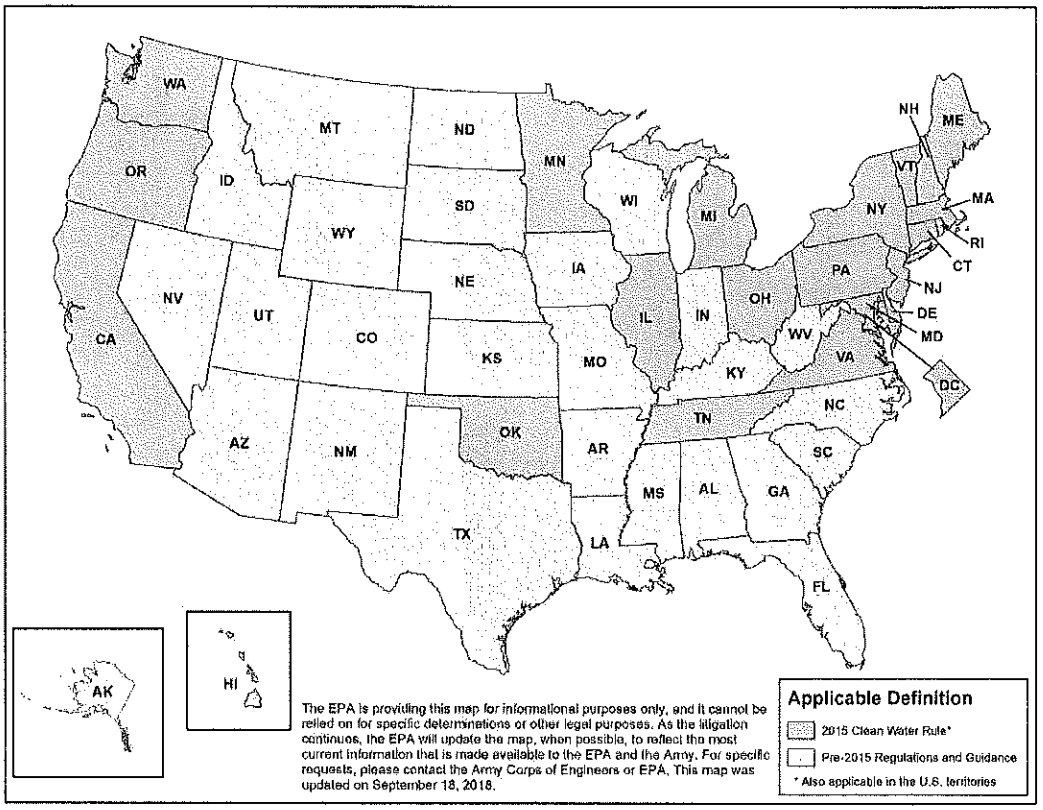
Congress amended the Federal Water Pollution Control Act (FWPCA), or Clean Water Act (CWA) as it is commonly called,[1] in 1972 to address longstanding concerns regarding the quality

[1] The FWCPA is commonly referred to as the CWA following the 1977 amendments to the FWPCA. Pub. L. No. 95-217, 91 Stat. 1566 (1977). For ease of reference, the agencies will generally refer to the FWPCA in this notice as the CWA or the Act.

EPA United States Environmental Protection Agency

Definition of "Waters of the United States": Rule Status and Litigation Update

The EPA and the Army continue to review the U.S. District Court for the District of South Carolina's decision to nationally enjoin the agencies' final rule that added an applicability date to the 2015 Clean Water Rule. Pursuant to the court's order, the 2015 Clean Water Rule is now in effect in 22 states, the District of Columbia, and the U.S. territories. Parties to the case, including the EPA and the Army, have filed motions appealing the order and seeking a stay of the district court's decision. While the litigation continues, the agencies are complying with the district court's order and implementation issues that arise are being handled on a case-by-case basis. The agencies recognize the uncertainty this decision has created and are committed to working closely with states and stakeholders to provide updated information on an ongoing basis regarding which rules are in place in which states. If a state, tribe, or an entity has specific questions about a pending jurisdictional determination or permit, please contact a local U.S. Army Corps of Engineers District office or the EPA.



LAST UPDATED ON OCTOBER 23, 2018

Final Rule: Definition of "Waters of the United States" – Addition of an Applicability Date to 2015 Clean Water Rule

Please visit "Definition of 'Waters of the United States': Rule Status and Litigation Update" for updates regarding the status of this final rule. On January 31, 2018, the Environmental Protection Agency and U.S. Department of the Army (the agencies) finalized a rule adding an applicability date to the 2015 Rule defining "waters of the United States." The 2015 Rule will not be applicable until February 6, 2020.

Given uncertainty about litigation in multiple district courts over the 2015 Rule, this action provides certainty and consistency to the regulated community and the public, and minimizes confusion as the agencies reconsider the definition of the "waters of the United States" that should be covered under the Clean Water Act.

The agencies' new rule is separate from the two-step process the agencies propose to take to reconsider the 2015 Rule.

The proposed rule published in the *Federal Register* on November 22, 2017. The public comment closed on December 13, 2017. Comments can be found in the docket. The final rule was signed on January 31, 2018, and was published in the *Federal Register* on February 6, 2018.

- Read the Final Rule
- Read the Memorandum: Consideration of Potential Economic Impacts for the Final Rule
- Access All Materials in the Docket
- Read the Proposed Rule

LAST UPDATED ON DECEMBER 11, 2018

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Part II

Department of Defense

Department of the Army, Corps of Engineers

33 CFR Part 328

Environmental Protection Agency

40 CFR Parts 110, 112, 116, *et al.*

Clean Water Rule: Definition of "Waters of the United States"; Final Rule

DEPARTMENT OF DEFENSE

Department of the Army, Corps of Engineers

33 CFR Part 328

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Parts 110, 112, 116, 117, 122, 230, 232, 300, 302, and 401

[EPA–HQ–OW–2011–0880; FRL–9927–20–OW]

RIN 2040–AF30

Clean Water Rule: Definition of "Waters of the United States"

AGENCY: U.S. Army Corps of Engineers, Department of the Army, Department of Defense; and Environmental Protection Agency (EPA).

ACTION: Final rule.

SUMMARY: The Environmental Protection Agency (EPA) and the U.S. Army Corps of Engineers (Corps) are publishing a final rule defining the scope of waters protected under the Clean Water Act (CWA or the Act), in light of the statute, science, Supreme Court decisions in *U.S.* v. *Riverside Bayview Homes, Solid Waste Agency of Northern Cook County* v. *U.S. Army Corps of Engineers (SWANCC),* and *Rapanos* v. *United States (Rapanos),* and the agencies' experience and technical expertise. This final rule reflects consideration of the extensive public comments received on the proposed rule. The rule will ensure protection for the nation's public health and aquatic resources, and increase CWA program predictability and consistency by clarifying the scope of "waters of the United States" protected under the Act.

DATES: This rule is effective on August 28, 2015. In accordance with 40 CFR part 23, this regulation shall be considered issued for purposes of judicial review at 1 p.m. Eastern time on July 13, 2015.

FOR FURTHER INFORMATION CONTACT: Ms. Donna Downing, Office of Water (4502–T), Environmental Protection Agency, 1200 Pennsylvania Avenue NW., Washington, DC 20460; telephone number 202–566–2428; email address: *CWAwaters@epa.go* v. Ms. Stacey Jensen, Regulatory Community of Practice (CECW–CO–R), U.S. Army Corps of Engineers, 441 G Street NW., Washington, DC 20314; telephone number 202–761–5856; email address: *USACE_CWA_Rule@usace.army.mil.*

SUPPLEMENTARY INFORMATION: This final rule does not establish any regulatory requirements. Instead, it is a definitional rule that clarifies the scope of "waters of the United States" consistent with the Clean Water Act (CWA), Supreme Court precedent, and science. Programs established by the CWA, such as the section 402 National Pollutant Discharge Elimination System (NPDES) permit program, the section 404 permit program for discharge of dredged or fill material, and the section 311 oil spill prevention and response programs, all rely on the definition of "waters of the United States." Entities currently are, and will continue to be, regulated under these programs that protect "waters of the United States" from pollution and destruction.

State, tribal, and local governments have well-defined and longstanding relationships with the Federal government in implementing CWA programs and these relationships are not altered by the final rule. Forty-six states and the U.S. Virgin Islands have been authorized by EPA to administer the NPDES program under section 402, and two states have been authorized by the EPA to administer the section 404 program. All states and forty tribes have developed water quality standards under the CWA for waters within their boundaries. A federal advisory committee has recently been announced to assist states in identifying the scope of waters assumable under the section 404 program.

The scope of jurisdiction in this rule is narrower than that under the existing regulation. Fewer waters will be defined as "waters of the United States" under the rule than under the existing regulations, in part because the rule puts important qualifiers on some existing categories such as tributaries. In addition, the rule provides greater clarity regarding which waters are subject to CWA jurisdiction, reducing the instances in which permitting authorities, including the states and tribes with authorized section 402 and 404 CWA permitting programs, would need to make jurisdictional determinations on a case-specific basis.

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I. General Information

A. How can I get copies of this document and related information?

1. *Docket.* An official public docket for this action has been established under Docket Id. No. EPA–HQ–OW–2011–0880. The official public docket consists of the documents specifically referenced in this action, any public comments received, and other information related to this action. The official public docket also includes a Technical Support Document that provides additional legal and scientific discussion for issues raised in this rule, and the Response to Comments document. Although a part of the official docket, the public docket does not include Confidential Business Information or other information whose disclosure is restricted by statute. The official public docket is the collection of materials that is available for public viewing at the OW Docket, EPA West, Room 3334, 1301 Constitution Ave. NW., Washington, DC 20004. This Docket Facility is open from 8:30 a.m.

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B. Under what legal authority is this rule issued?

The authority for this rule is the Federal Water Pollution Control Act, 33 U.S.C. 1251, *et seq.,* including sections 301, 304, 311, 401, 402, 404 and 501.

II. Executive Summary

In this final rule, the agencies clarify the scope of "waters of the United States" that are protected under the Clean Water Act (CWA), based upon the text of the statute, Supreme Court decisions, the best available peer-reviewed science, public input, and the agencies' technical expertise and experience in implementing the statute. This rule makes the process of identifying waters [1] protected under the CWA easier to understand, more predictable, and consistent with the law and peer-reviewed science, while protecting the streams and wetlands that form the foundation of our nation's water resources.

Congress enacted the CWA "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters," section 101(a), and to complement statutes that protect the navigability of waters, such as the Rivers and Harbors Act. 33 U.S.C. 401, 403, 404, 407. The CWA is the nation's single most important statute for protecting America's clean water against pollution, degradation, and destruction. To provide that protection, the Supreme Court has consistently agreed that the geographic scope of the CWA reaches beyond waters that are navigable in fact. Peer-reviewed science and practical experience demonstrate that upstream waters, including headwaters and wetlands, significantly affect the chemical, physical, and biological integrity of downstream waters by playing a crucial role in controlling sediment, filtering pollutants, reducing flooding, providing habitat for fish and other aquatic wildlife, and many other vital chemical, physical, and biological processes.

This final rule interprets the CWA to cover those waters that require protection in order to restore and maintain the chemical, physical, or biological integrity of traditional navigable waters, interstate waters, and the territorial seas. This interpretation is based not only on legal precedent and the best available peer-reviewed science, but also on the agencies' technical expertise and extensive experience in implementing the CWA over the past four decades. The rule will clarify and simplify implementation of the CWA consistent with its purposes through clearer definitions and increased use of bright-line boundaries to establish waters that are jurisdictional by rule and limit the need for case-specific analysis. The agencies emphasize that, while the CWA establishes permitting requirements for covered waters to ensure protection of water quality, these requirements only apply with respect to discharges of pollutants to the covered water. In the absence of a discharge of a pollutant, the CWA does not impose permitting restrictions on the use of such water.

Additionally, Congress has exempted certain discharges, and the rule does not affect any of the exemptions from CWA section 404 permitting requirements provided by CWA section 404(f), including those for normal farming, ranching, and silviculture activities. CWA section 404(f); 40 CFR 232.3; 33 CFR 323.4. This rule not only maintains current statutory exemptions, it expands regulatory exclusions from the definition of "waters of the United States" to make it clear that this rule does not add any additional permitting requirements on agriculture. The rule also does not regulate shallow subsurface connections nor any type of groundwater, erosional features, or land use, nor does it affect either the existing statutory or regulatory exemptions from NPDES permitting requirements, such as for agricultural stormwater discharges and return flows from irrigated agriculture, or the status of water transfers. CWA section 402(l)(1); CWA section 402(l)(2); CWA section 502(14); 40 CFR 122.3(f); 40 CFR 122.2.

Finally, even where waters are covered by the CWA, the agencies have adopted many streamlined regulatory requirements to simplify and expedite compliance through the use of measures such as general permits and standardized mitigation measures. The agencies will continue to develop general permits and simplified procedures, particularly as they affect crossings of covered ephemeral and intermittent tributaries jurisdictional under this rule to ensure that projects that offer significant social benefits, such as renewable energy development, can proceed with the necessary environmental safeguards while minimizing permitting delays.

The jurisdictional scope of the CWA is "navigable waters," defined in section 502(7) of the statute as "waters of the United States, including the territorial seas." The term "navigable waters" is used in a number of provisions of the CWA, including the section 402 National Pollutant Discharge Elimination System (NPDES) permit program, the section 404 permit program, the section 311 oil spill prevention and response program,[2] the water quality standards and total maximum daily load programs (TMDL) under section 303, and the section 401 state water quality certification process. However, while there is only one CWA definition of "waters of the United States," there may be other statutory factors that define the reach of a particular CWA program or provision.[3]

[1] The agencies use the term "water" and "waters" in categorical reference to rivers, streams, ditches, wetlands, ponds, lakes, oxbows, and other types of natural or man-made aquatic systems, identifiable by the water contained in these aquatic systems or by their chemical, physical, and biological indicators. The agencies use the terms "waters" and "water bodies" interchangeably in this preamble.

[2] While section 311 uses the phrase "navigable waters of the United States," EPA has interpreted it to have the same breadth as the phrase "navigable waters" used elsewhere in section 311, and in other sections of the CWA. *See United States* v. *Texas Pipe Line Co.,* 611 F.2d 345, 347 (10th Cir. 1979); *United States* v. *Ashland Oil & Transp. Co.,* 504 F.2d 1317, 1324–25 (6th Cir. 1974). In 2002, EPA revised its regulatory definition of "waters of the United States" in 40 CFR part 112 to ensure that the language of the rule was consistent with the regulatory language of other CWA programs. *Oil Pollution Prevention & Response; Non-Transportation-Related Onshore & Offshore Facilities,* 67 FR 47042, July 17, 2002. A district court vacated the rule for failure to comply with the Administrative Procedure Act, and reinstated the prior regulatory language. *American Petroleum Ins.* v. *Johnson,* 541 F. Supp. 2d 165 (D. D.C. 2008). However, EPA interprets "navigable waters of the United States" in CWA section 311(b), in the pre-2002 regulations, and in the 2002 rule to have the same meaning as "navigable waters" in CWA section 502(7).

[3] For example, the CWA section 402 (33 U.S.C. 1342) program regulates discharges of pollutants

Continued

Existing regulations (last codified in 1986) define "waters of the United States" as traditional navigable waters, interstate waters, all other waters that could affect interstate or foreign commerce, impoundments of waters of the United States, tributaries, the territorial seas, and adjacent wetlands. 33 CFR 328.3; 40 CFR 122.2.[4]

However, the Supreme Court has issued three decisions that provide critical context and guidance in determining the appropriate scope of "waters of the United States" covered by the CWA. In *United States* v. *Riverside Bayview Homes,* 474 U.S. 121 (1985) (*Riverside*), the Court, in a unanimous opinion, deferred to the Corps' ecological judgment that adjacent wetlands are "inseparably bound up" with the waters to which they are adjacent, and upheld the inclusion of adjacent wetlands in the regulatory definition of "waters of the United States." *Id.* at 134. The Court observed that the broad objective of the CWA to restore and maintain the integrity of the Nation's waters "incorporated a broad, systemic view of the goal of maintaining and improving water quality. . . . Protection of aquatic ecosystems, Congress recognized, demanded broad federal authority to control pollution, for '[w]ater moves in hydrologic cycles and it is essential that discharge of pollutants be controlled at the source.' In keeping with these views, Congress chose to define the waters covered by the Act broadly." *Id.* at 132–33 (*citing* Senate Report No. 92–414, p. 77 (1972)).

In *Solid Waste Agency of Northern Cook County* v. *U.S. Army Corps of Engineers,* 531 U.S. 159 (2001) (*SWANCC*), the Supreme Court held that the use of "isolated" non-navigable intrastate ponds by migratory birds was not by itself a sufficient basis for the exercise of federal regulatory authority under the CWA. Although the *SWANCC* decision did not call into question earlier decisions upholding the CWA's coverage of wetlands or other waters "adjacent" to traditional navigable waters, it created uncertainty with regard to the jurisdiction of other waters and wetlands that, in many instances, may play an important role in protecting the integrity of the nation's waters. The majority opinion in *SWANCC* introduced the concept that it was a "significant nexus" that informed the Court's reading of CWA jurisdiction over waters that are not navigable in fact.

Five years later, in *Rapanos* v. *United States,* 547 U.S. 715 (2006) (*Rapanos*), all Members of the Court agreed that the term "waters of the United States" encompasses some waters that are not navigable in the traditional sense. In addition, Justice Kennedy's opinion indicated that the critical factor in determining the CWA's coverage is whether a water has a "significant nexus" to downstream traditional navigable waters such that the water is important to protecting the chemical, physical, or biological integrity of the navigable water, referring back to the Court's decision in *SWANCC.* Justice Kennedy's concurrence in *Rapanos* stated that to constitute a "water of the United States" covered by the CWA, "a water or wetland must possess a 'significant nexus' to waters that are or were navigable in fact or that could reasonably be so made." *Id.* at 759 (Kennedy, J., concurring in the judgment) (*citing SWANCC,* 531 U.S. at 167, 172). Justice Kennedy concluded that wetlands possess the requisite significant nexus if the wetlands "either alone or in combination with similarly situated [wet]lands in the region, significantly affect the chemical, physical, and biological integrity of other covered waters more readily understood as 'navigable.'" 547 U.S. at 780.

In this rule, the agencies interpret the scope of the "waters of the United States" for the CWA using the goals, objectives, and policies of the statute, the Supreme Court case law, the relevant and available science, and the agencies' technical expertise and experience as support. In particular, the agencies looked to the objective of the CWA "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters," and the scientific consensus on the strength of the effects of upstream tributaries and adjacent waters, including wetlands, on downstream traditional navigable waters, interstate waters, and the territorial seas. An important element of the agencies' interpretation of the CWA is the significant nexus standard. This significant nexus standard was first informed by the ecological and hydrological connections the Supreme Court noted in *Riverside Bayview,* developed and established by the Supreme Court in *SWANCC,* and further refined in Justice Kennedy's opinion in *Rapanos.* The agencies also utilized the plurality standard in *Rapanos* by establishing boundaries on the scope of "waters of the United States" and in support of the exclusions from the definition of "waters of the United States." The analysis used by the agencies has been supported by all nine of the United States Courts of Appeals that have considered the issue.

The agencies assess the significance of the nexus in terms of the CWA's objective to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters." When the effects are speculative or insubstantial, the "significant nexus" would not be present. The science demonstrates that the protection of upstream waters is critical to maintaining the integrity of the downstream waters. The upstream waters identified in the rule as jurisdictional function as integral parts of the aquatic environment, and if these waters are polluted or destroyed, there is a significant effect downstream.

In response to the Supreme Court opinions, the agencies issued guidance in 2003 (post-*SWANCC*) and 2008 (post-*Rapanos*). However, these two guidance documents did not provide the public or agency staff with the kind of information needed to ensure timely, consistent, and predictable jurisdictional determinations. Many waters are currently subject to case-specific jurisdictional analysis to determine whether a "significant nexus" exists, and this time and resource intensive process can result in inconsistent interpretation of CWA jurisdiction and perpetuate ambiguity over where the CWA applies. As a result of the ambiguity that exists under current regulations and practice following these recent decisions, almost all waters and wetlands across the country theoretically could be subject to a case-specific jurisdictional determination.

Members of Congress, developers, farmers, state and local governments, energy companies, and many others requested new regulations to make the process of identifying waters protected under the CWA clearer, simpler, and faster. Chief Justice Roberts' concurrence in *Rapanos* underscores

from "point sources" to "waters of the United States," whether these pollutants reach jurisdictional waters directly or indirectly. The plurality opinion in *Rapanos* noted that "there is no reason to suppose that our construction today significantly affects the enforcement of § 1342. . . . The Act does not forbid the 'addition of any pollutant *directly* to navigable waters from any point source,' but rather the 'addition of any pollutant *to* navigable waters.'" 547 U.S. at 743.

[4] There are numerous regulations that utilize the definition of "waters of the United States" and each is codified consistent with its place in a particular section of the Code of Federal Regulations. For simplicity, throughout the preamble the agencies refer to the rule as organized into (a), (b), (c) provisions and intend the reference to encompass the appropriate cites in each section of the Code of Federal Regulations. For example, a reference to (a)(1) is a reference to all instances in the CFR identified as subject to this rule that state "All waters which are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide."

the importance of this rulemaking effort.[5] In this final rule, the agencies are responding to those requests from across the country to make the process of identifying waters protected under the CWA easier to understand, more predictable, and more consistent with the law and peer-reviewed science.

The agencies proposed a rule clarifying the scope of waters of the United States April 21, 2014 (79 FR 22188), and solicited comments for over 200 days. This final rule reflects the over 1 million public comments on the proposal, the substantial majority of which supported the proposed rule, as well as input provided through the agencies' extensive public outreach effort, which included over 400 meetings nationwide with states, small businesses, farmers, academics, miners, energy companies, counties, municipalities, environmental organizations, other federal agencies, and many others. The agencies sought comment on a number of approaches to specific jurisdictional questions, and many of these commenters and stakeholders urged EPA to improve upon the April 2014 proposal, by providing more bright line boundaries and simplifying definitions that identify waters that are protected under the CWA, all for the purpose of minimizing delays and costs, making protection of clean water more effective, and improving predictability and consistency for landowners and regulated entities.

The agencies' interpretation of the CWA's scope in this final rule is guided by the best available peer-reviewed science—particularly as that science informs the determinations as to which waters have a "significant nexus" with traditional navigable waters, interstate waters, or the territorial seas.

The relevant science on the relationship and downstream effects of waters has advanced considerably in recent years. A comprehensive report prepared by the EPA's Office of Research and Development entitled "Connectivity of Streams and Wetlands to Downstream Waters: A Review and Synthesis of the Scientific Evidence" [6] (hereafter the Science Report) synthesizes the peer-reviewed science.

The Science Report provides much of the technical basis for this rule. The Science Report is based on a review of more than 1,200 peer-reviewed publications. EPA's Science Advisory Board (SAB) conducted a comprehensive technical review of the Science Report and reviewed the adequacy of the scientific and technical basis of the proposed rule. The Science Report and the SAB review confirmed that:

- Waters are connected in myriad ways, including physical connections and the hydrologic cycle; however, connections occur on a continuum or gradient from highly connected to highly isolated.
- These variations in the degree of connectivity are a critical consideration to the ecological integrity and sustainability of downstream waters.
- The critical contribution of upstream waters to the chemical, physical, and biological integrity of downstream waters results from the accumulative contribution of similar waters in the same watershed and in the context of their functions considered over time.

The Science Report and the SAB review also confirmed that:

- Tributary streams, including perennial, intermittent, and ephemeral streams, are chemically, physically, and biologically connected to downstream waters, and influence the integrity of downstream waters.
- Wetlands and open waters in floodplains and riparian areas are chemically, physically, and biologically connected with downstream waters and influence the ecological integrity of such waters.
- Non-floodplain wetlands and open waters provide many functions that benefit downstream water quality and ecological integrity, but their effects on downstream waters are difficult to assess based solely on the available science.

Although these conclusions play a critical role in informing the agencies' interpretation of the CWA's scope, the agencies' interpretive task in this rule—determining which waters have a "significant nexus"—requires scientific and policy judgment, as well as legal interpretation. The science demonstrates that waters fall along a gradient of chemical, physical, and biological connection to traditional navigable waters, and it is the agencies' task to determine where along that gradient to draw lines of jurisdiction under the CWA. In making this determination, the agencies must rely, not only on the science, but also on their technical expertise and practical experience in implementing the CWA during a period of over 40 years. In addition, the agencies are guided, in part, by the compelling need for clearer, more consistent, and easily implementable standards to govern administration of the Act, including brighter line boundaries where feasible and appropriate.

Major Rule Provisions

In this final rule, the agencies define "waters of the United States" to include eight categories of jurisdictional waters. The rule maintains existing exclusions for certain categories of waters, and adds additional categorical exclusions that are regularly applied in practice. The rule reflects the agencies' goal of providing simpler, clearer, and more consistent approaches for identifying the geographic scope of the CWA. The rule recognizes jurisdiction for three basic categories: Waters that are jurisdictional in all instances, waters that are excluded from jurisdiction, and a narrow category of waters subject to case-specific analysis to determine whether they are jurisdictional.

Decisions about waters in each of these categories are based on the law, peer-reviewed science, and the agencies' technical expertise, and were informed by public comments. This rule replaces existing procedures that often depend on individual, time-consuming, and inconsistent analyses of the relationship between a particular stream, wetland, lake, or other water with downstream waters. The agencies have greatly reduced the extent of waters subject to this individual review by carefully incorporating the scientific literature and by utilizing agency expertise and experience to characterize the nature and strength of the chemical, physical, and biological connections between upstream and downstream waters. The result of applying this scientific analysis is that the agencies can more effectively focus the rule on identifying waters that are clearly covered by the CWA and those that are clearly not covered, making the rule easier to understand, consistent, and environmentally more protective.

The jurisdictional categories reflect the current state of the best available science, and are based upon the law and Supreme Court decisions. The agencies will continue a transparent review of the science, and learn from on-going

[5] Chief Justice Roberts' concurrence in *Rapanos* emphasized that "[a]gencies delegated rulemaking authority under a statute such as the Clean Water Act are afforded generous leeway by the courts in interpreting the statute they are entrusted to administer." *Id.* at 758. Chief Justice Roberts made clear that, if the agencies had undertaken such a rulemaking, "the Corps and the EPA would have enjoyed plenty of room to operate in developing *some* notion of an outer bound to the reach of their authority." *Id.* (Emphasis in original.)

[6] U.S. Environmental Protection Agency, *Connectivity of Streams and Wetlands to Downstream Waters: A Review and Synthesis of the Scientific Evidence* (Final Report), EPA/600/R–14/475F, (Washington, DC: U.S. Environmental Protection Agency, (2015)). *http://www.epa.gov/ncea.*

experience and expertise as the agencies implement the rule. If evolving science and the agencies' experience lead to a need for action to alter the jurisdictional categories, any such action will be conducted as part of a rule-making process.

The first three types of jurisdictional waters, traditional navigable waters, interstate waters, and the territorial seas, are jurisdictional by rule in all cases. The fourth type of water, impoundments of jurisdictional waters, is also jurisdictional by rule in all cases. The next two types of waters, "tributaries" and "adjacent" waters, are jurisdictional by rule, as defined, because the science confirms that they have a significant nexus to traditional navigable waters, interstate waters, or territorial seas. For waters that are jurisdictional by rule, no additional analysis is required.

The final two types of jurisdictional waters are those waters found after a case-specific analysis to have a significant nexus to traditional navigable waters, interstate waters, or the territorial seas, either alone or in combination with similarly situated waters in the region. Justice Kennedy acknowledged the agencies could establish more specific regulations or establish a significant nexus on a case-by-case basis, *Rapanos* at 782, and for these waters the agencies will continue to assess significant nexus on a case-specific basis.

The major elements of the final rule are briefly summarized here.

Traditional Navigable Waters, Interstate Waters, Territorial Seas, and Impoundments of Jurisdictional Waters

Consistent with existing regulations and the April 2014 proposed rule, the final rule includes traditional navigable waters, interstate waters, territorial seas, and impoundments of jurisdictional waters in the definition of "waters of the United States." These waters are jurisdictional by rule.

Tributaries

Previous definitions of "waters of the United States" regulated all tributaries without qualification. This final rule more precisely defines "tributaries" as waters that are characterized by the presence of physical indicators of flow—bed and banks and ordinary high water mark—and that contribute flow directly or indirectly to a traditional navigable water, an interstate water, or the territorial seas. The rule concludes that such tributaries are "waters of the United States." The great majority of tributaries as defined by the rule are headwater streams that play an important role in the transport of water, sediments, organic matter, nutrients, and organisms to downstream waters. The physical indicators of bed and banks and ordinary high water mark demonstrate that there is sufficient volume, frequency, and flow in such tributaries to a traditional navigable water, interstate water, or the territorial seas to establish a significant nexus. "Tributaries," as defined, are jurisdictional by rule.

The rule only covers as tributaries those waters that science tells us provide chemical, physical, or biological functions to downstream waters and that meet the significant nexus standard. The agencies identify these functions in the definition of "significant nexus" at paragraph (c)(5). Features not meeting this legal and scientific test are not jurisdictional under this rule. The rule continues the current policy of regulating ditches that are constructed in tributaries or are relocated tributaries or, in certain circumstances drain wetlands, or that science clearly demonstrates are functioning as a tributary. These jurisdictional waters affect the chemical, physical, and biological integrity of downstream waters. The rule further reduces existing confusion and inconsistency regarding the regulation of ditches by explicitly excluding certain categories of ditches, such as ditches that flow only after precipitation. Further, the rule explicitly excludes from the definition of "waters of the United States" erosional features, including gullies, rills, and ephemeral features such as ephemeral streams that do not have a bed and banks and ordinary high water mark.

Adjacent Waters

The agencies determined that "adjacent waters," as defined in the rule, have a significant nexus to traditional navigable waters, interstate waters, and the territorial seas based upon their hydrological and ecological connections to, and interactions with, those waters. Under this final rule, "adjacent" means bordering, contiguous, or neighboring, including waters separated from other "waters of the United States" by constructed dikes or barriers, natural river berms, beach dunes and the like. Further, waters that connect segments of, or are at the head of, a stream or river are "adjacent" to that stream or river. "Adjacent waters" include wetlands, ponds, lakes, oxbows, impoundments, and similar water features. However, it is important to note that "adjacent waters" do not include waters that are subject to established normal farming, silviculture, and ranching activities as those terms are used in Section 404(f) of the CWA.

The final rule establishes a definition of "neighboring" for purposes of determining adjacency. In the rule, the agencies identify three circumstances under which waters would be "neighboring" and therefore "waters of the United States":

(1) Waters located in whole or in part within 100 feet of the ordinary high water mark of a traditional navigable water, interstate water, the territorial seas, an impoundment of a jurisdictional water, or a tributary, as defined in the rule.

(2) Waters located in whole or in part in the 100-year floodplain and that are within 1,500 feet of the ordinary high water mark of a traditional navigable water, interstate water, the territorial seas, an impoundment, or a tributary, as defined in the rule ("floodplain waters").

(3) Waters located in whole or in part within 1,500 feet of the high tide line of a traditional navigable water or the territorial seas and waters located within 1,500 feet of the ordinary high water mark of the Great Lakes.

The agencies emphasize that the rule has defined as "adjacent waters" those waters that currently available science demonstrates possess the requisite connection to downstream waters and function as a system to protect the chemical, physical, or biological integrity of those waters. The agencies also emphasize that the rule does not cover "adjacent waters" that are otherwise excluded. Further, the agencies recognize the establishment of bright line boundaries in the rule for adjacency does not in any way restrict states from considering state specific information and concerns, as well as emerging science to evaluate the need to more broadly protect their waters under state law. The CWA establishes both national and state roles to ensure that states specific circumstances are properly considered to complement and reinforce actions taken at the national level.

"Adjacent" waters as defined are jurisdictional by rule. The agencies recognize that there are individual waters outside of the "neighboring" boundaries stated above where the science may demonstrate through a case-specific analysis that there exists a significant nexus to a downstream traditional navigable water, interstate water, or the territorial seas. However, these waters are not determined jurisdictional by rule and will be evaluated through a case-specific analysis. The strength of the science and

the significance of the nexus will be established on a case-specific basis as described below.

Case-Specific Significant Nexus

The rule identifies particular waters that are not jurisdictional by rule but are subject to case-specific analysis to determine if a significant nexus exists and the water is a "water of the United States." This category of case-specific waters is based upon available science and the law, and in response to public comments that encouraged the agencies to ensure more consistent determinations and reduce the complexity of conducting jurisdictional determinations. Consistent with the significant nexus standard articulated in the Supreme Court opinions, waters are "waters of the United States" if they significantly affect the chemical, physical, or biological integrity of traditional navigable waters, interstate waters, or the territorial seas. This determination will most typically be made on a water individually, but can, when warranted, be made in combination with other waters where waters function together.

In this final rule, the agencies have identified by rule, five specific types of waters in specific regions that science demonstrates should be subject to a significant nexus analysis and are considered similarly situated by rule because they function alike and are sufficiently close to function together in affecting downstream waters. These five types of waters are Prairie potholes, Carolina and Delmarva bays, pocosins, western vernal pools in California, and Texas coastal prairie wetlands. Consistent with Justice Kennedy's opinion in *Rapanos*, the agencies determined that such waters should be analyzed "in combination" (as a group, rather than individually) in the watershed that drains to the nearest traditional navigable water, interstate water, or the territorial seas when making a case-specific analysis of whether these waters have a significant nexus to traditional navigable waters, interstate waters, or territorial seas.

The final rule also provides that waters within the 100-year floodplain of a traditional navigable water, interstate water, or the territorial seas and waters within 4,000 feet of the high tide line or the ordinary high water mark of a traditional navigable water, interstate water, the territorial seas, impoundments, or covered tributary are subject to case-specific significant nexus determinations, unless the water is excluded under paragraph (b) of the rule. The science available today does not establish that waters beyond those defined as "adjacent" should be jurisdictional as a category under the CWA, but the agencies' experience and expertise indicate that there are many waters within the 100-year floodplain of a traditional navigable water, interstate water, or the territorial seas or out to 4,000 feet where the science demonstrates that they have a significant effect on downstream waters.

In circumstances where waters within the 100-year floodplain of a traditional navigable water, interstate water, or the territorial seas or within 4,000 feet of the high tide line or ordinary high water mark are subject to a case-specific significant nexus analysis and such waters may be evaluated as "similarly situated," it must be first demonstrated that these waters function alike and are sufficiently close to function together in affecting downstream waters. The significant nexus analysis must then be conducted based on consideration of the functions provided by those waters in combination in the point of entry watershed. A "similarly situated" analysis is conducted where it is determined that there is a likelihood that there are waters that function together to affect downstream water integrity. To provide greater clarity and transparency in determining what functions will be considered in determining what constitutes a significant nexus, the final rule lists specific functions that the agencies will consider.

In establishing both the 100-year floodplain and the 4,000 foot bright line boundaries for these case-specific significant nexus determinations in the rule, the agencies are carefully applying the available science. Consistent with the CWA, the agencies will work with the states in connection with the prevention, reduction and elimination of pollution from state waters. The agencies will work with states to more closely evaluate state-specific circumstances that may be present within their borders and, as appropriate, encourage states to develop rules that reflect their circumstances and emerging science to ensure consistent and effective protection for waters in the states. As is the case today, nothing in this rule restricts the ability of states to more broadly protect state waters.

Exclusions

All existing exclusions from the definition of "waters of the United States" are retained, and several exclusions reflecting longstanding agency practice are added to the regulation for the first time.

Prior converted cropland and waste treatment systems have been excluded from the definition of "waters of the United States" definition since 1992 and 1979 respectively, and continue to be excluded. Ministerial changes are made for purposes of clarity, but these two exclusions remain substantively and operationally unchanged. The agencies add exclusions for waters and features previously identified as generally exempt (*e.g.*, exclusion for certain ditches that are not located in or drain wetlands) in preamble language from **Federal Register** documents by the Corps on November 13, 1986, and by EPA on June 6, 1988. This is the first time these exclusions have been established by rule. The agencies for the first time also establish by rule that certain ditches are excluded from jurisdiction, including ditches with ephemeral flow that are not a relocated tributary or excavated in a tributary, and ditches with intermittent flow that are not a relocated tributary, or excavated in a tributary, or drain wetlands. The agencies add exclusions for groundwater and erosional features, as well as exclusions for some waters that were identified in public comments as possibly being found jurisdictional under proposed rule language where this was never the agencies' intent, such as stormwater control features constructed to convey, treat, or store stormwater, and cooling ponds that are created in dry land. These exclusions reflect the agencies' current practice, and their inclusion in the rule as specifically excluded furthers the agencies' goal of providing greater clarity over what waters are and are not protected under the CWA.

Role of States and Tribes Under the Clean Water Act

States and tribes play a vital role in the implementation and enforcement of the CWA. Section 101(b) of the CWA states that it is Congressional policy to preserve the primary responsibilities and rights of states to prevent, reduce, and eliminate pollution, to plan the development and use of land and water resources, and to consult with the Administrator with respect to the exercise of the Administrator's authority under the CWA.

Of particular importance, states and tribes may be authorized by the EPA to administer the permitting programs of CWA sections 402 and 404. Forty-six states and the U.S. Virgin Islands are authorized to administer the NPDES program under section 402, while two states administer the section 404 program. The CWA identifies the waters over which states may assume section 404 permitting jurisdiction. *See* CWA section 404(g)(1). The scope of waters

that are subject to state and tribal permitting is a separate inquiry and must be based on the statutory language in CWA section 404. States administer approved CWA section 404 programs for "waters of the United States" within the state, except those waters remaining under Corps jurisdiction pursuant to CWA section 404(g)(1) as identified in a Memorandum of Agreement between the state and the Corps. 40 CFR 233.14; 40 CFR 233.70(c)(2); 40 CFR 233.71(d)(2). EPA has initiated a separate process to address how the EPA can best clarify assumable waters for dredged and fill material permit programs pursuant to the Clean Water Act section 404(g)(1). 80 FR 13539 (Mar. 16, 2015). Additional CWA programs that utilize the definition of "waters of the United States" and are of importance to the states and tribes include the section 311 oil spill prevention and response program, the water quality standards and total maximum daily load (TMDL) programs under section 303, and the section 401 state water quality certification process.

States and federally-recognized tribes, consistent with the CWA, retain full authority to implement their own programs to more broadly and more fully protect the waters in their jurisdiction. Under section 510 of the CWA, unless expressly stated, nothing in the CWA precludes or denies the right of any state to establish more protective standards or limits than the Federal CWA. Congress has also provided roles for eligible Indian tribes to administer CWA programs over their reservations and expressed a preference for tribal regulation of surface water quality on Indian reservations to ensure compliance with the goals of the CWA. See 33 U.S.C. 1377; 56 FR 64876, 64878–79 (Dec. 12, 1991)). Tribes also have inherent sovereign authority to establish more protective standards or limits than the Federal CWA. Where appropriate, references to states in this document may also include eligible tribes. Many states and tribes, for example, regulate groundwater, and some others protect wetlands that are vital to their environment and economy but outside the jurisdiction of the CWA. Nothing in this rule limits or impedes any existing or future state or tribal efforts to further protect their waters. In fact, providing greater clarity regarding what waters are subject to CWA jurisdiction will reduce the need for permitting authorities, including the states and tribes with authorized section 402 and 404 CWA permitting programs, to make jurisdictional determinations on a case-specific basis.

Overview of the Preamble

The remainder of this preamble is organized as follows. Section III (Significant Nexus Standard) provides additional background on the rule, including a discussion of Supreme Court precedent, the science underpinning the rule, and the agencies' overall interpretive approach to applying the significant nexus standard. Section IV (Definition of Waters of the United States) explains the provisions of the final rule, including subsections on each of the major elements of the rule. Section V summarizes the economic analysis of the rule and Section VI addresses Related Acts of Congress, Executive Orders and Agency Initiatives.

III. Significant Nexus Standard

With this rule, the agencies interpret the scope of the "waters of the United States" for the CWA in light of the goals, objectives, and policies of the statute, the Supreme Court case law, the relevant and available science, and the agencies' technical expertise and experience. The key to the agencies' interpretation of the CWA is the significant nexus standard, as established and refined in Supreme Court opinions: Waters are "waters of the United States" if they, either alone or in combination with similarly situated waters in the region, significantly affect the chemical, physical, or biological integrity of traditional navigable waters, interstate waters, or the territorial seas. The agencies interpret specific aspects of the significant nexus standard in light of the science, the law, and the agencies' technical expertise: The scope of the region in which to evaluate waters when making a significant nexus determination; the waters to evaluate in combination with each other; and the functions provided by waters and strength of those functions, and when such waters significantly affect the chemical, physical, or biological integrity of the downstream traditional navigable waters, interstate waters, or the territorial seas.

In the rule, the agencies determine that tributaries, as defined ("covered tributaries"), and "adjacent waters", as defined ("covered adjacent waters"), have a significant nexus to downstream traditional navigable waters, interstate waters, and the territorial seas and therefore are "waters of the United States." In the rule, the agencies also establish that defined sets of additional waters may be determined to have a significant nexus on a case-specific basis: (1) Five specific types of waters that the agencies conclude are "similarly situated" and therefore must be analyzed "in combination" in the watershed that drains to the nearest traditional navigable water, interstate water, or the territorial seas when making a case-specific significant nexus analysis; and (2) waters within the 100-year floodplain of a traditional navigable water, interstate water, or the territorial seas, or waters within 4,000 feet of the high tide line or ordinary high water mark of traditional navigable waters, interstate waters, the territorial seas, impoundments or covered tributaries. The rule establishes a definition of significant nexus, based on Supreme Court opinions and the science, to use when making these case-specific determinations.

Significant nexus is not a purely scientific determination. The opinions of the Supreme Court have noted that as the agencies charged with interpreting the statute, EPA and the Corps must develop the outer bounds of the scope of the CWA, while science does not provide bright line boundaries with respect to where "water ends" for purposes of the CWA. Therefore, the agencies' interpretation of the CWA is informed by the Science Report and the review and comments of the SAB, but not dictated by them. With this context, this section addresses, first, the Supreme Court case law and the significant nexus standard, second, the relevant scientific conclusions reached by analysis of existing scientific literature, and third, the agencies' significant nexus determinations underpinning the rule. Section IV of the preamble addresses in more detail the precise definitions of the covered waters promulgated by the agencies to provide the bright line boundaries identifying "waters of the United States."

A. The Significant Nexus Standard

Congress enacted the CWA "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." Section 101(a). The agencies' longstanding regulations define "waters of the United States" for purposes of the Clean Water Act, and the Supreme Court has addressed the scope of "waters of the United States" protected by the CWA in three cases. The significant nexus standard evolved through those cases.

In *United States* v. *Riverside Bayview Homes,* 474 U.S. 121 (1985) (*Riverside*), which involved wetlands adjacent to a traditional navigable water in Michigan, the Court, in a unanimous opinion, deferred to the Corps' ecological judgment that adjacent wetlands are "inseparably bound up" with the waters

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Joe Martens
Commissioner

May 17, 2012

Attorneys at Law

Re: Determination on Petition to Designate Freshwater Wetlands of Unusual Local Importance at the Patrick Farm Site.

Dear

I write in response to your December 12, 2011 petition brought pursuant to Environmental Conservation Law Sections 24-0301 and 24-0105. Specifically, the petition requested that the Department designate an unmapped wetland area in the Town of Ramapo, Rockland County New York as freshwater wetlands of unusual local importance. A project known as the Patrick Farm Development Project has been proposed for the property where the wetlands are located (the "Site"). Department staff has also reviewed the additional information provided in your February 9, 2012 correspondence, and has reviewed the "White Paper" in support of your request. For the following reasons, the Department is not granting your petition.

The Environmental Conservation Law gives the Department authority to regulate freshwater wetlands in the state of New York which have an area of at least 12.4 acres or more. It is the policy of the state

> to preserve, protect and conserve freshwater wetlands and the benefits derived therefrom, to prevent the despoliation and destruction of freshwater wetlands, and to regulate use and development of such wetland to secure the nature benefits of freshwater wetlands, consistent with the general welfare and beneficial economic, social and agricultural development of the state.

