NPDES Compendium of Next Generation Compliance Examples

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Introduction to Next Generation Compliance

Next Generation Compliance is an EPA strategy to increase compliance with environmental regulations by using advances in pollutant monitoring and information technology combined with a focus on designing more effective regulations and permits to reduce pollution. Protecting clean air and water, and ensuring our communities are safe from pollution, is more complex today than ever. Whether it's pollution that's not apparent to the naked eye or large numbers of small sources that collectively have a big impact on the environment, new challenges require us to innovate and improve. Today's challenges require a modern approach to compliance with new tools and approaches while strengthening vigorous enforcement as the backbone of environmental protection.[1] Next Generation Compliance principles have been used to build compliance drivers into rules, permits, and enforcement settlements, resulting in better environmental performance, while also enabling regulators to more easily monitor and ensure compliance. These principles are demonstrated by tools such as:

- public accountability through increased transparency of compliance data,
- electronic reporting,
- advanced pollutant monitoring for point source discharges,
- ambient monitoring in water bodies, both upstream and downstream from dischargers, and
- third-party verification of compliance with environmental requirements.

As authorized by the Clean Water Act (CWA), the National Pollutant Discharge Elimination System (NPDES) program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. While Next Generation Compliance can and has been used across all environmental programs, this Compendium focuses primarily on use of Next Generation Compliance tools in the NPDES program to advance the goals of the CWA for point source discharges. These creative and innovative approaches illustrate how technological and behavioral advancements and efficiencies could improve compliance rates, increase transparency, and improve environmental performance. For more information about Next Generation Compliance in general, see https://www.epa.gov/compliance/next-generation-compliance.

While some Next Generation Compliance tools have been implemented with existing resources, others will require regulators to address overall management of existing data systems, current capabilities, and long-term resource needs. The Agency expects that the E-Enterprise for the Environment Initiative (see https://www.epa.gov/e-enterprise) will allow states, EPA, and tribes to collaboratively streamline business processes and drive and share innovations across agencies and programs. These efforts will support and build the foundation for more widespread use of Next Generation Compliance tools.

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[1] For a discussion of theoretical and empirical literature on the effectiveness of individual-facility monitoring and enforcement in promoting compliance through deterrence, see, e.g., *Monitoring, Enforcement, & Environmental Compliance: Understanding Specific & General Deterrence* (Oct. 2007) (State-of-Science White Paper prepared for EPA), *available at* https://archive.epa.gov/compliance/resources/reports/compliance/research/web/pdf/meec-whitepaper-task3.pdf; and U.S. EPA, Office of Enforcement and Compliance Assurance, *Compliance Literature Search Results – Citations to Over Two Hundred Compliance-Related Books and Articles From 1999 to 2007* (April 2007), *available at* https://archive.epa.gov/compliance/resources/reports/compliance/research/web/pdf/lit-results-2007.pdf.

EPA's Office of Water (OW) has also issued several documents which present concepts that support Next Generation Compliance. These include:

- *Promoting Water Technology Innovation for Clean and Safe Water, Water Technology Innovation Blueprint -- Version 2* (April 2014)[2] and associated *Progress Report,* which promotes and supports technology innovation to restore, protect, and ensure the sustainability of our water resources, focusing on 'market opportunities' where technology innovation could help solve water challenges.[3]
- *Municipal Separate Storm Sewer System Permits: Post-Construction Performance Standards & Water Quality-Based Requirements – A Compendium of Permitting Approaches* (June 2014)[4], which consists of permit examples which demonstrate clear, specific, and measurable permit requirements and, where feasible, numeric effluent limitations in NPDES permits for stormwater discharges.

Format and Use of Examples Included in this Compendium

The NPDES examples included in this Compendium are grouped into the following categories:

Each section provides an introduction to a Next Generation Compliance tool and explains how that tool has been used to help advance the goals of the NPDES program; it then describes considerations related to use of that Next Generation Compliance tool in NPDES rules, permits, and enforcement settlements; and lastly, each section lists examples from the NPDES program which illustrate use of that Next Generation Compliance tool. The attached Appendix provides excerpts of the relevant rule, permit, or settlement language, as well as links to the complete documents, for some of the examples. Throughout the document, there are also text boxes with examples of creative and innovative Next Generation Compliance approaches in practice today in other environmental programs.