ECL § 24-0103. Regulation of smaller wetlands is possible as either a discretionary or mandatory action under authority given to the Commissioner by law. Regulation of freshwater wetlands smaller than 12.4 acres is at the discretion of the Commissioner if it is determined by the Commissioner that the wetlands have "unusual local importance for one or more of the specific benefits set forth in subdivision seven of [Environmental Conservation Law] section 24-0105." *See* ECL § 24-0301. The Commissioner, however, shall designate an area of land or water of less than 12.4 acres as a wetland having unusual local importance if it contains any Class I characteristics. *See* 6 NYCRR § 664.7(c)(1).

THE PETITION FOR THE PATRICK FARM WETLANDS

On January 3, 2012, in my correspondence responding to your initial December 12, 2011 petition, I noted that Department staff have conducted field inspections of the Site and at that time determined that the wetland area does not meet the minimum legal threshold of 12.4 acres in area necessary for the Department to map and designate the wetland as regulated under the Environmental Conservation Law. At that time, the Department also determined that the wetland does not meet the established criteria as a freshwater wetland of unusual local importance. This initial determination was based upon Department staff observations during field inspections of the Site.

On February 9, 2012, Department staff received additional information in support of the petition to designate the Patrick Farm wetland as a freshwater wetland of unusual local importance. Department staff has reviewed that information and has revisited the January 3, 2012 determination declining to designate the wetland as a freshwater wetland of unusual local importance.

THE UNUSUAL LOCAL IMPORTANCE ANALYSIS

The Department's regulatory jurisdiction is generally limited to wetlands 12.4 acres or larger, unless a smaller wetland is determined to have "unusual local importance." The Department is obligated to designate a freshwater wetland as having "unusual local importance" if it can be classified as a Class I wetland. *See* 6 NYCRR § 664.7.

Is it a Class I Freshwater Wetland?

The six Class I freshwater wetland characteristics include:

- it is a classic kettlehole bog,
- it is resident habitat of an endangered or threatened animal species,
- it contains an endangered or threatened plant species,
- it supports an animal species in abundance or diversity unusual for the state or for the major region of the state in which it is found,
- it is tributary to a body of water which could subject a substantially developed area to significant damage from flooding or from additional flooding should the wetland be modified, filled, or drained, and
- it is adjacent or contiguous to a reservoir or other body of water that is used primarily for public water supply, or it is hydraulically connected to an aquifer which is used for public water supply.

Department staff found no evidence of endangered animal or plant species, or animal species in unusual abundance or diversity in the wetland. The wetland is not a kettlehole bog. There is no evidence demonstrating that alterations of the wetland would impact the flooding risks to the area, so the fifth characteristic is also not present. Regarding the first part of the sixth characteristic, the wetland is not adjacent to or contiguous with a reservoir or other body of water that is used for public water supply, and moreover, it does not appear that the water bodies downstream from the area are used "primarily" for water supply purposes. Regarding the second part of the sixth criteria, Department staff has determined that the wetland is not hydraulically connected to an aquifer. Although the property is near an aquifer used for public water supply, the wetland is not within the boundaries of the aquifer according to the Department's Geological Information Survey data and therefore cannot be considered "hydraulically connected." There is a stream that leaves the wetland, flows down-slope for a considerable distance, and then runs over that aquifer, but there is no evidence that this stream connects to the aquifer either underground or via surface flow, based upon Department staff's review of the geologic conditions of the Site.

For these reasons, Department staff has concluded that the petitioned Patrick Farm wetland does not possess any characteristics of a Class I wetland, and therefore, the wetland is not required by law to be designated as having "unusual local importance."

Does the Wetland Contain 4 or More Class II Characteristics Authorizing it to be considered Class I?

A freshwater wetland also may be considered a Class I wetland if "it contains four or more of the

enumerated Class II characteristics." 6 NYCRR § 664.5(a)(7). There are seventeen Class II characteristics. The most relevant characteristics for this inquiry include:

- it contains two or more wetland structural groups,
- it is associated with permanent open water outside the wetland,
- it is adjacent or contiguous to streams classified C(t) or higher, and
- it is within an urbanized area.

Portions of the wetland area on the Site possess three of the four characteristics. The area contains at least two wetland structural groups, is adjacent or contiguous to a Class B stream, and is located in an "urbanized area." However, a review by Department staff has determined that the wetland is not associated with permanent open water outside the wetland. Thus, the wetland does not possess the necessary four of the seventeen Class II characteristics required for designation as having "unusual local importance."

The Commissioner of the Department also has the discretion to determine that freshwater wetlands have "unusual local importance for one or more of the specific benefits set forth in subdivision seven of [Environmental Conservation Law] section 24-0105." ECL § 24-0301(1)(a). Such specific freshwater wetland benefits include, among others, flood and storm control, wildlife habitat, protection of subsurface water resources recreation, pollution treatment, erosion control and open space. ECL § 24-0105(7). Department staff have thoroughly reviewed the information submitted with the petition, and while there is no question that the Patrick Farm wetland provides some of these valuable wetlands benefits, it provides benefits that can be attributed to nearly any wetland and there is no evidence to suggest that any of these wetlands benefits provided rise to the level of having "unusual local importance" warranting such a designation.

Therefore, based on Department Staff's review of the petition and the additional information submitted for our consideration regarding the wetland on the Patrick Farm Site, the regulatory criteria are not sufficiently met authorizing us to designate the freshwater wetland as having "unusual local importance." On behalf of the Department staff, I thank you for your thoughtful submission and for your interest in protecting wetlands in the Hudson Valley area that you value.

Please feel free to contact me if I can be of any further assistance.

Sincerely,

William C. Janeway

William C. Janeway
Regional Director

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Joe Martens
Commissioner

November 16, 2012

Ramapo Organized for Sustainability and a Safe Aquifer (ROSA, Inc.)

Re: Determination on Petition to Designate Freshwater Wetlands of Unusual Local Importance at the Patrick Farm Site.

Dear

I write in response to the December 12, 2011 petition brought pursuant to Environmental Conservation Law Sections 24-0301 and 24-0105 and ROSA Inc.'s March 16, 2012 "Memorandum & Exhibits in Support of the Proposed Amendment of the Department's Freshwater Wetlands Map of Rockland County to Confirm Additional Wetlands on the Property Known as the Patrick Farm." Specifically, the petition requested that the Department designate an unmapped wetland area in the Town of Ramapo, Rockland County New York as freshwater wetlands of unusual local importance. A project known as the Patrick Farm Development Project has been proposed for the property where the wetlands are located (the "Site").

Department staff reviewed the additional information provided in the February 9, 2012 correspondence from Susan and Milton Shapiro, and the "White Paper" in support of the petition. Department staff has also reviewed the information provided in the March 16, 2012 correspondence from Suzanne Mitchell of ROSA, Inc. and the aforementioned Memorandum and Exhibits.

Based on Department Staff's review of the petition and the additional information submitted regarding the wetland on the Patrick Farm Site, the Department staff has determined that the Site did not sufficiently meet the regulatory criteria to authorize the Department to designate the freshwater wetland as having "unusual local importance." The Department set forth the basis for its decision to not grant the petition request in a letter dated May 17, 2012 to Susan and Milton Shapiro, which is enclosed for your reference. In arriving at that determination, Department staff thoroughly reviewed the February 9, 2012 submissions made by Susan and Milton Shapiro and March 16, 2012 submission by Suzanne Mitchell of ROSA, Inc., as well as the findings of Department staff regarding the geological and hydrological conditions of the Site. Department staff has also visited the site as part of its consideration of the submission by Petitioners.

Thank you for providing a thoughtful and well reasoned petition to the Department. Please feel free to contact me if I can be of any further assistance.

Sincerely,

William C. Janeway
Regional Director

Encs.
CC: Kelly Turturo
Dan Whitehead

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

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September 1, 2015

ROSA 4 Rockland Inc.

Re: Petition to Amend Environmental Conservation Law (ECL) Article 24 Freshwater Wetland Map on the Patrick Farm Property

Dear

The New York State Department of Environmental Conservation (NYSDEC or Department) has reviewed your petition dated January 13, 2015 to amend the Thiels Quadrangle for the Rockland County Article 24 Freshwater Wetland Regulatory Map. The petition requests the inclusion and subsequent regulation of wetlands associated with an existing farm pond on the "Patrick Farm" property that is located in the Town of Ramapo, Rockland County. The request was predicated on the United States Army Corps of Engineers Jurisdictional Determination (ACOE JD) entitled *Patrick Farm Wetland Delineation Map* dated 6/17/2104 [2014] by Carpenter Environmental Associates, Inc.

Environmental Conservation Law Article 24 Freshwater Wetland Law requires that for the Department to assert jurisdiction over a wetland that the wetland be included on the regulatory map. Wetlands are eligible to be included or added to the regulatory map if they are greater than 5 Hectares (12.4 acres) in total area. The intent of the regulatory map is to provide notice to landowners and the public about what wetlands are subject to regulation under Article 24. There is a formal process outlined in 6 New York Codes Rules and Regulations Part 664 for amending the regulatory map.

Throughout the Patrick Farm planning and approval process at the local and state level, Department staff have made numerous site visits to this property for the purpose of determining Department jurisdiction under multiple Environmental Conservation Laws and their associated implementing regulations. Based on these site visits, and through the use of GIS and other mapping tools, the Department previously determined that the wetlands associated with the farm pond, tributaries to the farm pond, and the outlet of the impoundment collectively do not meet the criteria necessary to be regulated under

Article 24. On November 21, 2006 Department Staff validated the wetland boundary for the two wetlands on the property that do appear on the regulatory map for the owner (TH-14 and TH-30). This was renewed on 2009 and is valid for 10 years.

The initial site visit on November 6, 2006 focused specifically on wetlands that were already on the regulatory map labeled TH-14 and TH-30. Subsequently, on 8/11/2011, staff returned to the site to look specifically at the wetlands associated with the farm pond in response to a previous request from ROSA 4 Rockland for the Department to assert Article 24 jurisdiction over these wetlands. During this site visit, staff determined that, based on conditions at that time, there was a little over 200' foot break in wetland vegetation between Wetland 4 and Wetland 5, as also shown on the 2014 ACOE JD provided with the current petition. Based on criteria in 6 NYCRR Part 664.7(b), these two wetland areas, although hydrologically connected, were greater than 50 Meters (164.04 feet) apart and were considered to be separate wetlands for purposes of mapping. Separating these wetland areas for the purpose of determining acreage resulted in the two wetland areas being significantly below the 5 Hectare (12.4 acre) regulatory threshold.

In response to the current ROSA 4 Rockland Petition, and as indicated in my April 3, 2015 initial response to your petition, Department staff performed another site visit with the property owner's environmental consultant on May 12, 2015. The purpose of the site visit was to determine if the ACOE JD mapping in the vicinity of the existing farm pond was consistent with the Department's Freshwater Wetland Delineation Manual and to make observations to determine if these wetlands meet the criteria for New York State DEC jurisdiction as outlined in 6 NYCRR Part 664 Freshwater Wetland Map and Classification Regulations.

During that May 2015 site visit, Department staff thoroughly checked the hydrologic connection between wetlands 4 and 5. Staff determined the length through field measurements of the hydrologic connection (absent wetland vegetation) of Tributary 3 for comparison to the threshold distance in 6 NYCRR Part 664.7(b). While close to the threshold criteria, results of the re-measurement were not compelling enough to allow us to use the cumulative acreage of both wetlands in determining the state's jurisdiction. Therefore, the new information or evidence does not support a determination that the area of the combined wetlands exceeds the regulatory threshold of 12.4 acres.

Additionally, Department staff also observed that the ACOE JD consistently depicts the delineated wetland boundary to be upland of where the guidance established in the Department's Freshwater Wetland Delineation Manual would dictate. Additionally, the ACOE JD does not separate out upland areas located entirely within the wetland boundary. Based on these observations, Department staff have concluded that the wetland boundaries shown on the ACOE JD, and the acreage calculations extrapolated from the ACOE JD, cannot be utilized directly to support the wetland's regulation under ECL Article 24.

Based on the above, the petition and additional information submitted do not provide a sufficient basis for us to overturn our previous determination. We have thus again concluded that this wetland does not meet the criteria to be regulated under ECL Article 24 and therefore cannot amend the regulatory map as requested by ROSA 4 Rockland.

If you have any specific questions regarding this determination, please feel free to contact Bill Rudge, Natural Resources Supervisor, at (845) 256-3094.

Sincerely,

Martin D. Brand
Regional Director

cc: Assemblywoman Ellen C. Jaffee
Senator David Carlucci
Assemblyman Kenneth P. Zebrowski
Edwin J. Day, Rockland County Executive
Christopher St. Lawrence, Supervisor, Town of Ramapo
Yechiel Lebovits, Applicant/Sponsor for Patrick Farms

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January 18, 2018

Village of Pomona

Dear

I write in response to your correspondence related to the parcel of land in Rockland County where Scenic Development LLC has proposed to build a residential development called "Patrick Farm". The New York State Department of Environmental Conservation ("DEC" or "Department") has reviewed the Village of Pomona's request and the information submitted in support of the request that DEC consider certain wetlands on the Patrick Farm property to be Wetlands of Unusual Local Importance so that the wetlands can be added to the Freshwater Wetland Regulatory Map for Rockland County and become regulated by New York State.

Over the past several years, the Department has reviewed six requests to add the wetlands on the Patrick Farm property to the State's official freshwater wetlands maps. Three of those requests were for the Department to designate the wetland as a Wetland of Unusual Local Importance because the wetland area is less than the statutory minimum 12.4 acres required to be a state regulated wetland (see 6 NYCRR Part 664.7(c)). The Department responded to the three requests in 2012 and advised that the wetland area did not meet the regulatory criteria to require designation as a Wetland of Unusual Local Importance and declined to amend the Freshwater Wetland Regulatory Map. I have enclosed those letters for your reference, including January 3, 2012 from DEC Regional Director William C. Janeway to Ms. Susan Shapiro, Esq.; May 17, 2012 from DEC Regional Director William C. Janeway to Milton B. Shapiro and Susan Hito Shapiro; and November 16, 2012 from Regional Director William C. Janeway to Ms. Melanie Golden.

The Department's 2012 determinations were based upon the same facts and issues raised in your correspondence, and reflect that among several other reasons, the subject wetland does not possess any Class I characteristics including that it is not located directly over an aquifer which is used for public water supply nor does it

possess at least four Class II characteristics. Therefore, the Department determined in 2012 that the Patrick Farm wetlands did not meet the regulatory criteria to require designation as a Wetland of Unusual Local Importance and declined to amend the regulatory map.

The above referenced letters remain the agency's determination regarding the presence of wetlands of Unusual Local Importance on the Patrick Farm property. DEC therefore declines to make any further determination regarding this issue.

Thank you for your continued interest in the protection of local wetlands and the State's natural resources.

Sincerely,

Kelly R. Turturro
Regional Director

Enclosure

38 A.D.3d 903, 832 N.Y.S.2d
653, 2007 N.Y. Slip Op. 02763

**1 In the Matter of Park Ridge Neighborhood Association et al., Petitioners
v
Erin M. Crotty et al., Respondents. (Proceeding No. 1.) In the Matter of Westchester Country Club, Inc., et al., Appellants, v Erin M. Crotty et al., Respondents. (Proceeding No. 2.)

Supreme Court, Appellate Division,
Second Department, New York
13745/05, 13813/05, 2005-09858
March 27, 2007

CITE TITLE AS: Matter of Park Ridge Neighborhood Assn. v Crotty

HEADNOTE

Environmental Conservation
Water Supply
Water Quality Certification

Respondents, their agents, servants and employees were enjoined from proceeding with any work on certain parcels pending issuance of water quality certification by State Department of Environmental Conservation (Department)—regulations governing Department's response to requests for water quality certifications under section 401 of Clean Water Act (33 USC § 1341 [a] [1]) provide that applicant for such permit "must apply for *and obtain* a water quality certification from the department" (6 NYCRR 608.9 [a] [emphasis supplied]); although applicable federal statute allows state to which permitting authority under Clean Water Act has been delegated to grant waiver of water quality certification (*see* 33 USC § 1341 [a]), Department's regulations, by which it is bound, do not; Department was without authority to grant waiver at issue.

Zarin & Steinmetz, White Plains, N.Y. (Daniel M. Richmond and David S. Steinmetz of counsel), for appellant Westchester Country Club, Inc., and Collier, Halpern, Newberg, Nolletti & Bock, LLP, White Plains, N.Y. (William J. Collier, Jr., and William Walsh of counsel), for appellant Harrison-Rye Realty Corp. (one brief filed).

Andrew M. Cuomo, Attorney General, New York, N.Y. (Michael S. Belohlavek and Norman Spiegel of counsel; Tomas Carbonell on the brief), for respondents Erin M. Crotty, as Commissioner of the New York State Department of Environmental Conservation, and New York State Department of Environmental Conservation in proceeding No. 2.

Thacher Proffitt & Wood LLP, White Plains, N.Y. (Kevin J. Plunkett and Darius P. Chafizadeh of counsel), for respondents Atlantic Development, LLC, Iliana Gardens, LLC, Collin Estates, LLC, and Sunshine Properties of Westchester, LLC, in proceeding No. 2.

Friedman, Harfenist, Langer & Kraut, Purchase, N.Y. (Steven Jay Harfenist of counsel), for amicus curiae Town/Village of Harrison.

In two related proceedings pursuant to CPLR article 78 to review a determination of the New York State Department of Environmental Conservation dated July 11, 2005, which granted a waiver of water quality certification in connection with an application by Atlantic Development, LLC, to fill federally-regulated wetlands, Westchester Country Club, Inc., and Harrison-Rye Realty Corp. appeal, as limited by their brief, from so much of an order and judgment (one paper) of the Supreme Court, Westchester County (Nicolai, J.), dated September 14, 2005, as denied the petition in proceeding No. 2, dismissed proceeding No.2, and vacated a temporary restraining order of the same court dated August 18, 2005, enjoining Atlantic Development, LLC, Iliana Gardens, LLC, Collin Estates, LLC, Sunshine Properties of Westchester, LLC, and Michael DeMartino, and their agents, servants, and employees from proceeding with any work on parcels designated as Blocks 12, 13, and 14 on Westchester County Tax Map No. 3322 until September 15, 2005.

Ordered that the order and judgment is reversed insofar as appealed from, on the law, with costs payable by the respondents ***904** appearing separately and filing separate briefs, the petition in proceeding No. 2 is granted, the determination is annulled, and Atlantic Development, LLC, Iliana Gardens, LLC, Collin Estates, LLC, Sunshine Properties of Westchester, LLC, and Michael DeMartino, and their agents, servants, and employees are enjoined from

proceeding with any work on parcels designated as Blocks 12, 13, and 14 on Westchester County Tax Map No. 3322 pending the issuance of a water quality certification by the New York State Department of Environmental Conservation.

The regulations of the New York State Department of Environmental Conservation (hereinafter the Department) that govern the Department's response to requests for water quality certifications under section 401 of the Clean Water Act (33 USC § 1341 [a] [1]) provide that the applicant for such a permit "must apply for *and obtain* a water quality certification from the department" (6 NYCRR 608.9 [a] [emphasis supplied]). Although the applicable federal statute allows a state to which permitting authority under the Clean Water Act [formerly the Federal Water Pollution Control Act] has been delegated to grant a waiver of water quality certification (*see* 33 USC § 1341 [a]), the Department's regulations, by which it is bound (*see Matter of Frick v Bahou*, 56 NY2d 777, 778 [1982]; *Matter of Steck v Jorling*, 219 AD2d 727, 729 [1995]), do not. The Department's argument that its regulations require water quality certification only where the waters in issue fall within its jurisdiction under the Freshwater Wetlands Act (ECL art 24) is inconsistent with the terms of the regulation, pursuant to which the certification requirement applies to any permit "that may result in any discharge into navigable waters as defined in section 502 of the Federal Water Pollution Control Act" (6 NYCRR 608.9 [a]). In addition, although the regulations authorize the Department to grant statewide water quality certifications in certain circumstances, they provide for no such certification, and no exemption or other such relief, on the ground that the wetland in issue is not subject to the Department's jurisdiction by virtue of federal jurisdiction over the wetland (*see* 6 NYCRR 608.9 [b]; *cf.* 6 NYCRR 608.9 [a]). The Department was without authority to grant the waiver at issue. Accordingly, the petition in proceeding No. 2 should have been granted and the determination granting the waiver of water quality certification should have been annulled. In light of this determination, it is unnecessary for us to address the appellants' contentions with respect to the applicability of the New York State Environmental Quality Review Act (ECL art 8) to such a determination. Miller, J.P., Spolzino, Goldstein and McCarthy, JJ., concur. ***905**

Chapter 78

FRESHWATER WETLANDS

GENERAL REFERENCES

Conservation Commission — See Ch. 10.

Flood damage prevention — See Ch. 74.

Stormwater management and erosion and sediment control – See Ch. 119.

Subdivision of land — See Ch. 123.

Zoning — See Ch. 138.

§ 78-1. Purpose; findings.

A. Declaration of policy. It is declared to be the public policy of the Town of Southeast to preserve, protect and conserve freshwater wetlands and the benefits derived therefrom, to prevent the despoliation and destruction of wetlands and watercourses, in order to secure the natural benefits therefrom for the protection of public health and safety and consistent with the general welfare and the beneficial economic, social and agricultural development of the Town.

B. Findings. The following findings are made:

(1) Wetlands and watercourses in the Town of Southeast are invaluable resources for flood protection, wildlife habitat, open space, nutrient retention and sediment trapping, visual/aesthetic reasons, water-based recreation, groundwater protection potential and drinking water.

(2) Wetlands and watercourses in the Town have been or are in jeopardy of being lost, despoiled or impaired by unregulated draining, dredging, filling, excavating, building, pollution or other acts inconsistent with the natural uses of such wetlands and watercourses.

(3) Recurrent flooding of areas of the Town, aggravated or caused by the loss of wetlands or alteration of watercourses, has serious effects upon natural ecosystems and presents serious hazards to the health, safety, welfare and property of the people in the Town, within and outside such wetlands and watercourses, including loss of life, loss and damage to private and public property, disruption of lives and livelihoods, interruption of commerce, transportation, communication and governmental services, and unsanitary and unhealthful living and environmental conditions.

(4) Wetlands and watercourses conservation is a matter of concern to the entire Town, and the establishment of preservation, protection and conservation practices is essential to the public health, safety

and welfare since actions on wetlands and watercourses in one location affect persons and property in other locations.

(5) Wetlands and watercourses overlap many properties and neighborhoods, and experience has demonstrated that effective wetlands and watercourses protection requires uniformity of preservation, protection and conservation throughout the Town.

(6) Loss, despoliation or impairment of wetlands deprives people of the Town some or all of the many and multiple benefits to be derived from wetlands, such as the following:

(a) Flood and stormwater runoff control by hydrologic adsorption and storage capacity of wetlands;

(b) Wildlife habitat by providing for breeding, nesting and feeding grounds and cover for many forms of wildlife, wildfowl and shorebirds, including migratory wildfowl and rare species.

(c) Protection of subsurface water resources and provision for valuable watersheds and recharging of groundwater supplies;

(d) Recreation by providing resource areas for hunting, fishing, boating, hiking, bird watching, photography, camping and other uses;

(e) Pollution treatment by serving as biological and chemical oxidation basins;

(f) Erosion control by serving as sedimentation areas and filtering basins, absorbing silt and organic matter, protecting channels and water bodies, dissipating erosive forces and anchoring shorelines;

(g) Education and scientific research by providing outdoor biophysical laboratories, living classroom and resources for training and education.

(h) Open space and aesthetic appreciation;

(i) Sources of nutrients in freshwater food cycles and the nursery ground and sanctuary for fish; and

(j) Vegetation providing temperature modification, purification of the air and natural products for harvest.

(7) Improper use and the despoliation or impairment of water sources deprives people of the benefits thereof, such as the following:

(a) Surface draining free from erosion and sedimentation and with capacity to carry runoff without danger of flooding;

(b) Fresh waters for potable water supply and for boating, swimming, fishing and other recreation; and

(c) Continuity of water flows and supplies throughout the year.

(8) Regulation of wetlands and watercourses is consistent with the legitimate interests of farmers and other landowners to graze and water livestock, make reasonable use of water resources, harvest natural products of the wetlands and selectively cut timber.

§ 78-2. Definitions.

As used in this chapter, the following terms shall have the meanings indicated below:

CONSERVATION COMMISSION — That municipal body heretofore created by the Town Board in accordance with the General Municipal Law of the State of New York and pursuant to Chapter 10 of the Town Code.

CONTROLLED AREA — Shall include all wetlands and the area surrounding the same based on hydrological soil grouping and all watercourses and adjacent contributory surfaces based on hydrological soil grouping and slope percentage as indicated by the distances on the chart below. "Hydrological soil grouping" (HSG) is defined as a system of grouping soils according to the water infiltration and transmission rate characteristics when the soil is thoroughly wet.

Wetland Buffer by Hydrological Soil Group

HSG		Buffer (feet)
A	High infiltration, transmission deeply drained	100
B	Moderate infiltration and transmission and moderately drained	133
C	Slow infiltration, transmission poor to well drained	166
D	Very slow infiltration, transmission, permanent water	200

Watercourse Buffer by Hydrological Soil Group or Slope Percentage

HSG	Slope%	Buffer (feet)
A or A and B	0-3%; 3-8%	100
B or C	8-15%	100
C or D	15-25%	130
D or E	25-35%	170
F	35-60%	200

PERSON — Shall include any person, corporation, firm, partnership, association, trust, estate, individual, joint venture, and any unit of government, agency or subdivision thereof that is subject to this chapter.

POLLUTION — Shall include, in addition to its usual meaning, the presence in the environment of man-induced conditions or contaminants in quantities or with characteristics which are or may be injurious to human, plant, wildlife, animal forms or life or property.

WATERCOURSES — Shall include the following:

A. Rivers, streams, brooks and waterways which are delineated on the current edition of the U.S. Department of Interior, Geological Survey, 7.5 Minute Series (topographic maps covering the Town of Southeast);

B. Any other streams, brooks and waterways containing running water more than six months a year; and

C. Lakes, ponds, marshes, swamps, bogs and all other bodies of water, natural or artificial, which are fed by or have surface discharge to another wetland or watercourse.

WETLANDS —

A. Lands and waters consisting of any of the following:

(1) Soil types which are poorly drained, very poorly drained, alluvial and floodplain soils as defined by the U.S. Department of Agriculture, Soil Conservation Service, which soil types in the Town of Southeast have the following map codes and names:

Map Code	Name
25	Sun silt loam
27	Sun (stony silt loam)
28	Fredon loam
35	Raynham silt loam
100	Fluvaquents
101	Carlisle muck
103	Freshwater marsh (aquents)
108	Udorthents wet substratum
251	Ridgebury loam
252	Ridgebury very stony loam
311	Fluvaquents
1011	Palms muck
1251	Leicester loam
1252	Leicester very stony loam

(2) Lands and submerged lands, commonly called "marshes," "swamps," "sloughs," "bogs" and "flats," supporting aquatic or semiaquatic vegetation of the following vegetative types.

(a) Wetland trees, which depend upon seasonal or permanent flooding or sufficiently waterlogged soils to give them a competitive advantage over other trees, including, among others, red maple (Acer rubrum), willows (Salix spp.), black spruce (Picea mariana); swamp white oak (Quercus bicolor), red ash (Fraxinum pennsylvanica), American elm (Ulmus americana) and larch (Larix laricina);

(b) Wetland shrubs, which depend upon seasonal or permanent flooding or sufficiently waterlogged soils to give them a competitive advantage over other shrubs, including, among others, alder (Alnus spp.), bottonbrush (Cepha lanthus occidentalis), bog rosemary (Andromeda glaucophylla), leatherleaf (Chamaedaphne calyculata), spice bush (Lindera benzoin), winter berry (Llex montans), red-osier dogwood (Cornus stolonifera) and highbush blueberry (Vaccinum corymbosum);

(c) Emergent vegetation, including, among other, cattails (Typha spp.), pickerelweed (Pontederia cordata), bulrushes (Scirpus spp.), arrow arum (Peltandra virginica), arrowheads (Saggittaria spp.), reed (Pharagnites communis), wild rice (Zigzania aquatica), bur-reeds (Spargantum spp.), purple loosestrife (Lythrum salicaria), swamp loosestrife (Decodor verticillatus) and water plantain (Alisma plantago-acquatica);

(d) Rooted, floating-leaved vegetation, including, among others, water lily (Nymphaea odorata), water shield (Brasenia schreberi) and spatterdock (Nuphar spp.);

(e) Free-floating vegetation, including, among others, duck weed (Lemna spp.), big duckweed (Spirodela Polyrhiz) and watermeal (Wolffia spp.);

(f) Wet meadow vegetation, which depends upon seasonal or permanent flooding or sufficiently waterlogged soils to give it a competitive advantage over other open land vegetation, including, among others, sedges (carex spp.), rushes (Juncus spp.), cattails (Typha spp.), rice cut grass (Leersia oryzoides), reed canary grass (Phalaris arundinance), swamp loosestrife (Decodon verticillatus), spikerush (Eleocharis spp.), skunk cabbage (Symplocarpus foetides) and false hellebore (Veratrum viride);

(g) Bog mat vegetation, including, among others, sphagnum mosses (Sphagnum spp.), bog rosemary (Andromeda glaucophylla), leatherleaf (Chamaedaphne calculata), pitcher

plant (Sarrancenia purpurea), and cranberries (Vaccineum macrocarpon and V. oxycoccos);

(h) Submergent vegetation, including, among others, pondweeds (Potamoziton spp.), mavads (Najas spp.), bladderworts (Ultricularia spp.), wild cherry (Vallisneri americana), coontails (Ceratophyllum demersum), water milfoils (Myriophyllum spp.), muskgrass (Chara), stonework (Nitella spp.), water weeds (Elodes spp.), and water smartweed (Polygonum amphihium).

(3) Lands and submerged lands containing remnants of any vegetation that is not aquatic or semiaquatic that has died because of wet conditions over a significantly long period, provided that such wet conditions do not exceed a maximum seasonal water depth of six feet, and provided further that such conditions can be expected to persist indefinitely, barring human intervention.

(4) Lands enclosed by aquatic or semiaquatic vegetation as set forth in Subsection A(2) and dead vegetation as set forth in Subsection A(3), the regulation of which is necessary to protect and preserve the aquatic and semiaquatic vegetation.

(5) Waters overlying the areas set forth in Subsection A(1) and A(3) and lands underlying areas set forth in Subsection A(4).

(6) Lands and waters possessing the characteristics described in Subsection A(1), (2), (3), (4) and (5) that are less than one acre but are both hydrologically connected to and within 50 meters (165 feet) of other wetlands and together with these exceed one acre.

B. Unvegetated open water is part of a wetland if it is more than 50% enclosed by wetland vegetation and is no larger than 2.5 hectares (6.2 acres). If the body of open water, substantially enclosed by wetland vegetation, is larger than 2.5 hectares, then only that portion within 50 meters (165 feet) of the wetland vegetation is part of the wetland.

C. Unvegetated open water adjacent to wetlands but not substantially surrounded by wetland vegetation may be considered to be part of the wetland to a depth of two meters (6.6 feet) below low water or to the maximum extent of nonpersistent emergents, if these grow at depths greater than two meters.

D. All areas within the one-hundred-year floodplain as shown on the latest map entitled "FIRM, Flood Insurance Rate Map; Town of Southeast, New York, Putnam County," prepared by the United States Department of Housing and Urban Development, Federal Insurance Administration, as amended from time to time.

WETLANDS INSPECTOR — The agent appointed by the Town Board to fulfill the designated enforcement and permit-processing responsibilities set forth in this chapter. A qualified Wetlands Inspector shall have a degree

from an accredited college or university in a related field, a minimum of two years of delineation experience, and scientific knowledge about the biogeophysical structure, function, or interrelationships of terrestrial and aquatic/semiaquatic plant and animal communities.**[Added 7-20-2006 by L.L. No. 7-2006]**

§ 78-3. Regulated activities; exclusions; permit application; application transmittal.

A. Regulated activities and permits. Any person desiring to conduct a regulated activity as set forth in § 78-3B in any controlled area shall obtain a permit therefor as hereinafter provided.

B. Activities regulated. Activities subject to regulation under this chapter shall include the following:

(1) Any form of dredging, draining, or excavation and any grading or removal of soil, mud, sand, gravel, silt or other earth material from any controlled area, either directly or indirectly; or

(2) Any form of dumping, filling or deposition of any soil, stones, sand, gravel, mud, rubbish, or fill of any kind in any controlled area, either directly or indirectly; or

(3) Erecting any building or other structure, construction of any road, driveway or motor vehicle parking facility, drivings or pilings, installation of any pipe or other conduit or the placing of any other obstructions within a controlled area, whether or not the same affect the ebb and flow of water; or

(4) The use of any chemicals, dyes, fertilizers, herbicides or similar materials in any controlled area such that the same may cause pollution of waters; or

(5) Creating a diversion of water flow in any watercourses; or

(6) Creating an increase or decrease in the flow, velocity or volume of water in any watercourse; or

(7) Introducing any influents of high thermal content such that the same are capable of causing deleterious ecological effect; or

(8) Destroying or permitting the destruction of any trees or other plant life within the controlled area of a watercourse or wetland. These actions shall be reviewed by the administering authority so as to determine if such acts affect the prevailing surface water runoff conditions, directly or indirectly; or

(9) Any other activity which substantially impairs any of the several functions served by the wetlands and watercourses or the benefits derived therefrom as the same are set forth in § 78-1 of this chapter.

C. Exclusions. Activities excluded from regulation under this chapter shall include the following:

(1) (Reserved)

(2) (Reserved)

(3) Public health activities under orders and regulations of the Putnam County Department of Health, provided that copies of such orders and regulations have been filed with the Town Clerk of the Town of Southeast and that the Water Control Board may request modification of such orders if it deems it necessary to implement the policy of this chapter;

(4) Mosquito control projects approved in writing by the New York State Department of Environmental Conservation;

(5) The operation, maintenance and repair of dams, retaining walls, docks and water control structures that were in existence on the effective date of this chapter;

(6) Emergency work which is necessary to protect health and safety or prevent damage to property, provided that the Town Clerk is given written notice within 48 hours after commencement of such work and within 48 hours after completion of the work, and provided that such work is limited to alleviation of the emergency condition; and

(7) Trimming, pruning and bracing of trees; decorative landscaping; including the addition of trees and plants.

D. Application for permit. Any person proposing to conduct a regulated activity as specified in § 78-3B shall file an application for a permit with the Wetlands Inspector in a form and with such information as the Wetlands Inspector may prescribe. The application shall be accompanied by a fee as set from time to time by the Town Board and four copies of at least the following information. If the same shall show sufficient detailed information the administering authority may waive the map requirement below and accept as a substitute therefor any subdivision plat map, grading plans and construction plans as the same may have been prepared for submission pursuant to the Town of Southeast Land Subdivision Regulations.[1] **[Amended 7-20-2006 by L.L. No. 7-2006]**

(1) The names of the owners of record of the land on which the activity is to be conducted and all adjacent owners;

(2) A detailed description of the proposed activity;

(3) A map showing the controlled area affected and any wetlands or watercourses therein, and the location, extent and nature of proposed activity. Said map shall be prepared and certified by a

1. **Editor's Note: See Ch. 123, Subdivision of Land.**

licensed surveyor, professional engineer or professional architect and show contours at two-foot intervals, stone walls, fence lines, tree lines and other major features of the land; and

(4) The names of all known claimants of water rights in, or adjacent to, the wetlands or watercourses.

E. Transmittal of application. Upon receipt, the Wetlands Inspector shall transmit a copy of each application, as follows: **[Amended 7-20-2006 by L.L. No. 7-2006]**

(1) To the Planning Board. **[Amended 8-30-2012 by L.L. No. 7-2012]**

(2) In the event that the wetland or watercourse crosses Town lines, to the Clerk of such adjoining township.

(3) In the event that the wetland or watercourse crosses Putnam County lines, to the Clerk of the adjoining county.

§ 78-4. Application procedure. [Amended 7-20-2006 by L.L. No. 7-2006]

A. Action on application by Wetlands Inspector.

(1) Upon receipt of the application, the Wetlands Inspector may request the submission of such additional information as he may deem necessary to determine compliance with this chapter, including but not limited to the following:

(a) An environmental inventory and an assessment of the location and the effects of the proposed activity;

(b) A chemical and biological evaluation of the waters involved and the effects thereupon by the proposed activity;

(c) Hydraulic and hydrological studies of the wetlands and watercourses;

(d) A geologic evaluation of the wetland setting; and

(e) A program consisting of a schedule, sequence and type of equipment to be used in the conduct of the proposed activity.

(2) The Wetlands Inspector shall also, upon receipt of the application, determine whether the proposed activity involves a project development plan application, as the same may be required pursuant to the Town of Southeast Zoning Ordinance,[2] or a subdivision application. In the event either, or both, of these are determined to be required, the Wetlands Inspector shall forthwith

2. Editor's Note: See Ch. 138, Zoning.

advise the Planning Board and request a recommendation from said Board.

B. Notice and hearing. The following notice and hearing requirements shall be applicable in the case of any application transmitted to the Planning Board and proposing a regulated activity that has other than minor significance as specified in § 78-4H. **[Amended 8-30-2012 by L.L. No. 7-2012]**

(1) The applicant shall post a sign on the property consistent with the requirements of § 138-44A.

(2) No sooner than five days and not later than 30 days after such publication of notice, the Planning Board shall hold a public hearing on the application, except that, if no notice of objection to the application is necessary, the Planning Board may dispense with such hearing. If no public hearing is to be held the Planning Board shall publish notice of its decision, setting forth the reasons therefor, and a copy of such notice shall be filed with the Town Clerk and transmitted to the officials and agencies specified in § 78-3E.

(3) Not less than 10 days prior to a hearing, if any, the applicant shall send notice of such hearing by U.S. Postal Service certified or registered mail, return receipt requested, to the owners of all lots in the Town abutting the property where the activity is proposed, or at the Planning Board's discretion to all property owners within 500 feet of the lot where the activity is proposed.

(4) Notice of any public hearing shall be published by the Planning Board in one newspaper having a general circulation in the Town not less than five days before such hearing. A copy of the notice shall be transmitted to the officials and agencies specified in § 78-3E.

(5) All such applications and the accompanying maps and documents, shall be open for public inspection in the office of the Town Clerk from and after publication of first notice under § 78-4B(1).

C. Report. Within 65 days after the application is received, or after notice has been published by the applicant under § 78-4B(1), whichever is later, the Planning Board, having received a report from the Wetland Inspector, shall make a determination as to whether or not the proposed regulated activity, with or without modification set by the Planning Board, conforms to the criteria set forth in § 78-4G. **[Amended 8-30-2012 by L.L. No. 7-2012]**

D. Extension of time. The applicant and the Planning Board may by mutual consent extend the time for a determination on the application.

E. Conditions. The Planning Board may specify requirements for modification of the proposed regulated activity and conditions or

limitations for conduct of the activity, including but not limited to the time for conduct and completion of the activity and a requirement to post a bond to guarantee completion of the work in accordance with plans.

F. Determination. The Planning Board shall make a written determination, including the reasons therefor and any modifications, conditions and limitations, at a Planning Board meeting to approve or deny the application and whether or not a permit is to be issued under this chapter. **[Amended 8-30-2012 by L.L. No. 7-2012]**

G. Criteria for approval. The following are criteria applicable to the approval of permits for proposed regulated activities in controlled areas, including wetlands and watercourses:

(1) The activity will not have a substantial adverse effect upon the natural function and benefits of a wetland or watercourse as set forth in § 78-1B(6); and

(2) The activity will not substantially change the natural channel of a watercourse or substantially inhibit the natural dynamics of a watercourse system; and

(3) The activity will not result in the degrading or pollution of waters; and

(4) The activity will not increase the potential for flooding; and

(5) Sufficient provision has been made for control of erosion, siltation and sedimentation during and after conduct of the activity; or

(6) The activity will alleviate or remove a hazard to the public health or safety.

H. Activities of minor significance. Any or all parts of § 78-3D can be waived at the discretion of the Planning Board with regard to activities of minor significance. Proposed regulated activities of minor significance which may be approved by the Planning Board include the following: **[Amended 8-30-2012 by L.L. No. 7-2012]**

(1) Activities for which a site plan, subdivision plat maps, construction plans and grading plans and plat plans for grading and removal of earth are not required.

(2) Where no building or other structure or sewage disposal system or well is proposed in a controlled area.

(3) Installation of a driveway to a one-family dwelling.

(4) Excavation, grading or depositing of less than 20 cubic yards of earth materials in a controlled area of a wetland or watercourse per application.

(5) Modification to less than 25 feet of a watercourse on a lot or parcel.

(6) The activity is not to be conducted in a floodplain.

(7) Removal of water-deposited silt or debris in order to restore the controlled area, including the wetland or watercourse, to the condition existing before the deposit.

(8) Incidental removal of trees and shrubs within the controlled area of wetlands or watercourses.

(9) Provided that all of the above activities are conducted in a manner to conform to the criteria set forth in § 78-4G(1) through (6) of this chapter.

I. Permit issuance or denial. Upon receipt of the determination of the Planning Board as provided in § 78-4F of this chapter, the Wetland Inspector shall issue or deny issuance of a permit, subject to any resolution adopted by the Planning Board, in accordance with § 78-4F. Such permit shall contain and be made subject to any and all conditions imposed by the Planning Board determination. **[Amended 8-30-2012 by L.L. No. 7-2012]**

§ 78-5. Administration and enforcement. [Amended 7-20-2006 by L.L. No. 7-2006]

A. Administration. This chapter shall be administered and enforced by a Wetland Inspector appointed by the Town Board. The Planning Board shall consult the Wetland Inspector prior to making a determination on a permit application. The Wetland Inspector shall keep records of all applications and permits, of all identifiable complaints of any violation of this chapter and of all notices of violation served by him and the action taken consequent thereon, which records shall be public records. He shall be in charge of all such records and public access thereto pursuant to the provisions of the Freedom of Information Law[3] and applicable rules. He shall file with the Southeast Town Clerk and the Planning Board Secretary a copy of each order or decision rendered by him. **[Amended 8-30-2012 by L.L. No. 7-2012]**

B. Procedures. The Town Board may by resolution adopt rules and procedures for the administration of this chapter, including the submission of applications.

C. Inspections. The Wetlands Inspector, or his authorized agents, may enter upon land or waters for the purpose of inspection to determine compliance with this chapter and for the purpose of undertaking any investigations, examinations, surveys or other activity necessary for the purpose of this chapter.

D. Suspension and revocation. The Wetlands Inspector is authorized to suspend or revoke a permit if he finds that the applicant has not complied with any of the conditions or limitations set forth in the permit

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3. Editor's Note: See Public Officers Law § 84 et seq.

or has exceeded the scope of the activity as set forth in the application. The Wetlands Inspector may suspend the permit if the applicant fails to comply with the terms and conditions set forth in the application.

E. Remedies. The Wetlands Inspector is authorized to order, in writing, the cessation of any regulated activity being conducted in violation of this chapter; he shall withdraw such order when he determines there is compliance herewith. The Wetlands Inspector is authorized to order, in writing, the remedying of any condition which is found to be in violation of this chapter. Any person who willfully violates this chapter shall be guilty of a misdemeanor, punishable by a fine of not less than $250 nor more than $1,000. The Town Board may impose, by order after a hearing, a civil penalty not to exceed $250 for each violation of this chapter. Each day of continued violation shall constitute a separate and additional violation. An order imposing a civil penalty shall be deemed a final determination for purposes of judicial review and the Town of Southeast may bring an action to recover such civil penalty in any court of competent jurisdiction. Such action shall be brought on behalf of the Town, and any amount recovered shall be paid into the general revenue funds of the Town. Such right of action or recovery may be released, compromised or adjusted by the Town Board. The proper authorities of the Town of Southeast may institute any appropriate action or proceeding to prevent, restrain, correct or abate any violation of this chapter and to achieve restoration of the affected wetland or watercourse to its condition prior to the violation.

F. Other laws. Approval of an application and issuance of a permit under this chapter shall not be construed to constitute compliance with any other regulation, ordinance or law nor to relieve the applicant from responsibility to obtain a permit thereunder. The Wetlands Inspector may at his discretion withhold issuance of a permit hereunder until any other required permit has been obtained by the applicant. This chapter is in addition to, and does not abrogate or lessen the effect of, any other regulation, ordinance or law pertaining to activities regulated hereunder and controlled areas to which this chapter is applicable.

G. Appeals. Any person aggrieved by any order or decision under this chapter may seek judicial review pursuant to Article 78 of the Civil Practice Law and Rules in the Supreme Court for the County of Putnam within 30 days after the date of the filing of such order or decision with the Southeast Town Clerk. In the alternative, any person aggrieved by any order or decision under this chapter may seek review by the Freshwater Wetlands Appeals Board of the New York State Department of Environmental Conservation within 30 days after the date of the filing of such order or decision with the Town Clerk.

H. Severability. The provisions of this chapter shall be severable, and if any clause, sentence, paragraph, subdivision or part thereof shall be adjudged by any court of competent jurisdiction to be invalid, such judgment shall not affect, impair or invalidate the remainder thereof but shall be confined in its operation to the clause, sentence,

paragraph, subdivision or part thereof directly involved in the controversy in which such judgment shall have been rendered.

“The Big Bright Green Pleasure Machine” a.k.a. Complying with Environmental Law, Testing and Equipment

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Collection of Groundwater Samples for Perfluorooctanoic Acid (PFOA) and Perfluorinated Compounds (PFCs) from Monitoring Wells Sample Protocol

Samples collected using this protocol are intended to be analyzed for perfluorooctanoic acid (PFOA) and other perfluorinated compounds by Modified (Low Level) Test Method 537.

The procedure used must be consistent with the NYSDEC March 1991 Sampling Guidelines and Protocols http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf with the following materials limitations.

At this time acceptable materials for sampling include: stainless steel, high density polyethylene (HDPE), PVC, silicone, acetate and polypropylene. Equipment blanks should be generated at least daily. Additional materials may be acceptable if pre-approved by NYSDEC. Requests to use alternate equipment should include clean equipment blanks. **NOTE: Grunfos pumps and bladder pumps are known to contain PFC materials (e.g. Teflon™ washers for Grunfos pumps and LDPE bladders for bladder pumps).** All sampling equipment components and sample containers should not come in contact with aluminum foil, low density polyethylene (LDPE), glass or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer. Standard two step decontamination using detergent and clean water rinse will be performed for equipment that does come in contact with PFC materials. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFC materials must be avoided. Many food and drink packaging materials and “plumbers thread seal tape” contain PFCs.

All clothing worn by sampling personnel must have been laundered multiple times. The sampler must wear nitrile gloves while filling and sealing the sample bottles.

Pre-cleaned sample bottles with closures, coolers, ice, sample labels and a chain of custody form will be provided by the laboratory.

1. Fill two pre-cleaned 500 mL HDPE or polypropylene bottle with the sample.
2. Cap the bottles with an acceptable cap and liner closure system.
3. Label the sample bottles.
4. Fill out the chain of custody.
5. Place in a cooler maintained at 4 ± 2º Celsius.

Collect one equipment blank for every sample batch, not to exceed 20 samples.

Collect one field duplicate for every sample batch, not to exceed 20 samples.

Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, not to exceed 20 samples.

Request appropriate data deliverable (Category A or B) and an electronic data deliverable.

Groundwater Sampling for Emerging Contaminants

April 2018

Issue: NYSDEC has committed to analyzing representative groundwater samples at remediation sites for emerging contaminants (1,4-dioxane and PFAS) as described in the below guidance.

Implementation

NYSDEC project managers will be contacting site owners to schedule sampling for these chemicals. Only groundwater sampling is required. The number of samples required will be similar to the number of samples where "full TAL/TCL sampling" would typically be required in a remedial investigation. If sampling is not feasible (e.g., the site no longer has any monitoring wells in place), sampling may be waived on a site-specific basis after first considering potential sources of these chemicals and whether there are water supplies nearby.

Upon a new site being brought into any program (i.e., SSF, BCP), PFAS and 1,4-dioxane will be incorporated into the investigation of groundwater as part of the standard "full TAL/TCL" sampling. Until an SCO is established for PFAS, soil samples do not need to be analyzed for PFAS unless groundwater contamination is detected. Separate guidance will be developed to address sites where emerging contaminants are found in the groundwater. The analysis currently performed for SVOCs in soil is adequate for evaluation of 1,4-dioxane, which already has an established SCO.

Analysis and Reporting

Labs should provide a full category B deliverable, and a DUSR should be prepared by a data validator, and the electronic data submission should meet the requirements provided at: https://www.dec.ny.gov/chemical/62440.html ,

The work plan should explicitly describe analysis and reporting requirements.

PFAS sample analysis: Currently, ELAP does not offer certification for PFAS compounds in matrices other than finished drinking water. However, laboratories analyzing environmental samples (ex. soil, sediments, and groundwater) are required, by DER, to hold ELAP certification for PFOA and PFOS in drinking water by EPA Method 537 or ISO 25101.

Modified EPA Method 537 is the preferred method to use for groundwater samples due to the ability to achieve 2 ng/L (ppt) detection limits. If contract labs or work plans submitted by responsible parties indicate that they are not able to achieve similar reporting limits, the project manager should discuss this with a DER chemist. Note: Reporting limits for PFOA and PFOS should not exceed 2 ng/L.

PFAS sample reporting: DER has developed a PFAS target analyte list (below) with the intent of achieving reporting consistency between labs for commonly reportable analytes. It is expected that reported results for PFAS will include, at a minimum, all the compounds listed. This list may be updated in the future as new information is learned and as labs develop new capabilities. If lab and/or matrix specific issues are encountered for any particular compounds, the NYSDEC project manager will make case-by-case decisions as to whether particular analytes may be temporarily or permanently discontinued from analysis for each site. Any technical lab issues should be brought to the attention of a NYSDEC chemist.

Some sampling using this full PFAS target analyte list is needed to understand the nature of contamination. It may also be critical to differentiate PFAS compounds associated with a site from other

sources of these chemicals. Like routine refinements to parameter lists based on investigative findings, the full PFAS target analyte list may not be needed for all sampling intended to define the extent of contamination. Project managers may approve a shorter analyte list (e.g., just the UCMR3 list) for some reporting on a case by case basis.

1,4-Dioxane Analysis and Reporting: The method detection limit (MDL) for 1,4-dioxane should be no higher than 0.28 µg/l (ppb). ELAP offers certification for both EPA Methods 8260 and 8270. In order to get the appropriate detection limits, the lab would need to run either of these methods in "selective ion monitoring" (SIM) mode. DER is advising the use of method 8270, since this method provides a more robust extraction procedure, uses a larger sample volume, and is less vulnerable to interference from chlorinated solvents (we acknowledge that 8260 has been shown to have a higher recovery in some studies).

Full PFAS Target Analyte List

Group	Chemical Name	Abbreviation	CAS Number
Perfluoroalkyl sulfonates	**Perfluorobutanesulfonic acid**	**PFBS**	**375-73-5**
	Perfluorohexanesulfonic acid	**PFHxS**	**355-46-4**
	Perfluoroheptanesulfonic acid	PFHpS	375-92-8
	Perfluorooctanessulfonic acid	**PFOS**	**1763-23-1**
	Perfluorodecanesulfonic acid	PFDS	335-77-3
Perfluoroalkyl carboxylates	Perfluorobutanoic acid	PFBA	375-22-4
	Perfluoropentanoic acid	PFPeA	2706-90-3
	Perfluorohexanoic acid	PFHxA	307-24-4
	Perfluoroheptanoic acid	**PFHpA**	**375-85-9**
	Perfluorooctanoic acid	**PFOA**	**335-67-1**
	Perfluorononanoic acid	**PFNA**	**375-95-1**
	Perfluorodecanoic acid	PFDA	335-76-2
	Perfluoroundecanoic acid	PFUA/PFUdA	2058-94-8
	Perfluorododecanoic acid	PFDoA	307-55-1
	Perfluorotridecanoic acid	PFTriA/PFTrDA	72629-94-8
	Perfluorotetradecanoic acid	PFTA/PFTeDA	376-06-7
Fluorinated Telomer Sulfonates	6:2 Fluorotelomer sulfonate	6:2 FTS	27619-97-2
	8:2 Fluorotelomer sulfonate	8:2 FTS	39108-34-4
Perfluorooctane-sulfonamides	Perfluroroctanesulfonamide	FOSA	754-91-6
Perfluorooctane-sulfonamidoacetic acids	N-methyl perfluorooctanesulfonamidoacetic acid	N-MeFOSAA	2355-31-9
	N-ethyl perfluorooctanesulfonamidoacetic acid	N-EtFOSAA	2991-50-6

Bold entries depict the 6 original UCMR3 chemicals

February 2019

Laboratory Guidance for Analysis of Per- and Polyfluoroalkyl Substances (PFAS) in Non-Potable Water and Solids

The Division of Environmental Remediation (DER) developed the following guidance for laboratories submitting PFAS data to DER. If laboratories cannot comply with any of the following requirements, they must contact Dana Maikels at dana.maikels@dec.ny.gov prior to analysis of samples.

1. Standards containing both branched and linear isomers must be used when standards are commercially available. Currently, quantitative standards are available for PFHxS, PFOS, NMeFOSAA, and NEtFOSAA. All isomer peaks present in the standard must be integrated and the areas summed. Samples must be integrated in the same manner as the standards.

   Since a quantitative standard does not exist for branched isomers of PFOA, the instrument must be calibrated using just the linear isomer and a technical (qualitative) PFOA standard must be used to identify the retention time of the branched PFOA isomers in the sample. The total response of PFOA branched and linear isomers must be integrated in the samples and quantitated using the calibration curve of the linear standard.

2. Quantifier and qualifier ions must be monitored for all target analytes (PFPeA and PFBA are an exception). The ratio of quantifier ion response to qualifier ion response must be calculated for each target analyte and the ratio compared to standards. Lab derived criteria can be used to determine if the ratios are acceptable.

3. The ion transitions below must be used for the following PFASs:

PFOA	413 > 369
PFOS	499 > 80
PFHxS	399 > 80
PFBS	299 > 80
6:2 FTS	427 > 407
8:2 FTS	527 > 507
NEtFOSAA	584 > 419
NMeFOSAA	570 > 419

4. For all target analyte ions used for quantification, signal to noise ratio must be 3:1 or greater.

5. For water samples, the entire sample bottle must be extracted, and the sample bottle rinsed with appropriate solvent to remove any residual PFAS.

6. Detections below the reporting limit should be reported and qualified with a J qualifier.

March 2019

Sampling for 1,4-Dioxane and Per- and Polyfluoroalkyl Substances (PFAS) Under DEC's Part 375 Remedial Programs

Objective

The Department of Environmental Conservation (DEC) is requiring sampling of all environmental media and subsequent analysis for the emerging contaminants 1,4-Dioxane and PFAS as part of all remedial programs implemented under 6 NYCRR Part 375, as further described in the guidance below.

Sample Planning

The number of samples required for emerging contaminant analyses is to be the same number of samples where "full TAL/TCL sampling" would typically be required in an investigation or remedial action compliance program.

Sampling of all media for ECs is required at all sites coming into or already in an investigative phase of any DER program. In other words, if the sampling outlined in the guidance hasn't already been done or isn't part of an existing work plan to be sampled for in the future, it will be necessary to go back out and perform the sampling prior to approving a SC report or issuing a decision document.

PFAS and 1,4-dioxane shall be incorporated into the investigation of potentially affected media, including soil, groundwater, surface water, and sediment as an addition to the standard "full TAL/TCL sampling." Biota sampling may be necessary based upon the potential for biota to be affected as determined pursuant to a Fish and Wildlife Impact analysis. Soil vapor sampling for PFAS and 1,4-dioxane is not required.

Upon an emerging contaminant being identified as a contaminant of concern (COC) for a site, those compounds must be assessed as part of the remedy selection process in accordance with Part 375 and DER-10 and included as part of the monitoring program upon entering the site management phase.

Soil imported to a site for use in a soil cap, soil cover, or as backfill must be sampled for 1,4-dioxane and PFAS contamination in general conformance with DER-10, section 5.4(e). Assessment of the soil data will be made on a site-specific basis to determine appropriateness for use.

The work plan should explicitly describe analysis and reporting requirements, including laboratory analytical procedures for modified methods discussed below.

Analysis and Reporting

Labs should provide a full category B deliverable, and a DUSR should be prepared by an independent 3rd party data validator. QA/QC samples should be collected as required in DER-10, Section 2.3(c). The electronic data submission should meet the requirements provided at: https://www.dec.ny.gov/chemical/62440.html.

PFAS analysis and reporting: DEC has developed a *PFAS Analyte List* (below) for remedial programs. It is expected that reported results for PFAS will include, at a minimum, all the compounds listed. If lab and/or matrix specific issues are encountered for any compounds, the DEC project manager, in consultation with the DEC remedial program chemist, will make case-by-case decisions as to whether certain analytes may be temporarily or permanently discontinued from analysis at each site.

Currently, ELAP does not offer certification for PFAS compounds in matrices other than finished drinking water. However, laboratories analyzing environmental samples (e.g., soil, sediments, and groundwater) are required by DER to hold ELAP certification for PFOA and PFOS in drinking water by EPA Method 537 or ISO 25101. Labs must also adhere to the requirements and criteria set forth in the Laboratory Guidance for Analysis of PFAS in Non-Potable Water and Solids.

Modified EPA Method 537 is the preferred method to use for environmental samples due to its ability to achieve very low detection limits. Reporting limits for PFAS in groundwater and soil are to be 2 ng/L (ppt) and 1 ug/kg (ppb), respectively. If contract labs or work plans submitted by responsible parties indicate that they are not able to achieve these reporting limits for the entire list of 21 PFAS, site-specific decisions will need to be made by the DEC project manager in consultation with the DEC remedial program chemist. Note: Reporting limits for PFOA and PFOS in groundwater should not exceed 2 ng/L.

Additional laboratory methods for analysis of PFAS may be warranted at a site. These methods include Synthetic Precipitation Leaching Procedure (SPLP) by EPA Method 1312 and Total Oxidizable Precursor Assay (TOP Assay).

SPLP is a technique for determining the potential for chemicals in soil to leach to groundwater and may be helpful in determining the need for addressing PFAS-containing soils or other solid material as part of the remedy. SPLP sampling need not be considered if there are no elevated PFAS levels in groundwater. If elevated levels of PFAS are detected in water, and PFAS are also seen in soil, then an SPLP test should be considered to better understand the relationship between the PFAS in the two media.

The TOP Assay can assist in determining the potential PFAS risk at a site. For example, some polyfluoroalkyl substances may transform to form perfluoroalkyl substances, resulting in an increase in perfluoroalkyl substance concentrations as contaminated groundwater moves away from the site. To conceptualize the amount and type of oxidizable perfluoroalkyl substances which could be liberated in the environment, a “TOP Assay” analysis can be performed, which approximates the maximum concentration of perfluoroalkyl substances that could be generated if all polyfluoroalkyl substances were oxidized.

PFAS-containing materials can be made up of per- and polyfluoroalkyl substances that are not analyzable by routine analytical methodology (LC-MS/MS). The TOP assay converts, through oxidation, polyfluoroalkyl substances (precursors) into perfluoroalkyl substances that can be detected by current analytical methodology. Please note that analysis of highly contaminated samples, such as those from an AFFF site, can result in incomplete oxidation of the samples and an underestimation of the total perfluoroalkyl substances. Please consult with a DEC remedial program chemist for assistance interpreting the results.

1,4-Dioxane analysis and reporting: The reporting limit for 1,4-dioxane in groundwater should be no higher than 0.35 µg/L (ppb) and no higher than 0.1 mg/kg (ppm) in soil. Although ELAP offers certification for both EPA Method 8260 SIM and EPA Method 8270 SIM in waters, DER is advising the use of Method 8270 SIM because it provides a more robust extraction procedure, uses a larger sample volume, and is less vulnerable to interference from chlorinated solvents. The analysis currently performed for SVOCs in soil is adequate for evaluation of 1,4-dioxane in soil, which already has an established SCO.

Refinement of sample analyses

As with other contaminants that are analyzed for at a site, the emerging contaminant analyte list may be refined for future sampling events based on investigative findings. Initially, however, sampling using this PFAS Analyte List and 1,4-dioxane is needed to understand the nature of contamination.

PFAS Analyte List

Group	Chemical Name	Abbreviation	CAS Number
Perfluoroalkyl sulfonates	Perfluorobutanesulfonic acid	PFBS	375-73-5
	Perfluorohexanesulfonic acid	PFHxS	355-46-4
	Perfluoroheptanesulfonic acid	PFHpS	375-92-8
	Perfluorooctanessulfonic acid	PFOS	1763-23-1
	Perfluorodecanesulfonic acid	PFDS	335-77-3
Perfluoroalkyl carboxylates	Perfluorobutanoic acid	PFBA	375-22-4
	Perfluoropentanoic acid	PFPeA	2706-90-3
	Perfluorohexanoic acid	PFHxA	307-24-4
	Perfluoroheptanoic acid	PFHpA	375-85-9
	Perfluorooctanoic acid	PFOA	335-67-1
	Perfluorononanoic acid	PFNA	375-95-1
	Perfluorodecanoic acid	PFDA	335-76-2
	Perfluoroundecanoic acid	PFUA/PFUdA	2058-94-8
	Perfluorododecanoic acid	PFDoA	307-55-1
	Perfluorotridecanoic acid	PFTriA/PFTrDA	72629-94-8
	Perfluorotetradecanoic acid	PFTA/PFTeDA	376-06-7
Fluorinated Telomer Sulfonates	6:2 Fluorotelomer sulfonate	6:2 FTS	27619-97-2
	8:2 Fluorotelomer sulfonate	8:2 FTS	39108-34-4
Perfluorooctane-sulfonamides	Perfluroroctanesulfonamide	FOSA	754-91-6
Perfluorooctane-sulfonamidoacetic acids	N-methyl perfluorooctanesulfonamidoacetic acid	N-MeFOSAA	2355-31-9
	N-ethyl perfluorooctanesulfonamidoacetic acid	N-EtFOSAA	2991-50-6

June 2019

Sampling for 1,4-Dioxane and Per- and Polyfluoroalkyl Substances (PFAS) Under DEC's Part 375 Remedial Programs

Objective

The Department of Environmental Conservation (DEC) is requiring sampling of all environmental media and subsequent analysis for the emerging contaminants 1,4-Dioxane and PFAS as part of all remedial programs implemented under 6 NYCRR Part 375, as further described in the guidance below.

Sample Planning

The number of samples required for emerging contaminant analyses is to be the same number of samples where "full TAL/TCL sampling" would typically be required in an investigation or remedial action compliance program.

Sampling of all media for ECs is required at all sites coming into or already in an investigative phase of any DER program. In other words, if the sampling outlined in the guidance hasn't already been done or isn't part of an existing work plan to be sampled for in the future, it will be necessary to go back out and perform the sampling prior to approving a SC report or issuing a decision document.

PFAS and 1,4-dioxane shall be incorporated into the investigation of potentially affected media, including soil, groundwater, surface water, and sediment as an addition to the standard "full TAL/TCL sampling." Biota sampling may be necessary based upon the potential for biota to be affected as determined pursuant to a Fish and Wildlife Impact analysis. Soil vapor sampling for PFAS and 1,4-dioxane is not required.

Upon an emerging contaminant being identified as a contaminant of concern (COC) for a site, those compounds must be assessed as part of the remedy selection process in accordance with Part 375 and DER-10 and included as part of the monitoring program upon entering the site management phase.

Special Testing Requirements for Import or Reuse of Soil: Soil imported to a site for use in a soil cap, soil cover, or as backfill must be tested for 1,4-dioxane and PFAS contamination in general conformance with DER-10, Section 5.4(e). Soil samples must be analyzed for 1,4-dioxane using EPA Method 8270, as well as the full list of PFAS compounds (currently 21) using EPA Method 537.1 (modified).

For 1,4-dioxane, soil exceeding the Unrestricted SCO of 0.1 ppm must be rejected per DER 10: Appendix 5 - Allowable Constituent Levels for Imported Fill or Soil, Subdivision 5.4(e).

If PFOA or PFOS is detected in any sample at or above 1 ppb, then a soil sample must be tested by the Synthetic Precipitation Leaching Procedure (SPLP) and the leachate analyzed. If the SPLP results exceed 70 ppt combined PFOA/S, then the source of backfill must be rejected. Remedial parties have the option of analyzing samples concurrently for both PFAS in soil and in the SPLP leachate to minimize project delays.

The work plan should explicitly describe analysis and reporting requirements, including laboratory analytical procedures for modified methods discussed below.

Analysis and Reporting

Labs should provide a full category B deliverable, and a DUSR should be prepared by an independent 3rd party data validator. QA/QC samples should be collected as required in DER-10, Section 2.3(c). The electronic data submission should meet the requirements provided at: https://www.dec.ny.gov/chemical/62440.html.

PFAS analysis and reporting: DEC has developed a *PFAS Analyte List* (below) for remedial programs. It is expected that reported results for PFAS will include, at a minimum, all the compounds listed. If lab and/or matrix specific issues are encountered for any compounds, the DEC project manager, in consultation with the DEC remedial program chemist, will make case-by-case decisions as to whether certain analytes may be temporarily or permanently discontinued from analysis at each site.

Currently, ELAP does not offer certification for PFAS compounds in matrices other than finished drinking water. However, laboratories analyzing environmental samples (e.g., soil, sediments, and groundwater) are required by DER to hold ELAP certification for PFOA and PFOS in drinking water by EPA Method 537 or ISO 25101. Labs must also adhere to the requirements and criteria set forth in the Laboratory Guidance for Analysis of PFAS in Non-Potable Water and Solids.

Modified EPA Method 537 is the preferred method to use for environmental samples due to its ability to achieve very low detection limits. Reporting limits for PFAS in groundwater and soil are to be 2 ng/L (ppt) and 1 ug/kg (ppb), respectively. If contract labs or work plans submitted by responsible parties indicate that they are not able to achieve these reporting limits for the entire list of 21 PFAS, site-specific decisions will need to be made by the DEC project manager in consultation with the DEC remedial program chemist. Note: Reporting limits for PFOA and PFOS in groundwater should not exceed 2 ng/L.

Additional laboratory methods for analysis of PFAS may be warranted at a site. These methods include Synthetic Precipitation Leaching Procedure (SPLP) by EPA Method 1312 and Total Oxidizable Precursor Assay (TOP Assay).

SPLP is a technique for determining the potential for chemicals in soil to leach to groundwater and may be helpful in determining the need for addressing PFAS-containing soils or other solid material as part of the remedy. SPLP sampling need not be considered if there are no elevated PFAS levels in groundwater. If elevated levels of PFAS are detected in water, and PFAS are also seen in soil, then an SPLP test should be considered to better understand the relationship between the PFAS in the two media.

The TOP Assay can assist in determining the potential PFAS risk at a site. For example, some polyfluoroalkyl substances may transform to form perfluoroalkyl substances, resulting in an increase in perfluoroalkyl substance concentrations as contaminated groundwater moves away from the site. To conceptualize the amount and type of oxidizable perfluoroalkyl substances which could be liberated in the environment, a “TOP Assay” analysis can be performed, which approximates the maximum concentration of perfluoroalkyl substances that could be generated if all polyfluoroalkyl substances were oxidized.

PFAS-containing materials can be made up of per- and polyfluoroalkyl substances that are not analyzable by routine analytical methodology (LC-MS/MS). The TOP assay converts, through oxidation, polyfluoroalkyl substances (precursors) into perfluoroalkyl substances that can be detected by current

analytical methodology. Please note that analysis of highly contaminated samples, such as those from an AFFF site, can result in incomplete oxidation of the samples and an underestimation of the total perfluoroalkyl substances. Please consult with a DEC remedial program chemist for assistance interpreting the results.

1,4-Dioxane analysis and reporting: The reporting limit for 1,4-dioxane in groundwater should be no higher than 0.35 µg/L (ppb) and no higher than 0.1 mg/kg (ppm) in soil. Although ELAP offers certification for both EPA Method 8260 and EPA Method 8270 for 1,4-dioxane, DER is advising the use of Method 8270 SIM for water samples and EPA Method 8270 for soil samples. EPA Method 8270 SIM is not necessary for soils if the lab can achieve the required reporting limits without the use of SIM. Note: 1,4-dioxane is currently listed as a VOC in the Part 375 SCO tables but will be moved to the SVOC table with the next update to Part 375.

Refinement of sample analyses: As with other contaminants that are analyzed for at a site, the emerging contaminant analyte list may be refined for future sampling events based on investigative findings. Initially, however, sampling using this PFAS Analyte List and 1,4-dioxane is needed to understand the nature of contamination.

PFAS Analyte List

Group	Chemical Name	Abbreviation	CAS Number
Perfluoroalkyl sulfonates	Perfluorobutanesulfonic acid	PFBS	375-73-5
	Perfluorohexanesulfonic acid	PFHxS	355-46-4
	Perfluoroheptanesulfonic acid	PFHpS	375-92-8
	Perfluorooctanesulfonic acid	PFOS	1763-23-1
	Perfluorodecanesulfonic acid	PFDS	335-77-3
Perfluoroalkyl carboxylates	Perfluorobutanoic acid	PFBA	375-22-4
	Perfluoropentanoic acid	PFPeA	2706-90-3
	Perfluorohexanoic acid	PFHxA	307-24-4
	Perfluoroheptanoic acid	PFHpA	375-85-9
	Perfluorooctanoic acid	PFOA	335-67-1
	Perfluorononanoic acid	PFNA	375-95-1
	Perfluorodecanoic acid	PFDA	335-76-2
	Perfluoroundecanoic acid	PFUA/PFUdA	2058-94-8
	Perfluorododecanoic acid	PFDoA	307-55-1
	Perfluorotridecanoic acid	PFTriA/PFTrDA	72629-94-8
	Perfluorotetradecanoic acid	PFTA/PFTeDA	376-06-7
Fluorinated Telomer Sulfonates	6:2 Fluorotelomer sulfonate	6:2 FTS	27619-97-2
	8:2 Fluorotelomer sulfonate	8:2 FTS	39108-34-4
Perfluorooctane-sulfonamides	Perfluroroctanesulfonamide	FOSA	754-91-6
Perfluorooctane-sulfonamidoacetic acids	N-methyl perfluorooctanesulfonamidoacetic acid	N-MeFOSAA	2355-31-9
	N-ethyl perfluorooctanesulfonamidoacetic acid	N-EtFOSAA	2991-50-6

FINAL

Guidance for Evaluating Soil Vapor Intrusion in the State of New York

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Prepared by:

NEW YORK STATE DEPARTMENT OF HEALTH
Center for Environmental Health
Bureau of Environmental Exposure Investigation

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New York State Departments of Health and Environmental Conservation — Web Sites on Soil Vapor Intrusion

This guidance, policy documents, training documents, fact sheets, etc. are available to the public on the following web sites:

New York State Department of Health
http://www.health.state.ny.us/environmental/indoors/vapor_intrusion

New York State Department of Environmental Conservation
http://www.dec.state.ny.us/website/der/guidance/vapor/index.html

As new information becomes available (e.g., revisions or amendments to the guidance, new fact sheets, etc.), these web sites will be updated accordingly.

Preface

This guidance has been prepared by the New York State Department of Health (NYSDOH) in consultation with the New York State Department of Environmental Conservation (NYSDEC) — collectively referred to as "the State" throughout this document. It is intended as general guidance for parties evaluating soil vapor intrusion in the State of New York. The guidance is not a regulation, rule or requirement.

The guidance describes the State's methodology for evaluating soil vapor intrusion at a site. It reflects our experience in conducting soil vapor intrusion investigations and presents a reasonable and practical approach to identifying and addressing current and potential human exposures to contaminated subsurface vapors associated with known or suspected volatile chemical contamination. The approach presented is analogous to the approach taken when investigating contamination in other environmental media (e.g., groundwater, soil, etc.) and addressing corresponding exposure concerns.

The guidance is organized into five sections:

Section 1 introduces the concept of soil vapor intrusion, associated human exposure issues, factors affecting soil vapor intrusion, factors affecting indoor air quality, and the general approach recommended to evaluating vapor intrusion;

Section 2 provides guidance on collecting appropriate and relevant data that can be used to identify current or potential human exposures;

Section 3 discusses how the investigation data are evaluated, recommends actions based on the evaluation, and presents tools that are used when determining appropriate actions to address exposures;

Section 4 provides an overview of soil vapor intrusion mitigation methods and basic recommendations pertaining to their selection for use, installation and design, post-mitigation testing, operation, maintenance and monitoring, termination of operation, and annual certification; and

Section 5 describes outreach techniques commonly used to inform the community about soil vapor intrusion issues.

The State recommends that the guidance be considered anywhere soil vapor intrusion is evaluated in the State of New York — whether the evaluation is undertaken voluntarily by a corporation, a municipality, or private citizen, or whether it is performed under one of the State's environmental remediation programs.

PLEASE NOTE:

- While soil vapor intrusion can also occur with "naturally-occurring" subsurface gases (e.g., radon, methane and hydrogen sulfide), the document discusses soil vapor intrusion in terms of environmental contamination only.
- The guidance document addresses soil vapor intrusion. However, vapor intrusion can also occur through direct volatilization of contaminants from groundwater into indoor air. This can occur when, for example, a basement slab is in contact with contaminated groundwater, contaminated groundwater enters (floods) a basement or crawl space, or contaminated groundwater enters a sump pit drainage system. In such cases, volatile

chemicals can be transferred directly from groundwater to indoor air without the intervening contamination of soil vapor. Although exposures of this nature are not discussed in this guidance, they should be addressed on a site-specific and building-specific basis.

- Throughout the guidance references are made to specific brands of field equipment. These references are for discussion purposes only and are intended to be illustrative. They should not be interpreted as endorsements by the State of any one company or their products.

ACRONYMNS and ABBREVIATIONS

ASTM	American Society for Testing and Materials
ATSDR	Agency for Toxic Substance and Disease Registry
BASE	Building Assessment and Survey Evaluation
BTSA	[NYSDOH] Bureau of Toxic Substance Assessment
CME	Continuing Medical Education
CSEMs	Case Studies in Environmental Medicine
DUSR	Data Usability Summary Report
ELAP	Environmental Laboratory Approval Program
EPA	United States Environmental Protection Agency
GC	Gas Chromatograph
HEI	Health Effects Institute
HVAC	Heating, Ventilating and Air-conditioning
mcg/m^3	micrograms per cubic meter
MeCl	Methylene Chloride
MEK	Methyl Ethyl Ketone; 2-Butanone
MTBE	Methyl-*tert*-Butyl Ether
NAPL	Non-Aqueous Phase Liquid
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OM&M	Operation, Maintenance and Monitoring
OSHA	Occupational Safety and Health Administration
OVM	Organic Vapor Monitor
PCBs	Polychlorinated Biphenyls
PCE	Tetrachloroethene or Perchloroethylene
PID	Photoionization Detector
QA/QC	Quality Assurance/Quality Control
RIOPA	Relationship of Indoor, Outdoor, and Personal Air
SF_6	Sulfur Hexafluoride
SSD	Sub-slab Depressurization System
SIM	Selective Ion Monitoring
SMD	Sub-Membrane Depressurization
SVE	Soil Vapor Extraction
SVOCs	Semi-volatile Organic Compounds
TAL	Target Analyte List
TCA	Trichloroethane
TCDD	Tetrachlorodibenzo-*p*-Dioxin Equivalents
TCE	Trichloroethene
TCL	Target Compound List
VOCs	Volatile Organic Compounds

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Section 1: Introduction

This section introduces the concept of soil vapor intrusion, associated human exposure issues, factors affecting soil vapor intrusion, factors affecting indoor air quality, and the general approach to evaluating vapor intrusion.

1.1 Soil vapor intrusion

The phrase "soil vapor intrusion" refers to the process by which volatile chemicals migrate from a subsurface source into the indoor air of buildings. Soil vapor, also referred to as soil gas, is the air found in the pore spaces between soil particles (Figure 1.1). Primarily because of a difference between interior and exterior pressures, soil vapor can enter a building through cracks or perforations in slabs or basement floors and walls, and through openings around sump pumps or where pipes and electrical wires go through the foundation. For example, heating, ventilation or air-conditioning (HVAC) systems and/or the operation of large mechanical appliances (e.g., exhaust fans, dryers, etc.) may create a negative pressure that can draw soil vapor into the building. This intrusion is similar to how radon gas enters buildings from the subsurface.

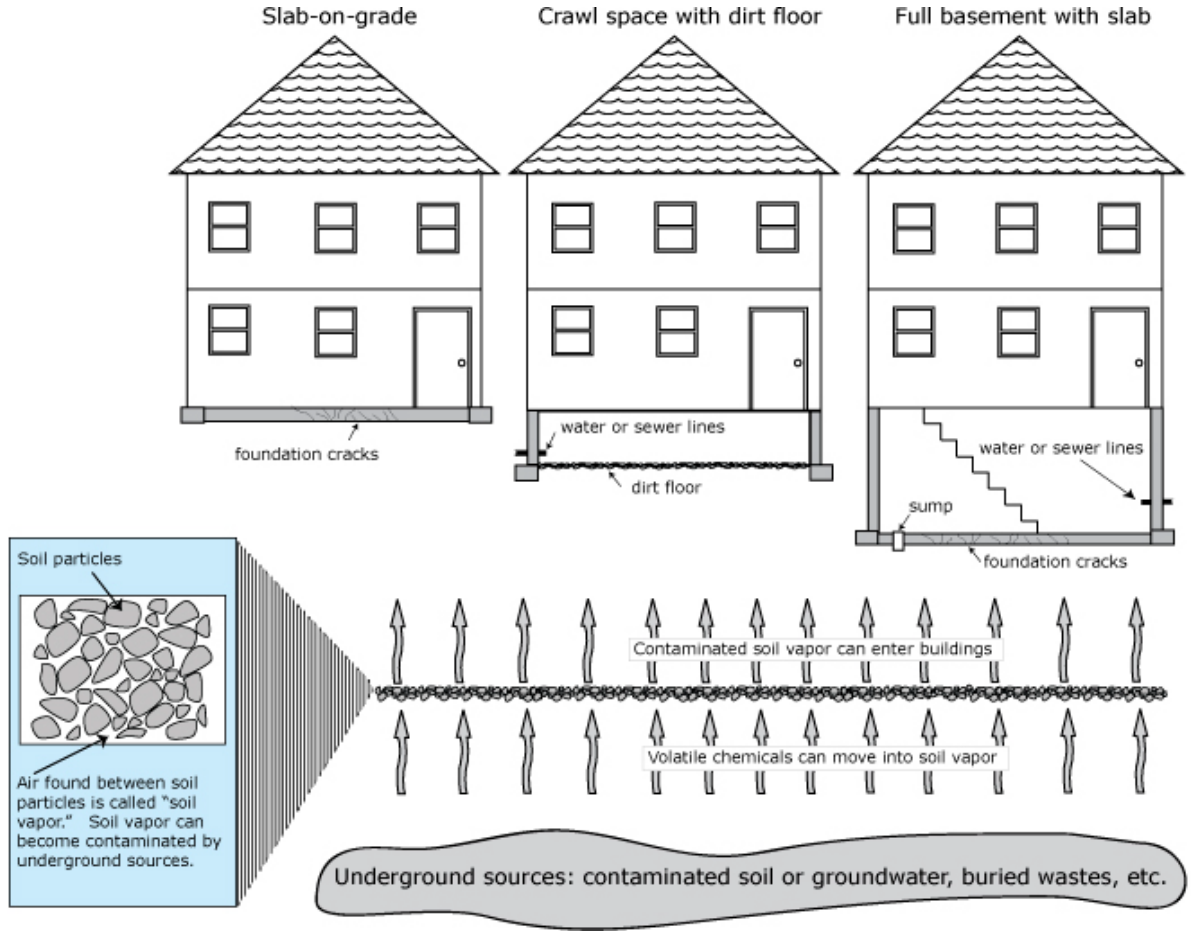

Figure 1.1
Generalized diagram of soil vapor intrusion

Soil vapor can become contaminated when chemicals evaporate from subsurface sources. Chemicals that can emit vapors are called "volatile chemicals." Volatile chemicals include volatile organic compounds (VOCs), some semi-volatile organic compounds (SVOCs), and some inorganic substances such as elemental mercury. Subsurface sources of volatile chemicals can include the following:

a. groundwater or soil that contains volatile chemicals;

b. non-aqueous phase liquid (NAPL);

c. buried wastes; and

d. underground storage tanks or drums.

If soil vapor is contaminated and enters a building, indoor air quality may be affected.

When contaminated vapors are present in the zone directly next to or under the foundation of a building, vapor intrusion is possible. Soil vapor can enter a building whether the building is old or new, or whether it is on a slab or has a crawl space or basement (Figure 1.1). However, the subsurface source of the contaminated vapor (e.g., contaminated soil or groundwater) does not need to be directly beneath a structure to contaminate the vapor immediately beneath the building's foundation (as suggested in Figure 1.1).

1.2 Soil vapor intrusion and human exposure

Humans can be exposed to contaminated soil vapor when the vapor is drawn into the building due to pressure differences [Section 1.1] and mixed with the indoor air. Inhalation is the primary route of exposure, or the manner in which the volatile chemicals, once in the indoor air, actually enter the body.

Both current and potential exposures are considered when evaluating soil vapor intrusion at sites (i.e., locations of suspected or known environmental contamination). *Current* exposures exist when vapor intrusion is documented in an occupied building. *Potential* exposures exist when volatile chemicals are present in the vapor phase beneath a building, but have not affected indoor air quality due to current site conditions. Potential exposures also exist when there is a chance that contaminated soil vapors may move beneath existing buildings not currently affected, when indoor air is affected but the building is currently unoccupied, or when there is a chance that new buildings can be built over existing subsurface vapor contamination.

Exposure to a volatile chemical due to vapor intrusion does not necessarily mean that health effects will occur. Whether or not a person experiences health effects depends on several factors, including the length of exposure (short-term or acute versus long-term or chronic), the amount of exposure (i.e., dose), the frequency of exposure, the toxicity of the volatile chemical and the individual's sensitivity to the chemical.

1.3 Factors affecting soil vapor migration and intrusion

Predicting the extent of soil vapor contamination from soil or groundwater contamination, as well as the potential for human exposure from soil vapor intrusion into buildings, is complicated by factors that can affect soil vapor migration and intrusion. For example, soil vapor contaminant plumes may not mimic groundwater contaminant plumes since different factors affect the migration pattern of each medium. In addition to the operation of HVAC systems, the operation of kitchen vents in restaurants or of elevators in office buildings may

induce pressure gradients that result in the migration of vapor-phase contaminants away from a groundwater source of vapors and toward these buildings. This is similar to when the pumping of production wells or water supply wells draws contaminated groundwater away from its natural flow path.

Factors that can affect soil vapor migration and intrusion generally fall into two categories: environmental and building factors. Examples of environmental factors are provided in Table 1.1, and examples of building factors in Table 1.2. These factors are considered when conducting an investigation of the soil vapor intrusion pathway [Section 2] and when evaluating the results [Section 3].

Table 1.1 Environmental factors that may affect soil vapor intrusion

Environmental Factor	Description
Soil conditions	Generally, dry, coarse-grained soils facilitate the migration of subsurface vapors and wet, fine-grained or highly organic soils retard migration.
Volatile chemical concentrations	The potential for vapor intrusion generally increases with increasing concentrations of volatile chemicals in groundwater or subsurface soils, as well as with the presence of NAPL.
Source location	The potential for vapor intrusion generally decreases with increasing distance between the subsurface source of vapor contamination and overlying buildings. For example, the potential for vapor intrusion associated with contaminated groundwater decreases with increasing depth to groundwater.
Groundwater conditions	Volatile chemicals dissolved in groundwater may off-gas to the vadose zone from the surface of the water table. If contaminated groundwater is overlain by clean water (upper versus lower aquifer systems or significant downward groundwater gradients), then vapor phase migration or partitioning of the volatile chemicals is unlikely. Additionally, fluctuations in the groundwater table may results in contaminant smear zones. The "smear zone" is the area of subsurface soil contamination within the range of depths where the water table fluctuates. Chemicals floating on top of the water table, such as petroleum components, can sorb onto soils within this zone as the water table fluctuates. Sorption of chemicals can influence their gaseous and aqueous phase diffusion in the subsurface, and ultimately the rate at which they migrate.
Surface confining layer	A surface confining layer (e.g., frost layer, pavement or buildings) may temporarily or permanently retard the migration of subsurface vapors to outdoor air. Confining layers can also prevent rainfall from reaching subsurface soils, creating relatively dry soils that further increase the potential for soil vapor migration.
Fractures in bedrock and/or tight clay soils	Fractures in bedrock and desiccation fractures in clay can increase the potential for vapor intrusion beyond that expected for the bulk, unfractured bedrock or clay matrix by facilitating vapor migration (in horizontal and vertical directions) and movement of contaminated groundwater along spaces between fractures.
Underground conduits	Underground conduits (e.g., sewer and utility lines, drains or tree roots, septic systems) with highly permeable bedding materials relative to native materials can serve as preferential pathways for vapor migration due to relatively low resistance to flow.
Weather conditions	Wind and barometric pressure changes and thermal differences between air and surrounding soils may induce pressure gradients that affect soil vapor intrusion.
Biodegradation processes	Depending upon environmental conditions (e.g., soil moisture, oxygen levels, pH, mineral nutrients, organic compounds, and temperature), the presence of appropriate microbial populations, and the degradability of the volatile chemical of concern, biodegradation in the subsurface may reduce the potential for vapor intrusion. For example, readily biodegradable chemicals in soil vapor may not migrate a significant distance from a source area while less degradable chemicals may travel farther.

Table 1.2 Building factors that may affect vapor intrusion

Building Factor	Description
Operation of HVAC systems, fireplaces, and mechanical equipment (e.g., clothes dryers or exhaust fans/vents)	Operation may create a pressure differential between the building or indoor air and the surrounding soil that induces or retards the migration of vapor-phase contaminants toward and into the building. Vapor intrusion can be enhanced as the air vented outside is replaced.
Heated building	When buildings are closed up and heated, a difference in temperature between the inside and outdoor air induces a stack effect, venting warm air from higher floors to the outside. Vapor intrusion can be enhanced as the air is replaced in the lower parts of the building.
Air exchange rates	The rate at which outdoor air replenishes indoor air may affect vapor migration into a building as well the indoor air quality. For example, newer construction is typically designed to limit the exchange of air with the outside environment. This may result in the accumulation of vapors within a building.
Foundation type	Earthen floors and fieldstone walls may serve as preferential pathways for vapor intrusion.
Foundation integrity	Expansion joints or cold joints, wall cracks, or block wall cavities may serve as preferential pathways for vapor intrusion.
Subsurface features that penetrate the building's foundation	Foundation perforations for subsurface features (e.g., electrical, gas, sewer or water utility pipes, sumps, and drains) may serve as a preferential pathway for vapor intrusion.

1.4 Factors affecting indoor air quality

Chemicals are a part of our everyday life. They are found in the household products we use and in items we bring into our homes. As such, chemicals are found in indoor air of homes not affected by intrusion of contaminated soil vapor. Examples of alternate sources of volatile chemicals in indoor air are given in Table 1.3. Similarly, volatile chemicals can be in the outdoor air that enters a home or place of business. Certain commercial and industrial facilities, such as gasoline stations and dry cleaners, and vehicle exhaust are examples of possible sources of volatile chemicals in outdoor air.

Commonly found concentrations of these chemicals in indoor and outdoor air are referred to as "background levels." These levels are generally determined from the results of samples collected in homes, offices and outdoor areas not known to be affected by external sources of volatile chemicals (for example, a home not known to be near a chemical spill, a hazardous waste site, a dry-cleaner, or a factory). Background sources of volatile chemicals are considered when conducting an investigation of the soil vapor intrusion pathway [Section 2] and when evaluating the results [Section 3].