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[2] Available at https://www.epa.gov/sites/production/files/2014-04/documents/clean_water_blueprint_final.pdf.

[3] For additional information about innovations related to the CWA, see, e.g., the following documents: U.S. EPA, Office of Water, *Establishing Total Maximum Daily Load (TMDL) Wasteload Allocations (WLAs) for Storm Water Sources and NPDES Permit Requirements Based on Those WLAs* (November 2014), *available at* https://www.epa.gov/tmdl/establishing-total-maximum-daily-load-tmdl-wasteload-allocations-wlas-storm-water-sources-and; Association of Clean Water Administrators, *Examples of State Innovations: Clean Water Act Compliance, a White Paper* (April 2013), *available at* http://www.acwa-us.org/.

[4] Available at https://www.epa.gov/npdes/pubs/sw_ms4_compendium.pdf.

Each example in this Compendium demonstrates one or more Next Generation Compliance tools that are already in use in various NPDES contexts. By itself, this Compendium does not require the use of Next Generation Compliance tools in the NPDES program. Regions, states, and tribes may use these tools as appropriate and practical.

Designing More Effective Rules and Permits

Regulators can improve compliance in rules and permits by identifying their key compliance challenges upfront and addressing them by designing the regulations and permits to leverage applicable compliance drivers using the principles and tools.[5] For instance, clarity and simplicity reduce the risk of noncompliance resulting from simple misunderstanding.[6]

As discussed in EPA's *MS4 Permit Improvement Guide*,[7] an effort should be made to ensure that permits are clear, specific, measurable, and enforceable by, among other things:

- Avoiding vague phrases such as "as feasible" and "as possible"; and
- Setting forth objective standards, criteria or processes which will aid the permittee in complying with the permit, as well as the permitting authority in determining compliance.

Example of Clear and Objective Regulatory Requirements and Applicability Criteria

- Outlining permit requirements: Tennessee's 2015 Storm Water Multi-Sector General Permit for Industrial Activities developed outlines of TMSP permit requirements by sector (e.g., timber products facilities, landfill and land application sites) that provide a plain English summaries of various permit requirements. The permittee is still obligated to comply with all terms and conditions outlined in the permit, but the sector summaries are helpful guides to certain permit provisions which may typically have low compliance rates. See http://www.tennessee.gov/environment/article/permit-water-storm-water-multi-sector-general-permit-industrial-activities.

Example of Structuring Permit to Avoid Deficiencies

- Requiring submittal of SWPPP to obtain general permit coverage: Maryland Department of Environment's 2014 General Permit for Discharges from Stormwater Associated with Industrial Activities requires that a Stormwater Pollution Prevention Plan (SWPPP) be submitted along with a complete and accurate Notice of Intent (NOI) in order to be covered by the general permit. By requiring that SWPPPs be submitted along with NOIs, it allows the State to ensure upfront that these important documents are developed and complete. See Appendix for more details.

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[5] Hindin, D. and Silberman, J., Designing More Effective Rules and Permits, George Washington Journal of Energy & Environmental Law (Spring 2016), available at https://gwujeel.files.wordpress.com/2016/05/completed_jeel_vol7_issue2_designingmoreeffectiverulesandpermits.pdf.

[6] See, e.g., Sarah L. Stafford, Rational or Confused Polluters? Evidence From Hazardous Waste Compliance Contributions, 5 Econ. Analysis & Pol'y 1 (2006). Stafford presents the "first national study to explicitly consider the role that complexity plays in the environmental compliance decision." Id. at 4.

[7] Available at https://www.epa.gov/npdes/pubs/ms4permit_improvement_guide.pdf.

Transparency in the NPDES Program

What are the Benefits of Transparency?