Table 1.3 Alternate sources of volatile chemicals in indoor air

Source	Description
Outdoor air	Outdoor sources of pollution can affect indoor air quality due to the exchange of outdoor and indoor air in buildings through natural ventilation, mechanical ventilation or infiltration. Outdoor sources of volatile compounds include automobiles, lawn mowers, oil storage tanks, dry cleaners, gasoline stations, industrial facilities, etc.
Attached or underground garages	Volatile chemicals from sources stored in the garage (e.g., automobiles, lawn mowers, oil storage tanks, gasoline containers, etc.) can affect indoor air quality due to the exchange of air between the garage and indoor space.
Off-gassing	Volatile chemicals may off-gas from building materials (e.g., adhesives or caulk), furnishings (e.g., new carpets or furniture), recently dry-cleaned clothing, or areas (such as floors or walls) contaminated by historical use of volatile chemicals in a building. Volatile chemicals may also off-gas from contaminated groundwater that infiltrates into the basement (e.g., at a sump) or during the use of contaminated domestic well water (e.g., at a tap or in a shower).
Household products	Household products include, but are not limited to, cleaners, mothballs, cigarette smoke, paints, paint strippers and thinners, air fresheners, lubricants, glues, solvents, pesticides, fuel oil storage, and gasoline storage.
Occupant activities	For example, in non-residential settings, the use of volatile chemicals in industrial or commercial processes or in products used for building maintenance. In residential settings, the use of products containing volatile chemicals for hobbies (e.g., glues, paints, etc.) or home businesses. People working at industrial or commercial facilities where volatile chemicals are used may bring the chemicals into their home on their clothing.
Indoor emissions	These include, but are not limited to, combustion products from gas, oil and wood heating systems that are vented outside improperly, as well as emissions from industrial process equipment and operations.

1.5 General approach to evaluating soil vapor intrusion

Since no two sites are exactly alike, the approach to evaluating soil vapor intrusion is dependent upon site-specific conditions. A thorough understanding of the site, including its history of use, characteristics (e.g., geology, geography, identified environmental contamination, etc.) and potentially exposed populations, is used to develop an investigation plan. Existing information is reviewed to determine what data are available and what additional data should be collected (i.e., to guide the investigation). In addition, factors affecting soil vapor migration and intrusion [Section 1.3] and indoor air quality [Section 1.4] are also considered when both conducting an investigation [Section 2] and evaluating the results [Section 3].

This data gathering and review process should be repeated until each of the following questions can be answered:

[1] Are subsurface vapors contaminated (i.e., soil vapor as defined in Section 1.1, including vapors located immediately beneath the foundation or slab of a building)? If so, what are the nature and extent of contamination? What is/are the source(s) of the contamination?

[2] What are the current and potential exposures to contaminated subsurface vapors via soil vapor intrusion?

[3] What actions, if any, should be taken to prevent or mitigate exposures related to soil vapor intrusion and to remediate subsurface vapor contamination?

When determining what actions, if any, are appropriate to mitigate current or prevent future human exposures, all information known about a site is considered (i.e., a "whole picture" approach is taken) because each site presents its own unique set of circumstances. This information includes, but is not limited to, the following: nature and extent of contamination in all environmental media, factors affecting vapor migration and intrusion, current and future site uses, off-site land uses, presence of alternate sources of volatile chemicals, and completed or proposed remedial actions.

Actions taken to minimize or prevent exposures typically do not preclude the site from being used for a desired purpose or from being developed. If appropriate, mitigation systems can be installed at existing buildings or installed during the construction of new buildings. In many cases, installation of mitigation systems on new buildings may be a prudent, proactive action. The costs associated with installing a system at the time of a building's construction are often considerably less than the costs associated with retrofitting a system to the building after construction is completed. Furthermore, in many parts of New York State, the mitigation system would also address concerns about human exposures to radon. To learn more about radon in New York State, please refer to the Radon: Frequently Asked Questions Fact Sheet in Appendix H or visit the NYSDOH's web site at http://www.health.state.ny.us/nysdoh/radon/radonhom.htm or contact the NYSDOH's Radon Program at 1-800-458-1158.

1.6 Conceptual site model

In accordance with the NYSDEC's *Draft DER-10 Technical Guidance for Site Investigation and Remediation* (NYSDEC 2002), subsurface vapors and soil vapor intrusion should be included in an overall conceptual model for the site. As described in the NYSDEC's technical guidance, a conceptual site model should be used to develop a general understanding of the site to evaluate potential risks to public health and the environment and to assist in identifying and setting priorities for the activities to be conducted at the site. The conceptual site model also identifies potential sources of contamination, types of contaminants and affected media, release mechanisms and potential contaminant pathways, and actual/potential human and environmental receptors.

The components of a conceptual site model specific to soil vapor intrusion are provided throughout Section 1 of the guidance. The general approach for evaluating soil vapor intrusion described in Section 1.5 is analogous to the development of a conceptual site model specific to soil vapor intrusion. For additional information about the use of conceptual site models in the investigation and remediation of sites or a description of the conceptual site model process, the reader is referred to the NYSDEC's technical guidance.

1.7 Applicability of guidance

This guidance should be considered anywhere soil vapor intrusion is evaluated in the State of New York, whether the evaluation is being undertaken voluntarily by a corporation, a municipality, or private citizen, or under one of the state's environmental remediation programs.

1.7.1 Residential and non-residential settings

The guidance should be followed in residential and non-residential settings where people may be exposed involuntarily to chemicals from soil vapor intrusion.

1.7.2 Chlorinated and non-chlorinated volatile chemical sites

The guidance should be used when evaluating soil vapor intrusion at chlorinated and non-chlorinated volatile chemical sites, including petroleum hydrocarbon sites and manufactured gas plant sites. While the likelihood for exposures related to soil vapor intrusion may differ between sites due to site-specific conditions and chemical-specific properties, the extent of volatile chemical contamination and the nature of the contamination, these factors should be considered when developing the conceptual site model and implementing an investigation plan (as discussed in Sections 1.5 and 1.6). For example, if the conceptual site model suggests that soil vapor intrusion is not a concern at a petroleum hydrocarbon site due to biodegradation, the work plan might include the measurement of select bioparameters (e.g., oxygen, carbon dioxide, methane, etc.), along with the petroleum hydrocarbons, at varying depths to demonstrate bioattenuation in the vadose. The work plan might include sub-slab vapor sampling as well to demonstrate that conditions beneath nearby buildings are also resulting in bioattenuation of the petroleum hydrocarbons.

1.7.3 Current, new and past remedial sites

As discussed in the NYSDEC's Program Policy *DER-13: Strategy for Prioritizing Vapor Intrusion Evaluations at Remedial Sites in New York* (NYSDEC 2006), the soil vapor intrusion pathway will be evaluated at all completed, current and future remedial sites New York State. This soil vapor intrusion guidance document complements the NYSDEC's policy by providing recommendations on how to evaluate soil vapor intrusion. The combined goal of the policy and guidance documents is to conduct soil vapor intrusion evaluations as efficiently and effectively as possible at all remedial sites in New York.

1.8 Updates to the guidance

The investigation, evaluation, mitigation and remediation of soil vapor are evolving disciplines and this guidance document will be updated periodically, as appropriate. The history of the document's release is provided on the inside of the cover page. In addition, changes to the document are noted in Appendix A. The current version of the document supercedes previous versions. The current version of the guidance is available on the NYSDOH's web site (*http://www.health.state.ny.us/environmental/indoors/vapor_intrusion/*) or by contacting the NYSDOH's Bureau of Environmental Exposure Investigation [see Contact Information on the inside of the cover page]. Revisions or amendments to the guidance will be posted on the NYSDOH's web site.

Section 2: Investigation of the Soil Vapor Intrusion Pathway

Soil vapor is an environmental medium, like groundwater and soil, that should be characterized during the investigation of a site. This section provides guidance on collecting appropriate and relevant data that can be used to identify current or potential human exposures to contaminated subsurface vapors associated with a site. As discussed in Section 1.5, no two sites are exactly alike. Site-specific and/or building-specific conditions may warrant modifying the recommendations herein. Therefore, guidance provided in this section is presented in terms of general steps and strategies that should be applied when approaching an investigation of soil vapor intrusion.

2.1 Sites at which an investigation is appropriate

Data collected to date do not support the use of pre-determined concentrations of volatile chemicals (i.e., screening criteria) in either groundwater or soil to trigger a soil vapor intrusion investigation. Therefore, although the level of investigation may vary, the pathway should be investigated at any site with the following:

a. an existing subsurface source (e.g., on the basis of preliminary environmental sampling) or likely subsurface source (e.g., on the basis of known previous land uses) of volatile chemicals [Section 1.1]; and

b. existing buildings or the possibility that buildings may be constructed near a subsurface source of volatile chemicals.

2.2 Types of samples

The following are types of samples that are collected to investigate the soil vapor intrusion pathway:

a. subsurface vapor samples:

   1. *soil vapor* samples (i.e., soil vapor samples not beneath the foundation or slab of a building) and

   2. *sub-slab vapor* samples (i.e., soil vapor samples immediately beneath the foundation or slab of a building);

b. crawl space air samples;

c. indoor air samples; and

d. outdoor air samples.

The types of samples that should be collected depend upon the specific objective(s) of the sampling, as described below.

2.2.1 Soil vapor

Soil vapor samples are collected to determine whether this environmental medium is contaminated, characterize the nature and extent of contamination, and identify possible sources of the contamination. Our experience to date indicates soil vapor results alone typically cannot be relied upon to rule out sampling at nearby buildings. For example, concentrations of volatile chemicals in sub-slab vapor samples have been substantially higher (e.g., by a factor of 100 or more) than concentrations found in nearby soil vapor

samples (e.g., collected at 8 feet below grade near the building). This may be due to differences in factors such as soil moisture content and pressure gradients. Therefore, exposures are evaluated primarily based on sub-slab vapor, indoor air and outdoor air sampling results and soil vapor results are primarily used as a tool to guide these investigations.

Soil vapor sampling results are also used when evaluating the effectiveness of direct or indirect measures to remediate contaminated subsurface vapors. (Soil vapor extraction is an example of a direct remedial measure, and groundwater pumping and treating an indirect measure.)

2.2.2 Sub-slab vapor

Sub-slab vapor samples are collected to characterize the nature and extent of soil vapor contamination immediately beneath a building with a basement foundation and/or a slab-on-grade. Sub-slab vapor sampling results are used in conjunction with indoor air and outdoor air sampling results when evaluating the following:

a. *current* human exposures;

b. the potential for *future* human exposures (e.g., if the structural integrity of the building changes or the use of the building changes); and

c. site-specific attenuation factors (i.e., the ratio of indoor air to sub-slab vapor concentrations).

Sub-slab vapor samples are often collected after soil vapor characterization and/or other environmental sampling (e.g., soil and groundwater characterization) indicate they are warranted. Sub-slab samples are typically collected concurrently with indoor and outdoor air samples. However, outside of the heating season, sub-slab vapor samples may be collected independently depending on the sampling objective (e.g., to characterize the extent of subsurface vapor contamination outside of the heating season to develop a more comprehensive, focused investigation plan for the heating season).

2.2.3 Crawl space air

Similar to sub-slab vapor samples, crawl space air samples are collected to characterize the nature and extent of contamination immediately beneath a building with a crawl space foundation. Crawl space air sampling results are used in conjunction with indoor air and outdoor air sampling results when evaluating the following:

a. *current* human exposures; and

b. the potential for *future* human exposures (e.g., if the structural integrity of the building changes or the use of the building changes).

2.2.4 Indoor air

Indoor air samples are collected to characterize exposures to air within a building, including those with earthen floors. Indoor air sampling results are used when evaluating the following:

a. *current* human exposures;

b. the potential for *future* exposures (e.g., if a currently vacant building should become occupied); and

c. site-specific attenuation factors (e.g., the ratio of indoor air to sub-slab vapor concentrations).

Indoor air samples are often collected after subsurface vapor characterization and other environmental sampling (e.g., soil and groundwater characterization) indicate they are warranted. When indoor air samples are collected, concurrent sub-slab vapor, crawl space air (if applicable) and outdoor air samples are collected to evaluate the indoor air results appropriately. However, indoor air and outdoor air samples, without sub-slab vapor samples, may be collected when confirming the effectiveness of a mitigation system [Section 4].

In addition, site-specific situations may warrant collecting indoor air samples prior to characterizing subsurface vapors and/or without concurrent sub-slab vapor sampling to examine immediate inhalation hazards. Examples of such situations may include, but are not limited to, the following:

a. in response to a spill event to qualitatively and/or quantitatively characterize the contamination;

b. if high readings are obtained in a building when screening with field equipment (e.g., a photoionization detector (PID), an organic vapor analyzer, or an explosimeter) and the source is unknown;

c. if significant odors are present and the source needs to be characterized; or

d. if groundwater beneath the building is contaminated, the building is prone to groundwater intrusion or flooding (e.g., sump pit overflows), and subsurface vapor sampling is not feasible. In these situations, the collection of water samples from the sump may also be appropriate.

2.2.5 Outdoor air

Outdoor air samples are collected to characterize site-specific background outdoor air conditions. Outdoor air samples should be collected simultaneously with indoor air samples to evaluate the potential influence, if any, of outdoor air on the indoor air sampled. Outdoor air samples may also be collected concurrently with soil vapor samples to identify potential outdoor air interferences associated with infiltration of outdoor air into the sampling apparatus while the soil vapor was collected.

2.3 Phase of a site investigation in which to sample

There is no single phase (e.g., preliminary site characterization or remedial investigation) of a site investigation during which sampling to evaluate the soil vapor intrusion pathway is appropriate. Initiation of investigation activities for this specific purpose should be determined on a site-by-site basis. However, if exposures due to soil vapor intrusion appear likely at any point during the investigation, evaluation of this exposure pathway should not be delayed.

If the locations of likely source areas are reasonably known, sampling earlier during the investigation of a site rather than later is recommended because of the iterative nature of the sampling process [Section 2.5]. However, if current site conditions are not well-defined, then sampling after contamination in other environmental media (e.g., groundwater and soil) has been characterized may be considered. In the latter scenario, groundwater, soil and other site information may be used to guide an investigation of the soil vapor intrusion pathway, such as selecting locations for subsurface vapor samples based on likely migration pathways and source areas [Sections 2.6.1 and 2.6.2]. At a minimum, depth to groundwater and soil stratigraphy should be identified prior to collecting soil vapor samples.

Sampling may be delayed at parcels that are undeveloped or contain unoccupied buildings provided

a. characterization of the parcel is not needed to
    1. address exposures in the surrounding area;
    2. design remedial measures for subsurface vapor contamination; or
    3. monitor or confirm the effectiveness of remedial measures; and
b. measures are in place that assure that the parcel will not be developed, or buildings occupied, without addressing exposure concerns [Section 3.6].

If exposures due to soil vapor intrusion appear likely, and a delay of sampling is contemplated, the State (i.e., the NYSDEC and NYSDOH) should be informed of the contemplated delay and the rationale for the delay. Furthermore, the party contemplating the delay should consider any comments the State may have on the information provided.

2.4 Time of year in which to sample

2.4.1 Soil vapor

Soil vapor samples are collected at any time during the year. Often, sampling is completed during the summer so the results can be used as a tool when selecting buildings to be sampled during the heating season.

2.4.2 Buildings

Sub-slab vapor samples and, unless immediate sampling is appropriate, indoor air samples are typically collected during the heating season because soil vapor intrusion is more likely to occur when a building's heating system is in operation and doors and windows are closed. In New York State, heating systems are generally expected to be operating routinely from November 15th to March 31st. However, these dates are not absolute; the timeframe for sampling may vary depending on factors such as the location of the site (e.g., upstate versus downstate) and the weather conditions for a particular year.

A soil vapor intrusion investigation at a building may be conducted outside of the heating season if the concern for vapor intrusion is greater during another time of year. This may occur at certain industrial buildings, for instance, where HVAC systems are actively managed to control the ratio of recirculated indoor air to make-up air from outside the building. Information about the site and potentially affected structures, including the factors discussed in Section 1.3, should be considered in determining the timing of an investigation.

Samples may be collected at any time of year if exposures due to soil vapor intrusion appear likely. However, samples collected at times when soil vapor intrusion is not expected to have its greatest effect on indoor air quality (typically, samples collected outside of the heating season) should not be used to rule out exposures. For example, results indicating "no further action" or "monitoring required" should be verified when soil vapor intrusion is believed to be most likely to ensure these actions are protective throughout the year.

2.5 Number of sampling rounds

Investigating the soil vapor intrusion pathway usually involves more than one round of subsurface vapor, indoor air and/or outdoor air sampling, for reasons such as the following:

a. to characterize the nature and extent of subsurface vapor contamination (similar to the delineation of groundwater contamination) and to address corresponding exposure concerns;

b. to evaluate fluctuations in concentrations due to

    1. different weather conditions (e.g., seasonal effects),

    2. changes in building conditions (e.g., various operating conditions of a building's HVAC system),

    3. changes in source strength, or

    4. vapor migration or contaminant biodegradation processes (particularly when degradation products may be more toxic than the parent compounds); or

c. to confirm sampling results or the effectiveness of mitigation or remedial systems.

Overall, as discussed in Section 1.5, successive rounds of sampling should be conducted until the following questions can be answered:

a. Are subsurface vapors contaminated? If so, what are the nature and extent of contamination? What is/are the source(s) of the contamination?

b. What are the current and potential exposures to contaminated subsurface vapors?

c. What actions, if any, are appropriate to prevent or mitigate exposures and to remediate subsurface vapor contamination?

Toward this end, multiple rounds of sampling may be appropriate to characterize the nature and extent of subsurface vapor contamination such that

a. both potential and current exposures are addressed [Section 2.6];

b. measures can be designed to remediate subsurface vapor contamination, either directly (e.g., SVE system) or indirectly (e.g., soil excavation or groundwater remediation), given that monitoring and mitigation are considered temporary measures implemented to address exposures related to vapor intrusion until contaminated environmental media are remediated [Section 3.4]; and

c. the effectiveness of remedial measures can be monitored and confirmed (e.g., endpoint sampling) [Section 4.5].

2.6 Sampling locations

The general approach for selecting sampling locations as part of a soil vapor intrusion investigation is similar to the approach for the investigation of other environmental media (e.g., soil and groundwater). Sampling locations should be selected with consideration of the conceptual site model [Section 1.6]. These locations should be selected to meet the stated objectives of the sampling program. Additionally, similar to the investigation of soil and groundwater, it is typical to start at a known or suspected source and work outward. The specific approach, however, will be dependent upon site-specific and building-specific conditions.

2.6.1 Soil vapor

If available, existing environmental data (e.g., groundwater and soil data) and site background information should be used to select locations for sampling soil vapor as part of a vapor intrusion investigation. Locations will vary depending upon surface features (e.g., presence or absence of buildings, areas of pavement, or vacant lot) and subsurface characteristics (e.g., soil stratigraphy, buried structures, utility corridors, or clay lenses), as well as the specific purpose of the sampling. Therefore, a figure illustrating proposed sampling locations (with respect to both areal position and depth), actual locations sampled in the field, and relevant on-site and off-site features should be included in all sampling work plans and reports.

Examples of how locations may vary given the specific purpose of the sampling follow. They include general guidelines that should be followed when selecting soil vapor sampling locations:

a. to evaluate the **potential for current on-site or off-site exposures**, samples should be collected
    1. in the vicinity of a building's foundation [see special sampling consideration at the end of Section 2.6.1 if sampling around a building with no surrounding surface confining layer], as well as between the building's foundation and the source (if known and not located beneath the building),
    2. along the site's perimeter, and
    3. at a depth comparable to the depth of foundation footings (determined on a building-specific or site-specific basis) or at least 1 foot above the water table in areas where the groundwater table is less than 6 feet below grade;
b. to evaluate the **potential for future exposures if development** on a known or suspected contaminated area on-site or off-site is possible, representative samples should be collected
    1. in areas with either known or suspected subsurface sources of volatile chemicals, in areas where elevated readings were obtained with field equipment during previous environmental investigations, and in areas of varying concentrations of contamination in the upper groundwater,
    2. in a grid pattern across the area (at an appropriate spacing interval for the size of the area) if information is limited for the area, and
    3. at multiple depths from the suspected subsurface source, or former source, to a depth comparable to the expected depth of foundation footings;

c. to evaluate the **potential for off-site soil vapor contamination**, samples should be collected

    1. along the site's perimeter,
    2. in areas of potential subsurface sources of vapor contamination (e.g., a groundwater plume that has migrated off-site), and
    3. at a depth comparable to the depth of foundation footings (determined on a site-specific basis) or at least 1 foot above the water table in areas where the groundwater table is less than 6 feet below grade;

d. to evaluate on-site and off-site **preferential migration pathways** in areas with low permeability soils, samples should be collected

    1. along preferential soil vapor flow paths, such as sewer lines, utility corridors, trenches, pipelines, and other subsurface structures that are likely to be bedded with higher permeability materials, and
    2. at depths corresponding to these subsurface features (will depend on site-specific conditions);

e. to characterize on-site or off-site **contamination in the vadose zone**, samples should be collected

    1. in areas with either known or suspected sources of volatile chemicals, in areas where elevated readings were obtained with field equipment (e.g., PID) during previous soil and groundwater investigations, and in areas of varying concentrations of contamination in the upper groundwater regime, and
    2. at appropriate depths associated with these areas (will depend on site-specific conditions); and

f. to investigate the **influence of contaminated groundwater or soil on soil vapor** and to characterize the **vertical profile** of contamination, samples should be collected from clusters of soil vapor probes at varying depths in the vadose zone [Figure 2.2, Section 2.7.1] and preferably in conjunction with the collection of groundwater or soil samples.

Soil vapor samples collected at depths shallower than 5 feet below grade may be prone to negative bias due to infiltration of outdoor air. Therefore, samples from these depths should be collected only if appropriate (based on site-specific conditions), and sampling procedures and results should be reviewed accordingly. The depth of sampling near buildings with slab-on-grade foundations is dependent upon site-specific conditions (e.g., building surrounded by grassy or surface confining layer).

When collecting soil vapor samples around a building with no surrounding surface confining layer (e.g., pavement or sidewalk), samples should be located in native or undisturbed soils away from fill material surrounding the building (approximately 10 feet away from the building) to avoid sampling in an area that may be influenced by the building's operations. For example, operation of HVAC systems, fireplaces, or mechanical equipment (e.g., clothes dryers or exhaust fans/vents) in a building may exacerbate the infiltration of outdoor air into the vadose zone adjacent to the building. As a result, soil vapor samples collected in uncovered areas adjacent to the building may not be representative.

Investigations of soil vapor contamination should proceed outward from known or suspected subsurface sources, as appropriate, on an areal basis until the nature and extent of

subsurface vapor contamination has been characterized and human exposures have been addressed.

2.6.2 Sub-slab vapor

Existing environmental data (e.g., soil vapor, groundwater and soil data), site background information, and building construction details (e.g., basement, slab-on-grade, or multiple types of foundations, HVAC systems, etc.) should be considered when selecting buildings and locations within buildings for sub-slab vapor sampling.

At a minimum, these general guidelines should be followed when selecting buildings to sample for sub-slab vapors:

a. buildings, including residential dwellings, located above or directly adjacent to known or suspected areas of subsurface volatile chemical contamination should be sampled;

b. buildings in which screening with field equipment (e.g., PID, ppbRAE, Jerome Mercury Vapor Analyzer, etc.) suggests a completed migration pathway, such as when readings are above background and from unidentified sources or when readings show increasing gradients, should be sampled; and

c. buildings within known or suspected areas of subsurface volatile chemical contamination that are used or occupied by sensitive population groups (e.g., daycare facilities, schools, nursing homes, etc.) should be given special consideration for sampling.

Investigations of sub-slab vapor and/or indoor air contamination should proceed outward from known or suspected sources, as appropriate, on an areal basis until the nature and extent of subsurface vapor contamination has been characterized and potential and current human exposures have been addressed. In cases of widespread vapor contamination and depending upon the basis for making decisions (e.g., a "blanket mitigation" approach within a specified area of documented vapor contamination [Section 3.3.1]), a representative number of buildings from an identified study area, rather than each building, may be sampled. Prior to implementation, this type of sampling approach should be approved by State agency personnel.

Within a building, sub-slab vapor samples should be collected

a. in at least one central location away from foundation footings, and

b. from the soil or aggregate immediately below the basement slab or slab-on-grade.

The number of sub-slab vapor samples that should be collected in a building depends upon the number of slabs (e.g., multiple slabs-on-grade in a large warehouse) and foundation types (e.g., combined basement and slab-on-grade in a residence). At least one sub-slab vapor sample should be collected from each representative area.

2.6.3 Indoor air

Existing environmental data (e.g., soil vapor, groundwater and soil data), site background information, and building construction details (e.g., basement, slab-on-grade, or multiple types of foundations; number and operation of HVAC systems; elevator shafts; tunnels or other confined-space entry points; etc.) should be considered when selecting buildings and

locations within buildings for indoor air sampling. Indoor air samples are typically collected concurrently with sub-slab vapor and outdoor air samples [Section 2.2.4].

At a minimum, these general guidelines should be followed when selecting buildings to sample for indoor air:

a. where sub-slab vapor samples were collected without indoor air samples, buildings in which elevated concentrations of contaminants were measured in sub-slab vapor samples should be sampled;

b. buildings, including residential dwellings, located above or directly adjacent to known or suspected subsurface sources of volatile chemicals or known soil vapor contamination should be sampled;

c. buildings in which screening with field equipment (e.g., PID, ppbRAE, Jerome Mercury Vapor Analyzer, etc.) suggests a completed migration pathway, such as when readings are above background and from unidentified sources or when readings show increasing gradients, should be sampled; and

d. buildings within known or suspected areas of subsurface volatile chemical contamination that are used or occupied by sensitive population groups (e.g., daycare facilities, schools, nursing homes, etc.) should be given special consideration for sampling.

To characterize contaminant concentration trends and potential exposures, indoor air samples should be collected

a. from the crawl space area,

b. from the basement (where vapor infiltration is suspected, such as near sump pumps or indoor wells, or in a central location) at a height approximately three feet above the floor to represent a height at which occupants normally are seated and/or sleep,

c. from the lowest level living space (in centrally-located, high activity use areas) at a height approximately three feet above the floor to represent a height at which occupants normally are seated and/or sleep, and

d. if in a commercial setting (e.g., a strip mall), from multiple tenant spaces at a height approximately three feet above the floor to represent a height at which occupants normally are seated.

These locations are illustrated in Figure 2.1.

Investigations of indoor air contamination should proceed outward from known or suspected subsurface sources, as appropriate, on an areal basis until potential and current human exposures associated with soil vapor intrusion have been addressed. In cases of widespread vapor contamination and depending upon the basis for making decisions (e.g., a "blanket mitigation" approach within a specified area of documented vapor contamination), a representative number of buildings from an identified study area, rather than each building, may be sampled. Prior to implementation, this type of sampling approach should be approved by State agency personnel.

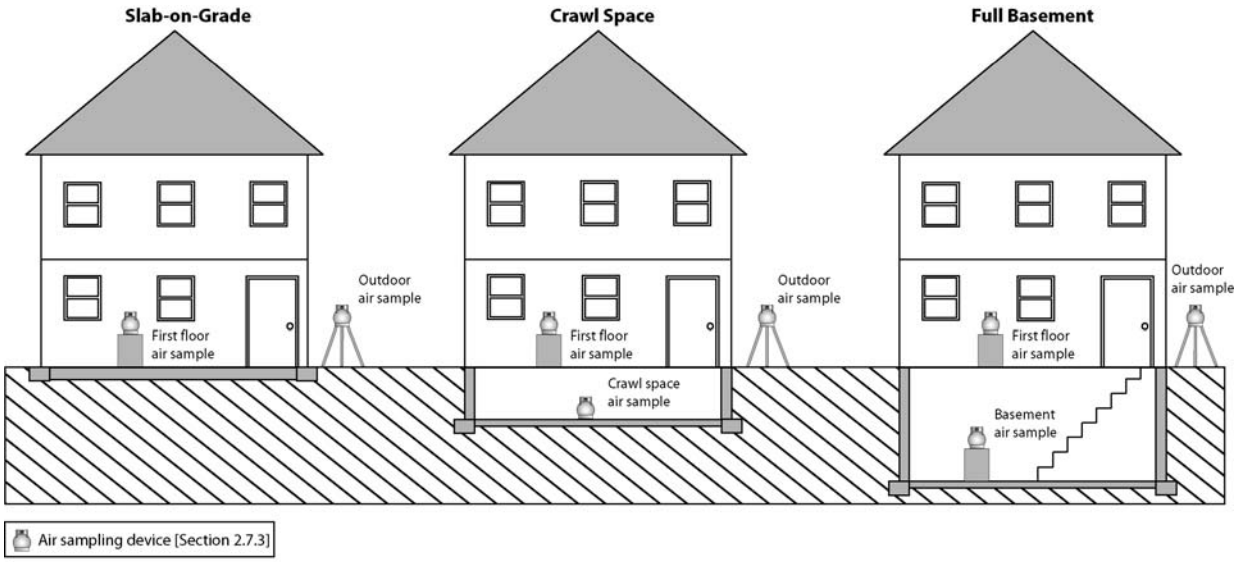

Figure 2.1
Schematic of indoor and outdoor air sampling locations

2.6.4 Outdoor air

Typically, an outdoor air sample is collected outside of each building where an indoor air sample is collected. However, if several buildings are being sampled within a localized area, representative outdoor air samples may be appropriate. For example, one outdoor air sample may be sufficient for three houses being sampled in a cul-de-sac. Outdoor air samples should be collected from a representative upwind location, away from wind obstructions (e.g., trees or bushes), and at a height above the ground to represent breathing zones (3 to 5 feet) [Figure 2.1]. A representative sample is one that is not biased toward obvious sources of volatile chemicals (e.g., automobiles, lawn mowers, oil storage tanks, gasoline stations, industrial facilities, etc.). For buildings with HVAC systems that draw outdoor air into the building, an outdoor air sample collected near the outdoor air intake may be appropriate.

2.7 Sampling protocols

The procedures recommended here may be modified depending on site-specific conditions, the sampling objectives, or emerging technologies and methodologies. Alternative sampling procedures should be described thoroughly and proposed in a work plan submitted for review by the State. The State will review and comment on the proposed procedure and consider the efficacy of the alternative sampling procedure based on the objectives of investigation. In all cases, work plans should thoroughly describe the proposed sampling procedure. Similarly, the procedures that were implemented in the field should be documented and included in the final report of the sampling results.

2.7.1 Soil vapor

Soil vapor probe installations [Figure 2.2] may be permanent, semi-permanent or temporary. In general, permanent or semi-permanent installations are preferred for data consistency reasons and to ensure outdoor air infiltration does not occur. Temporary probes should only be used if measures are taken to ensure that an adequate surface seal is created to prevent outdoor air infiltration and if tracer gas is used at every sampling location. [See Section 2.7.5 for additional information about the use of tracer gas when collecting soil vapor samples.] Soil vapor implants or probes should be constructed in the same manner at all sampling locations to minimize possible discrepancies. The following procedures should be included in any permanent construction protocol:

a. implants should be installed using an appropriate method based on site conditions (e.g., direct push, manually driven, auger — if necessary to attain the desired depth or if sidewall smearing is a concern, etc.);

b. porous, inert backfill material (e.g., glass beads, washed #1 crushed stone, etc.) should be used to create a sampling zone 1 to 2 feet in length;

c. implants should be fitted with inert tubing (e.g., polyethylene, stainless steel, nylon, Teflon®, etc.) of the appropriate size (typically 1/8 inch to 1/4 inch diameter) and of laboratory or food grade quality to the surface;

d. soil vapor probes should be sealed above the sampling zone with a bentonite slurry for a minimum distance of 3 feet to prevent outdoor air infiltration and the remainder of the borehole backfilled with clean material;

e. for multiple probe depths, the borehole should be grouted with bentonite between probes to create discrete sampling zones or separate nested probes should be installed [Figure 2.2]; and

f. steps should be taken to minimize infiltration of water or outdoor air and to prevent accidental damage (e.g., setting a protective casing around the top of the probe tubing and grouting in place to the top of bentonite, sloping the ground surface to direct water away from the borehole like a groundwater monitoring well, etc.).

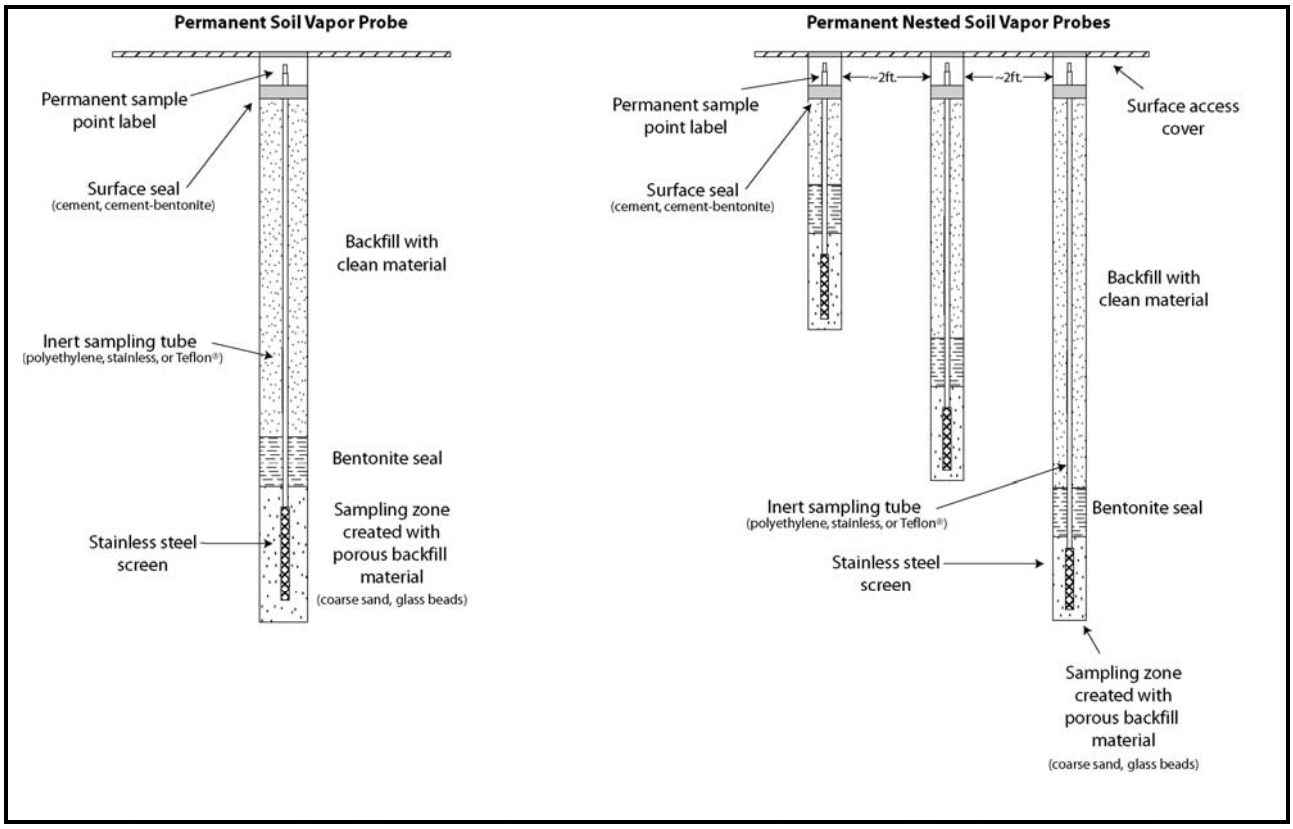

Figure 2.2

Schematics of a generic permanent soil vapor probe
and permanent nested soil vapor probes

[Note: Many variations exist and may be proposed in a work plan. Proposed installations should meet the sampling objectives and requirements of the analytical methods.]

To obtain representative samples and to minimize possible discrepancies, soil vapor samples should be collected in the following manner at all locations:

a. at least 24 hours after the installation of permanent probes and shortly after the installation of temporary probes, one to three implant volumes (i.e., the volume of the sample probe and tube) should be purged prior to collecting the samples;

b. flow rates for both purging and collecting should not exceed 0.2 liters per minute to minimize outdoor air infiltration during sampling;

c. samples should be collected, using conventional sampling methods, in an appropriate container — one which

   i. meets the objectives of the sampling (e.g., investigation of areas where low or high concentrations of volatile chemicals are expected; to minimize losses of volatile chemicals that are susceptible to photodegradation),

   ii. is consistent with the sampling and analytical methods (e.g., low flow rate; Summa® canisters if analyzing by using EPA Method TO-15), and

   iii. is certified clean by the laboratory;

d. sample size depends upon the volume of that will achieve minimum reporting limits [Section 2.9]; and

e. a tracer gas (e.g., helium, butane, sulfur hexafluoride, etc.) should be used when collecting soil vapor samples to verify that adequate sampling techniques are being implemented (i.e., to verify infiltration of outdoor air is not occurring) [Section 2.7.5].

In some cases, weather conditions may present certain limitations on soil vapor sampling. For example, condensation in the sample tubing may be encountered during winter sampling due to low outdoor air temperatures. Devices, such as tube warmers, may be used to address these conditions. Anticipated limitations to the sampling should be discussed prior to the sampling event so appropriate measures can be taken to address these difficulties and produce representative and reliable data.

When soil vapor samples are collected, the following actions should be taken to document local conditions during sampling that may influence interpretation of the results:

a. if sampling near a commercial or industrial building, uses of volatile chemicals during normal operations of the facility should be identified;

b. outdoor plot sketches should be drawn that include the site, area streets, neighboring commercial or industrial facilities (with estimated distance to the site), outdoor air sampling locations (if applicable), and compass orientation (north);

c. weather conditions (e.g., precipitation and outdoor temperature) should be noted for the past 24 to 48 hours; and

d. any pertinent observations should be recorded, such as odors and readings from field instrumentation.

Additional information that could be gathered to assist in the interpretation of the results includes barometric pressure, wind speed and wind direction.

The field sampling team should maintain a sample log sheet summarizing the following:

a. sample identification,

b. date and time of sample collection,

c. sampling depth,

d. identity of samplers,

e. sampling methods and devices,

f. purge volumes,

g. volume of soil vapor extracted,

h. if canisters used, the vacuum before and after samples were collected,

i. apparent moisture content (dry, moist, saturated, etc.) of the sampling zone, and

j. chain of custody protocols and records used to track samples from sampling point to analysis.

2.7.2 Sub-slab vapor

During colder months, heating systems should be operating to maintain normal indoor air temperatures (i.e., 65 – 75 °F) for at least 24 hours prior to and during the scheduled sampling time. Prior to installation of the sub-slab vapor probe, the building floor should be inspected and any penetrations (cracks, floor drains, utility perforations, sumps, etc.) should be noted and recorded. Probes should be installed at locations where the potential for ambient air infiltration via floor penetrations is minimal.

Sub-slab vapor probe installations [Figure 2.3] may be permanent, semi-permanent or temporary. A vacuum should not be used to remove drilling debris from the sampling port. Sub-slab implants or probes should be constructed in the same manner at all sampling locations to minimize possible discrepancies. The following procedures should be included in any construction protocol:

a. permanent recessed probes should be constructed with brass or stainless steel tubing and fittings;

b. temporary probes should be constructed with inert tubing (e.g., polyethylene, stainless steel, nylon, Teflon®, etc.) of the appropriate size (typically 1/8 inch to 1/4 inch diameter), and of laboratory or food grade quality;

c. tubing should not extend further than 2 inches into the sub-slab material;

d. porous, inert backfill material (e.g., glass beads, washed #1 crushed stone, etc.) should be added to cover about 1 inch of the probe tip for permanent installations; and

e. the implant should be sealed to the surface with non-VOC-containing and non-shrinking products for temporary installations (e.g., permagum grout, melted beeswax, putty, etc.) or cement for permanent installations.

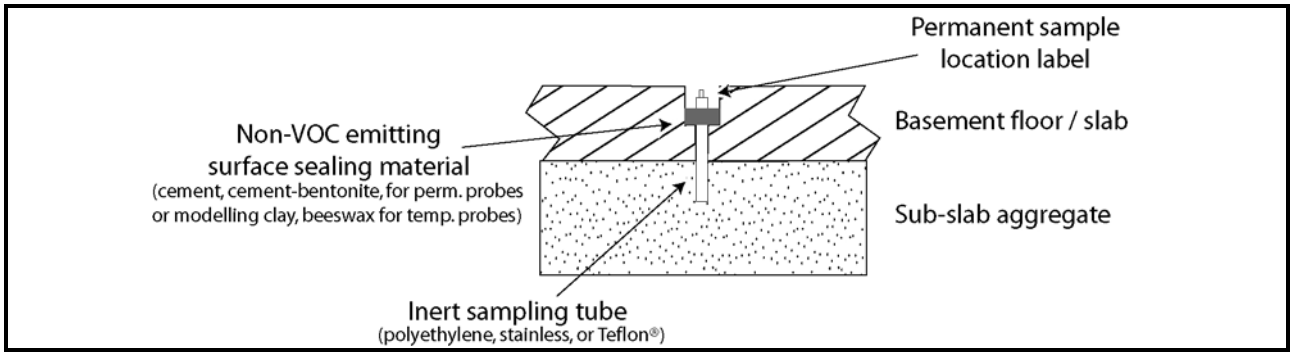

Figure 2.3

Schematic of a generic sub-slab vapor probe

[Note: Many variations exist and may be proposed in a work plan. Proposed installations should meet the sampling objectives and requirements of the analytical methods.]

To obtain representative samples that meet the data quality objectives, sub-slab vapor samples should be collected in the following manner:

a. after installation of the probes, one to three volumes (i.e., the volume of the sample probe and tube) must be purged prior to collecting the samples to ensure samples collected are representative;

b. flow rates for both purging and collecting must not exceed 0.2 liters per minute to minimize ambient air infiltration during sampling; and

c. samples should be collected, using conventional sampling methods, in an appropriate container — one which

    i. meets the objectives of the sampling (e.g., investigation of areas where low or high concentrations of volatile chemicals are expected; to minimize losses of volatile chemicals that are susceptible to photodegradation),

    ii. is consistent with the sampling and analytical methods (e.g., low flow rate; Summa® canisters if analyzing by using EPA Method TO-15), and

    iii. is certified clean by the laboratory;

d. sample size depends upon the volume of that will achieve minimum reporting limits [Section 2.9], the flow rate, and the sampling duration; and

e. ideally, samples should be collected over the same period of time as concurrent indoor and outdoor air samples.

When sub-slab vapor samples are collected, the following actions should be taken to document conditions during sampling and ultimately to aid in the interpretation of the sampling results [Section 3]:

a. historic and current storage and uses of volatile chemicals should be identified, especially if sampling within a commercial or industrial building (e.g., use of volatile chemicals in commercial or industrial processes and/or during building maintenance);

b. the use of heating or air conditioning systems during sampling should be noted;

c. floor plan sketches should be drawn that include the floor layout with sampling locations, chemical storage areas, garages, doorways, stairways, location of basement sumps or subsurface drains and utility perforations through building foundations, HVAC system air supply and return registers, compass orientation (north), footings that create separate foundation sections, and any other pertinent information should be completed;

d. outdoor plot sketches should be drawn that include the building site, area streets, outdoor air sampling locations (if applicable), compass orientation (north), and paved areas;

e. weather conditions (e.g., precipitation and indoor and outdoor temperature) and ventilation conditions (e.g., heating system active and windows closed) should be reported; and

f. any pertinent observations, such as spills, floor stains, smoke tube results, odors and readings from field instrumentation (e.g., vapors via PID, ppbRAE, Jerome Mercury Vapor Analyzer, etc.), should be recorded.

Additional documentation that could be gathered to assist in the interpretation of the results includes information about air flow patterns and pressure relationships obtained by using smoke tubes or other devices (especially between floor levels and between suspected

contaminant sources and other areas), the barometric pressure and photographs to accompany floor plan sketches.

The field sampling team should maintain a sample log sheet summarizing the following:

a. sample identification,
b. date and time of sample collection,
c. sampling depth,
d. identity of samplers,
e. sampling methods and devices,
f. soil vapor purge volumes,
g. volume of soil vapor extracted,
h. if canisters used, vacuum of canisters before and after samples collected,
i. apparent moisture content (dry, moist, saturated, etc.) of the sampling zone, and
j. chain of custody protocols and records used to track samples from sampling point to analysis.