Transparency has long been used in the NPDES program to make the performance of regulators and regulated parties more visible to the public – for example, requiring regulated entities to post information on websites (e.g., permit requirements, discharge monitoring reports (DMRs), stormwater management plans, annual reports, best management practices (BMPs)). Making information public in this way can improve the accountability and performance of regulators by making their decisions more visible and accessible. It can also make regulators more efficient as they can better access information to use and share. Transparency also enhances incentives for compliance.[8] It serves to increase public awareness, enabling regulated entities and the public to identify concerns and potential violations that should be addressed better by regulators or through direct stakeholder action.[9]

As an example of the benefits of transparency across an entire program area, EPA's Combined Sewer Overflow (CSO) Control Policy, and Clean Water Act section 402(q) adopting the policy as law, requires publicly owned treatment works (POTWs) served by combined sewer systems to ensure that the public receives adequate notification of CSO occurrences and CSO impacts. See 59 Fed. Reg. 18688, 18691 (April 19, 1994). Public notification can inform the public of the location of CSO outfalls, the actual occurrences of CSOs, the possible health and environmental effects of CSOs, and the recreational or commercial activities curtailed as a result of CSOs. Combining this required public notification with modern technologies, such as web posting or online maps, represents Next Generation Compliance. Sources themselves may be required to provide public notification, and/or regulators such as states or EPA can also advance public access by posting information or sending email alerts to interested parties who sign up to receive them.

Transparency in Rules, Permits, and Settlements

Reported information is more transparent when it is presented in a relevant format and with context understandable to the public. For example:

- Depending on the purpose of the data, a live data feed or a near real-time posting of data may be useful. If a live online data feed could be difficult to understand and interpret, both for regulators and the public, lead time can be provided before information is posted. Some examples below have specified that posting should be soon after sampling and reports are due; some specify a particular timeframe.

[8] See, e.g., Laplante, B., Lanoie, P. & Foulon, J., *Incentives for Pollution Control - Regulation and Public Disclosure*, No. 2291, Policy Research Working Paper Series, The World Bank (2000), *available at* http://ideas.repec.org/p/wbk/wbrwps/2291.html.

[9] See, e.g., Fung, A. & O'Rourken, D., *Reinventing Environmental Regulation from the Grassroots Up: Explaining and Expanding the Success of the Toxics Release Inventory*, Env. Man., Vol. 25(2), pp. 115–127 (2000), *available at* http://nature.berkeley.edu/orourke/PDF/tri.pdf.

- Posted information is more accessible if it is as few clicks as possible from the regulated entity's home page.
- Web postings that use plain language terms to describe the information allow Internet search engines to easily find the information.

Where information has been available for download, data formats such as CSV files allow for easier data analysis than, for example, PDF files. When information is available for individual facilities as well as in "drillable" summary form, data analysis becomes reproducible with online tools.

Communication, outreach, and educational materials can be used to provide guidance on how to interpret displayed data in the appropriate context related to national standards and health benchmarks. If users of state or EPA websites are able to easily report errors to the appropriate EPA or state data stewards, this helps expose data errors and improve the sources of the data over time.

Transparency Examples

The following examples of NPDES rules, permits, and settlements are grouped to show the types of transparency provisions implemented, such as for regulated entities to post information online, through public signage, or transmission of information through email or other electronic notifications. There are also examples of EPA- or state-run websites designed to provide information about water quality to the public.

Requirements to Post Relevant Information to the Web

- Public posting of SWPPP: EPA's 2015 Multi-Sector General Permit for Stormwater Discharges Associated with Industrial Activity (MSGP) requires permittees to make their SWPPPs publicly available by posting it on the Internet or by including specific information from the SWPPP on the NOI form. See Appendix for more details.

- Public posting of SWPPP: The 2014 Middle Rio Grande Watershed Based Municipal Separate Storm Sewer System (MS4) Permit requires public accessibility of the Storm Water Management Program (SWMP) document and annual reports online via the Internet and during normal business hours at the MS4 operator's main office, a local library, posting on the Internet and/or other readily accessible location for public inspection and copying. The permit also encourages the MS4 operator to hold a public meeting on the notice of intent (NOI), SWMP, and annual reports upon a showing of significant public interest. See Appendix for more details.

> ➢ Innovations from Other Environmental Programs:
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> In 2015, EPA issued an Administrative Order to the Village of Ridgewood, New Jersey to address Safe Drinking Water Act violations. The AO requires Ridgewood to evaluate, assess, and monitor its wells to determine the conditions that led to source water fecal contamination and post the monitoring data on their website at http://water.ridgewoodnj.net/.

- Web posting of sampling data: Logan International Airport NPDES permit requires the Massachusetts Port Authority (Massport) to make results of water quality sampling at airport outfalls available on the Massport website. The website has links to each month's DMRs, as well as quarterly summaries, going back to 2008. Available at http://www.massport.com/environment/environmental-reporting/water-quality/monitoring-results/. See Appendix for more details.

- Real-time web notice of CSOs: City of Seattle, Washington NPDES Permit requires the city to implement web-based public notification system to inform the citizens of when and where CSOs occur. The process must include (a) mechanism to alert persons of the occurrence of CSOs and (b) a system to determine the nature and duration of conditions that are potentially harmful for users of receiving waters due to CSOs. Seattle and King County, Washington maintain a real-time public notification website that has CSO overflow information updated with available data every 10 minutes for King County sites, and every 60 minutes for Seattle sites. The King County and City of Seattle CSO website is available at http://www.kingcounty.gov/environment/wastewater/CSOstatus/Overview.aspx. See Appendix for more details.

- Web posting and PDR for consent decree (CD) deliverables: City of Shreveport, Louisiana's 2013 CD requires the City to make significant upgrades to reduce overflows from its sanitary sewer system to resolve violations stemming from illegal discharges of raw sewage. Shreveport established a Public Document Repository (PDR) for hard copies of deliverables required under the consent decree as well as a website for electronic versions of such deliverables. The website contains extensive information concerning the water and sewer capital improvements, project schedules, the location of active construction projects, and the documents which are part of the PDR so that citizens can access PDR documents without having to travel to City Hall. See www.cleanwatershreveport.com. See Appendix for more details.

- Web posting of CD and submissions: Metropolitan St. Louis Sewer District (MSD) 2011 CD requires MSD to post the following information on its website:
    - All written submissions to EPA must be posted and remain on the site for three years;
    - The CD itself must be posted on MSD's website and intranet website and MSD must direct all current employees, new employees, and any contractor or consultant retained to perform work under the CD to read the consent decree;
    - A fats, oil, and grease (FOG) education information page; and
    - A building backup clean-up guide produced in multiple languages.

  The website postings are available at http://www.stlmsd.com/our-organization/organization-overview/consent-decree. See Appendix for more details.

- Public comment and web posting of CD deliverables: Greenville, Mississippi's 2016 CD requires the City to post a copy of deliverables that are due to EPA and Mississippi Department of Environmental Quality on the City's website and provide notice of such action by email to all parties who have requested such notice. The City must also provide the local library a brief synopsis of each deliverable and instructions on how to find the document on the City's website. The City must also allow the public a period of thirty days to comment on certain deliverables

and maintain on its website until termination of the CD all written comments received from EPA and MDEQ along with all submitted versions of deliverables. See Appendix for more details.

Requirements to Post Information at the Discharge Point[10]

- Posting signs at CSOs in multiple languages: City of Cambridge, Massachusetts & City of Chelsea, Massachusetts NPDES permits require the permittee to post signs at all CSO structures. The signs must be a minimum of 12 inches by 18 inches in size and should either include a symbol for CSOs or be in additional languages if determined that the primary language of a substantial percentage of the residents in the vicinity of a given outfall structure is not English. The Cambridge permit also requires signs at public access locations, and other sites as identified by the Massachusetts Department of Environmental Protection. See Appendix for more details.

DC Water's Potomac River CSO indicator light.

- Indicator lights at CSOs: As part of a 2005 EPA enforcement settlement, District of Columbia Water and Sewer Authority (DC Water) must operate CSO Event Indicator Lights to notify river users of CSO discharges. The Potomac River light, pictured here, is located on the River's north shore, near the mouth of Rock Creek. Another light is located on the north shore of the Anacostia River in front of DC Water's Main Pumping Station. A red light must be illuminated during a CSO occurrence and a yellow light must be illuminated for 24 hours after a CSO has stopped. The CSO Event Indicator lights are operated via remote signals originating from nearby the CSO outfalls responsible for the event conditions. See Appendix for more details.

- Posting signs and other public notice of SSOs: EPA issued administrative compliance orders to Metropolitan St. Louis Sewer District to require MSD to post 24 inch by 18 inch signs at all streams, creeks, drainage ditches, and swales receiving sanitary sewer overflow (SSO) discharges. The orders also require MSD to notify the public about the posting of these discharge signs through annual customer bill inserts as well as on the MSD website. These notices include a description of where each sign will be installed in relation to the constructed SSO; why the sign is being installed; and a phone number so anyone observing a discharge can call to report it. See Appendix for more details.