2.7.3 Indoor air

[Reference: NYSDOH's *Indoor Air Sampling & Analysis Guidance (February 1, 2005)*]

During colder months, heating systems should be operating to maintain normal indoor air temperatures (i.e., 65 – 75 °F) for at least 24 hours prior to and during the scheduled sampling time. If possible, prior to collecting indoor samples, a pre-sampling inspection [Section 2.11.1] should be performed to evaluate the physical layout and conditions of the building being investigated, to identify conditions that may affect or interfere with the proposed sampling, and to prepare the building for sampling. This process is described in Section 2.11.1.

In general, indoor air samples should be collected in the following manner:

a. sampling duration should reflect the exposure scenario being evaluated without compromising the detection limit or sample collection flow rate (e.g., an 8 hour sample from a workplace with a single shift versus a 24 hour sample from a workplace with multiple shifts). To ensure that air is representative of the locations sampled and to avoid undue influence from sampling personnel, samples should be collected for at least 1 hour. If the goal of the sampling is to represent average concentrations over longer periods, then longer duration sampling periods may be appropriate. Typically, 24 hour samples are collected from residential settings;
b. personnel should avoid lingering in the immediate area of the sampling device while samples are being collected;
c. sample flow rates must conform to the specifications in the sample collection method and, if possible, should be consistent with the flow rates for concurrent outdoor air and sub-slab samples; and
d. samples must be collected, using conventional sampling methods, in an appropriate container — one which

i. meets the objectives of the sampling (e.g., investigation of areas where low or high concentrations of volatile chemicals are expected; to minimize losses of volatile chemicals that are susceptible to photodegradation),

ii. is consistent with the sampling and analytical methods (e.g., low flow rate; Summa® canisters if analyzing by using EPA Method TO-15), and

iii. is certified clean by the laboratory.

At sites with tetrachloroethene contamination, passive air monitors that are specifically analyzed for tetrachloroethene (i.e., "perc badges") are commonly used to collect indoor and outdoor air samples. If site characterization activities indicate that degradation products of tetrachloroethene also represent a vapor intrusion concern, perc badges may be used to indicate the likelihood of vapor intrusion (i.e., by using tetrachloroethene as a surrogate) followed, as appropriate, by more comprehensive sampling and laboratory analyses to quantify both tetrachloroethene and its degradation products. Perc badge samples ideally should be collected over a twenty-four hour period, but for no less than eight hours.

The following actions should be taken to document conditions during indoor air sampling and ultimately to aid in the interpretation of the sampling results [Section 3]:

a. historic and current uses and storage of volatile chemicals should be identified, especially if sampling within a commercial or industrial building (e.g., use of volatile chemicals in commercial or industrial processes and/or during building maintenance);

b. a product inventory survey documenting sources of volatile chemicals present in the building during the indoor air sampling that could potentially influence the sample results should be completed [Section 2.11.2];

c. the use of heating or air conditioning systems during sampling should be noted;

d. floor plan sketches should be drawn that include the floor layout with sampling locations, chemical storage areas, garages, doorways, stairways, location of basement sumps or subsurface drains and utility perforations through building foundations, HVAC system supply and return registers, compass orientation (north), footings that create separate foundation sections, and any other pertinent information should be completed;

e. outdoor plot sketches should be drawn that include the building site, area streets, outdoor air sampling locations (if applicable), compass orientation (north), and paved areas;

f. weather conditions (e.g., precipitation and indoor and outdoor temperature) and ventilation conditions (e.g., heating system active and windows closed) should be reported; and

g. any pertinent observations, such as spills, floor stains, smoke tube results, odors and readings from field instrumentation (e.g., vapors via PID, ppbRAE, Jerome Mercury Vapor Analyzer, etc.), should be recorded.

Additional documentation that could be gathered to assist in the interpretation of the results includes information about air flow patterns and pressure relationships obtained by using smoke tubes or other devices (especially between floor levels and between suspected contaminant sources and other areas), the barometric pressure and photographs to accompany floor plan sketches.

The field sampling team should maintain a sample log sheet summarizing the following:

a. sample identification,
b. date and time of sample collection,
c. sampling height,
d. identity of samplers,
e. sampling methods and devices,
f. depending upon the method, volume of air sampled,
g. if canisters are used, vacuum of canisters before and after samples collected, and
h. chain of custody protocols and records used to track samples from sampling point to analysis.

2.7.4 Outdoor air

Outdoor air samples should be collected simultaneously with indoor air samples to evaluate the potential influence, if any, of outdoor air on indoor air quality. They may also be collected simultaneously with soil vapor samples to identify potential outdoor air interferences associated with infiltration of outdoor air into the sampling apparatus while the soil vapor was collected. To obtain representative samples that meet the data quality objectives, outdoor air samples should be collected in a manner consistent with that for indoor air samples (described in Section 2.7.3).

The following actions should be taken to document conditions during outdoor air sampling and ultimately to aid in the interpretation of the sampling results [Section 3]:

a. outdoor plot sketches should be drawn that include the building site, area streets, outdoor air sampling locations, the location of potential interferences (e.g., gasoline stations, factories, lawn movers, etc.), compass orientation (north), and paved areas;
b. weather conditions (e.g., precipitation and outdoor temperature) should be reported; and
c. any pertinent observations, such as odors, readings from field instrumentation, and significant activities in the vicinity (e.g., operation of heavy equipment or dry cleaners) should be recorded.

2.7.5 Tracer gas

When collecting soil vapor samples as part of a vapor intrusion evaluation, a tracer gas serves as a quality assurance/quality control measure to verify the integrity of the soil vapor probe seal. Without the use of a tracer, there is no way to verify that a soil vapor sample has not been diluted by outdoor air.

Depending on the nature of the contaminants of concern, a number of different compounds can be used as a tracer. Typically, sulfur hexafluoride (SF_6) or helium are used as tracers because they are readily available, have low toxicity, and can be monitored with portable measurement devices. Butane and propane (or other gases) could also be used as a tracer in some situations. Compounds other than those mentioned here may be appropriate, provided they meet project-specific data quality objectives. Where applicable, steps should

be taken to ensure that the gas used by the laboratory to clean the air sampling container is different from the gas used as a tracer during sampling (e.g., helium).

The protocol for using a tracer gas is straightforward: simply enrich the atmosphere in the immediate vicinity of the area where the probe intersects the ground surface with the tracer gas, and measure a vapor sample from the probe for the presence of high concentrations (> 10%) of the tracer. A cardboard box, a plastic pail, or even a garbage bag can serve to keep the tracer gas in contact with the probe during the testing. If there are concerns about infiltration of ambient air through other parts of the sampling train (such as around the fittings, not just at the probe/ground interface), then consideration should be given to ensuring that the tracer gas is in contact with the entire sampling apparatus. In these cases, field personnel may prefer to use a liquid tracer — soaking paper towels with a liquid tracer and placing the towels around the probe/ground interface, around fittings, and/or in the corner of a shroud.

There are two basic approaches to testing for the tracer gas:

1. include the tracer gas in the list of target analytes reported by the laboratory; or
2. use a portable monitoring device to analyze a sample of soil vapor for the tracer prior to and after sampling for the compounds of concern. (Note that the tracer gas samples can be collected via syringe, Tedlar® bag etc. They need not be collected in Summa® canisters or minicans.)

The advantage of the second approach is that the real time tracer sampling results can be used to confirm the integrity of the probe seals prior to formal sample collection.

Figure 2.4 depicts common methods for using tracer gas. In examples a, b and c, the tracer gas is released in the enclosure prior to initially purging the sample point. Care should be taken to avoid excessive purging prior to sample collection. Care should also be taken to prevent pressure build-up in the enclosure during introduction of the tracer gas. Inspection of the installed sample probe, specifically noting the integrity of the surface seal and the porosity of the soil in which the probe is installed, will help to determine the tracer gas setup. Figure 2.4a may be most effective at preventing tracer gas infiltration, however, it may not be appropriate in some situations depending on site-specific conditions. Figures 2.4b and 2.4c may be sufficient for probes installed in tight soils with well-constructed surface seals. Figure 2d provides an example of using a liquid tracer. In all cases, the same tracer gas application should be used for all probes at any given site.

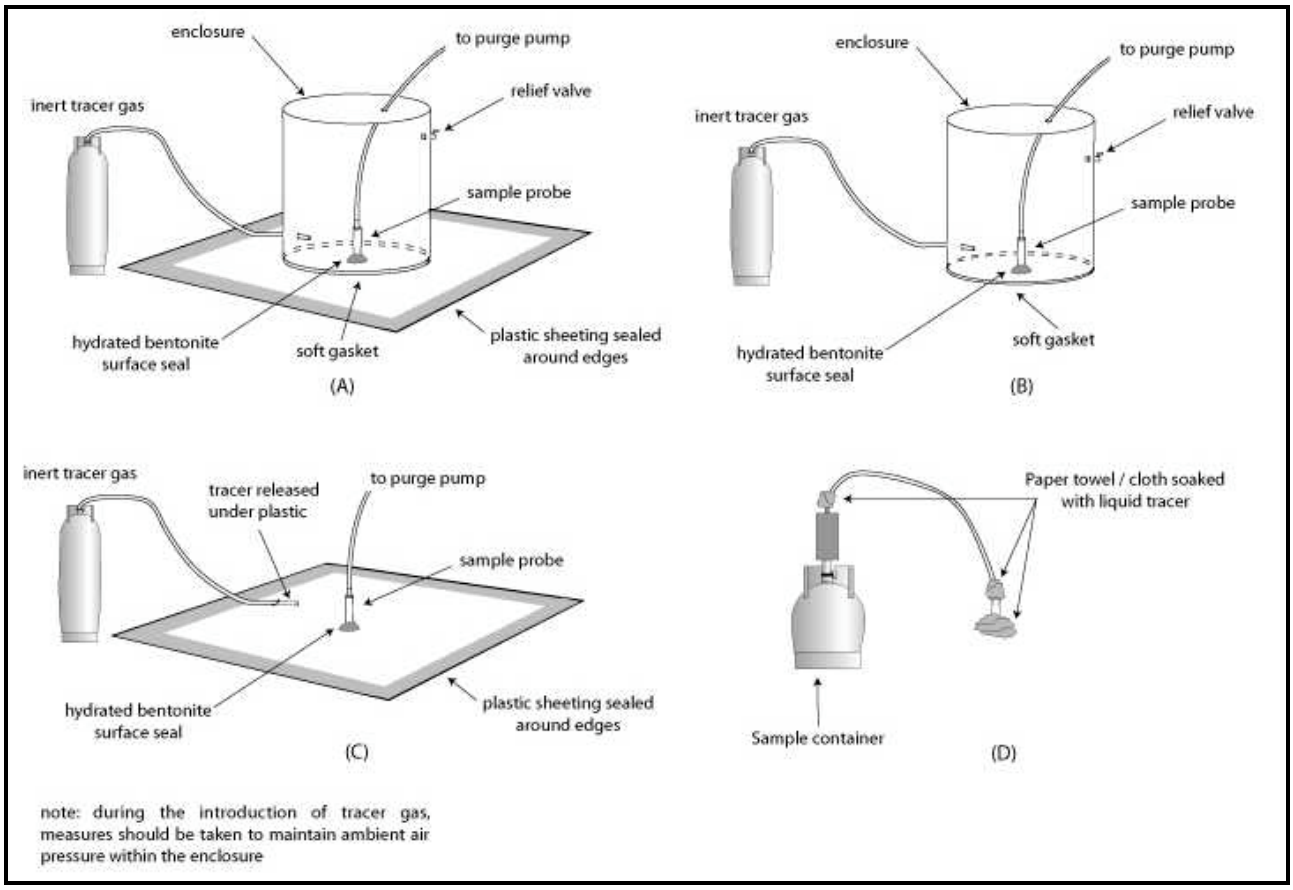

Figure 2.4
Schematics of generic tracer gas applications when collecting soil vapor samples

Because minor leakage around the probe seal should not materially affect the usability of the soil vapor sampling results, the mere presence of the tracer gas in the sample should not be a cause for alarm. Consequently, portable field monitoring devices with detection limits in the low ppm range are more than adequate for screening samples for the tracer. If high concentrations (> 10%) of tracer gas are observed in a sample, the probe seal should be enhanced to reduce the infiltration of outdoor air.

Where permanent or semi-permanent sampling probes are used, tracer gas samples should be collected at each of the sampling probes during the initial stages of a soil vapor sampling program. If the results of the initial samples indicate that the probe seals are adequate, reducing the number of locations at which tracer gas samples are employed may be considered. At a minimum, tracer gas samples should be collected with at least 10% of the soil vapor samples collected in subsequent sampling rounds. When using permanent soil vapor probes as part of a long-term monitoring program, annual testing of the probe integrity is recommended. Where temporary probes are used, tracer gas should be used at every sampling location, every time.

2.8 Quality assurance / quality control (QA / QC)

[Reference: NYSDOH's *Indoor Air Sampling & Analysis Guidance (February 1, 2005)*]

In general, appropriate QA/QC procedures should be followed during all aspects of sample collection and analysis to ensure that sampling error is minimized and high quality data are obtained. Sampling team members should avoid actions (e.g., fueling vehicles, using permanent marking pens, wearing freshly dry-cleaned clothing or personal fragrances, etc.) which can cause sample interference in the field. Portable air monitoring equipment or field instrumentation should be properly maintained, calibrated and tested to ensure validity of measurements. Air sampling equipment should be stored, transported and between samples decontaminated in a manner consistent with the best environmental consulting practices to minimize problems such as field contamination and cross-contamination. Samples should be collected using certified clean sample devices. Where applicable, steps should be taken to ensure that the gas used by the laboratory to clean the sample device is different from the gas used as a tracer during sampling (e.g., helium). Samples should meet sample holding times and temperatures, and should be delivered to the analytical laboratory as soon as possible after collection. In addition, laboratory accession procedures should be followed, including field documentation (sample collection information and locations), chain of custody, field blanks, field sample duplicates and laboratory duplicates, as appropriate.

Some methods call for collecting samples in duplicate (e.g., indoor air sampling using passive sampling devices for tetrachloroethene) to assess errors. Duplicate and/or split samples should be collected in accordance with the sampling and analytical methods being implemented.

For certain regulatory programs, a Data Usability Summary Report (DUSR) or equivalent report may be required to determine whether or not the data, as presented, meets the site or project specific criteria for data quality and data use. This requirement may dictate the level of QC and the category of data deliverable to request from the laboratory. Guidance on preparing these reports is available by contacting the NYSDEC's Division of Environmental Remediation.

New York State Public Health Law requires laboratories analyzing environmental samples collected from within New York State to have current Environmental Laboratory Approval Program (ELAP) certification for the appropriate analyte and environmental matrix combinations. If ELAP certification is not currently required for an analyte (e.g., trichloroethene), the analysis should be performed by a laboratory that has ELAP certification for similar compounds in air and uses analytical methods with minimum reporting limits similar to background (e.g., tetrachloroethene via EPA Method TO-15). Questions about a laboratory's current certification status should be directed to an ELAP representative at 518-485-5570 or by email at elap@health.state.ny.us.

The work plan should state that all samples that will be used to make decisions on appropriate actions to address exposures and environmental contamination will be analyzed by an ELAP-certified laboratory. The name of the laboratory should also be provided. Similarly, the name of the laboratory that was used should be included in the report of the sampling results. For samples collected and tested in the field for screening purposes by using field testing technology, the qualifications of the field technician should be documented in the work plan.

2.9 Analytical methods

[Reference: NYSDOH's *Indoor Air Sampling & Analysis Guidance (February 1, 2005)*]

Proposed analytical procedures should be identified in work plans. Similarly, the analytical procedures that were used and corresponding reporting limits should be identified when reporting the sampling results. When selecting an appropriate analytical method, the data quality objectives should be considered. As described in Section 3, comparing sampling results for volatile chemicals with background concentrations and with indoor air/sub-slab vapor matrices are critical components of the data evaluation process. Therefore, samples should be analyzed by methods that can achieve minimum reporting limits to allow for comparison of the results with background levels and with the levels presented in the matrices [Section 3.4.2]. If there are additional data quality objectives, they should be considered also. Typically, a minimum reporting limit of 1 microgram per cubic meter (1 mcg/m^3) or less is sufficient for most analytes. Examples of commonly used analytical methods include the following:

a. EPA Method TO-15 for a wide range of VOCs (e.g., samples from evacuated canisters),

b. NYSDOH Method 311-9 for tetrachloroethene (i.e., samples from perc badges),

c. EPA Method TO-17 for VOCs (e.g., samples collected with sorbent tubes), and

d. EPA Method TO-15 for VOCs with selective ion monitoring (SIM) (e.g., to achieve minimum reporting limits lower than those achieved with Method TO-15 alone).

The laboratory should verify that they are capable of detecting the appropriate analytes and can report them at the appropriate reporting limit.

2.9.1 Subsurface vapor

Soil vapor and sub-slab vapor samples should be analyzed for a wide range of volatile chemicals during the first round of sampling (at a minimum) — unless it can be demonstrated that an abbreviated or site-specific analyte list is appropriate. This is analogous to analyzing groundwater samples for a suite of compounds (e.g., EPA's target analyte list/target compound list (TAL/TCL) chemicals) during the initial rounds of site characterization. Based on the initial sampling results, development and application of a site-specific analyte list may be considered for analysis of subsequent soil vapor and sub-slab vapor samples.

If a site-specific analyte list is developed, it should include the following:

a. volatile chemicals which have been previously detected in environmental media (e.g., soil, groundwater and air) at the site;

b. volatile chemicals which are known or demonstrated constituents of the contamination in question (e.g., petroleum products or tars from former manufactured gas plants); and

c. expected degradation products of the chemicals mentioned in a or b.

A site-specific analyte list might also include indicator compounds to assist in identifying and differentiating subsurface sources of volatile chemical contamination. The following are examples of indicator compounds that have been included in site-specific analyte lists given the nature of the contamination or type of site:

a. gasoline: benzene, toluene, ethylbenzene, xylenes, trimethylbenzene isomers, individual C-4 to C-8 aliphatics (e.g., hexane, cyclohexane, dimethylpentane, 2,2,4-trimethylpentane, etc.), and appropriate oxygenate additives (e.g., methyl-*tert*-butyl ether, ethanol, etc.);

b. middle distillate fuels (#2 fuel oil, diesel and kerosene): n-nonane, n-decane, n-undecane, n-dodecane, ethylbenzene, xylenes, trimethylbenzene isomers, tetramethylbenzene isomers, naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene;

c. manufactured gas plant sites: trimethylbenzene isomers, tetramethylbenzene isomers, thiopenes, indene, indane, and naphthalene;

d. natural gas: propane, propene, butane, iso-butane, methylbutane, and n-pentane with lower levels of higher molecular weight aliphatic, olefinic, and some aromatic compounds; and

e. solvent-using industries: the solvent and its expected degradation products (e.g., tetrachloroethene, trichloroethene, dichloroethene(s), and vinyl chloride).

2.9.2 Indoor air

Indoor and outdoor air samples should be analyzed for a wide range of volatile chemicals if there are no existing data for subsurface vapors — unless it can be demonstrated that an abbreviated or site-specific analyte list is appropriate. If indoor air sampling is appropriate based on the levels of volatile chemicals in subsurface vapors, analysis of indoor air samples specifically for those volatile chemicals may be considered.

2.9.3 Outdoor air

Outdoor air samples should be analyzed in a manner consistent with corresponding indoor air samples.

2.10 Field laboratories and mobile gas chromatographs (GCs)

Use of field laboratories and mobile GCs as screening tools when collecting soil vapor samples may be considered on a site-specific basis. However, without ELAP certification, screening tools such as these are not acceptable when collecting sub-slab vapor, indoor air and outdoor air samples for the purpose of evaluating exposures related to soil vapor intrusion. ELAP certification for a particular laboratory does not indicate mobile laboratory or GC certification. Mobile laboratories and GCs have specific certification requirements through ELAP. Questions regarding a mobile laboratory's certification should be directed to the laboratory itself.

2.11 Surveys and pre-sampling building preparation

[Reference: NYSDOH's *Indoor Air Sampling & Analysis Guidance (February 1, 2005)*]

2.11.1 Pre-sampling building inspection and preparation

A pre-sampling inspection should be performed prior to each sampling event to identify and minimize conditions that may interfere with the proposed testing. The inspection should evaluate the type of structure, floor layout, air flows and physical conditions of the building(s) being studied. This information, along with information on sources of potential

indoor air contamination [Section 2.11.2], should be identified on a building inventory form. An example of a building inventory form is given in Appendix B. Items to be included in the building inventory include the following:

a. construction characteristics, including foundation cracks and utility penetrations or other openings that may serve as preferential pathways for vapor intrusion;

b. presence of an attached garage;

c. recent renovations or maintenance to the building (e.g., fresh paint, new carpet or furniture);

d. mechanical equipment that can affect pressure gradients (e.g., heating systems, clothes dryers or exhaust fans);

e. use or storage of petroleum products (e.g., fuel containers, gasoline operated equipment and unvented kerosene heaters); and

f. recent use of petroleum-based finishes or products containing volatile chemicals.

Each room on the floor of the building being tested and on lower floors, if possible, should be inspected. This is important because even products stored in another area of a building can affect the air of the room being tested.

The presence and description of odors (e.g., solvent, moldy) and portable vapor monitoring equipment readings (e.g., PIDs, ppbRAE, Jerome Mercury Vapor Analyzer, etc.) should be noted and used to help evaluate potential sources. This includes taking readings near products stored or used in the building. Where applicable, readings should be provided in units that denote the calibration gas (e.g., isobutylene-equivalent ppm, benzene-equivalent ppm, etc.).

Potential interference from products or activities releasing volatile chemicals should be controlled to the extent practicable. Removing the source from the indoor environment prior to testing is the most effective means of reducing interference. Ensuring that containers are tightly sealed may be sufficient. When testing for volatile organic compounds, containers should be tested with portable vapor monitoring equipment to determine whether compounds are leaking. The inability to eliminate potential interference may be justification for not testing, especially when testing for similar compounds at low levels. The investigator should consider the possibility that chemicals may adsorb onto porous materials and may take time to dissipate.

In some cases, the goal of the testing is to evaluate the impact from products used or stored in the building (e.g., pesticide misapplications, school renovation projects). If the goal of the testing is to determine whether products are an indoor volatile chemical contaminant source, the removing these sources does not apply.

Once interfering conditions are corrected (if applicable), ventilation may be appropriate prior to sampling to minimize residual contamination in the indoor air. If ventilation is appropriate, it should be completed 24 hours or more prior to the scheduled sampling time. Where applicable, ventilation can be accomplished by operating the building's HVAC system to maximize outside air intake. Opening windows and doors, and operating exhaust fans may also help or may be appropriate if the building has no HVAC system.

Air samples are sometimes designed to represent typical exposure in a mechanically ventilated building and the operation of HVAC systems during sampling should be noted on

the building inventory form [Appendix B]. When samples are collected, the building's HVAC system should be operating in a manner consistent with normal operating conditions when the building is occupied (e.g., schools, businesses, etc.). Unnecessary building ventilation should be avoided within 24 hours prior to and during sampling. During colder months, heating systems should be operating to maintain normal indoor air temperatures (i.e., 65 – 75 °F) for at least 24 hours prior to and during the scheduled sampling time.

Depending upon the goal of the indoor air sampling, some situations may warrant deviation from the above protocol regarding building ventilation. In such cases, building conditions and sampling efforts should be understood and noted within the framework and scope of the investigation.

To avoid potential interferences and dilution effects, occupants should make a reasonable effort to avoid the following for 24 hours prior to sampling:

a. opening any windows, fireplace dampers, openings or vents;
b. operating ventilation fans unless special arrangements are made;
c. smoking in the building;
d. painting;
e. using a wood stove, fireplace or other auxiliary heating equipment (e.g., kerosene heater);
f. operating or storing automobile in an attached garage;
g. allowing containers of gasoline or oil to remain within the house or garage area, except for fuel oil tanks;
h. cleaning, waxing or polishing furniture, floors or other woodwork with petroleum- or oil-based products;
i. using air fresheners, scented candles or odor eliminators;
j. engaging in any hobbies that use materials containing volatile chemicals;
k. using cosmetics including hairspray, nail polish, nail polish removers, perfume/cologne, etc.;
l. lawn mowing, paving with asphalt, or snow blowing;
m. applying pesticides;
n. using building repair or maintenance products, such as caulk or roofing tar; and
o. bringing freshly dry-cleaned clothing or furnishings into the building.

2.11.2 Product inventory

The primary objective of the product inventory is to identify potential air sampling interference by characterizing the occurrence and use of chemicals and products throughout the building, keeping in mind the goal of the investigation and site-specific contaminants of concern. For example, it is not appropriate to provide detailed information for each individual container of like items. However, it is appropriate to indicate that "20 bottles of perfume" or "12 cans of latex paint" were present with containers in good condition. This information is used to help formulate an indoor environment profile.

An inventory should be provided for each room on the floor of the building being tested and on lower floors, if possible. This is important because even products stored in another area of a building can affect the air of the room being tested.

The presence and description of odors (e.g., solvent, moldy) and portable vapor monitoring equipment readings (e.g., PIDs, ppbRAE, Jerome Mercury Vapor Analyzer, etc.) should be noted and used to help evaluate potential sources. This includes taking readings near products stored or used in the building. Where applicable, readings should be provided in units that denote the calibration gas (e.g., isobutylene-equivalent ppm, benzene-equivalent ppm, etc.).

Products in buildings should be inventoried every time air is tested to provide an accurate assessment of the potential contribution of volatile chemicals. If available, chemical ingredients of interest (e.g., analyte list) should be recorded for each product. If the ingredients are not listed on the label, record the product's exact and full name, and the manufacturer's name, address and telephone number, if available. In some cases, material Safety Data Sheets may be useful for identifying confounding sources of volatile chemicals in air. Adequately documented photographs of the products and their labeled ingredients can supplement the inventory and facilitate recording the information.

2.12 Role of modeling

At sites where there is a potential for human exposures to subsurface contamination due to soil vapor intrusion (as described in Section 2.1), use of modeling as the sole means of evaluating potential exposures should be avoided. The limitations of modeling (e.g., exclusion of preferential migration pathways) introduce uncertainty as to whether human exposure is occurring, in absence of actual field data. Conclusions drawn from modeling should be verified with actual field data. For example, if modeling results indicate indoor air concentrations are predicted to be below applicable guidelines or levels of concern, indoor air and/or sub-slab vapor sampling would be appropriate to verify a conclusion that mitigation or other actions are not needed.

Modeling may, however, be used as a tool in the evaluation process. Examples of situations in which modeling may be used as a tool include, but are not limited to, the following:

a. to help identify potential migration pathways on the basis of site-specific conditions;

b. to estimate potential exposures when field samples cannot be collected (e.g., access to collect the samples is denied or buildings have not yet been constructed over the subsurface contamination); and

c. to identify a preferred order for sampling buildings by predicting expected indoor air concentrations within each of the buildings if there are numerous buildings overlying the subsurface contamination.

Use of any model at a site should be discussed with the agencies prior to the model's development and application. If a model is used, it should incorporate site-specific parameters (e.g., attenuation factors, soil conditions, concentrations of volatile chemicals, depth to subsurface source, characteristics of subsurface source, and foundation slab thickness) as much as possible. Furthermore, both the limitations of the model (e.g., exclusion of preferential migration pathways) and the sensitivity of the variables in the model should be understood and identified with the modeling results.

Section 3: Data Evaluation and Recommendations for Action

Section 3 describes the process by which data obtained during the investigation are evaluated. The goals of the evaluation are as follows:

a. to determine what volatile chemicals, if any, are present in the investigated media;

b. to identify the likely cause(s) of their presence; and

c. to identify completed and potential human exposures whether actions to address exposures should be taken.

Also discussed are actions typically recommended based on the evaluation. Actions to remediate the source(s) of soil vapor contamination, such as soil excavation or air-sparge/soil vapor extraction systems, are beyond the scope of this guidance and are not included.

3.1 Data quality

Before the data are evaluated, their representativeness and reliability should be verified. To assess analytical errors and the usability of the data, a qualified person should review the analytical data package and all associated QA/QC information to make sure that

a. the data package is complete;

b. holding times have been met;

c. the QC data fall within the protocol limits and specifications;

d. the data have been generated using established and agreed upon analytical protocols;

e. the raw data confirm the results provided in the data summary sheets and QC verification forms; and

f. correct data qualifiers have been used.

As discussed in Section 2.8, for sites in an environmental remediation program (e.g., State Superfund), a DUSR or equivalent report should be generated in accordance with NYSDEC guidance and should be submitted for regulatory review and approval.

If the investigation was not completed in accordance with the guidelines set forth in Section 2, additional investigation may be appropriate to either replace or complement the existing data. For example, product inventories [Section 2.11.2] filled out incompletely or incorrectly may need to be redone (and in some cases with additional air sampling) so that likely sources of volatile chemicals in the indoor air can be identified and appropriate actions to mitigate exposures can be recommended.

3.2 Overview

The results of individual soil vapor, sub-slab vapor, indoor air and outdoor air samples are not reviewed in isolation. Rather, they are evaluated with the consideration of several additional factors, which include the following:

a. the nature and extent of contamination in *all* environmental media;

b. factors that affect vapor migration and intrusion;

c. completed or proposed remedial actions;

d. sources of volatile chemicals;

e. background levels of volatile chemicals in air;

f. relevant standards, criteria and guidance values; and

g. past, current and future land uses.

These factors are described in detail in this subsection.

3.2.1 Nature and extent of contamination in all environmental media

The type of volatile chemicals present and the extent of contamination in all environmental media — including soil, groundwater, subsurface vapors, indoor air and outdoor air — is considered when evaluating the data. Trends in environmental data (e.g., groundwater monitoring results show concentrations of volatile chemicals are decreasing) are also considered. This information is used to identify possible sources of contamination and migration pathways, as well as to recommend appropriate actions to address exposures.

3.2.2 Factors that affect vapor migration and intrusion

As discussed in Section 1.3, there are numerous site-specific environmental factors [Table 1.1] and building factors [Table 1.2] that can affect soil vapor migration and intrusion. This information is used to identify possible sources of contamination and migration pathways, as well as to recommend appropriate actions to address exposures.

3.2.3 Sources of volatile chemicals

An understanding of the likely sources of the chemicals is crucial for determining appropriate actions to address exposure, as well as identifying the parties responsible for implementing the actions. Volatile chemicals that are not site-related may be present in the investigated media for reasons such as the following:

a. *subsurface vapors* — misuse, misapplication, or improper disposal of the chemicals to the subsurface, unidentified subsurface sources of vapor contamination, presence of septic systems (where products, such as cleaning agents or degreasers, may be disposed), biodegradation of natural organic matter in soil, infiltration into the subsurface from a building under positive pressure in which the chemicals are heavily used (i.e., reverse process from soil vapor intrusion), etc.;

b. *indoor air* — use and storage (current or historic) of volatile chemical-containing products, off-gassing from building materials or new furnishings, use of contaminated groundwater during private well usage, infiltration of outdoor air containing volatile chemicals, etc. [Table 1.3]; and

c. *outdoor air* — emissions from automobiles, lawn mowers, oil storage tanks, gasoline stations, dry cleaners or other commercial/industrial facilities, etc. [Table 1.3].

Site-related chemicals may also be present for these same reasons. Information about household products and their ingredients are available on web sites, such as the National Institute of Health's site at http://householdproducts.nlm.nih.gov.

3.2.4 Background levels of volatile chemicals in air

Chemicals are part of our everyday life [Section 1.4]. As such, they are found in the indoor air of buildings not affected by intrusion of contaminated soil vapor. They are also found in the outdoor air that enters a home or place of business. Commonly found concentrations of these chemicals in indoor and outdoor air are referred to as "background levels." Background levels of volatile chemicals are one of the factors considered when evaluating sampling results at a site [Section 3.3.2 – 3.3.4]. Estimates of background levels come from studies where air samples were collected in homes, offices and outdoor areas.

Several studies have been conducted, both nationally and in the State of New York, to provide information on indoor and outdoor air background levels in a variety of settings (e.g., residential or commercial buildings). Each of these studies offers useful information and has its own limitations. Each database provides statistical measures of background levels and the criteria used to select sampling locations. The criteria in some of the studies required that sampling locations not be located near known sources of volatile chemicals (for example, not near a chemical spill, hazardous waste site, dry-cleaner, or factory). The criteria may also have included checking containers of volatile chemicals in or near the building to make sure they are tightly closed or removing those products before samples are taken. Depending on the criteria for site selection and sampling conditions, statistical measures of background levels in a given study may differ from what would be expected if indoor air were sampled in randomly selected homes.

The background databases that are used for evaluating indoor and outdoor air data are introduced below. A more detailed description of each database along with statistical measures of background levels are provided in Appendix C.

a. *NYSDOH 2003: Study of Volatile Organic Chemicals in Air of Fuel Oil Heated Homes*

   Results of indoor and outdoor air samples collected from 104 single-family fuel oil heated homes throughout New York State. Samples collected in evacuated canisters and analyzed for 69 aromatic, aliphatic, and halogenated hydrocarbons, and ketones by modified EPA Method TO-15. Limitations: only fuel oil heated homes were included, homes were not randomly selected, and five boroughs of New York City were excluded.

b. *EPA 2001: Building Assessment and Survey Evaluation (BASE) Database*

   Study of measured concentrations of volatile organic compounds from 100 randomly selected public and commercial office buildings. Samples collected by evacuated canisters and/or tube methodologies. Limitations: only represents office settings, two methodologies used for sampling and analysis that are not completely overlapping and do not show agreement in results in some cases.

c. *NYSDOH 1997: Control Home Database*

   Indoor and outdoor air samples compiled from 53 residences in New York State that were considered "control Homes" with neighborhood, construction, and occupancy similar to potentially impacted homes that were being investigated at the time. Limitations: multiple methodologies for sampling and analysis, small sample size, and varying detection limits often higher than current background levels.

d. *EPA 1988: National Ambient Volatile Organic Compounds (VOCs) Data Base Update*

   Published and unpublished air data compiled by the EPA in 1988. The document includes data from studies between 1970 to 1987. The database covers more than

300 chemicals in indoor and outdoor settings. Limitations: data are compiled from numerous studies with limitations on selection or screening criteria, data are 20-35 years old, indoor air data include both residential and office spaces, sample size for some analytes is very small (less than 10). Outdoor air data include rural, suburban, urban, source dominated and remote locations.

e. *Health Effects Institute (HEI) 2005: Relationship of Indoor, Outdoor, and Personal Air (RIOPA)*

Indoor, outdoor and personal air concentrations of 18 VOCs, 10 carbonyl compounds and particulate matter (PM2.5) were measured in 100 homes in each of 3 cities between the summer of 1999 and the spring of 2001. Limitations: limited numbers of VOCs, passive organic vapor badge method is subject to sampling bias in stationary versus mobile locations, the passive organic vapor badge method is only approved for tetrachloroethene in New York State.

Among the databases, the Upper Fence (see *NOTE below) values from the NYSDOH Fuel Oil Study data may be used as initial benchmarks when evaluating residential indoor air (see Appendix C.1) and the 90th percentile values from the EPA BASE data for indoor air in office and commercial buildings (see Appendix C.2). These initial benchmark values should be considered along with the overall distribution of results in the background database to characterize sampling results from a single building or from multiple buildings in a community. The Health Effects Institute 2005 database and the older NYSDOH and EPA databases can also provide useful information on the range of concentrations found in air. The database or combination of databases that best represents site-specific conditions should be used as the basis for comparison. State agency personnel should review and have the opportunity to comment on the proposed use of other databases or subsets of data within a database for evaluating test results.

*NOTE: The Upper Fence is calculated as 1.5 times the interquartile range (difference between the 25th and 75th percentile values) above the 75th percentile value. It is a boundary estimate used to account for outliers in the data.

3.2.5 Relevant standards, criteria and guidance values

a. *Subsurface vapors*

The State of New York does not have any standards, criteria or guidance values for concentrations of volatile chemicals in subsurface vapors (either soil vapor or sub-slab vapor).

b. *Indoor and outdoor air*

The NYSDOH has developed several guidelines for chemicals in air. The development process is initiated for specific situations. For example, in New York State, particularly in New York City, dry cleaners are often located in apartment buildings. Because air in buildings mixes to some extent and the dry cleaning chemical tetrachloroethene (PCE) is volatile, it may migrate to residential apartments. When the NYSDOH became aware of this problem and how widespread it is, the NYSDOH developed an air guideline for PCE of 100 micrograms per cubic meter (mcg/m^3). In addition to PCE, the NYSDOH has developed guidelines for methylene chloride (also referred to as dichloromethane) and trichloroethene (TCE) in air, as well as dioxin and polychlorinated biphenyls (PCBs) in indoor air. Each guideline went through a peer review process, in which expert scientists outside of the NYSDOH reviewed the technical documentation that describes

the scientific basis for the guidance value. The peer reviewers provided technical comments on the data and methods used to derive the guidelines, each of which were addressed by the NYSDOH. Upon completion of the reviews and responses to comments, the guidelines were finalized.

Air guideline values derived by the NYSDOH are summarized in Table 3.1. Additional information about these guidelines is provided in the following:

- Appendix D — overview of how the NYSDOH develops air guidelines; and
- Appendix H — copies of fact sheets that discuss the air guidelines for PCE and TCE.

The purpose of a guideline is to help guide decisions about the nature of efforts to reduce exposure to the chemical. Reasonable and practical actions should be taken to reduce exposures when indoor air levels are above background, even when they are below the guideline. The urgency to complete these actions increases with indoor air levels, particularly when air levels are above the guideline, and additional actions taken if the initial actions do not sufficiently reduce levels. In all cases, the specific corrective actions to be taken depend on a case-by-case evaluation of the situation. The goal of the recommended actions is to reduce chemical levels in indoor air to as close to background as practical.

Table 3.1 Air guideline values derived by the NYSDOH

Chemical		Air Guideline Value (mcg/m^3)	Reference
methylene chloride (also referred to as dichloromethane)	MeCl	60	1
polychlorinated biphenyls	PCBs	1*	2,3
tetrachlorodibenzo-*p*-dioxin equivalents	TCDD	0.00001*	3,4
tetrachloroethene	PCE	100	5
trichloroethene	TCE	5	6,7

*The guideline is specific to indoor air.

References:

[1] NYSDOH. 1988. Letter from N. Kim to T. Allen, Division of Air, New York State Department of Environmental Conservation. November 28, 1988.
[2] NYSDOH. 1985. Binghamton State Office Building (BSOB) Re-Entry Guidelines: PCBs. Document 1330P. Albany, NY: Bureau of Toxic Substance Assessment.
[3] NYSDOH. 1988. Letter from D. Axelrod to J. Egan, New York State Office of General Services. March 8, 1988.
[4] NYSDOH. 1984. Re-Entry Guidelines. Binghamton State Office Building. Document 0549P. Albany, NY: Bureau of Toxic Substance Assessment.
[5] NYSDOH. 1997. Tetrachloroethene Ambient Air Criteria Document. Albany, NY: Bureau of Toxic Substance Assessment.
[6] NYSDOH. 2003. Letter from N. Kim to D. Desnoyers, Division of Environmental Remediation, New York State Department of Environmental Conservation. October 31, 2003. [Provided in Appendix D.]
[7] NYSDOH. 2006. Final Report: Trichloroethene (TCE) Air Criteria Document. Center for Environmental Health, Bureau of Toxic Substance Assessment. Troy, NY.

3.2.6 Completed or proposed remedial actions

The status and effectiveness of actions taken to remediate environmental contamination (e.g., soil removal, groundwater treatment, soil vapor extraction, etc.) are considered when making decisions pertaining to additional sampling and the selection of mitigation actions. For example,

a. if a comparison of pre-remediation and post-remediation subsurface vapor sampling results indicates negligible improvement in the quality of subsurface vapors,
    1. additional sampling may be appropriate to document a decreasing trend in subsurface vapor concentrations;
    2. termination of mitigation system operations may not be appropriate without additional sampling; or
    3. additional remedial actions may be appropriate to address contaminated subsurface vapors;
b. when monitoring a building is appropriate, it may be more cost-effective to install a mitigation system if subsurface contamination is wide-spread and is expected to take many years to remediate; and
c. if exposures in an on-site building will be addressed concurrently by a method selected to remediate subsurface contamination (e.g., a soil vapor extraction system), installation of a mitigation system may be redundant. However, if the remedial system is not expected to be operational in the immediate future, or if it is not expected to mitigate indoor air levels in a reasonable time frame, a mitigation system may still be appropriate. [Refer to Section 4.1 for a description of the appropriate use of concurrent techniques.]

3.2.7 Past, current and future land uses

Past, current and future land uses are considered when evaluating the investigation data and determining appropriate actions for further investigation or measures to address exposures. For example,

a. if the parcel or buildings were historically used for commercial or industrial purposes (e.g., gasoline station, automotive repair facility, electroplating facility, etc.), but are currently used for residential purposes or commercial or industrial purposes where volatile chemicals are not used in current operations, off-gassing of volatile chemicals from building materials [Table 1.3] or additional subsurface sources should be considered;
b. subsurface vapor sampling of a parcel that is undeveloped or contains unoccupied buildings may be appropriate based on the data evaluation. However, sampling may be delayed as discussed in Section 2.3;
c. air sampling of a building may be appropriate based on the data evaluation. However, provisions may be put in place to defer sampling until occupancy of the building is expected; or
d. if actions should be taken to mitigate exposures related to soil vapor intrusion should the site be developed, the appropriate mitigation method will depend upon the proposed land use — a parking lot, recreational field, single-family home, commercial building, high-rise building with underground parking, occupied or unoccupied building, etc. — since each presents a different exposure scenario.

3.3 Sampling results and recommended actions

This subsection describes the process for evaluating sampling results. It also describes actions that may be recommended based on the evaluation. The evaluation procedures and actions described may not be directly applicable to samples collected as part of an emergency response. For guidance on how to proceed in such situations, refer to Section 3.5.

3.3.1 Soil vapor

If soil vapor samples are collected from locations where there are no known sources of volatile chemicals, we do not expect the chemicals to reach detectable levels in the samples. However, concentrations of volatile chemicals in soil vapor are commonly detected. This is likely due to several factors, including infiltration of outdoor air into the subsurface (to a limited extent) and background interferences (similar to indoor and outdoor air [Section 3.2.4]).

New York State currently does not have any standards, criteria or guidance values for concentrations of compounds in soil vapor. Additionally, there are currently no databases available of background levels of volatile chemicals in soil vapor. In the absence of this information, soil vapor sampling results are reviewed "as a whole," in conjunction with the results of other environmental sampling and the site conceptual model, to identify trends and spatial variations in the data [Section 3.2.1]. To put some perspective on the data, soil vapor results might be compared to background outdoor air levels [Section 3.2.4], site-related outdoor air sampling results, or the NYSDOH's guidelines for volatile chemicals in air [Table 3.1].

These comparisons are used to

a. identify areas of relatively elevated concentrations of volatile chemicals in soil vapor;
b. select buildings for sub-slab vapor, indoor air and outdoor air sampling;
c. identify possible sources of subsurface vapor contamination;
d. monitor the progress, or verify the completion, of efforts to remediate subsurface vapor contamination (either directly or indirectly); and
e. characterize the nature and extent of subsurface vapor contamination.

When determining appropriate actions, the following should also be considered:

a. Soil vapor results may not indicate a traditional plume-like pattern of contamination (as is often described for groundwater). Rather, the nature and extent of contamination may follow a "hit and miss" pattern.

b. Our experience to date indicates soil vapor results alone typically cannot be relied upon to rule out sampling at nearby buildings. For example, concentrations of volatile chemicals in sub-slab vapor samples have been substantially higher (e.g., by a factor of 100 or more) than concentrations found in nearby soil vapor samples (e.g., collected at 8 feet below grade near the building). This may be due to differences in factors such as soil moisture content and pressure gradients. Therefore, exposures are evaluated primarily based on sub-slab vapor, indoor air and outdoor air sampling results and soil vapor results are primarily used as a tool to guide these investigations.

There are no concentrations of volatile chemicals in soil vapor that automatically trigger action or no further action. Based on the comparisons and considerations described, the following actions may be recommended:

a. *No further soil vapor sampling*

The nature and extent of subsurface vapor contamination has been adequately characterized with respect to addressing exposures and designing measures to remediate subsurface vapor contamination (either directly or indirectly).