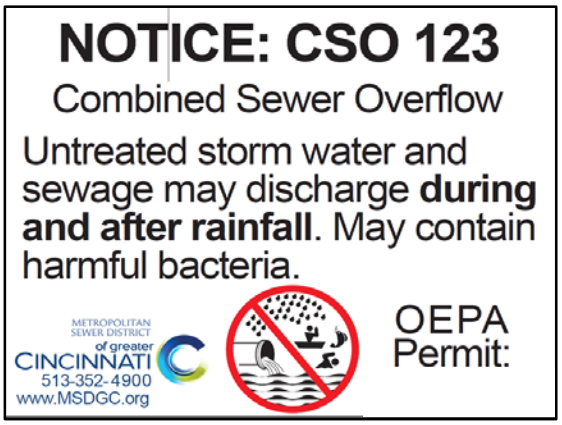
Metro St. Louis Sewer District SSO discharge sign.

[10] Even though posting signage, as contrasted with electronic notification of pollution discharges, is a relatively low-tech form of public notification, requirements for regulated entities to provide public notice at CSO or SSO outfalls in an easily understandable format is becoming a more widespread practice and is an easily-implementable way to provide notice to communities.

- Posting signs at CSOs with certification: Jersey City Municipal Utilities Authority (JCMUA)'s 2011 consent decree requires JCMUA to post and maintain signs within 10 feet of all CSOs. The signs must be visible to the unaided eye from land and water from a distance of 100 feet. The consent decree also requires an authorized representative of JCMUA to certify that all signs have been posted and remain in place. See Appendix for more details.

State Regulations that Require Posting of Signs at all Discharge Points

- Regulation requiring signs posted at all outfalls: Ohio EPA's regulations require all NPDES permittees to post signs at their outfalls, including, but not limited to, discharges of process wastewater, non-contact cooling water, sewage or discharges from remediation sites, and bypass or CSO discharges. The signs must include, at a minimum, the name of the permittee, the permit number, and the outfall number printed in letters not less than two inches high. The sign must be a minimum of two feet by two feet and the bottom of the sign must be a minimum of three feet above the ground. See Appendix for more details.



- Regulation requiring signs for permittees who discharge to surface waters: New York DEC regulations require permittees who discharge to surface waters to post signs not less than 18 inches by 24 inches with the permit number, the name and telephone number of the permittee, and the name, address and telephone number of the State regional office in which the discharge is located. See Appendix for more details.

- Regulation requiring signs for CSOs in sensitive areas: Indiana regulations require CSO public notification programs to include signage for CSOs located in sensitive areas in order to ensure that the public receives the necessary information pertaining to health risks and CSO impacts. The signs must have a header stating "NOTICE" followed by "This is a combined sewer overflow outfall. This water can become polluted during or after rain events or snow melt. In the event of discharges from this outfall during dry weather or for more detailed information please call [local sewer authority and phone number]. CSO outfall [#]." See Appendix for more details.

Email or Text Alerts of SSO and CSO Discharges

- Email notification of discharges: New York Department of Environmental Conservation (NYSDEC)'s Division of Water allows the public to sign up for email notifications of water related topics through the Making Waves subscription service. Topics include a weekly SSO and known CSO discharge report summary, listing the number of Sewage Discharge Reports received and the total reported volume for that week. The weekly alerts also provide notification of harmful algae blooms, with links to maps and other relevant information. Sign-up for the email notification is available at https://public.govdelivery.com/accounts/NYSDEC/subscriber/new.

- Statute requiring notice of discharges and use of mass alert system: New York's Sewage Pollution Right-to-Know Act requires the NYSDEC to develop regulations to require POTWs and operators of publicly owned sewer systems (POSSs) to report untreated and partially treated sewage discharges to NYSDEC and New York State health department within two hours of discovery and to the public and adjoining municipalities within four hours of discovery. NYSDEC worked with the NYS Division of Homeland Security and Emergency Services to transition POTWs and POSSs to use the NY-Alert mass notification system for reporting sewage releases and distributing this information to the public. A single online form through the NY-Alert system was made available in early 2015 and is being used to notify the appropriate parties for two-hour notification and the public for the four-hour notification. See Appendix for more details.