Sub-slab vapor samples, rather than soil vapor samples, will be used to identify potential exposures and to characterize the nature and extent of subsurface vapor contamination since soil vapor results are not following a consistent pattern (i.e., hit and miss).

b. *Additional soil vapor sampling*

To characterize the nature and extent of subsurface vapor contamination if soil vapor results are following a consistent pattern (e.g., traditional plume-like pattern).

To identify possible sources of subsurface vapor contamination.

To verify sampling results that appear inconsistent with previous sampling and/or the current understanding of the site [Sections 3.2.1 and 3.2.2].

To resample locations where results may have been invalidated by short-circuiting (outdoor air infiltration), cross contamination, or other problems.

To monitor the progress, or verify the completion, of efforts to remediate subsurface vapor contamination (either directly or indirectly).

c. *Sub-slab vapor, indoor air and outdoor air sampling*

Generally, if soil vapor results are fairly consistent throughout the study area, buildings closest to the site are sampled first. The investigation then proceeds outward, as appropriate, on an areal basis until potential and current human exposures have been adequately addressed. If there is an area of relatively elevated concentrations of volatile chemicals in soil vapor (when looking at the soil vapor results as a whole), then the buildings in this area are also sampled.

d. *Address exposures related to soil vapor intrusion*

Provisions on parcels may be appropriate so that the parcel will not be developed or buildings occupied without addressing exposure concerns [Sections 2.3 and 3.6].

As discussed previously, soil vapor sampling results alone typically do not drive actions to mitigate exposures in existing buildings. Rather, they guide sampling efforts in buildings. However, a "blanket mitigation" approach may be taken provided the nature and extent of soil vapor contamination has been sufficiently characterized. A "blanket mitigation" approach is where an area is defined within which each building may be offered a mitigation system. The offer is made regardless of what actions may be appropriate based on an evaluation of air results (e.g., no further action or monitoring).

Notes:

a. The recommended actions may be modified or supported upon consideration of the factors given in Section 3.2.

b. Additional sampling may become appropriate based on the migration of subsurface contamination (e.g., contaminated groundwater or vapors) or if environmental monitoring indicates a change in chemical constituents (e.g., the production of degradation products that may be more toxic than the parent compounds).

3.3.2 Sub-slab vapor

The goals of collecting sub-slab vapor samples are to identify potential and current (when collected concurrently with indoor and outdoor air samples) exposures associated with soil vapor intrusion and to characterize the nature and extent of subsurface vapor contamination. As discussed in Sections 3.2.5 and 3.3.1, New York State currently does not have any standards, criteria or guidance values for concentrations of compounds in sub-slab vapor. Additionally, there are no databases available of background levels of volatile chemicals in subsurface vapors.

The detection of volatile chemicals in sub-slab vapor samples does not necessarily indicate soil vapor intrusion is occurring or actions should be taken to address exposures. When making these decisions, the State considers the following:

a. the sampling results — sub-slab vapor, indoor air, outdoor air, soil vapor;

b. background concentrations of volatile chemicals in indoor air;

c. the NYSDOH's guidelines for volatile chemicals in air [Table 3.1];

d. human health risks (i.e., cancer and non-cancer health effects) associated with exposure to the volatile chemical in air;

e. attenuation factors (i.e., the ratio of indoor air to sub-slab vapor concentrations),

f. the NYSDOH's decision matrices [described in Section 3.4], and

g. the factors described in Section 3.2.

Based on this evaluation, the following actions may be recommended:

a. *No further action*

When the volatile chemical is not detected in the indoor air and sub-slab sample results are not expected to substantially affect indoor air quality.

b. *Take reasonable and practical actions to identify source(s) and reduce exposures*

The concentration detected in the indoor air sample is likely due to indoor and/or outdoor sources rather than soil vapor intrusion given the concentration detected in the sub-slab vapor sample. Therefore, steps should be taken to identify potential source(s) and to reduce exposures accordingly (e.g., by keeping containers tightly capped or by storing volatile organic compound-containing products in places where people do not spend much time, such as a garage or outdoor shed). Resampling may be recommended to demonstrate the effectiveness of actions taken to reduce exposures.

c. *Resampling*

Resampling may also be recommended when the results are not consistent with the conceptual site model. For example, when the sub-slab vapor results of a building do not indicate a need to take action, but the sub-slab vapor results of adjacent buildings indicate a need to take actions to address exposures related to soil vapor intrusion.

Resampling may be appropriate if samples were collected outside of the heating season. As discussed in Section 2.4.2, results obtained outside of the heating season should not be used to rule out exposures related to soil vapor intrusion.

d. *Monitoring*

Monitoring, including sub-slab vapor, basement air, lowest occupied living space air, and outdoor air sampling, may be recommended to determine whether concentrations in indoor air or sub-slab vapor have changed. It is also recommended to determine what affect, if any, active soil and groundwater remediation techniques (e.g., chemical oxidation, air sparging, etc.) may be having on subsurface vapor and indoor air quality. The type and frequency of monitoring is determined on a site-specific and building-specific basis, taking into account applicable environmental data and building operating conditions.

e. *Mitigate*

Mitigation may be appropriate to minimize current or potential exposures associated with soil vapor intrusion. Mitigation methods are described in Section 4.

Notes:

a. The recommended actions may be modified or supported upon consideration of the factors given in Section 3.2.

b. Additional sampling may be appropriate based on the migration of subsurface contamination (e.g., contaminated groundwater or vapors) or if environmental monitoring indicates a change in chemical constituents (e.g., the production of degradation products that may be more toxic than the parent compounds).

c. Monitoring and mitigation measures to address exposures related to soil vapor intrusion are considered interim measures implemented until contaminated environmental media (e.g., soil, groundwater and/or soil vapor) are remediated.

d. Actions more protective of human health may be proposed. For example, such a decision may be based on a comparison of the costs associated with resampling or monitoring to the costs associated with installation and monitoring of a mitigation system.

e. Additional sampling associated with post-mitigation testing, operation, maintenance and monitoring activities, and termination of mitigation system operations is described in Section 4.

3.3.3 Indoor air

Indoor air samples are used to assess current exposures to volatile chemicals in air. The detection of volatile chemicals in indoor air samples does not necessarily indicate soil vapor intrusion is occurring or actions should be taken to address exposures. When making these decisions, the State considers the following:

a. the sampling results — sub-slab vapor, indoor air, outdoor air, soil vapor;

b. background concentrations of volatile chemicals in indoor air;

c. the NYSDOH's guidelines for volatile chemicals in air [Table 3.1];

d. human health risks (i.e., cancer and non-cancer health effects) associated with exposure to the volatile chemical in air;

e. attenuation factors (i.e., the ratio of indoor air to sub-slab vapor concentrations), and

f. the NYSDOH's decision matrices [described in Section 3.4], and

g. the factors described in Section 3.2.

When evaluating indoor air data, the results are compared to background levels of volatile chemicals in indoor air [Section 3.2.4], the NYSDOH's guidelines for volatile chemicals in air [Table 3.1], the NYSDOH's decision matrices [Section 3.4], and human health risks (i.e., cancer and non-cancer health effects) associated with exposure to the volatile chemical in air. This helps to put the results into perspective and to determine the need for action and the urgency with which actions should be taken. As discussed in Section 3.2.5, the urgency to complete reasonable and practical actions to reduce exposures increases with indoor air levels, particularly when air levels are above a guideline.

Generally, if the results are comparable to background levels, then no further action is needed to address *current* human exposures. However, additional sampling may be appropriate if

a. samples were collected at times when vapor intrusion is not expected to have its greatest effect on indoor air quality (typically, samples collected outside of the heating season). As discussed in Section 2.4, these results may not be used to rule out exposures related to soil vapor intrusion;

b. the potential for exposures related to soil vapor intrusion should be monitored based on the sub-slab vapor results [Section 3.3.2]; and/or

c. subsurface conditions change over time (e.g., due to the migration of contaminated groundwater or vapors).

If the concentrations of volatile chemicals are not consistent with background levels, then the likely cause of the exposure should be determined. Understanding the source is crucial for selecting the best method to address exposures. For example, although a volatile chemical may be detected in the sub-slab vapor sample, the results may indicate that indoor air effects are more likely to be coming from products stored in the building or from outdoor air rather than from contaminated soil vapors. Therefore, a sub-slab depressurization system to minimize exposures associated with soil vapor intrusion may not be appropriate.

As discussed in Sections 1.4 and 3.2.3, volatile chemicals may be present in the indoor air due to any one, or a combination, of the following:

a. the indoor environment itself and/or building characteristics;

b. off-gassing of volatile chemicals from contaminated water that may enter the building at the tap or shower head, or during flooding events, or contaminated water that rests in a sump or a subsurface drain;

c. outdoor sources; and/or

d. migration from the subsurface (i.e., soil vapor intrusion).

To determine the likely cause, the following assessment is completed:

a. qualitative and quantitative comparisons are made between the types and concentrations of the contaminants found in the indoor air sample(s) and those found in the outdoor air and sub-slab vapor sample;

b. qualitative and quantitative comparisons are made between indoor air results obtained in different locations of the building (e.g., different floors or rooms);

c. indoor air results are compared to the product inventory to evaluate the extent to which indoor sources are affecting indoor air quality; and

d. the indoor air quality questionnaire and building inventory form is reviewed to identify potential preferential pathways for soil vapor intrusion into the building, potential outdoor sources of volatile chemicals to the outdoor air (e.g., gasoline station or dry cleaner), and routes of air distribution within the building (e.g., HVAC system operations, airflow observations, etc.).

If a likely source or multiple sources can be identified from the available information, one or more of the following actions may be recommended given the source:

a. *Indoor source or building characteristics*

Products containing volatile chemicals should be tightly capped. Alternatively, the products can be stored in places where people do not spend much time, such as a garage or outdoor shed. If the products are no longer needed, consideration should be given to disposing of them properly (e.g., hazardous waste cleanup days). The list of products and corresponding readings from field instrumentation provided in the product inventory [Appendix B] can help identify products that may be contributing to the levels that were detected in the indoor air.

If exposures are assumed to be associated with off-gassing of new building materials, paint, etc., resampling may be appropriate to confirm this assumption or to confirm that actions taken to address these exposures have been effective.

b. *Off-gassing from contaminated groundwater within the building*

Measures should be taken to prevent contaminated groundwater from entering the house (e.g., filter on private well supply, sealed sump, etc.).

c. *Outdoor source*

No further action to address exposures related to soil vapor intrusion, unless the evaluation for soil vapor intrusion cannot be completed until outdoor interferences are addressed.

d. *Soil vapor intrusion*

Depending upon the relationship between indoor air concentrations and sub-slab vapor concentrations and the results of environmental sampling in the area, resampling, monitoring or mitigation may be recommended by the State.

1. Resampling, including sub-slab vapor, basement air, lowest occupied living space air, and outdoor air sampling, may be recommended when the results are not consistent with the conceptual site model. For example, when indoor air results are comparable or higher than the corresponding sub-slab vapor results and the results do not appear to be due to building characteristics or alternate sources (either indoor or outdoor).

2. Monitoring, including sub-slab vapor, basement air, lowest occupied living space air, and outdoor air sampling, may be recommended to determine whether concentrations in indoor air or sub-slab vapor have changed. It is also recommended to determine what affect, if any, active soil and groundwater remediation techniques (e.g., chemical oxidation, air sparging, etc.) may be having on subsurface vapor and indoor air quality. The type and frequency of monitoring is determined on a site-specific and building-specific basis, taking into account applicable environmental data and building operating conditions.

3. Methods to mitigate exposures related to soil vapor intrusion are described in Section 4.

The party responsible for implementing the recommended actions will differ depending upon several factors, including the identified source of the volatile chemicals, the environmental remediation program, and site-specific and building-specific conditions. For example, to the extent that all site data and site conditions demonstrate that soil vapor intrusion is not occurring and that the potential for soil vapor intrusion to occur is not likely, the vapor intrusion investigation would be considered complete. In general, if indoor exposures represent a concern due to indoor sources, then the State will provide guidance to the property owner and/or tenant on ways to reduce their exposure. If indoor exposures represent a concern due to outdoor sources, then the NYSDEC will decide who is responsible for further investigation and any necessary remediation. Depending upon the outdoor source, this responsibility may or may not fall upon the party conducting the soil vapor intrusion investigation.

Likely sources may not be evident given the information available. Therefore, the above recommendations cannot be made. This situation most often arises for the following reasons:

a. Interfering indoor sources are identified. However, the possibility of vapor intrusion cannot be ruled out due to the concentrations of the same volatile chemicals detected in the sub-slab vapor sample. Differentiating the contribution of each source is not possible.

b. Indoor air samples were collected without concurrent outdoor air and sub-slab vapor samples. Depending upon other information that may be available (e.g., building inventory and well-characterized subsurface vapor contamination), identifying likely sources and recommending appropriate actions may not be possible.

c. All appropriate air samples are collected. However, the indoor air quality questionnaire and building inventory forms are filled out incompletely or incorrectly. The contribution of indoor sources cannot be evaluated.

When the source(s) of volatile chemicals to indoor air cannot be identified with confidence, resampling is typically recommended with corrections made as appropriate. For example, using the three scenarios presented above:

a. resampling occurs after interferences are removed;

b. concurrent indoor air, outdoor air and sub-slab vapor samples are collected; and

c. an indoor air quality questionnaire and building inventory form is filled out completely and correctly when samples are collected.

Notes: See notes presented in Section 3.3.2.

3.3.4 Outdoor air

Outdoor air sampling results are primarily used to evaluate the extent to which outdoor air may be contributing to the levels of volatile chemicals detected in indoor air. However, people are also exposed to the outdoor air and the outdoor air results are indicative of outdoor air conditions. As such, outdoor air results are also reviewed to determine whether outdoor air conditions present a potential concern that requires further investigation.

As discussed in Sections 1.4 and 3.2.3, volatile chemicals may be present in outdoor air due to emissions from automobiles, lawn mowers, oil storage tanks, gasoline stations, and dry cleaners or other commercial and industrial facilities. To determine what extent, if any, outdoor air is affecting indoor air quality, indoor air results are compared to outdoor air results. To determine whether outdoor air conditions present a potential concern that requires further investigation, the State looks at the data set as a whole and considers the following:

a. background concentrations of volatile chemicals in outdoor air;

b. the NYSDOH's guidelines for volatile chemicals in air [Table 3.1];

c. human health risks (i.e., cancer and non-cancer health effects) associated with exposure to the volatile chemical in air; and

d. the factors described in Section 3.2.

3.4 Decision matrices

3.4.1 Overview

Decision matrices are risk management tools, developed by the NYSDOH in conjunction with other agencies, to provide guidance on a case-by-case basis about actions that should be taken to address current and potential exposures related to soil vapor intrusion. The matrices are intended to be used when evaluating the results from buildings with full slab foundations. The matrices encapsulate the data evaluation processes and actions recommended to address exposures discussed in Sections 3.3.2 and 3.3.3. The general format of a decision matrix is shown in Table 3.2.

Table 3.2 General format of a decision matrix

	Indoor Air Concentration of Volatile Chemical (mcg/m^3)		
Sub-slab Vapor Concentration of Volatile Chemical (mcg/m^3)	Concentration Range 1	Concentration Range 2	Concentration Range 3
Concentration Range 1	ACTION	ACTION	ACTION
Concentration Range 2	ACTION	ACTION	ACTION
Concentration Range 3	ACTION	ACTION	ACTION

Indoor air and sub-slab vapor concentration ranges in a matrix are selected based on a number of considerations in addition to health risks. For example, factors that are considered when selecting the ranges include, but are not limited to, the following:

a. human health risks (i.e., cancer and non-cancer health effects) associated with exposure to the volatile chemical in air;

b. the NYSDOH's guidelines for volatile chemicals in air [Table 3.1];

c. background concentrations of volatile chemicals in air [Section 3.2.4];

d. analytical capabilities currently available; and

e. attenuation factors (i.e., the ratio of indoor air to sub-slab vapor concentrations).

3.4.2 Matrices

The NYSDOH has developed two matrices, which are included at the end of Section 3.4, to use as tools in making decisions when soil vapor may be entering buildings. The first decision matrix was originally developed for TCE and the second for PCE. As summarized in Table 3.3, four chemicals have been assigned to the two matrices to date.

Table 3.3 Volatile chemicals and their decision matrices

Chemical	**Soil Vapor/Indoor Air Matrix***
Carbon tetrachloride	Matrix 1
Tetrachloroethene (PCE)	Matrix 2
1,1,1-Trichloroethane (1,1,1-TCA)	Matrix 2
Trichloroethene (TCE)	Matrix 1

*The decision matrices are available at the end of Section 3.4.

Because the matrices are risk management tools and consider a number of factors, the NYSDOH intends to assign chemicals to one of these two matrices, if possible. For example, if a chemical other than those already assigned to a matrix is identified as a chemical of concern during a soil vapor intrusion investigation, assignment of that chemical into one of the existing decision matrices will be considered by the NYSDOH. Factors that will be considered in assigning a chemical to a matrix include, but are not limited to, the following:

a. human health risks, including such factors as a chemical's ability to cause cancer, reproductive, developmental, liver, kidney, nervous system, immune system or other effects, in animals and humans and the doses that may cause those effects;

b. the data gaps in its toxicologic database;

c. background concentrations of volatile chemicals in indoor air [Section 3.2.4]; and

d. analytical capabilities currently available.

If the NYSDOH determines that the assignment of the chemical into an existing matrix is inappropriate, then the NYSDOH will either modify an existing matrix or develop a new matrix.

To use the matrices appropriately as a tool in the decision-making process, the following should be considered:

a. The matrices are generic. As such, it may be appropriate to modify a recommended action to accommodate building-specific conditions (e.g., dirt floor in basement, crawl spaces, etc.) and/or factors provided in Section 3.2 of the guidance (e.g., current land use, environmental conditions, etc.). For example, resampling may be recommended when the matrix indicates "no further action" for a particular building, but the results of adjacent buildings (especially sub-slab vapor results) indicate a need to take actions to address exposures related to soil vapor intrusion. Additionally, actions more protective of public health than those specified within the matrix may be proposed at any time. For example, the party implementing the actions may decide to install sub-slab depressurization systems on buildings where the matrix indicates "no further action" or "monitoring." Such an action is usually undertaken for reasons other than public health (e.g., seeking community acceptance, reducing excessive costs, etc.).

b. Indoor air concentrations detected in samples collected from the building's basement or, if the building has a slab-on-grade foundation, from the building's lowest occupied living space should be used.

c. Actions provided in the matrix are specific to addressing human exposures. Implementation of these actions does not preclude investigating possible sources of vapor contamination, nor does it preclude remediating contaminated soil vapors or the source of soil vapor contamination.

d. When current exposures are attributed to sources other than vapor intrusion, the agencies should be provided documentation(e.g., applicable environmental data, completed indoor air sampling questionnaire, digital photographs, etc.) to support a proposed action other than that provided in the matrix and to support assessment and follow-up by the agencies.

3.4.3 Description of recommended actions

Actions recommended in the matrix are based on the relationship between sub-slab vapor concentrations and corresponding indoor air concentrations. They are intended to address both potential and current human exposures and include the following:

a. *No further action*

When the volatile chemical is not detected in the indoor air sample and the concentration detected in the corresponding sub-slab vapor sample is not expected to substantially affect indoor air quality.

b. *Take reasonable and practical actions to identify source(s) and reduce exposures*

The concentration detected in the indoor air sample is likely due to indoor and/or outdoor sources rather than soil vapor intrusion given the concentration detected in the sub-slab vapor sample. Therefore, steps should be taken to identify potential source(s) and to reduce exposures accordingly (e.g., by keeping containers tightly capped or by storing volatile chemical-containing products in places where people do not spend much time, such as a garage or shed). Resampling may also be recommended to demonstrate the effectiveness of actions taken to reduce exposures.

d. *Monitor*

Monitoring, including sub-slab vapor, basement air, lowest occupied living space air, and outdoor air sampling, is appropriate to determine whether concentrations in the indoor air or sub-slab vapor have changed. Monitoring may also be appropriate to determine whether existing building conditions (e.g., positive pressure HVAC systems) are maintaining the desired mitigation endpoint and to determine whether changes are appropriate.

The type and frequency of monitoring is determined on a site-specific and building-specific basis, taking into account applicable environmental data and building operating conditions.

e. *Mitigate*

Mitigation is appropriate to minimize current or potential exposures associated with soil vapor intrusion. Methods to mitigate exposures related to soil vapor intrusion are described in Section 4.

f. *Monitor / Mitigate*

Monitoring or mitigation may be recommended after considering the magnitude of sub-slab vapor and indoor air concentrations along with building- and site-specific conditions.

Soil Vapor / Indoor Air Matrix 1

October 2006

	INDOOR AIR CONCENTRATION of COMPOUND (mcg/m^3)			
SUB-SLAB VAPOR CONCENTRATION of COMPOUND (mcg/m^3)	< 0.25	0.25 to < 1	1 to < 5.0	5.0 and above
< 5	1. No further action	2. Take reasonable and practical actions to identify source(s) and reduce exposures	3. Take reasonable and practical actions to identify source(s) and reduce exposures	4. Take reasonable and practical actions to identify source(s) and reduce exposures
5 to < 50	5. No further action	6. MONITOR	7. MONITOR	8. MITIGATE
50 to < 250	9. MONITOR	10. MONITOR / MITIGATE	11. MITIGATE	12. MITIGATE
250 and above	13. MITIGATE	14. MITIGATE	15. MITIGATE	16. MITIGATE

No further action:
Given that the compound was not detected in the indoor air sample and that the concentration detected in the sub-slab vapor sample is not expected to significantly affect indoor air quality, no additional actions are needed to address human exposures.

Take reasonable and practical actions to identify source(s) and reduce exposures:
The concentration detected in the indoor air sample is likely due to indoor and/or outdoor sources rather than soil vapor intrusion given the concentration detected in the sub-slab vapor sample. Therefore, steps should be taken to identify potential source(s) and to reduce exposures accordingly (e.g., by keeping containers tightly capped or by storing volatile organic compound-containing products in places where people do not spend much time, such as a garage or outdoor shed). Resampling may be recommended to demonstrate the effectiveness of actions taken to reduce exposures.

MONITOR:
Monitoring, including sub-slab vapor, basement air, lowest occupied living space air, and outdoor air sampling, is needed to determine whether concentrations in the indoor air or sub-slab vapor have changed. Monitoring may also be needed to determine whether existing building conditions (e.g., positive pressure heating, ventilation and air-conditioning systems) are maintaining the desired mitigation endpoint and to determine whether changes are needed. The type and frequency of monitoring is determined on a site-specific and building-specific basis, taking into account applicable environmental data and building operating conditions. Monitoring is an interim measure required to evaluate exposures related to soil vapor intrusion until contaminated environmental media are remediated.

MITIGATE:
Mitigation is needed to minimize current or potential exposures associated with soil vapor intrusion. The most common mitigation methods are sealing preferential pathways in conjunction with installing a sub-slab depressurization system, and changing the pressurization of the building in conjunction with monitoring. The type, or combination of types, of mitigation is determined on a building-specific basis, taking into account building construction and operating conditions. Mitigation is considered a temporary measure implemented to address exposures related to soil vapor intrusion until contaminated environmental media are remediated.

MONITOR / MITIGATE:
Monitoring or mitigation may be recommended after considering the magnitude of sub-slab vapor and indoor air concentrations along with building- and site-specific conditions.

See additional notes on page 2.

ADDITIONAL NOTES FOR MATRIX 1

This matrix summarizes the minimum actions recommended to address current and potential exposures related to soil vapor intrusion. To use the matrix appropriately as a tool in the decision-making process, the following should be noted:

[1] The matrix is generic. As such, it may be appropriate to modify a recommended action to accommodate building-specific conditions (e.g., dirt floor in basement, crawl spaces, etc.) and/or factors provided in Section 3.2 of the guidance (e.g., current land use, environmental conditions, etc.). For example, resampling may be recommended when the matrix indicates "no further action" for a particular building, but the results of adjacent buildings (especially sub-slab vapor results) indicate a need to take actions to address exposures related to soil vapor intrusion. Additionally, actions more protective of public health than those specified within the matrix may be proposed at any time. For example, the party implementing the actions may decide to install sub-slab depressurization systems on buildings where the matrix indicates "no further action" or "monitoring." Such an action is usually undertaken for reasons other than public health (e.g., seeking community acceptance, reducing excessive costs, etc.).

[2] Actions provided in the matrix are specific to addressing human exposures. Implementation of these actions does not preclude investigating possible sources of vapor contamination, nor does it preclude remediating contaminated soil vapors or the source of soil vapor contamination.

[3] Appropriate care should be taken during all aspects of sample collection to ensure that high quality data are obtained. Since the data are being used in the decision-making process, the laboratory analyzing the environmental samples must have current Environmental Laboratory Approval Program (ELAP) certification for the appropriate analyte and environmental matrix combinations. Furthermore, samples should be analyzed by methods that can achieve a minimum reporting limit of 0.25 microgram per cubic meter for indoor and outdoor air samples. For sub-slab vapor samples, a minimum reporting limit of 5 micrograms per cubic meter is recommended for buildings with full slab foundations, and 1 microgram per cubic meter for buildings with less than a full slab foundation.

[4] Sub-slab vapor and indoor air samples are typically collected when the likelihood of soil vapor intrusion to occur is considered to be the greatest (i.e., worst-case conditions). If samples are collected at other times (typically, samples collected outside of the heating season), then resampling during worst-case conditions may be appropriate to verify that actions taken to address exposures related to soil vapor intrusion are protective of human health.

[5] When current exposures are attributed to sources other than soil vapor intrusion, the agencies should be given documentation (e.g., applicable environmental data, completed indoor air sampling questionnaire, digital photographs, etc.) to support a proposed action other than that provided in the matrix box and to support agency assessment and follow-up.

[6] The party responsible for implementing the recommended actions will differ depending upon several factors, including the identified source of the volatile chemicals, the environmental remediation program, and site-specific and building-specific conditions. For example, to the extent that all site data and site conditions demonstrate that soil vapor intrusion is not occurring and that the potential for soil vapor intrusion to occur is not likely, the soil vapor intrusion investigation would be considered complete. In general, if indoor exposures represent a concern due to indoor sources, then the State will provide guidance to the property owner and/or tenant on ways to reduce their exposure. If indoor exposures represent a concern due to outdoor sources, then the NYSDEC will decide who is responsible for further investigation and any necessary remediation. Depending upon the outdoor source, this responsibility may or may not fall upon the party conducting the soil vapor intrusion investigation.

Soil Vapor / Indoor Air Matrix 2

October 2006

	INDOOR AIR CONCENTRATION of COMPOUND (mcg/m^3)			
SUB-SLAB VAPOR CONCENTRATION of COMPOUND (mcg/m^3)	< 3	3 to < 30	30 to < 100	100 and above
< 100	1. No further action	2. Take reasonable and practical actions to identify source(s) and reduce exposures	3. Take reasonable and practical actions to identify source(s) and reduce exposures	4. Take reasonable and practical actions to identify source(s) and reduce exposures
100 to < 1,000	5. MONITOR	6. MONITOR / MITIGATE	7. MITIGATE	8. MITIGATE
1,000 and above	9. MITIGATE	10. MITIGATE	11. MITIGATE	12. MITIGATE

No further action:
Given that the compound was not detected in the indoor air sample and that the concentration detected in the sub-slab vapor sample is not expected to significantly affect indoor air quality, no additional actions are needed to address human exposures.

Take reasonable and practical actions to identify source(s) and reduce exposures:
The concentration detected in the indoor air sample is likely due to indoor and/or outdoor sources rather than soil vapor intrusion given the concentration detected in the sub-slab vapor sample. Therefore, steps should be taken to identify potential source(s) and to reduce exposures accordingly (e.g., by keeping containers tightly capped or by storing volatile organic compound-containing products in places where people do not spend much time, such as a garage or outdoor shed). Resampling may be recommended to demonstrate the effectiveness of actions taken to reduce exposures.

MONITOR:
Monitoring, including sub-slab vapor, basement air, lowest occupied living space air, and outdoor air sampling, is needed to determine whether concentrations in the indoor air or sub-slab vapor have changed. Monitoring may also be needed to determine whether existing building conditions (e.g., positive pressure heating, ventilation and air-conditioning systems) are maintaining the desired mitigation endpoint and to determine whether changes are needed. The type and frequency of monitoring is determined on a site-specific and building-specific basis, taking into account applicable environmental data and building operating conditions. Monitoring is an interim measure required to evaluate exposures related to soil vapor intrusion until contaminated environmental media are remediated.

MITIGATE:
Mitigation is needed to minimize current or potential exposures associated with soil vapor intrusion. The most common mitigation methods are sealing preferential pathways in conjunction with installing a sub-slab depressurization system, and changing the pressurization of the building in conjunction with monitoring. The type, or combination of types, of mitigation is determined on a building-specific basis, taking into account building construction and operating conditions. Mitigation is considered a temporary measure implemented to address exposures related to soil vapor intrusion until contaminated environmental media are remediated.

MONITOR / MITIGATE:
Monitoring or mitigation may be recommended after considering the magnitude of sub-slab vapor and indoor air concentrations along with building- and site-specific conditions.

See additional notes on page 2.

ADDITIONAL NOTES FOR MATRIX 2

This matrix summarizes the minimum actions recommended to address current and potential exposures related to soil vapor intrusion. To use the matrix appropriately as a tool in the decision-making process, the following should be noted:

[1] The matrix is generic. As such, it may be appropriate to modify a recommended action to accommodate building-specific conditions (e.g., dirt floor in basement, crawl spaces, etc.) and/or factors provided in Section 3.2 of the guidance (e.g., current land use, environmental conditions, etc.). For example, resampling may be recommended when the matrix indicates "no further action" for a particular building, but the results of adjacent buildings (especially sub-slab vapor results) indicate a need to take actions to address exposures related to soil vapor intrusion. Additionally, actions more protective of public health than those specified within the matrix may be proposed at any time. For example, the party implementing the actions may decide to install sub-slab depressurization systems on buildings where the matrix indicates "no further action" or "monitoring." Such an action is usually undertaken for reasons other than public health (e.g., seeking community acceptance, reducing excessive costs, etc.).

[2] Actions provided in the matrix are specific to addressing human exposures. Implementation of these actions does not preclude investigating possible sources of vapor contamination, nor does it preclude remediating contaminated soil vapors or the source of soil vapor contamination.

[3] Appropriate care should be taken during all aspects of sample collection to ensure that high quality data are obtained. Since the data are being used in the decision-making process, the laboratory analyzing the environmental samples must have current Environmental Laboratory Approval Program (ELAP) certification for the appropriate analyte and environmental matrix combinations. Furthermore, samples should be analyzed by methods that can achieve a minimum reporting limit of 3 micrograms per cubic meter for indoor and outdoor air samples. For sub-slab vapor samples, a minimum reporting limit of 5 micrograms per cubic meter is recommended.

[4] Sub-slab vapor and indoor air samples are typically collected when the likelihood of soil vapor intrusion to occur is considered to be the greatest (i.e., worst-case conditions). If samples are collected at other times (typically, samples collected outside of the heating season), then resampling during worst-case conditions may be appropriate to verify that actions taken to address exposures related to soil vapor intrusion are protective of human health.

[5] When current exposures are attributed to sources other than soil vapor intrusion, the agencies should be given documentation (e.g., applicable environmental data, completed indoor air sampling questionnaire, digital photographs, etc.) to support a proposed action other than that provided in the matrix box and to support agency assessment and follow-up.

[6] The party responsible for implementing the recommended actions will differ depending upon several factors, including the identified source of the volatile chemicals, the environmental remediation program, and site-specific and building-specific conditions. For example, to the extent that all site data and site conditions demonstrate that soil vapor intrusion is not occurring and that the potential for soil vapor intrusion to occur is not likely, the soil vapor intrusion investigation would be considered complete. In general, if indoor exposures represent a concern due to indoor sources, then the State will provide guidance to the property owner and/or tenant on ways to reduce their exposure. If indoor exposures represent a concern due to outdoor sources, then the NYSDEC will decide who is responsible for further investigation and any necessary remediation. Depending upon the outdoor source, this responsibility may or may not fall upon the party conducting the soil vapor intrusion investigation.

3.5 Emergency response

The NYSDOH's staff are responsible for recommending that residents relocate in cases where there may be health risks resulting from exposure to petroleum spills. These roles and responsibilities are outlined in Environmental Health Manual Technical Reference and Procedural Items BTSA-01. Air sampling is appropriate in some cases for demonstrating that spill cleanup and engineering controls have been effective in reducing indoor air impacts and associated health risks to residents. At a minimum, air samples are collected from the basement, first floor and from outdoors. Whether sub-slab or soil gas samples will be taken is evaluated on a case-by-case basis. Air testing data are sometimes used as the basis for ending emergency relocation financial support. For additional information, please contact the NYSDOH's Bureau of Toxic Substance Assessment by calling 1-800-458-1158.

Emergency actions not related to petroleum spills are handled on a case-by-case basis.

3.6 Parcels that are undeveloped or contain unoccupied buildings

If investigation of a parcel that is undeveloped or contains unoccupied buildings is being delayed until the site is being developed or occupied, measures should be in place that assure the State that no development or occupation will occur without addressing the exposures. Institutional controls may be used for this purpose. An institutional control is any non-physical means of enforcing a restriction on the use of real property that

a. limits human or environmental exposure,

b. provides notice to potential owners, operators or members of the public, or

c. prevents actions that would interfere with the effectiveness of remedial actions or with the effectiveness and/or integrity of operation, maintenance or monitoring activities at a site.

An institutional control that is often used is an environmental easement. An environmental easement is an enforced mechanism used for property where the remedial actions leave residual contamination that makes the property suitable for some, but not all uses, or includes engineering controls that must be maintained for the easement to be effective. The purpose of the easement is to ensure that such use restrictions or engineering controls remain in place. An environmental easement

a. can only be created by the property owner (the *grantor*) through a written instrument recorded in the appropriate county recording office. It can only be granted to the State (the *grantee*) and can only be extinguished or amended by a written instrument executed by the Commissioner of the Department of Environmental Conservation and duly recorded;

b. is binding upon all subsequent owners and occupants of the property. The deed or deeds for the property (as well as any other written instruments conveying any interest in the property) must contain a prominent notice that it is subject to an environmental easement; and

c. may be enforced in perpetuity against the *grantor*, subsequent owners of the property, lessees, and any person using the property by its grantor, by the State, or by the municipality in which the property is located.

If these actions cannot be implemented, alternative measures should be in place that assure the State that the parcel will not be developed or buildings occupied without addressing the exposure concerns. For example, arrangements should be made for the town, village or city

to notify the appropriate party when new construction or tenants are proposed for the parcel (e.g., permit applications and grants) or ownership of the parcel changes.

Section 4: Soil Vapor Intrusion Mitigation

As discussed in Section 1.1, soil vapor can enter a building through cracks or perforations in slabs or basement floors and walls, and through openings around sump pumps or where pipes and electrical wires go through the foundation primarily because of a difference between interior and exterior pressures. This intrusion is similar to how radon gas enters buildings from the subsurface. Fortunately, given this similarity, well-established techniques for mitigating exposures to radon may also be used to mitigate exposures related to soil vapor intrusion.

Once it is determined that steps should to be taken to address exposures associated with soil vapor intrusion, they should be implemented with all due expediency. This section provides an overview of:

a. methods of mitigation,

b. installation and design of mitigation systems,

c. post-mitigation testing,

d. operation, maintenance and monitoring of mitigation systems,

e. termination of mitigation system operations, and

f. annual certification.

Mitigation is considered to be an interim measure to address exposures until contaminated environmental media are remediated, or until mitigation is no longer needed to address exposures related to soil vapor intrusion.

4.1 Methods of mitigation

The most effective mitigation methods involve sealing infiltration points and actively manipulating the pressure differential between the building's interior and exterior (on a continuous basis). As discussed in the following subsections, the appropriate method to use will largely depend upon the building's foundation design. Furthermore, buildings having more than one foundation design feature (e.g., a basement under one portion of the house and a crawl space beneath the remainder) may require a combination of mitigation methods. This section describes methods of mitigation that are expected to be the most reliable options under a wide range of circumstances. Occasionally, there are site-specific or building-specific conditions under which alternative methods (such as HVAC modification, sealing, room pressurization, passive ventilation systems, or vapor barriers) may be more appropriate. Such mitigation proposals may be considered on a case-by-case basis.

4.1.1 Buildings with a basement slab or slab-on-grade foundation

In conjunction with *sealing* potential subsurface vapor entry points, an active *sub-slab depressurization system* (SSD system) is the preferred mitigation method for buildings with a basement slab or slab-on-grade foundation. A SSD system uses a fan-powered vent and piping to draw vapors from the soil beneath the building's slab (i.e., essentially creating a vacuum beneath the slab) and discharge them to the atmosphere. This results in lower sub-slab air pressure relative to indoor air pressure, which prevents the infiltration of sub-slab vapors into the building.

The most common approach to achieving depressurization beneath the slab is to insert the piping through the floor slab into the crushed rock or soil underneath. However, the EPA, in their "Consumer's Guide to Radon Reduction" (EPA 402-K-03-002; revised February 2003), lists the following approaches as ways to reduce radon levels in a building, either in place of the more common sub-slab suction point method or in conjunction with that method:

a. *Drain tile suction* — Some houses have drain tiles or perforated pipe to direct water away from the foundation of the house. Suction on these tiles or pipes is often effective;

b. *Sump hole suction* — If the building has a sump pump to remove unwanted water, the sump can be capped so that it can continue to drain water and serve as the location for piping. If the sump is not used as the suction or extraction point, the associated wiring and piping should be sealed and an air-tight cover should be installed to enhance the performance of the SSD system; and

c. *Block wall suction* — If the building has hollow block foundation walls, the void network within the wall may be depressurized by drawing air from inside the wall and venting it to the outside. This method is often used in combination with sub-slab depressurization.

The depressurization approach, or combination of approaches, selected for a building should be determined on a building-specific basis due to building-specific features that may be conducive to a specific depressurization approach. For example, if the contaminants are entering the building through a block wall, block wall suction in conjunction with traditional sub-slab depressurization may be more effective at minimizing exposures related to soil vapor intrusion rather than sub-slab depressurization alone.

Although sealing is not a reliable mitigation technique on its own, it can significantly improve the effectiveness of a SSD system since it limits the flow of subsurface vapors into the building. All joints, cracks and other penetrations of slabs, floor assemblies and foundation walls below or in contact with the ground surface should be sealed with materials that prevent air leakage.

If the State concurs that a SSD system is not a practicable alternative or that exposures will be mitigated concurrently by a method selected to remediate subsurface contamination, alternative mitigation methods may be considered, such as the following:

a. *HVAC modification* — a technique where the building's HVAC system is modified to avoid depressurization of the building relative to underlying and surrounding soil (i.e., to maintain a positive pressure within the building); and

b. S*oil vapor extraction (SVE) system* — a technique used to remediate contaminated subsurface soil vapor. SVE systems use high flow rates, induced vacuum or both to collect and remove contamination, while SSD systems use a minimal flow rate to effect the minimum pressure gradient (see the EPA's technical guidance documents for recommended gradients; Section 4.2.3) needed to reverse air flow across a building's foundation. Depending upon the SVE system's design, the system may also serve to mitigate exposures. For example, the SVE system's radius of influence includes the subsurface beneath affected buildings or horizontal legs of the system will be installed beneath affected buildings. However, complications can arise if the SVE system is no longer effective at remediating contaminated vapors, exposures should still be mitigated due to residual vapor contamination.

4.1.2 Buildings with a crawl space foundation

A *soil vapor retarder* with *sub-membrane depressurization (SMD) system* is the preferred mitigation method for buildings with a crawl space foundation. A soil vapor retarder is a synthetic membrane or other comparable material that is placed on the ground in the crawl space to retard the flow of soil vapors into the building. A SMD system is similar to a SSD system. It uses a fan-powered vent and piping to draw vapors from beneath the soil vapor retarder and discharge them to the atmosphere. This results in lower air pressure beneath the membrane relative to air pressure in the crawl space, which prevents the infiltration of subsurface vapors into the building.

If the State concurs that a soil vapor retarder with a SMD system is not a practicable alternative or that exposures will be mitigated concurrently by a method selected to remediate subsurface contamination, alternative mitigation methods may be considered, such as the following:

a. *HVAC modification* — a technique where the building's HVAC system is modified to avoid depressurization of the building relative to the crawl space;

b. C*rawl space ventilation with sealing* — a technique that uses a fan to draw air out of the crawl space; and

c. *SVE system* [Section 4.1.1].

4.1.3 Buildings with dirt floor basements

Either a SSD system with a newly poured slab or a SMD system with a soil vapor retarder may be used. However, the former method is preferred.

4.1.4 Buildings with multiple foundation types

Mitigation in a building with a combination of foundations should be achieved by applying the specific methods described previously [Sections 4.1.1 through 4.1.3] to the corresponding foundation segments of the building. Special consideration should be given to the points at which different foundation types join, since additional soil vapor entry routes exist in such locations. Often, the various systems can be installed and connected to a common depressurization system and fan.

4.1.5 Undeveloped parcels

If sampling results indicate a mitigation system is recommended to address exposures in buildings that may be constructed, then a SSD system with sealing, or a SMD system with a soil vapor retarder, or a combination of these methods is recommended, as appropriate to the design of the proposed buildings.

4.1.6 Additional references

The following documents provide additional information on selecting an appropriate mitigation method:

a. *A Consumer's Guide to Radon Reduction*
EPA [EPA 402-K-03-002, revised February 2003]

This document provides assistance in selecting a qualified radon mitigation contractor to reduce the radon levels in a home, determining an appropriate radon reduction method, and maintaining a radon reduction system. It is available at the EPA's web site: http://www.epa.gov/iaq/radon/pubs/index.html; and

b. *Reducing Radon in Schools: A Team Approach*
EPA [EPA 402-R-94-008, April 1994]

This document will provide assistance in determining the best way to reduce elevated radon levels found in a school. It provides guidance on the process of confirming a radon problem, selecting the best mitigation strategy, and directing the efforts of a multidisciplinary team assembled to address elevated radon levels in a way that will contribute to the improvement of the overall indoor air quality of the school. Copies can be ordered from the EPA's Indoor Air Quality Information Clearinghouse at 1-800-438-4318.

4.2 Design and installation of mitigation systems

Once a mitigation method is selected, it should be designed and installed. The components of the design and installation of mitigation systems, the procedures for specific mitigation techniques, and references for technical guidance are provided in the following subsections.

4.2.1 General recommendations

Systems should be designed and installed by a professional engineer or environmental professional. In most areas of the state, there are contractors who have met certain requirements and are trained to identify and fix radon problems in buildings. To obtain the names of local contractors, contact the NYSDOH's Radon Program at 1-800-458-1158, extension 27556, or visit the National Radon Safety Board's web site (www.nrsb.org) or National Environmental Health Association's web site (www.neha.org).

Typically, the party responsible for remediating the site is responsible for arranging design and installation activities. If no responsible party is available, the State will arrange for the design and installation of the system. All design and installation activities should be documented and reported to the agencies. Furthermore, once a mitigation system is installed, an information package should be given to the building's owner and tenants, if applicable, to facilitate their understanding of the system's operation, maintenance and monitoring [Section 5.6].

With the exception of SVE systems, the mitigation methods introduced in Section 4.1 are not intended to remediate the source of subsurface vapors (e.g., contaminated groundwater, soil, etc.). Rather, they are designed to minimize the infiltration of subsurface vapors into a building. For consistency in implementing the techniques in residential buildings, mitigation systems should be designed and installed in accordance with the following:

a. *Standard Practice for Installing Radon Mitigation Systems in Existing Low-rise Residential Buildings* (ASTM E-2121)

American Society for Testing and Materials (ASTM) International [ASTM E-2121-03, February 10, 2003]

This document applies to existing buildings. The purpose of this document is to provide radon mitigation contractors with uniform standards that will ensure quality and effectiveness in the design, installation, and evaluation of radon mitigation systems in detached and attached residential buildings three stories or less in height. Information on how to obtain a copy of this standard is available in Appendix E; and

b. *Model Standards and Techniques for Control of Radon in New Residential Buildings* EPA [EPA 402-R-94-009, March 1994]

This document applies to new construction and contains information on how to incorporate radon reduction techniques and materials in residential construction. A copy of this document is provided in Appendix F.

4.2.2 System-specific recommendations

Basic design and installation recommendations for mitigation systems follow. These are based upon recommendations and requirements given by the EPA for mitigating exposures related to radon intrusion (for additional information see EPA's web site on radon at http://www.epa.gov/iaq/radon/pubs/index.html).

a. *Sealing* — To improve the effectiveness of depressurization and ventilation systems and to limit the flow of subsurface vapors into the building, materials that prevent air leakage should be used, such as elastomeric joint sealant (as defined in ASTM C920-87), compatible caulks, non-shrink mortar, grouts, expanding foam, "Dranjer" drain seals, or airtight gaskets. Some effective sealants may contain volatile organic compounds; in some situations, this may be a consideration in choosing an appropriate sealing material.

b. *Soil vapor retarder (membrane)* —

1. To retard the infiltration of subsurface vapors into the building and enhance the performance of a SMD system, a minimum 6 mil (or 3 mil cross-laminated) polyethylene or equivalent flexible sheeting material should be used.

2. The sheet should cover the entire floor area and be sealed at seams (with at least a 12 inch overlap) and penetrations, around the perimeter of interior piers and to the foundation walls.

3. Enough of the sheeting should be used so it will not be pulled away from the walls when the depressurization system is turned on and the sheet is drawn down.

4. If a membrane is installed in areas that may have future foot traffic (e.g., a dirt floor in a basement), consideration should be given to also installing a wearing surface such as sand or stone to protect the integrity of the membrane. Additionally, a layer of fine sand may be prudent beneath the membrane to protect it from penetrations by sharp objects in the dirt floor.

c. *Depressurization systems —*

1. The systems should be designed to avoid the creation of other health, safety, or environmental hazards to building occupants (e.g., backdrafting of natural draft combustion appliances).

2. The systems should be designed to minimize soil vapor intrusion effectively while minimizing excess energy usage, to avoid compromising moisture and temperature controls and other comfort features, and to minimize noise.

3. To evaluate the potential effectiveness of a SSD before it is installed, a diagnostic test (commonly referred to as a "communication" test) should be performed to measure the ability of a suction field and air flow to extend through the material beneath the slab. This test is commonly conducted by applying suction on a centrally located hole drilled through the concrete slab and simultaneously observing the movement of smoke downward into small holes drilled in the slab at locations separated from the central suction hole. A similar quantitative evaluation may also be performed by using a digital micromanometer or comparable instrument. Depending on test results, multiple suction points may be needed to achieve the desired effectiveness of the system.

4. Passive systems (i.e., a SSD system without a vent fan) are not as effective as active systems and their performance varies depending upon ambient temperatures and wind conditions. Therefore, active systems should be used to ensure exposures are being addressed.

5. The vent fan and discharge piping should not be located in or below a livable or occupied area of the building to avoid entry of extracted subsurface vapors into the building in the event of a fan or pipe leak.

6. To avoid entry of extracted subsurface vapors into the building, the vent pipe's exhaust should be

    i. above the eave of the roof (preferably, above the highest eave of the building at least 12 inches above the surface of the roof),

    ii. at least 10 feet above ground level,

    iii. at least 10 feet away from any opening that is less than 2 feet below the exhaust point, and

    iv. 10 feet from any adjoining or adjacent buildings, or HVAC intakes or supply registers.

7. Rain caps, if used, should be installed so as not to increase the potential for extracted subsurface vapors to enter the building.

8. To avoid accidental changes to the system that could disrupt its function, the depressurization system should be labeled clearly. An example of such labeling is shown in Figure 5.1.

9. A warning device or indicator should be installed to alert building occupants if the active system stops working properly. Examples of system failure warning devices and indicators include the following: a liquid gauge (e.g., a

manometer), a sound alarm, a light indicator, and a dial (needle display) gauge. The warning device or indicator should be placed where it can be easily heard or seen. The party installing the system should verify the warning device or indicator is working properly. Building occupants should be made aware of the warning device or indicator (what it is, where it is located, how it works, how to read/understand it, and what to do if it indicates the system is not working properly).

d. *HVAC systems* — HVAC systems should be carefully designed, installed and operated to avoid depressurization of basements and other areas in contact with the soil.

e. *Crawl space ventilation* —

1. Ventilation systems should be designed to avoid the creation of other health, safety, or environmental hazards to building occupants (e.g., backdrafting of natural draft combustion appliances).

2. Openings and cracks in floors above the crawl space that would permit conditioned air to pass into or out of the occupied spaces of the building, should be identified, closed and sealed.

f. *SVE systems designed to also mitigate exposures* —

1. The systems should be designed to avoid the creation of other health, safety, or environmental hazards to building occupants (e.g., backdrafting of natural draft combustion appliances).

2. To avoid reentry of soil vapor into the building(s), the exhaust point should be located away from the openings of buildings and HVAC air intakes. Depending upon the concentrations of volatile chemicals in subsurface vapors and the expected mass removal rate, treatment (e.g., via carbon filters) of the SVE system effluent may be appropriate to minimize outdoor air effects.

3. The SVE system's radius of influence should adequately address buildings requiring mitigation, as well as subsurface sources requiring remediation. If it does not, additional actions may be appropriate. For example, if the radius of influence does not completely extend beneath a building, a complementary air monitoring program may be appropriate to confirm that exposures are being addressed adequately while the SVE system is operating.

4.2.3 Technical guidance

To address exposures effectively in larger buildings, some of the same techniques used in residential buildings can be scaled up in size, number, or performance (e.g., adjustments in the size and air movement capacity of the vent pipe fan, or installation of multiple suction points through the slab instead of a single point). The design of the techniques may also be modified (e.g., installation of horizontal pipes beneath the building instead of a single suction point).

Detailed technical guidance on designing and installing mitigation systems in residential and non-residential buildings is provided in various documents, such as the following, released by the EPA and others:

a. References provided in ASTM's E-2121 (see Appendix E for information on how to obtain a copy) and the EPA's *Model Standards and Techniques for Control of Radon in New Residential Buildings* (Appendix F);

b. *Radon Reduction Techniques for Existing Detached Houses: Technical Guidance (Third Edition) for Active Soil Depressurization Systems*
EPA [EPA 625/R-93-011, October 1993]

This technical guidance document has been prepared to serve as a comprehensive aid in the detailed selection, design, installation, and operation of indoor radon reduction measures for existing houses based on active soil depressurization techniques. It is intended for use by radon mitigation contractors, building contractors, concerned homeowners, state and local officials and other interested persons. Copies can be ordered from the EPA's Indoor Air Quality Information Clearinghouse at 1-800-438-4318;

c. *Protecting Your Home From Radon: A Step-by-Step Manual for Radon Reduction*
Kladder *et al.*, 1993

This manual is designed to provide sufficient information to a homeowner to make many of the basic repairs that can significantly reduce radon levels in the home;

d. *Building Radon Out: A Step-by-Step Guide on How to Build Radon-Resistant Homes*
EPA [EPA 402-K-01-002, April 2001]

This fully illustrated guide contains all the information needed in one place to educate home builders about radon-resistant new construction (RRNC), including the following: basic questions and detailed answers about radon and RRNC, specific planning steps before installing a system, detailed installation instructions with helpful illustrations, tips and tricks when installing a system, marketing know-how when dealing with homebuyers, and architectural drawings. This document is available at the EPA's web site: http://www.epa.gov/iaq/radon/pubs/index.html; and

e. *Radon Prevention in the Design and Construction of Schools and Other Large Buildings*
EPA [EPA 625-R-92-016, June 1994]

It is typically easier and much less expensive to design and construct a new building with radon-resistant and/or easy-to-mitigate features, than to add these features after the building is completed and occupied. Specific guidelines on how to incorporate radon prevention features in the design and construction of schools and other large buildings are detailed in this manual. Copies can be ordered from the EPA's Indoor Air Quality Information Clearinghouse at 1-800-438-4318. This document is also available on the EPA Office of Research and Development's web site: http://www.epa.gov/ORD/NRMRL/pubs/625r92016/625r92016.htm.

4.3 Post-mitigation or confirmation testing

Once a mitigation system is installed, its effectiveness and proper installation should be confirmed. The party that installed the system should conduct post-mitigation testing and for developing a post-mitigation testing plan. Minimum objectives for post-mitigation testing associated with specific mitigation methods are provided in the following

subsections. All post-mitigation testing activities should be documented and reported to the agencies.

4.3.1 SSD systems with sealing

a. Reasonable and practical actions should be taken to identify and fix leaks. With the depressurization system operating, smoke tubes are used to check for leaks through concrete cracks, floor joints, and at the suction point. Any leaks identified should be resealed until smoke is no longer observed flowing through the opening.

b. Once a depressurization system is installed, its operation may compete with the proper venting of fireplaces, wood stoves and other combustion or vented appliances (e.g., furnaces, clothes dryers, and water heaters), resulting in the accumulation of exhaust gases in the building and the potential for carbon monoxide poisoning. Therefore, in buildings with natural draft combustion appliances, the building should be tested for backdrafting of the appliances. Backdrafting conditions should be corrected before the depressurization system is placed in operation.

c. The distance that a pressure change is induced in the sub-slab area (i.e., a pressure field extension test) should be conducted. Analogous to a communication test, this test is commonly conducted by operating the depressurization system and simultaneously observing the movement of smoke downward into small holes (e.g., 3/8 inch) drilled through the slab at sufficient locations to demonstrate that a vacuum is being created beneath the entire slab. A similar quantitative evaluation may also be performed by using a digital micromanometer or comparable instrument. If adequate depressurization is not occurring, the reason (e.g., improper fan operation) should be identified and corrected.

d. Adequate operation of the warning device or indicator should be confirmed.

e. Except as indicated below, post-mitigation indoor and outdoor air sampling should be conducted in all buildings where pre-mitigation samples were collected and in all buildings where physical data suggest possible impediments to comprehensive sub-slab communication of the depressurization system (i.e., locations with wet or dense sub-slab soils, multiple foundations and footings, minimal pressure differentials between the interior and sub-slab). Generally, indoor and outdoor air sampling locations, protocols and analytical methods should be consistent between pre-mitigation and post-mitigation sampling, where applicable. In buildings with basements, post-mitigation indoor air sampling from the basement alone (i.e., without a concurrent indoor air sample from the first floor) is recommended in most circumstances.

   Typically, post-mitigation sampling should be conducted no sooner than 30 days after installing a depressurization system. If the system is installed outside of the heating season or at the end of a season, post-mitigation air sampling may be postponed until the heating season.

   In cases of widespread mitigation due to vapor contamination and depending upon the basis of making decisions (e.g., a "blanket mitigation" approach within a specified area of documented vapor contamination [Section 3.3.1]), a representative number of buildings from an identified study area, rather than each building, may be

sampled. Prior to implementation, this type of post-mitigation sampling approach should be approved by State agency personnel.

In newly constructed buildings, a site-specific and building-specific indoor air sampling plan is recommended due to potential interferences caused by the off-gassing of volatile chemicals in new building materials (e.g., paints, carpets, furniture, etc. [Section 1.4]). In these situations, if indoor air sampling is appropriate samples should be

i. collected while the system is operational but before potentially interfering factors are brought into the building,

ii. analyzed for a targeted list of volatile chemicals based on previous environmental sampling (e.g., groundwater, soil, soil vapor, etc.), and/or

iii. collected while the system is operational but after potentially interfering factors have had an opportunity to off-gas.

If post-mitigation sampling results do not indicate a significant decrease in the concentrations of volatile chemicals previously believed to be present in the indoor air due to soil vapor intrusion, the reason (e.g., indoor or outdoor sources, improper operation of the mitigation system, etc.) should be identified and corrected as appropriate.

4.3.2 SMD systems with soil vapor retarder

a. Reasonable and practical actions should be taken to identify and fix leaks. With the depressurization system operating, smoke tubes are used to check for leaks in the membrane at seams, edge seals and at locations where the sheet was sealed around obstructions. Any leaks identified should be resealed until smoke is no longer observed flowing through the opening.

b. Backdrafting conditions should be evaluated and corrected [Section 4.3.1].

c. Adequate operation of the warning device or indicator should be confirmed.

d. Post-mitigation indoor and outdoor air testing should be conducted in buildings where pre-mitigation samples were collected [as discussed in Section 4.3.1].

4.3.3 HVAC modifications

a. Check the building for positive pressure conditions (e.g., verify a pressure controller is maintaining the desired pressure differential and/or measure the pressure differential between the sub-slab and indoor air by using field instruments).

b. Backdrafting conditions should be evaluated and corrected [Section 4.3.1].

c. Adequate operation of the warning device or indicator, if applicable, should be confirmed.

d. Post-mitigation indoor and outdoor air testing should be conducted in buildings where pre-mitigation samples were collected [Section 4.3.1].

4.3.4 Crawl space ventilation and sealing

a. Reasonable and practical actions should be taken to identify and fix leaks. With the ventilation system operating, smoke tubes are used to check for leaks in openings and cracks in floors above the crawl space that were sealed during installation of the system. Any leaks identified should be resealed until smoke is no longer observed flowing through the opening.

b. Backdrafting conditions should be evaluated and corrected [Section 4.3.1].

c. Adequate operation of the warning device or indicator, if applicable, should be confirmed.

d. Post-mitigation indoor and outdoor air testing should be conducted in buildings where pre-mitigation samples were collected [as discussed in Section 4.3.1].

4.3.5 SVE systems designed to also mitigate exposures

a. Backdrafting conditions should be evaluated and corrected [Section 4.3.1].

b. The distance that a pressure change is induced in the sub-slab area should be conducted. This may be done by operating the SVE system and simultaneously observing the movement of smoke downward into small holes (e.g., 3/8 inch) drilled through the building's slab at sufficient locations to demonstrate that a vacuum is being created beneath the entire slab.

c. Adequate operation of the warning device or indicator, if applicable, should be confirmed.

d. Post-mitigation indoor and outdoor air testing should be conducted in buildings where pre-mitigation samples were collected [Section 4.3.1].

4.4 Operation, maintenance and monitoring of mitigation systems

When mitigation systems are implemented at a site, the operation, maintenance and monitoring (OM&M) protocols for the systems should be included in a site-specific site management plan (formerly referred to as operation, maintenance and monitoring plan). The party that installed the system should conduct OM&M activities and should develop the site management plan. Recommendations for minimum OM&M activities associated with specific mitigation methods are provided in the following subsections. Also included is a discussion of non-routine maintenance. All routine and non-routine OM&M activities should be documented and reported to the agencies.

4.4.1 SSD and SMD systems

Routine maintenance should commence within 18 months after the system becomes operational, and should occur every 12 to 18 months thereafter. Based upon a demonstration of the system's reliability, the State recommends that, if a different frequency is desired, a petition describing the alternative frequency and the reasons that frequency is preferred be submitted to the State. Any comments the State may have on the petition should be considered before the frequency is altered.

During routine maintenance, the following activities (at a minimum) should be conducted:

a. a visual inspection of the complete system (e.g., vent fan, piping, warning device or indicator, labeling on systems, soil vapor retarder integrity, etc.),

b. identification and repair of leaks [Sections 4.3.1 and 4.3.2], and

c. inspection of the exhaust or discharge point to verify no air intakes have been located nearby.

As appropriate preventative maintenance (e.g., replacing vent fans), repairs and/or adjustments should be made to the system to ensure its continued effectiveness at mitigating exposures related to soil vapor intrusion. The need for preventative maintenance will depend upon the life expectancy and warranty for the specific part, as well as visual observations over time. The need for repairs and/or adjustments will depend upon the results of a specific activity compared to that obtained when system operations were initiated.

If significant changes are made to the system or when the system's performance is unacceptable, the system may need to be redesigned and restarted. Many, if not all, of the post-mitigation testing activities, as described in Sections 4.3.1 and/or 4.3, may be appropriate. The extent of such activities will primarily depend upon the reason for the changes and the documentation of sub-slab depressurization.

Generally, air monitoring is not recommended if the system has been installed properly and is maintaining a vacuum beneath the entire slab.

In addition to the routine OM&M activities described here, the building's owner and tenants are given information packages that explains the system's operation, maintenance and monitoring [Section 5.6]. Therefore, at any time during the system's operation, the building's owner or tenants may check that the system is operating properly.

4.4.2 Other mitigation systems

For other mitigation systems (e.g., HVAC modifications, crawl space ventilation, etc.), routine maintenance activities are generally comparable to post-mitigation testing activities [Section 4.3]. Activities typically include a visual inspection of the complete system, and identification and repair of leaks. System performance checks, such as air stream velocity measurements of ventilation systems, also should be performed.

As appropriate, preventative maintenance (e.g., replacing filters, cleaning lines, etc.), repairs and/or adjustments should be made to the system to ensure its continued effectiveness at mitigating exposures related to soil vapor intrusion. If significant changes are made to the system or when the system's performance is unacceptable, redesigning and restarting the system may be appropriate[Section 4.4.1].

Air monitoring, such as periodic sub-slab vapor, indoor air and outdoor air sampling, may be appropriate to determine whether existing building conditions are maintaining the desired mitigation endpoint and to determine whether changes are appropriate. The type and frequency of monitoring is determined based upon site-specific and building-specific conditions, taking into account applicable environmental data, building operating conditions, and the mitigation method employed.

4.4.3 Non-routine maintenance

Non-routine maintenance may also be appropriate during the operation of a mitigation system. Examples of such situations include the following:

a. the building's owners or occupants report that the warning device or indicator indicates the mitigation system is not operating properly;

b. the mitigation system becomes damaged; or

c. the building has undergone renovations that may reduce the effectiveness of the mitigation system.

Activities conducted during non-routine maintenance visits will vary depending upon the reason for the visit. In general, building-related activities may include examining the building for structural or HVAC system changes, or other changes that may affect the performance of the depressurization system (e.g., new combustion appliances, deterioration of the concrete slab, or significant changes to any of the building factors listed in Table 1.2). Depressurization system-related activities may include examining the operation of the warning device or indicator and the vent fan, or the extent of sub-slab depressurization. Repairs or adjustments should be made to the system as appropriate. If appropriate, the system should be redesigned and restarted [Section 4.4.1].

4.5 Termination of mitigation system operations

Mitigation systems should not be turned off, until the State receives, and has had the opportunity to comment on, a proposal to turn off mitigation systems. The party seeking to turn off the mitigation systems should consider any comments the State may have on the proposal, except in emergency situations. Systems should remain in place and operational until they are no longer needed to address current or potential exposures related to soil vapor intrusion. This determination should be based upon several factors, including the following:

a. subsurface sources (e.g., groundwater, soil, etc.) of volatile chemical contamination in subsurface vapors have been remediated based upon an evaluation of appropriate post-remedial sampling results;

b. residual contamination, if any, in subsurface vapors is not expected to affect indoor air quality significantly based upon soil vapor and/or sub-slab vapor sampling results;

c. residual contamination, if any, in subsurface vapors is not affecting indoor air quality when active mitigation systems are turned off based upon indoor air, outdoor air and sub-slab vapor sampling results at a representative number of buildings; and

d. there is no "rebound" effect for which additional mitigation efforts would be appropriate observed when the mitigation system is turned off for prolonged periods of time. This determination should be based upon indoor air, outdoor air and/or sub-slab vapor sampling from the building over a time period, determined by site-specific conditions.

Given the prevalence of radon throughout the State of New York, consideration should be given to leaving the system in place and operating to address exposures related to radon intrusion after concurrence is reached that the system is no longer needed to mitigate exposures related to soil vapor intrusion. This action should be done only with permission of the property owner and after the property owner is aware of their responsibilities in

operating, monitoring and maintaining the system for this specific purpose. If the property owner declines the offer, the system should be shut down and, if requested, removed in a timely manner.

4.6 Annual certification and notification recommendations

Mitigation systems are considered engineering controls, defined as any physical barrier or method employed to

1. actively or passively contain, stabilize, or monitor hazardous waste or petroleum,
2. restrict the movement of hazardous waste or petroleum to ensure the long-term effectiveness of remedial actions, or
3. eliminate potential exposure pathways to hazardous waste or petroleum.

Therefore, depending upon the remedial program, submission of an annual certification to the State may be required. This certification must be prepared and submitted by a professional engineer or environmental professional and affirm that the engineering controls are in place, are performing properly and remain effective. This requirement of certification remains in effect until the State provides notification, in writing, that this certification is no longer needed.

If a property owner declines a mitigation system, the party responsible for arranging the design and installation of the system should renew the offer on an annual basis, unless they demonstrate environmental conditions have changed such that a system is no longer needed.

Section 5: Community Outreach

While community outreach is an essential component of the investigation and remediation of any site, it is particularly critical when evaluating soil vapor intrusion at a site due to the following:

a. a heightened awareness by environmental professionals and the general public (both nationally and state-wide) for the importance of soil vapor intrusion;

b. the relatively complicated nature of the exposure pathway (e.g., chemicals in groundwater or soil ending up in the indoor air of buildings versus contaminated groundwater entering the house through the use of a private well);

c. the unknowns associated with the evolving science of investigating, evaluating, and mitigating exposures related to soil vapor intrusion; and

d. the relatively complicated nature of mitigating the exposure pathway (e.g., the design, installation and operation of a sub-slab depressurization system in a home versus an immediate switch from using private well water to using bottled water).

When people have been or may be exposed to contamination, providing them with accurate and timely information about those exposures is extremely important. This information should include details about the types of chemicals, the levels of exposure, and possible health effects from those exposures. In addition, information should include details about the planning and progress of the investigation and remediation efforts. Techniques commonly used to inform the community about soil vapor intrusion issues are described in this section. The type, or types, of techniques selected for a site will vary depending upon the community's needs, site-specific conditions and remedial program-specific requirements.

5.1 Site contact list

A contact list contains names, addresses and telephone numbers of individuals and organizations with interest or involvement in a site. They may be affected by or interested in the site, or have information that staff needs to make effective remedial decisions. Contact lists typically include residents near the site, elected officials, appropriate federal, state, and local government contacts, local media, organized environmental groups and the responsible party, as well as local businesses, civic and recreational groups, religious facilities, school district officials, and all staff (NYSDEC, NYSDOH, county health department, EPA, etc.) involved in the site. The checklist provided in Appendix G.1 will help to identify who should be included in a particular site's contact list.

With respect to soil vapor intrusion, the site contact list is often used to

a. send a fact sheet announcing a proposed investigation in the area, a major project decision or proposal, the project's status or progress, a public meeting or availability session, or the availability of documents in the repositories;

b. contact building owners and tenants to arrange sampling dates and times and to transmit sampling results (in written form and/or verbally); and

c. provide community members with verbal updates on the project's status or progress.

The member of the project team (defined as the NYSDEC, NYSDOH, responsible party, etc.) that develops and maintains the site contact list is determined on a site-specific and/or

program-specific basis. Development and revision of the contact list are ongoing activities throughout the site's investigation and remediation. Guidance on how to create a site contact list is provided in Appendix G.1.

5.2 Project staff contact sheet

As implied by the name, this is a summary of the contact information for staff working on the site that can be handed out to the community. Often included on the sheet are the name, title, affiliation, role or area of expertise, address, telephone number, email address, facsimile number for each staff member. The contact sheet provides the community with a quick reference on whom to call with questions, comments or concerns about the site. Project staff may also use the site contact sheet to direct inquiries to the most appropriate person. This is particularly useful when there are many agencies working on the site and many issues, such as site investigation, health studies, medical outreach, etc., being addressed.

The site contact sheet should be handed out at public meetings or availability sessions, when door-to-door visits and sampling are conducted, and in conjunction with other appropriate outreach activities. The sheet should be developed early on in the process and kept up-to-date. The member of the project team that develops and maintains the staff contact sheet is determined on a site-specific and/or program-specific basis.

5.3 Fact sheets

A fact sheet is a written summary of important information about a site. It presents information in clear and concise terms for the community. Fact sheets aid consistent distribution of information and citizens' understanding of significant issues associated with site-related activities. With respect to soil vapor intrusion, fact sheets are often used to

a. announce a proposed soil vapor intrusion investigation in the area, either as a stand-alone activity or in conjunction with the site's overall investigation;

b. summarize the results of an investigation and the anticipated next steps in the process;

c. invite the public to a meeting or availability session to discuss the proposed investigation, the results of a recently completed investigation, the anticipated next steps, etc.; and

d. provide additional information on topics associated with soil vapor intrusion, such as specific air guidelines for volatile chemicals.

The member of the project team that plans, develops and distributes the fact sheet is determined on a site-specific and/or program-specific basis. Factors to consider when designating the lead include the site's remedial program, the expected content of the fact sheet, and the relationship of various team members with the community. For example, if the community strongly distrusts the responsible party and wants to know how the state is determining that their actions are appropriate, the state should be the lead. A combination of team members may also be suitable.

All team members should be included in reviewing and finalizing the fact sheet. Once the state approves the fact sheet, it may be released to the public. Timely distribution of the fact sheet is important. Sufficient time should be allowed in the development and review

schedule to ensure that the fact sheet is distributed — *and that it is received* — before the critical activity takes place. Specific timeframes for release include the following:

a. 2 weeks prior to a public meeting or availability session, or commencement of field activities;

b. within 24 hours of receiving a specific request for an available fact sheet from the community (e.g., members of the community that did not receive a copy of the fact sheet in the mail);

c. if applicable, before a comment period begins (otherwise a 30-day comment period becomes, in reality, a 25-day comment period); and

d. if appropriate, concurrently with letters to the community explaining sampling results.

Copies of fact sheets commonly used to supplement discussions related to soil vapor intrusion are provided in Appendix H. They are also available from the NYSDOH's soil vapor intrusion web page: http://www.health.state.ny.us/environmental/indoors/vapor_intrusion/. Additional guidance on how to plan, develop and distribute fact sheets is provided in Appendix G.2.

5.4 Public gatherings

The following are several types of public gatherings where project staff can meet with the community:

a. Traditional Public Meetings: Project staff generally present information and answer questions. Citizens are encouraged to ask questions and provide comments;

b. Public Availability Sessions: The session is held in a casual setting, without a formal agenda and presentation. Staff generally conduct an availability session about a specific aspect of a site, which it publicizes ahead of time. The format promotes detailed individual or small group discussion between staff and the public. An availability session may be targeted to a specific subgroup of the overall community. For example, a session may be held where project staff meet with building owners and tenants to discuss their individual sampling results;

c. Public Forum: The forum is held in a casual setting, without a formal presentation. Typically, the format is one of "question and answer" — a panel of project staff (or, if applicable, outside experts) answer questions asked by community members in an open discussion; and

d. Other: Project staff may be invited to give presentations or to make themselves available for questions at community group meetings, such as community or neighborhood board meetings, school board meetings, etc.

If appropriate, a combination of the above may be used. The type, or combination of types, of gathering (if any) selected should be decided based on site-specific, program requirements and community-specific conditions, such as the following:

a. Is the investigation limited to on-site buildings, to a localized area of off-site buildings, or to the off-site neighborhood surrounding the site?;

b. Is the soil vapor investigation being performed as part of ongoing site investigation activities (and consequently ongoing outreach activities), or is this issue being revisited at a site where remediation was considered "complete?";

c. What type of outreach has the community favored in the past?;

d. What are the objectives of the meeting? Can one meeting type accomplish each of the objectives or are different meeting types needed on successive days (e.g., public meeting followed by an availability session)?; and

e. Who is the desired audience? Should the meeting be held in the afternoon to accommodate an elderly population and repeated in the evening for people who work during normal business hours?

The member of the project team that coordinates and implements the gathering is determined on a site-specific and/or program-specific basis. Factors to consider when designating the lead include the site's remedial program, the expected subject of the meeting, and the relationship of various team members with the community. A combination of team members may also be appropriate.

Additional guidance on how to plan and conduct a public meeting and an availability session is provided in Appendices G.3 and G.4.

5.5 Letters transmitting results

When indoor air and/or sub-slab vapor samples are collected from within or beneath a building, a letter providing the sampling results and the conclusions drawn from the data evaluation should be transmitted to the building's owner. If the building is a rental property, the transmittal letter should be sent to the tenants residing in the areas where the samples were collected and a copy to the property owner/landlord. In some cases where responsible parties are carrying out indoor air sampling, access agreements are commonly executed between such a party and the property owner. Consequently, the transmittal letter may be sent to the property owner, and where feasible by prior arrangement with the property owner and/or tenant, with a copy to the tenant.

A transmittal letter should include the following (as applicable):

a. the address of the building sampled;

b. the date samples were collected;

c. the type of samples collected (e.g., sub-slab vapor, indoor air and outdoor air);

d. indoor air sampling locations (e.g., basement, crawl space, first floor living room, etc.)

e. who collected the samples (e.g., the state, or [Consultant Name] on behalf of [Responsible Party name], etc.);

f. why samples were collected (e.g., to evaluate the potential for exposures associated with soil vapor intrusion);

g. the site name and number (usually included in the subject line);

h. the compound(s) or group of compounds of concern (e.g., trichloroethene or volatile organic compounds);

i. an overview of the sampling results (e.g., a table summarizing compounds detected in each sample and/or a figure illustrating sampling locations and corresponding results);

j. copies of the laboratory sheets for each sample collected and the completed building questionnaire/inventory;

k. a statement of the conclusions drawn and the next steps (e.g., soil vapor intrusion appears to be the likely source of volatile chemicals in your indoor air and we would like to install a sub-slab depressurization system to minimize exposures);

l. if applicable, what information should be shared with employees and/or patrons of the facility (e.g., the transmittal letter and enclosed fact sheets, a situation-specific fact sheet and cover memorandum, etc.);

m. contact information for project staff; and

n. fact sheets that supplement information provided in the letter.

The member of the project team that transmits the letter is typically the member that conducted the investigation. A representative of each member should be copied on each transmittal. For example, for investigations conducted by the state, letters are transmitted by the NYSDOH; state and local agencies, as well as a representative for the responsible party (or other non-agency project staff), should be copied. For investigations conducted by the responsible party, the responsible party should transmit letters that have been reviewed and approved by the state, and copy state and local agency representatives.

The level of detail provided in the letter will depend upon who transmits the letter. For example, letters written by the NYSDOH may recommend actions to reduce exposures to indoor sources (i.e., not site-related sources) of volatile chemicals, or address expected risks associated with an identified exposure. Letters transmitted by a responsible party generally focus on site-related contamination and their identified next steps. These letters generally refer the recipients to the state for questions regarding non-site-related compounds and health concerns. For additional guidance on the content of the transmittal letters, contact the NYSDOH's Bureau of Environmental Exposure Investigation at 1-800-458-1158, extension 27850.

Timely distribution of the transmittal letter is important. Generally, final (i.e., verified) sampling results from the laboratory are available 6 to 8 weeks after the samples are submitted. As soon as they are available, final results should be forwarded to the team member that is transmitting them. Sufficient time should be allowed in the development and review schedule to ensure that the letter is transmitted within 2 weeks after final results are available.

If there is significant community interest in the sampling results, reasonable attempts should be made to inform the building owners and tenants of their results verbally in addition to sending a transmittal letter. Other interested community members, such as residents, press and elected officials, may be given an overview of the investigation results and the conclusions drawn *after* each building owner and tenant has been notified.

5.6 Soil vapor intrusion mitigation information

Once a mitigation system (e.g., sub-slab depressurization system) is installed in a building, an information package should be given to the building's owner and tenants, if applicable, to facilitate their understanding of the system's operation, maintenance and monitoring. This package should include the following:

a. a description of the mitigation system installed and its basic operating principles;

b. how the owner or tenant can check that the system is operating properly;

c. how the system will be maintained and monitored and by whom;

d. a list of appropriate actions for the owner or tenant to take if the system's warning device or indicator (e.g., pressure gauge, alarm, etc.) indicates system degradation or failure; and

e. contact information (e.g., names, telephone numbers, etc.) if the owner or tenant has questions, comments or concerns.

The building's owner should also receive the following information:

a. any building permits required by local codes;

b. copies of contracts and warranties; and

c. a description of the proper operating procedures of any mechanical or electrical system installed, including manufacturer's operation and maintenance instructions and warranties.

Wherever possible, illustrations should be provided. For example, pictures of a manometer under normal operating conditions [Figure 5.1], as well as drawings or schematics showing the system at work [Figure 5.2].

The member of the project team who provides this information is the member who installed the mitigation system.

Figure 5.1
Manometer indicating the SSD system is operating properly.

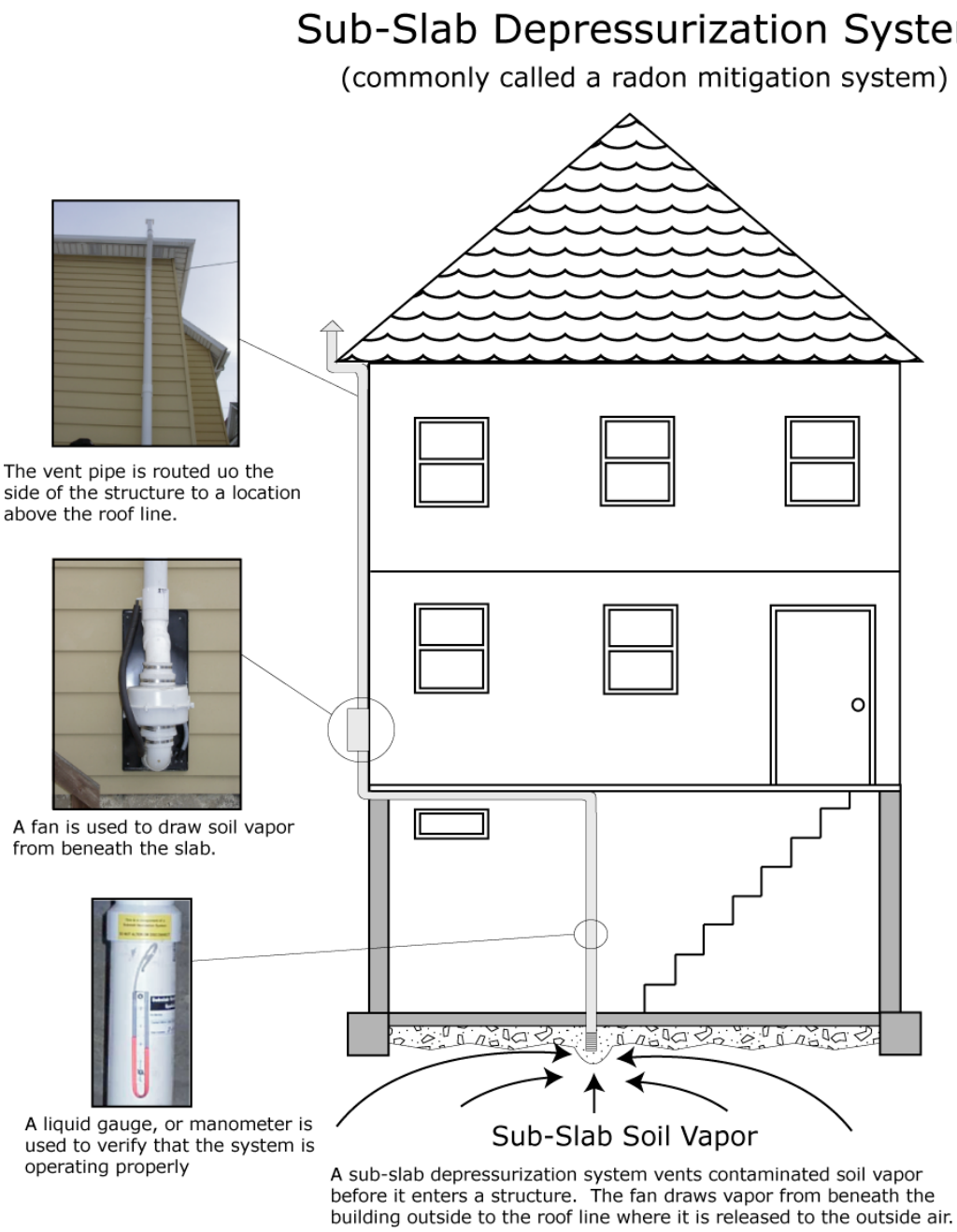

Figure 5.2
Example of an illustration showing how a SSD system works.

5.7 Toll-free "800" numbers

Toll-free information numbers provide quick, easy access for people who have questions, comments or concerns about a site. At a minimum, the NYSDOH site project manager's name and the following "800" number should be shared with the community in fact sheets and transmittal letters, at public gatherings, when samples are collected, and with other outreach techniques for their use if they have health-related questions, concerns or comments related to soil vapor intrusion at the site.

NYSDOH
Center for Environmental Health
Bureau of Environmental Exposure Investigation
Toll-free Information Line

1-800-458-1158, ext. 27850

Note: The "800" number is an *information* line — not a "*hotline*" — because callers may not receive immediate response, such as on nights or weekends.

Similarly, applicable toll-free numbers setup and maintained by other project team members should also be shared with the community whenever appropriate. Additional information on the use of toll-free "800" numbers as an outreach tool is provided in Appendix G.5.

5.8 Door-to-door visits

Door-to-door visits involve gathering or distributing site information by meeting individuals at their residences or businesses. Typically, this outreach technique is used to supplement other communication, such as telephone calls and letters. With respect to soil vapor intrusion, project staff may visit residents near a site to provide information, answer questions, or obtain permission for activities on private properties. All team members should be aware of the specifics of the door-to-door visits (e.g., who will be conducting the visits, the reason, the dates, etc.).

Additional information on conducting door-to-door visits is provided in Appendix G.6.

5.9 Document repositories

A document repository is a collection of documents and other information developed during the investigation and remediation of a site. It is located in a convenient, public facility, such as a library, so that affected and interested members of the public can easily access and review important information about the site. A repository is maintained through the site's operation and maintenance phase, or until its release from the applicable remedial program.

A site document repository helps the public review

a. documents about which the state is seeking public comment;

b. studies, reports and other information; and

c. complete versions of documents summarized in fact sheets, meeting presentations or media releases (summaries should note the locations of local repositories where the complete documents are available).

The member of the project team that establishes and maintains the document repository is determined on a site-specific and/or program-specific basis. Additional guidance on how to establish and maintain a document repository is provided in Appendix G.7.

5.10 Medical community outreach

Outreach to the medical community is an activity or combination of activities undertaken to assist local health care providers in caring for people who have concerns about site-specific environmental exposures. The goal of this type of outreach is to assist the individual provider by giving him/her much of the site-specific information related to the contaminants and to provide information about the site itself. This type of outreach is undertaken whenever the NYSDOH and/or other health agencies determine that the site-specific contaminants may be unfamiliar to the local medical community. Conversely, this outreach can be undertaken when community members express the concern that their health care providers may be unfamiliar with potential adverse health effects related to contaminants at the site.

The targeted audience for this type of outreach consists of specific groups of health care providers most likely to treat people with concerns about potential environmental exposures. Some examples of targeted groups of specialists could include any combination of the following: Family Practice, Internal Medicine, Preventive Medicine, Oncology, Neurology, Allergy, Pediatrics, Obstetrics, Dermatology and Emergency Medicine. Likewise, materials can be sent to medical and nursing schools, residency programs, and medical libraries if they are located nearby. Developing the targeted list of health-care providers is a cooperative effort between local and state departments of health, with input from the community as well.

The NYSDOH, in partnership with the Agency for Toxic Substance and Disease Registry (ATSDR) and the local health department, can conduct these activities, which could include any one or a combination of the following:

a. announcements made at public meetings that the NYSDOH Center for Environmental Health will mail out information packets to individual physicians at the request of any concerned citizen;

b. an article placed in a local newspaper, or, if applicable, in a newsletter periodically sent to residents, stating that the NYSDOH Center for Environmental Health will mail out packets to individual physicians at the request of any concerned citizen. The NYSDOH "800" number and two NYSDOH contact names would be given;

c. an article submitted to the newsletter of the local county medical society, stating that the NYSDOH and the ATSDR have information to help providers with questions about site-related contamination in the area of the site. The NYSDOH "800" number and two NYSDOH contact names would be given; and

d. materials sent to medical and nursing schools, residency programs, and medical libraries if they are located nearby.

Local and state departments of health, and ATSDR, have developed appropriate outreach materials. The information packets should contain a letter to the physician, site-specific fact sheets, brochures, and booklets about potential exposures and about the contaminants in the area of the site. As an example, here is a list of fact sheets and pamphlets that an information packet for a site with PCE and TCE as contaminants of concern might contain:

a. a letter of explanation to the provider, including the NYSDOH "800" number to call for access to more information, as well as two NYSDOH contacts with whom to speak initially;

b. a site-specific fact sheet written for the community, explaining various site-related issues;

c. a compact disc of ATSDR case studies in environmental medicine (CSEMs), with opportunities for earning many free continuing medical education (CME) credits through the Centers for Disease Control and Prevention;

d. a hard copy of both the "Trichloroethylene (TCE) Toxicity" and "Taking an Environmental Exposure History" case studies;

e. two small "quick reference guides" produced by ATSDR about evaluating environmental exposures and doing an exposure history;

f. a NYSDOH fact sheet on Trichloroethene (TCE) in indoor and outdoor air;

g. an ATSDR fact sheet on Trichloroethylene (TCE);

h. a NYSDOH fact sheet on Tetrachloroethene (PERC) in indoor and outdoor air; and

i. an ATSDR fact sheet on Tetrachloroethylene (PERC).

For additional information on this outreach tool, please contact the NYSDOH Center for Environmental Health's Outreach and Education Unit at 1-800-458-1158, extension 27530.

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Soil Vapor/Indoor Air Matrix A

May 2017

Analytes Assigned:
Trichloroethene (TCE), *cis*-1,2-Dichloroethene (*c*12-DCE), 1,1-Dichloroethene (11-DCE), Carbon Tetrachloride

	INDOOR AIR CONCENTRATION of COMPOUND (mcg/m^3)		
SUB-SLAB VAPOR CONCENTRATION of COMPOUND (mcg/m^3)	< 0.2	0.2 to < 1	1 and above
< 6	1. No further action	2. No Further Action	3. IDENTIFY SOURCE(S) and RESAMPLE or MITIGATE
6 to < 60	4. No further action	5. MONITOR	6. MITIGATE
60 and above	7. MITIGATE	8. MITIGATE	9. MITIGATE

No further action: No additional actions are recommended to address human exposures.

Identify Source(s) and Resample or Mitigate: We recommend that reasonable and practical actions be taken to identify the source(s) affecting the indoor air quality and that actions be implemented to reduce indoor air concentrations to within background ranges. For example, if an indoor or outdoor air source is identified, we recommend the appropriate party implement actions to reduce the levels. In the event that indoor or outdoor sources are not readily identified or confirmed, resampling (which might include additional sub-slab vapor and indoor air sampling locations) is recommended to demonstrate that SVI mitigation actions are not needed. Based on the information available, mitigation might also be recommended when soil vapor intrusion cannot be ruled out.

Monitor: We recommend monitoring (sampling on a recurring basis), including but not necessarily limited to sub-slab vapor, basement air and outdoor air sampling, to determine whether concentrations in the indoor air or sub-slab vapor have changed and/or to evaluate temporal influences. Monitoring might also be recommended to determine whether existing building conditions (e.g., positive pressure heating, ventilation and air-conditioning systems) are maintaining the desired mitigation endpoint and to determine whether changes are needed. The type and frequency of monitoring is determined based on site-, building- and analyte-specific information, taking into account applicable environmental data and building operating conditions. Monitoring is an interim measure required to evaluate exposures related to soil vapor intrusion until contaminated environmental media are remediated.

Mitigate: We recommend mitigation to minimize current or potential exposures associated with soil vapor intrusion. The most common mitigation methods are sealing preferential pathways in conjunction with installing a sub-slab depressurization system and changing the pressurization of the building in conjunction with monitoring. The type, or combination of types, of mitigation is determined on a building-specific basis, taking into account building construction and operating conditions. Mitigation is considered a temporary measure implemented to address exposures related to soil vapor intrusion until contaminated environmental media are remediated.

These general recommendations are made with consideration being given to the additional notes on page 2.

ADDITIONAL NOTES FOR MATRIX A

This matrix summarizes actions recommended to address current and potential exposures related to soil vapor intrusion. To use the matrix appropriately as a tool in the decision-making process, the following should be noted:

[1] The matrix is generic. As such, it may be appropriate to modify a recommended action to accommodate analyte-specific, building-specific conditions (e.g., dirt floor in basement, crawl spaces, thick slabs, current occupancy, etc.), and/or factors provided in Section 3.2 of the guidance (e.g., current land use, environmental conditions, etc.). For example, collection of additional samples may be recommended when the matrix indicates "no further action" for a particular building, but the results of adjacent buildings (especially sub-slab vapor results) indicate a need to take actions to address exposures related to soil vapor intrusion. Mitigation might be recommended when the results of multiple contaminants indicate monitoring is recommended. Proactive actions may be proposed at any time. For example, the party implementing the actions may decide to install sub-slab depressurization systems on buildings where the matrix indicates "no further action" or "monitoring." Such an action might be undertaken for reasons other than public health (e.g., seeking community acceptance, reducing costs, etc.). However, actions implemented *in lieu* of sampling will typically be expected to be captured in the final engineering report and site management plan, and might not rule out the need for post-implementation sampling (e.g., to document effectiveness or to support terminating the action).

[2] Actions provided in the matrix are specific to addressing human exposures. Implementation of these actions does not preclude investigating possible sources of soil vapor contamination, nor does it preclude remediating contaminated soil vapor or the source of soil vapor contamination.

[3] Appropriate care should be taken during all aspects of sample collection to ensure that high quality data are obtained. Since the data are being used in the decision-making process, the laboratory analyzing the environmental samples must have current Environmental Laboratory Approval Program (ELAP) certification for the appropriate analyte and environmental matrix combinations. Furthermore, samples should be analyzed by methods that can achieve a minimum reporting limit of 0.20 microgram per cubic meter for indoor and outdoor air samples. For sub-slab vapor samples and dirt floor soil vapor samples, a minimum reporting limit of 1 microgram per cubic meter is recommended.

[4] Sub-slab vapor and indoor air samples are typically collected when the likelihood of soil vapor intrusion is considered to be the greatest (i.e., worst-case conditions). If samples are collected at other times (typically, samples collected outside of the heating season), then resampling during worst-case conditions might be appropriate to verify that actions taken to address exposures related to soil vapor intrusion are protective of human health.

[5] When current exposures are attributed to sources other than soil vapor intrusion, the agencies should be given documentation (e.g., applicable environmental data, completed indoor air sampling questionnaire, digital photographs, etc.) to support a proposed action other than that provided in the matrix box and to support agency assessment and follow-up.

[6] The party responsible for implementing the recommended actions will differ depending upon several factors, including but not limited to the following: the identified source of the volatile chemicals, the environmental remediation program, and analyte-specific, site-specific and building-specific factors.

Soil Vapor/Indoor Air Matrix B

May 2017

Analytes Assigned:
Tetrachloroethene (PCE), 1,1,1-Trichloroethane (111-TCA), Methylene Chloride

	INDOOR AIR CONCENTRATION of COMPOUND (mcg/m^3)		
SUB-SLAB VAPOR CONCENTRATION of COMPOUND (mcg/m^3)	< 3	3 to < 10	10 and above
< 100	1. No further action	2. No Further Action	3. IDENTIFY SOURCE(S) and RESAMPLE or MITIGATE
100 to < 1,000	4. No further action	5. MONITOR	6. MITIGATE
1,000 and above	7. MITIGATE	8. MITIGATE	9. MITIGATE

No further action: No additional actions are recommended to address human exposures.

Identify Source(s) and Resample or Mitigate: We recommend that reasonable and practical actions be taken to identify the source(s) affecting the indoor air quality and that actions be implemented to reduce indoor air concentrations to within background ranges. For example, if an indoor or outdoor air source is identified, we recommend the appropriate party implement actions to reduce the levels. In the event that indoor or outdoor sources are not readily identified or confirmed, resampling (which might include additional sub-slab vapor and indoor air sampling locations) is recommended to demonstrate that SVI mitigation actions are not needed. Based on the information available, mitigation might also be recommended when soil vapor intrusion cannot be ruled out.

Monitor: We recommend monitoring (sampling on a recurring basis), including but not necessarily limited to sub-slab vapor, basement air and outdoor air sampling, to determine whether concentrations in the indoor air or sub-slab vapor have changed and/or to evaluate temporal influences. Monitoring might also be recommended to determine whether existing building conditions (e.g., positive pressure heating, ventilation and air-conditioning systems) are maintaining the desired mitigation endpoint and to determine whether changes are needed. The type and frequency of monitoring is determined based on site-, building- and analyte-specific information, taking into account applicable environmental data and building operating conditions. Monitoring is an interim measure required to evaluate exposures related to soil vapor intrusion until contaminated environmental media are remediated.

Mitigate: We recommend mitigation to minimize current or potential exposures associated with soil vapor intrusion. The most common mitigation methods are sealing preferential pathways in conjunction with installing a sub-slab depressurization system and changing the pressurization of the building in conjunction with monitoring. The type, or combination of types, of mitigation is determined on a building-specific basis, taking into account building construction and operating conditions. Mitigation is considered a temporary measure implemented to address exposures related to soil vapor intrusion until contaminated environmental media are remediated.

These general recommendations are made with consideration being given to the additional notes on page 2.

ADDITIONAL NOTES FOR MATRIX B

This matrix summarizes actions recommended to address current and potential exposures related to soil vapor intrusion. To use the matrix appropriately as a tool in the decision-making process, the following should be noted:

[1] The matrix is generic. As such, it may be appropriate to modify a recommended action to accommodate analyte-specific, building-specific conditions (e.g., dirt floor in basement, crawl spaces, thick slabs, current occupancy, etc.), and/or factors provided in Section 3.2 of the guidance (e.g., current land use, environmental conditions, etc.). For example, collection of additional samples may be recommended when the matrix indicates "no further action" for a particular building, but the results of adjacent buildings (especially sub-slab vapor results) indicate a need to take actions to address exposures related to soil vapor intrusion. Mitigation might be recommended when the results of multiple contaminants indicate monitoring is recommended. Proactive actions may be proposed at any time. For example, the party implementing the actions may decide to install sub-slab depressurization systems on buildings where the matrix indicates "no further action" or "monitoring." Such an action might be undertaken for reasons other than public health (e.g., seeking community acceptance, reducing costs, etc.). However, actions implemented *in lieu* of sampling will typically be expected to be captured in the final engineering report and site management plan, and might not rule out the need for post-implementation sampling (e.g., to document effectiveness or to support terminating the action).

[2] Actions provided in the matrix are specific to addressing human exposures. Implementation of these actions does not preclude investigating possible sources of soil vapor contamination, nor does it preclude remediating contaminated soil vapor or the source of soil vapor contamination.

[3] Appropriate care should be taken during all aspects of sample collection to ensure that high quality data are obtained. Since the data are being used in the decision-making process, the laboratory analyzing the environmental samples must have current Environmental Laboratory Approval Program (ELAP) certification for the appropriate analyte and environmental matrix combinations. Furthermore, samples should be analyzed by methods that can achieve a minimum reporting limit of 1 microgram per cubic meter for indoor and outdoor air samples. For sub-slab vapor samples and dirt floor soil vapor samples, a minimum reporting limit of 1 microgram per cubic meter is recommended.

[4] Sub-slab vapor and indoor air samples are typically collected when the likelihood of soil vapor intrusion is considered to be the greatest (i.e., worst-case conditions). If samples are collected at other times (typically, samples collected outside of the heating season), then resampling during worst-case conditions might be appropriate to verify that actions taken to address exposures related to soil vapor intrusion are protective of human health.

[5] When current exposures are attributed to sources other than soil vapor intrusion, the agencies should be given documentation (e.g., applicable environmental data, completed indoor air sampling questionnaire, digital photographs, etc.) to support a proposed action other than that provided in the matrix box and to support agency assessment and follow-up.

[6] The party responsible for implementing the recommended actions will differ depending upon several factors, including but not limited to the following: the identified source of the volatile chemicals, the environmental remediation program, and analyte-specific, site-specific and building-specific factors.

Soil Vapor/Indoor Air Matrix C

May 2017

Analytes Assigned:
Vinyl Chloride

	INDOOR AIR CONCENTRATION of COMPOUND (mcg/m^3)	
SUB-SLAB VAPOR CONCENTRATION of COMPOUND (mcg/m^3)	< 0.2	0.2 and above
< 6	1. No further action	2. IDENTIFY SOURCE(S) and RESAMPLE or MITIGATE
6 to < 60	3. MONITOR	4. MITIGATE
60 and above	5. MITIGATE	6. MITIGATE

No further action: No additional actions are recommended to address human exposures.

Identify Source(s) and Resample or Mitigate: We recommend that reasonable and practical actions be taken to identify the source(s) affecting the indoor air quality and that actions be implemented to reduce indoor air concentrations to within background ranges. For example, if an indoor or outdoor air source is identified, we recommend the appropriate party implement actions to reduce the levels. In the event that indoor or outdoor sources are not readily identified or confirmed, resampling (which might include additional sub-slab vapor and indoor air sampling locations) is recommended to demonstrate that SVI mitigation actions are not needed. Based on the information available, mitigation might also be recommended when soil vapor intrusion cannot be ruled out.

Monitor: We recommend monitoring (sampling on a recurring basis), including but not necessarily limited to sub-slab vapor, basement air and outdoor air sampling, to determine whether concentrations in the indoor air or sub-slab vapor have changed and/or to evaluate temporal influences. Monitoring might also be recommended to determine whether existing building conditions (e.g., positive pressure heating, ventilation and air-conditioning systems) are maintaining the desired mitigation endpoint and to determine whether changes are needed. The type and frequency of monitoring is determined based on site-, building- and analyte-specific information, taking into account applicable environmental data and building operating conditions. Monitoring is an interim measure required to evaluate exposures related to soil vapor intrusion until contaminated environmental media are remediated.

Mitigate: We recommend mitigation to minimize current or potential exposures associated with soil vapor intrusion. The most common mitigation methods are sealing preferential pathways in conjunction with installing a sub-slab depressurization system and changing the pressurization of the building in conjunction with monitoring. The type, or combination of types, of mitigation is determined on a building-specific basis, taking into account building construction and operating conditions. Mitigation is considered a temporary measure implemented to address exposures related to soil vapor intrusion until contaminated environmental media are remediated.

These general recommendations are made with consideration being given to the additional notes on page 2.

ADDITIONAL NOTES FOR MATRIX C

This matrix summarizes actions recommended to address current and potential exposures related to soil vapor intrusion. To use the matrix appropriately as a tool in the decision-making process, the following should be noted:

[1] The matrix is generic. As such, it may be appropriate to modify a recommended action to accommodate analyte-specific, building-specific conditions (e.g., dirt floor in basement, crawl spaces, thick slabs, current occupancy, etc.), and/or factors provided in Section 3.2 of the guidance (e.g., current land use, environmental conditions, etc.). For example, collection of additional samples may be recommended when the matrix indicates "no further action" for a particular building, but the results of adjacent buildings (especially sub-slab vapor results) indicate a need to take actions to address exposures related to soil vapor intrusion. Mitigation might be recommended when the results of multiple contaminants indicate monitoring is recommended. Proactive actions may be proposed at any time. For example, the party implementing the actions may decide to install sub-slab depressurization systems on buildings where the matrix indicates "no further action" or "monitoring." Such an action might be undertaken for reasons other than public health (e.g., seeking community acceptance, reducing costs, etc.). However, actions implemented *in lieu* of sampling will typically be expected to be captured in the final engineering report and site management plan, and might not rule out the need for post-implementation sampling (e.g., to document effectiveness or to support terminating the action).

[2] Actions provided in the matrix are specific to addressing human exposures. Implementation of these actions does not preclude investigating possible sources of soil vapor contamination, nor does it preclude remediating contaminated soil vapor or the source of soil vapor contamination.

[3] Appropriate care should be taken during all aspects of sample collection to ensure that high quality data are obtained. Since the data are being used in the decision-making process, the laboratory analyzing the environmental samples must have current Environmental Laboratory Approval Program (ELAP) certification for the appropriate analyte and environmental matrix combinations. Furthermore, samples should be analyzed by methods that can achieve a minimum reporting limit of 0.20 microgram per cubic meter for indoor and outdoor air samples. For sub-slab vapor samples and dirt floor soil vapor samples, a minimum reporting limit of 1 microgram per cubic meter is recommended.

[4] Sub-slab vapor and indoor air samples are typically collected when the likelihood of soil vapor intrusion is considered to be the greatest (i.e., worst-case conditions). If samples are collected at other times (typically, samples collected outside of the heating season), then resampling during worst-case conditions might be appropriate to verify that actions taken to address exposures related to soil vapor intrusion are protective of human health.

[5] When current exposures are attributed to sources other than soil vapor intrusion, the agencies should be given documentation (e.g., applicable environmental data, completed indoor air sampling questionnaire, digital photographs, etc.) to support a proposed action other than that provided in the matrix box and to support agency assessment and follow-up.

[6] The party responsible for implementing the recommended actions will differ depending upon several factors, including but not limited to the following: the identified source of the volatile chemicals, the environmental remediation program, and analyte-specific, site-specific and building-specific factors.

Where are We Headed with PFAS Remediation Standards in New York?

By Linda Shaw

Knauf Shaw LLP

Between February 2019 until the present, the New York State Department of Environmental Conservation ("NYSDEC") issued four guidance documents on the special sampling protocols environmental consultants and laboratories must following in order to obtain emerging contaminants data for 21 PFAS compounds and 1,4-dioxane, with each new guidance document updating the last version. Just when geology has been recognized as a profession in New York pursuant to Education Law Article 145 §7204-a, emerging contaminants sampling not only creates an entirely new pathway of liability for consultants and their clients, with guidance documents and protocols changing every few months, but also which requires geologists and qualified environmental professionals to wear a cotton linen wardrobe washed more than 5 times to remove PFAS containing Scotch Guard coating (which are still likely washed in PFAS containing laundry detergent products). Despite the volatility of the agency's continual changing policies, NYSDEC would not take "no" for an answer when remedial parties asked why they were being required to sample for compounds that not only have no cleanup standards, but which are still prevalent on our clothes, in our daily household soaps and coated on our pots and pans. This article will summarize the ever-changing policies surrounding emerging contaminant sampling, and then explore where and when NYSDEC and New York State Department of Health ("NYSDOH") plan to develop cleanup standards and require remediation of emerging contaminants.

How did we get here?

In 2009, the United States Environmental Protection Agency ("EPA") issued Provisional Health Advisories ("Provisional Health Advisories") "to assess potential risk from exposure to [PFOS and PFOA] through drinking water," setting provisional health advisory levels of 200 parts per trillion ("ppt") for PFOS and 400 ppt for PFOA ("Provisional Levels"), but no sampling was required until 2012.[1]

Shortly after drinking water sampling commenced, the significance of these compounds in drinking water above these initial Provisional Levels became apparent. The initial New York PFAS case was in Hoosick Falls, New York, where PFOA contaminated the town's water supply. Next, was the City of Newburgh's water supply. Newburgh proactively sampled its own drinking water, found levels under the Provisional Levels, but then later after May 19, 2016, when EPA lowered these Levels, and issued a lifetime health advisory of 70 ppt for long-term exposure to PFOA and PFOS in drinking water, overnight Newburgh's drinking water supply became contaminated since it contained levels above 70 ppt. High levels of PFAS compounds were then found in its Washington Lake reservoir caused by discharges of fire-fighting foam into the watershed that leads directly into the reservoir from the Stewart Air National Guard Base and

[1] See 2009 United States EPA Provisional Health Advisories for Perfluorooctanoic Acid (PFOA) and Perfluorooctane retrieved from https://www.epa.gov/sites/production/files/2015-09/documents/pfoa-pfos-provisional.pdf (last visited July 22, 2019).

Stewart International Airport owned by the State. The City of Newburgh remains unable to use its reservoir and has been pulled into the nationwide Multidistrict Litigation *IN RE: AQUEOUS FILM-FORMING FOAMS PRODUCTS LIABILITY LITIGATION*, MDL No. 2873, being handled by the Charleston South Carolina District Court, despite having distinct remediation claims from all of the other plaintiffs who are only suing PFAS manufacturers for products liability.

Around this same time in late 2016, NYSDEC also lost the completely unrelated *FMC Corp. vs. NYSDEC* case, 143 A.D.3d 112840 N.Y.S.3d 220 (3rd Dept. October 2016), in which case the Third Department Appellate Division essentially ruled that NYSDEC did not have authority to take over a cleanup of an off-site school property since FMC still had an interim status permit, and was entitled to a hearing on NYSDEC's selected remedy. After losing this case, NYSDEC was on a mission for more power as the emerging contaminant crisis commenced.

Clean Water Infrastructure Act – April 2017

The Hoosick Falls and Newburgh cases, coupled with the loss of the *FMC* case, prompted the NYSDEC to encourage the New York State legislature to very rapidly adopt into law the Clean Water Infrastructure Act ("CWIA") in mid-April 2017, after little to no debate. Just slightly before the passage of this new Law, on March 3, 2017, NYSDEC filed a Notice of Adoption for amendments to 6 NYCRR Part 597, Hazardous Substances Identification, Release Prohibition, and Release Reporting which finalized the:

(1) addition of perfluorooctanoic acid (PFOA-acid, Chemical Abstracts Service (CAS) No. 335-67-1), ammonium perfluorooctanoate (PFOA-salt, CAS No. 3825-26-1), perfluorooctane sulfonic acid (PFOS-acid, CAS No. 1763-23-1), and perfluorooctane sulfonate (PFOS-salt, CAS No. 2795-39-3) to the list of hazardous substances at 6 NYCRR § 597.3; and
(2) prohibited the use of firefighting foam that may contain PFOA-acid, PFOA-salt, PFOS-acid or PFOS-salt for training but continuing to allow foams containing these substances to fight fires.

NYSDEC brilliantly orchestrated the adoption of this new Law by first using an unknown source of funding to investigate a large number of water supply system throughout the state (largely upstate and on Long Island in Republican Districts) and then promising funding to fix the new problem.

Many new sections of law were created by the CWIA, including: New York Environmental Conservation Law ("ECL") §§ 3–0315 (funds a GIS data system); §§ 15–3301-3305 (Source Water Protection Projects provisions, which provide NYSDEC with new Land Acquisition powers); §§ 27–1201-1211(Mitigation and remediation of certain solid waste sites and drinking water contamination provisions); New York Public Health Law § 1112 (Emerging Contaminant Monitoring); §1113 (Drinking Water Quality Council); §1114 (Lead Service Line Replacement Grant program), § 1285–s (Intermunicipal water infrastructure grants program), § 1285–t (Water infrastructure emergency financial assistance), § 1285–u (Septic system replacement fund); New York State Finance law § 97–b (Creation of a hazardous waste remedial revolving loan fund); and New York Soil & Water Conservation District Law § 11–b (enables costs to be incurred for various projects and conservation easements).

The CWIA was adopted in three parts:

- Part M Emerging Contaminant Monitoring - Public Health Law § 1112
- Part R Drinking Water Quality Council - Public Health Law § 1113

- Part T Clean Water Infrastructure Act - which included all of the other provisions of law listed above.

The CWIA created a fund of $2.5 billion aimed at:

- Helping municipalities upgrade their drinking and wastewater treatment facilities,
- Helping homeowners improve their septic systems and
- Enabling land trusts to purchase watersheds, remediate solid waste sites, mitigate drinking water contamination and help farmers comply with Department regulations.

A. Part M Emerging Contaminant Monitoring - Public Health Law § 1112

This Section of the CWIA defines "Emerging contaminants" as "any physical, chemical, microbiological or radiological substance listed as an emerging contaminant pursuant subdivision 3".[2]

Subdivision 3 says that the Commissioner of Health shall promulgate regulations to identify and list substances as an "emerging contaminant" that meet the following criteria:

- are not subject to any other substance-specific drinking water regulation of the Department that establishes a maximum contaminant level, maximum residual disinfectant level, or action level;
- are known or anticipated to occur in public water systems; and
- because of their quantity, concentration, or physical, chemical or infectious characteristics, may cause physical injury or illness, or otherwise pose a potential hazard to human health when present in drinking water.

Obviously, this is a very broad definition, which can greatly expand over time since there are thousands of PFAS compounds.

B. Part R Drinking Water Quality Council - Public Health Law § 1113

The Drinking Water Quality Council, which includes 12 members, is tasked in this section of the CWIA with developing a list of emerging contaminants for the NYSDOH to consider, develop well testing material for private homes, and work with other state agencies to oversee the pursuit of parties responsible for the contamination. The 12 members consist of:

- DOH Commissioner Health or designee (Chair)
- DEC Commissioner designee;
- DEC designee with expertise in water resources;
- DOH designee with expertise in drinking water;
- 4 Governor appointed designees who represents water purveyors, expertise in toxicology/health risk assessment; microbiology; and environmental engineering; and
- 4 Senate and Assembly designees 2 who represents water purveyors, and 2 with expertise in toxicology/health risk assessment.

[2] NYSDEC's website defines Per- and Polyfluoroalkyl Substances (PFAS) as "a group of chemicals used to make fluoropolymer coatings and products that resist heat, oil, stains, grease, and water. Fluoropolymer coatings are blends of resins and lubricants used in products such as water-repellent clothing, furniture, adhesives, paint and varnish, food packaging, heat-resistant non-stick cooking surfaces and insulation of electrical wires." Chemicals in this group include perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS). https://www.dec.ny.gov/chemical/108831.html

On December 18, 2018, the Council adopted "the nation's most protective maximum contaminant levels[3]" (MCLs) for PFOA, PFOS and 1,4-dioxane. Specifically, the Council recommended MCLs of 10 parts per trillion (ppt) for PFOA, 10 ppt for PFOS, and an MCL of 1 part per billion (ppb) for 1,4-dioxane. https://www.health.ny.gov/press/releases/2018/2018-1218_drinking_water_quality_council_recommendations.htm

C. PART T Clean Water Infrastructure Act

The final part of the CWIA has two new ECL titles:

- ECL Article 15 Title 33 – This new section of law authorizes NYSDEC to provide state assistance to municipalities, not-for-profit corporations and soil and water conservation districts to undertake land acquisition projects for source water protection. However, it is important to note state assistance may not be provided to fund any land acquisition project which is undertaken by eminent domain unless such process is undertaken with a willing seller. The Department is supposed to give priority to projects which protect or recharge drinking water sources and watersheds, including riparian buffers and wetlands, and shall promote an equitable regional distribution of funds by evaluating the project's contribution to the protection of drinking water supplies; the presence of a water assessment/protection plan or other similar plan; and financial need or hardship.

- ECL Article 27 Title 12 – This new section of law in ECL §§ 27–1201-1211, called "Mitigation and remediation of certain solid waste sites and drinking water contamination", is most significant new section of law for environmental practitioners because it essentially provides NYSDEC with new, extremely broad "Superfund" powers while providing site owners with extremely limited to no due process rights.

Title 12 includes new definitions for contaminant, and contamination, drinking water contamination site, mitigation, solid waste site and solid waste management facility:

- "Contaminant" means emerging contaminants pursuant to section eleven hundred twelve of the public health law, and, for solid waste sites, shall include parameters identified in regulations required to be tested by landfills to ensure the protection of groundwater quality.

- "Contamination" or "contaminated" means the presence of a contaminant in any environmental media, including soil, surface water, or groundwater, sufficient to cause or substantially contribute to an exceedance of standards, criteria, and guidance values established by the Department or drinking water standards, including maximum contaminant levels, notification levels, maximum residual disinfectant levels or action levels established by the Department of Health.

- "Drinking water contamination site" means any area or site that is causing or substantially contributing to the contamination of one or more public drinking water supplies.

- "Mitigation" means the investigation, sampling, management, or treatment of a solid waste site or drinking water contamination site required to ensure the availability of safe drinking water, including public water systems and individual onsite water supply systems necessary to meet

[3] These were the most stringent levels until California just recently reduced their "notification" levels to 5.1 parts per trillion (ppt) for PFOA and 6.5 ppt for PFOS. https://www.nrdc.org/experts/anna-reade/california-pfas-missing-forest-through-trees. "Green" States like New York and California seem to be in competition to have the lowest emerging contaminant numbers without much thought as to the cost and other ramifications of remediating these "forever" chemicals while they remain prevalent in many daily household and industrial products.

standards, criteria, and guidance values established by the Department or drinking water standards, including maximum contaminant levels, notification levels, maximum residual disinfectant levels, or action levels established by the Department of Health that can be successfully carried out with available, implementable and cost-effective technology. "Mitigation" activities include but are not limited to the installation of drinking water treatment systems, the provision of alternative water supplies, or repair of a landfill cap. "Mitigation" does not mean remediation.

- "Solid waste site" means a site where (a) the Department has a reasonable basis to suspect that the illegal disposal of solid waste occurred or, (b) a court of competent jurisdiction has determined that an illegal disposal of solid waste occurred, or (c) the Department knows or has a reasonable basis to suspect that an inactive solid waste management facility, which does not have a current monitoring program, is impacting or contaminating one or more drinking water supplies. Solid waste site shall not include a site which is currently subject to investigation or remediation pursuant to title thirteen or fourteen of this article or any site which completed such programs and was either delisted by or received a certificate of completion from the Department.

ECL § 27-1203, entitled “Mitigation and remediation of solid waste sites”, authorizes NYSDEC to conduct preliminary investigations to determine if a solid waste site is causing or substantially contributing to imminent or documented drinking water source contamination. Where the DEC has determined through a preliminary investigation conducted that a solid waste site is causing or substantially contributing to contamination of a public drinking water supply, the NYSDEC may mitigate and remediate a solid waste site or area which is necessary to ensure that drinking water meets applicable standards. To conduct mitigation and remediation of solid waste site, NYSDEC shall have the following authorization:

- The DEC shall have the authority to enter all solid waste sites for the purpose of preliminary investigation, mitigation and remediation;
- Where the Department has determined through a preliminary investigation that a solid waste site is causing or substantially contributing to contamination of a public drinking water supply:
    - The owner or operator of a solid waste site shall cooperate with any and all remedial measures deemed necessary;
    - Remedial measures shall be conducted in conjunction with the Department of Health;
    - The remedial goal is to ensure that drinking water meets applicable standards, including maximum contaminant levels, notification levels, maximum residual disinfectant levels, or action levels established by the Department of Health; and
    - If the DEC or the Department of Health determines that a solid waste site poses a significant threat to the public health or environment due to hazardous waste, the Department shall refer the site to the Superfund Program.

ECL §27-1205, entitled “Mitigation of Contaminants in Drinking Water”, the NYSDEC and NYSDOH may undertake all reasonable and necessary additional mitigation measures to ensure that drinking water meets applicable standards, including maximum contaminant levels, notification levels, maximum residual disinfectant levels, or action levels established by NYSDOH. Wherever the NYSDOH Commissioner has required a public water system to take action to reduce exposure to an emerging contaminant or emerging contaminants and has determined that the concentration of the emerging contaminant constitutes an actual or potential threat to public health based on the best available scientific information pursuant to Public Health Law §1112, NYSDEC and NYSDOH shall have the following authorization:

To undertake the development and implementation of all necessary and reasonable mitigation and remediation measures of drinking water contamination, as approved by the Department of Health, to address emerging contaminants in public water supplies.

At first blush, the focus of these new provisions appears to be clearly on sites contaminated with emerging contaminants impacting drinking water supplies. However, NYSDEC has already started to require investigation and remediation at brownfield sites that are clearly not impacting drinking water supplies in urban areas.

The additional concern with this new ECL title is the lack of due process. Only a 2 or 10-day notice and opportunity for hearing is provided. NYSDEC may enter any drinking water contamination site and areas near such site to undertake all reasonable and necessary mitigation and remediation for such site, provided:

- Written notice was sent to the owners or occupants of such site or nearby areas of the intended entry and work at least 10 days prior to such initial entry unless such owners and occupants consent to an earlier date; but
- If DEC has "substantial evidence" that such drinking water contamination site is causing or substantially contributing to the contamination of drinking water, 2 days' written notice shall be sufficient.

The DEC Commissioner may order, after notice and opportunity for a hearing, the owner and/or operator and/or any person responsible for such contamination to:

- undertake all reasonable and necessary mitigation and remediation, as approved by DOH, to ensure that drinking water meets applicable standards, including maximum contaminant levels, notification levels, maximum residual disinfectant levels, or action levels established by DOH, and
- employ feasible measures that can be successfully carried out with available, implementable and cost-effective technology, subject to DEC and DOH approval of the Department, and
- to implement such program within reasonable time limits specified in the order.

While a very short opportunity for a hearing is provided, NYSDEC staff have upfront subpoena powers, which allows immediate access to all records and witness testimony:

- DEC can enter all properties served by the public water system, any individual onsite water supply systems impacted by the contamination, and any land and any surface or underground water sources impacted by the contamination.
- DEC shall have access to copy all books, papers, documents and records pertinent to an ongoing investigation of drinking water contamination.
- Staff can sign and issue subpoenas in the name of the Department requiring the production of books, papers, documents and other records and may take testimony by depositions under oath of any person relating to the ongoing investigation of a drinking water contamination identified in this title.

The polluter ultimately pays the bill once NYSDEC gathers substantial evidence that the drinking water contamination site is causing or substantially contributing to drinking water contamination. NYSDEC can charge the drinking water response account, and then recover the money from any responsible person in any action or proceeding brought pursuant to the state finance law, this title, other state or federal statute, or common law if the person so authorized in writing is an employee, agent, consultant, or contractor of a responsible person acting at the direction of the Department. In exchange for needed

water infrastructure project dollars throughout the State, municipalities may find themselves paying more than they receive when the initial CWIA grant money runs out, after being named responsible parties in PFAS or 1,4-dioxane Superfund cases.

Emerging Contaminant Due Diligence

At the January 2019 EELS Section Annual Bar Association conference, three consultants debated how they are handling PFAS environmental due diligence in New York considering that sampling is being required by NYSDEC at all remedial sites for 21 PFAS compounds (even though only 2 have been deemed hazardous substances), while ASTM protocols still do not required emerging contaminants to be considered since 1,4-dioxane and PFAS substances are not yet deemed hazardous substances under the federal CERCLA statute. As a result, the current ASTM due diligence guidelines do not yet officially require emerging contaminants to be considered during a due diligence evaluation of a site.

However, attorneys are beginning to recommend analysis to evaluate this business risk (particularly at a site which had a fire or involved the use or manufacturing of PFAS substances) to preserve the *Bona Fide* Prospective Purchaser or Innocent Purchaser Defenses. Recall the *Bona Fide* Prospective Purchaser Defense in Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) §§101(40) & 107(r) allows purchasers after January 11, 2002 to avoid liability for contaminated property provided the prospective purchaser:

- Conducts an "all appropriate inquiries" within 6 months prior to acquisition (i.e. perform Phase I Due Diligence Investigation pursuant to ASTM Standard E1527-13, or the regulatory standard at 40 C.F.R. Part 312)
- The Phase I states disposal of hazardous substances occurred prior to acquisition and establishes no potentially responsible party (PRP) affiliation with the prospective purchaser; and
- The purchaser satisfies any ongoing obligations and cooperates with any government response actions.

Therefore, it is in the best interest of the purchaser of a site for their consultant to cover this business risk. Who pays for the remediation, if a Phase I and II are performed, data is generated, and then remediation is required if the party qualifies as a bona fide prospective purchaser? The answer to this question and many others remains unclear.

Emerging Contaminant Guidance Documents

While there were apparently several one-page emerging contaminant guidance documents dating back to as early as June 2016, the first guidance document to be widely distributed since sampling was being required at all remedial sites was the one-page February 2019 Laboratory Guidance for Analysis of Per- and Polyfluoroalkyl Substances (PFAS). The Division of Environmental Remediation (DER) created the guidance for laboratories submitting PFAS data to DER, and if they could not comply, they were required to contact Dana Maikels at dana.maikels@dec.ny.gov. The third paragraph of the document contained an admission that "a quantitative standard does not exist for branched isomers of PFOA…". Labs subsequently confirmed that there is an ELAP Certified Methodology for sampling PFOA and PFOS in groundwater (even though it is only a *modified* EPA Test Method 537), but admitted certified methodologies are lacking for the numerous other PFAS substances in active daily use in average household consumer and industrial products. In addition, labs indicated that they had to purchase expensive new sampling equipment because potential PFAS containing materials, previously believed to be inert, were incorporated into their sampling equipment and had to be removed. Finally, they added

that consultants could easily cause sample contamination if they did not follow elaborate new sampling protocols, which included wearing clothes washed many times to avoid contamination from water and stain resistant PFAS containing coatings typically present on most textiles.

Next came the March 2019 "Sampling for 1,4-Dioxane and Per- and Polyfluoroalkyl Substances (PFAS) Under DEC's Part 375 Remedial Programs" guidance, which required sampling for PFAS compounds in "all media" other than soil vapor including "soil, groundwater, surface water, and sediment". In addition, this guidance stated that "the number of samples required for emerging contaminant analyses is to be the same number of samples where 'full TAL/TCL sampling' would typically be required in an investigation or remedial action compliance program" and "sampling of all media for ECs is required at all sites coming into or already in an investigative phase of any DER program". Nowhere in either of these guidance documents is there any mention that the site has to be suspected of contaminating a drinking water source or supply.

This guidance document, which was slightly updated in June 2019 to include special testing for the import or reuse of soil, is disconcerting on many levels. First, it is a guidance document, which is not vetted through any public process. Second, this guidance completely contradicted an earlier April 2018 guidance, which stated that:

> Until an SCO is established for PFAS, soil samples do not need to be analyzed for PFAS unless groundwater contamination is detected. Separate guidance will be developed to address sites where emerging contaminants are found in the groundwater.

Next, neither the March 2019 or June 2019 guidance documents provide any real explanation why soil now has to be sampled before SCOs are established and before certified methodologies even exist for sampling PFAS in soil.

DER-10 interprets Public Health Law Section 502 and states that "data upon which decisions impacting human health are based must be confirmed by an ELAP-accredited laboratory, accordingly confirmation and documentation samples will require analysis by an ELAP-accredited laboratory." DER-10 Appendix 2A at 212. Accordingly, DER-10 requires that "final delineation samples," which determine whether remedial cleanup requirements have been achieved, are performed by an ELAP-accredited laboratory. DER-10 §§ 1.3(b)(3), 2.4(d)(7). Similarly, for initial investigations, the "analysis must be conducted by an [ELAP-accredited laboratory] for the category of parameters analyzed. DER-10 §2.1(a)(5).

DER-10 further interprets Section 502.2 of the Public Health Law to provide that for laboratories to be ELAP-accredited they must meet the ELAP requirements ***for that specific analytical method***. [emphasis added]. DER-10 Appendix 2A. Yet the March and June 2019 Guidance documents each admit that "ELAP does not offer certification for PFAS compounds in matrices other than finished drinking water," but requires that labs analyzing soil and sediment samples hold ELAP drinking water certification for PFOA and PFOS. However, there is no current ELAP certification for PFAS compounds in soil. Therefore, these guidance documents are arguably contrary to the Public Health Law, and DER-10, by requiring PFAS analytical results for soil because there is no ELAP certified method for the soil. It is also arguably unethical for environmental engineers to be relying on this type of data under their own codes of ethics.[4]

[4] The National Society of Professional Engineers Code of Ethics indicates that Engineers must "[h]old paramount the safety, health, and welfare of the public" and once authorized by their client, disclose data subject to applicable law or as required by the Code pursuant to applicable standards. https://www.nspe.org/sites/default/files/resources/pdfs/Ethics/CodeofEthics/Code-2007-July.pdf

Finally, based on the US EPA's February 2019 PFAS Action Plan, the agency was supposed to be developing a certified methodology and "Interim Recommendations for addressing Groundwater Contaminated with PFOA and PFOS to support site-specific cleanup efforts". It is now basically the fall of 2019 and that agency has not developed either the final methodology for sampling or cleanup recommendations. The concern is that US EPA may end up developing a different methodology than what has been used to date, calling all of the existing data into question.

The concern for environmental practitioners as a result of the lack of an ELAP certification for PFAS in soil, and in groundwater for PFAS compounds other than PFOA and PFOS, is that disparate sample results can occur and the data may not be reliable to determine liability.

Next, there is no consideration as to cost or the long-term implication of the data gathering exercise that has just occurred. PFAS samples are very expensive to analyze and if soil contamination is found, landfills do not want to accept PFAS waste because landfills already have significant PFAS contamination. Moreover, since there are no cleanup standards, any amount of PFAS in soil and groundwater will be increasingly problematic for disposal. Labs, Consultants and Remedial Parties are being put in a very difficult position being forced to develop non-verifiable data, upon which remedial and public health decisions will rely, and then may be faced with having to pay for the incineration of PFAS containing soil as hazardous waste even though PFAS is still contained in many every day products:

- Textiles and leather products (Gore-Tex, Polartec, Scotch Guard)
- Fire Fighting Foam
- Metal plating
- Stain-resistant carpet
- Photographic industry
- Photolithography
- Semi-conductors
- Paper packaging (fast food wrappers)
- Non-stick coating additives
- Cleaning products
- Pesticides

Where are we going next?

After the sampling demands imposed by the DEC on remedial sites for the last year and a half, many environmental practitioners are now faced with sites that have some PFOS, PFOA and 1,4-dioxane levels above the new proposed MCLs, and sites that contain one or more of the other 19 PFAS compounds. Practitioners need to know what levels will trigger remediation decisions and what type of remediation technology will be required. To date, there has been no clear response from either NYSDEC or NYSDOH. At the May 2019 Certificate of Completion meeting, after NYSDEC admitted that after its almost two-year long data collection effort, many sites do have low-level, ubiquitous, area-wide PFAS and 1,4-dioxane contamination, the agency punted on questions asked about remedial standards and technologies that will be required. In preparation for this article, high level staff at the NYSDEC were asked the following questions, and their written responses are shown in bold below. However, these responses provided little additional guidance on what levels will trigger remediation and what technologies will be required to perform remedial work:

The Code of Ethics of the American Society of Civil Engineers (which generally is generally applicable to environmental engineers) and is available at http://www.asce.org/code-of-ethics/) states: Engineers shall hold paramount the safety, health and welfare of the public and shall strive to comply with the principles of sustainable development in the performance of their professional duties.

On September 22, 2019, the NYSBA Annual Fall Conference will be having a session on PFAS sampling and remediation. It would be good for the environmental law section to hear the latest update from the agency on where we are headed with PFAS and 1,4-dioxane remediation. Have you made any decision yet on when remediation will or will not be required? **PFOA, PFOS, and 1,4-dioxane are ECL § 27-1301(1) hazardous wastes and 6 NYCRR § 375-1.2(g) contaminants. Therefore, they must be addressed in accordance with the requirements for addressing hazardous wastes and contaminants at contaminated sites. This includes compliance with the Environmental Conservation Law, 6 NYCRR Part 375, and DER-10.**

Also for sites getting out of the program this year, are you only going to require monitoring if PFAS or 1,4-dioxane levels are above a certain number? **A site's remedial investigation should be sufficient to determine whether the site is a source of PFOA, PFOS and/or 1,4-dioxane. A site that is a source area must be remediated before getting a Certificate of Completion.**

The following additional questions below were sent after these responses were received, and as of September 18, 2019, the response below in bold was received:

But remediated to what standards?? Also how does anyone remediate PFAS at 100-200 ppt? You are not going to make people put Carbon Treatment systems in for these levels are you? I am trying to get a sense of a number that would trigger remediation, if there is one, because at a PFAS conference back in April, the DOH person indicated that it is going to be a long time before actual numeric cleanup standards can be developed using the technical guidance. I am not sure if that is because PFAS is both a carcinogen and a non-carcinogen.

If the site is a source of contamination above the HAL or MCL, it needs to be addressed. There are a range of options depending on the proximity to drinking water supplies, site-specific conditions, etc., which should be evaluated in the Feasibility Study or Alternatives Analysis. These include excavation, capping, pump & treat, in-situ carbon and others. Shortly after promulgation of the MCL for PFOA/PFOS, DEC expects to release soil cleanup objectives for the protection of groundwater for these compounds.

When following up with the high level DOH person with week, who spoke at an April 2019 PFAS conference, his response to the question as to when standards would be developed for just PFOA, PFOS and 1,4-dioxane was "you should talk to the DEC".

Since sampling to date on many urban brownfield sites not impacting drinking water has revealed groundwater exceedances of these substances in the 20 to 200 ppt range, we all really do need to be concerned about where of this is all going, particularly since we each apparently have on average 400 ppt of PFAS in our own bodies. Are we all walking Superfund sites if DEC starts to require remediation at sites that have contamination in this range? Moreover, are we the responsible parties since we have PFAS coatings on our clothes that flake off into our washing machines, which is then discharged into our septic fields? These may sound like crazy questions, but the reality is that we may all be walking PFAS polluters. While traditionally, drinking water quality standards have been used for groundwater remediation standards, regardless of whether the groundwater is used for drinking water or not, the new PFOS and PFOA MCLs are so low, if contaminant levels over the new parts per trillion MCLs will be remediation standards, then it may be that most properties in New York, including residential properties, may need remediation.

NYSDEC's responses above state that if a "site is a source of PFOA, PFOS and/or 1,4-dioxane" … that site "must be remediated", however, this advice rings hollow when a "source" has not yet been defined. If an urban site has hits of 200 ppt of PFOA or PFOS, and there is also that same level in the street near a sewer next door, is the site the source, the sewer the source, or is this just background contamination? With respect to remediation, Granulated Activated Carbon (GAC) systems can work to remediate PFOS and PFOA when present at high levels, but the systems require frequent filter changeouts to avoid break through, are expensive to install, and it is not yet clear what levels of "clean" can be achieved by these systems, not to mention the costly disposal of the filters many disposal facilities do not want to accept or are still accepting at a premium. However, GAC systems do not work well on the short chain PFAS substances and new resin based remedial technologies are only just "emerging".

NYSDEC and NYSDOH have a difficult decision to make as many sites are trying to exit the Brownfield Cleanup Program in the Generation 2 program by December 2019. Will the agencies do the right thing and let sites finish the program with a monitoring requirement if low levels of emerging contaminants have been identified, which NYSDEC has acknowledged are being found on many brownfield sites, or will they deny issuance of a Certificate of Completion? Many of us will soon find out the answer to that question as the end of the year will be soon upon us.

Conclusion

The article concludes with a reminder to the agencies of the advice in Judge Cherlundo's Supreme Court decision in *Destiny v. NYSDEC*, 63 A.D.3d 1568, 879 N.Y.S.2d 865 (4th Dep't 2009), *lv. den'd* 2009 WL 3161769, 2009 N.Y. Slip Op. 07124 (4th Dep't 2009), that guidance should not be used to change or make law. "Clearly, in deciding to adopt the 'guidance factors', the DEC has opted to make itself a fiscal watchdog without legislative authority. Moreover, by adopting the so called 'guidance factors' the DEC has chosen to rewrite the statute that was clearly written by the legislature, the effect of which is to not only dull, but to emasculate the clear intent of the statute, by administrative agency fiat. Such activities cannot - and should not - be condoned."

The Clean Water Infrastructure Act was designed to address drinking water. NYSDEC has already strayed too far from the purpose of this new law by requiring sampling at every remedial site whether there is a potential impact on drinking water or not, only to have data they now do not know what to do with, but which should inform the development of cleanup standards. PFAS remediation should be required on those sites that are directly impacting drinking water resources, while products and our own clothes start to wean away from PFAS containing substances now apparently considered hazardous. Sampling methodologies also need to be clearly validated and verifiable. EPA needs to start to advocate for manufacturers to stop using these substances where they are unnecessary. Until then, requiring developers of contaminated sites to remediate low level emerging contaminant contamination is not only unfair, it will be futile since the sources of contamination are ongoing.

In the interim, it may make sense if data is problematic at a given site, to take multiple rounds of samples and use multiple labs to determine if the first round was accurate. This is a new emerging field of risk with non-industrial products being used in everyday household products causing this new form of contamination that cannot be easily remediated or disposed of. Who could have ever imagined that we could become the source of this new emerging form of ubiquitous contamination simply by washing our clothes and our pots and pans down our drains into our leach fields and sewers? If emerging contaminants have caused area-wide ubiquitous contamination, there needs to be some sound policy making on how to focus on the most impacted sites or this issue can turn our own backyards into contaminated

brownfield real estate. Frankly, focusing resources on how to remediate our own PFAS contaminated bodies should also be more of a priority than remediating low level emerging contaminant subsurface contamination one site at a time.

This issue, like other historic environmental issues, requires a thoughtful policy making process with many stakeholders at the table such as the process that led to the original Brownfield Cleanup Program law. The EELS section of the Bar stands ready to assist the state agencies if they want our assistance.