- Regulations requiring 24-hour notice of "significant spills": South Carolina's regulations require all wastewater utilities to provide public notice of any significant spill of 5,000 gallons or more within 24 hours of discovery. See Appendix for more details.

➢ Innovations from Other Environmental Programs:

Under the Safe Drinking Water Act, information is provided to the public with appropriate context through the annual consumer confidence report for drinking water systems, providing customers with information on how well the community water system is treating their drinking water.

- Permit requiring CSO public notice using mass media and/or Internet notice: Metropolitan Water Reclamation District of Greater Chicago (MWRDGC) NPDES permits[11] require MWRDGC to develop a public notification plan with consideration given to including mass media and/or Internet notification. Under this plan:
  - The public can sign up for daily emails and/or text messages when a confirmed CSO event or diversion to Lake Michigan occurs.
  - MWRDGC posts a map of the city's waterways, color-coded based on CSO data compiled by District staff. Blue segments indicate that no CSOs have been confirmed by the District. Red segments indicate a confirmed CSO occurrence in that segment or in a segment upstream.
  - MWRDGC is required to install two-sided weatherproof signage at CSO outfall locations.

  More information about the public notification plan, including how to sign up for notifications, is available at http://www.mwrd.org/irj/portal/anonymous/overview. See Appendix for more details.

- Permits requiring email notice to local groups and annual press release of CSO events: City of Cambridge, Massachusetts & City of Chelsea, Massachusetts NPDES permits require the permittees notify local health agents and local watershed advocacy groups by email within 24 hours of the onset of CSO discharge events and issue an annual press release discussing past CSOs. Cambridge is also required to include the following information on its website:
  - General information regarding CSOs, including their potential health impacts;
  - Locations of CSO discharges in the Charles River and Alewife Brook watersheds;

[11] Stickney Water Reclamation Plant NPDES Permit; Calumet Water Reclamation Plant NPDES Permit; North Side Water Reclamation Plant NPDES Permit; James C. Kirie Water Reclamation Plant NPDES Permit; and the Lemont Water Reclamation Plant NPDES Permit.

- The overall status of all CSO abatement programs;
- Web links to CSO communities and watershed advocacy groups; and
- The most recent information on all CSO activations and volumes in both watersheds.

The website postings are available at https://www.cambridgema.gov/theworks/ourservices/stormwatermanagement/combinedsewageroverflows1/combinedseweroverflowcsodata and http://www.chelseama.gov/water-sewer-services/pages/chelsea-annual-cso-reports. See Appendix for more details.

- Settlement requiring voice or text alerts of SSO, diversion, bypass, or effluent limit violation emergency situations: City of Columbia, South Carolina's 2013 consent decree requires immediate notification to the public and other impacted entities, such as users with a downstream water intake, of an emergency situation caused by an SSO, diversion, bypass, or effluent limit violation. The City has developed a public notice program which uses a mass notification service to issue voice or text alerts about potential safety hazards or concerns related to water and sewer issues. Sign-up for the Columbia notifications is available at http://www.columbiasc.net/utilities-engineering. See Appendix for more details.

EPA-Hosted Websites Providing Information about NPDES Permit and Enforcement Data, as well as Related Water Quality Information

- EPA's NPDES General Permit Inventory is a national web based inventory for NPDES general permits issued by states and EPA. The inventory includes approximately 850 general permits and is designed with a search tool to provide easily accessible information to the public on master general permits, such as: permit category, permit number, state, permit title, EPA Region, issuance and expiration dates, estimated number of facilities covered by each master general permit, and permitting authority. Where a general permit is available on a state website, the web inventory provides a link so that the specific terms of the general permit can be easily viewed. See https://ofmpub.epa.gov/apex/aps/f?p=GPWI:Home.

- EPA's MyWATERS Mapper dynamically displays snapshots of OW program data, depicting the status of NPDES permits for each State; summary information from the Clean Watershed Needs Survey; and water quality assessments. The website contains water-related geographic themes such as 12-digit watersheds, the national stream network known as the National Hydrography Dataset, and other water-related map layers. It also enables the user to create customized maps at national and local scales. See https://watersgeo.epa.gov/mwm/.

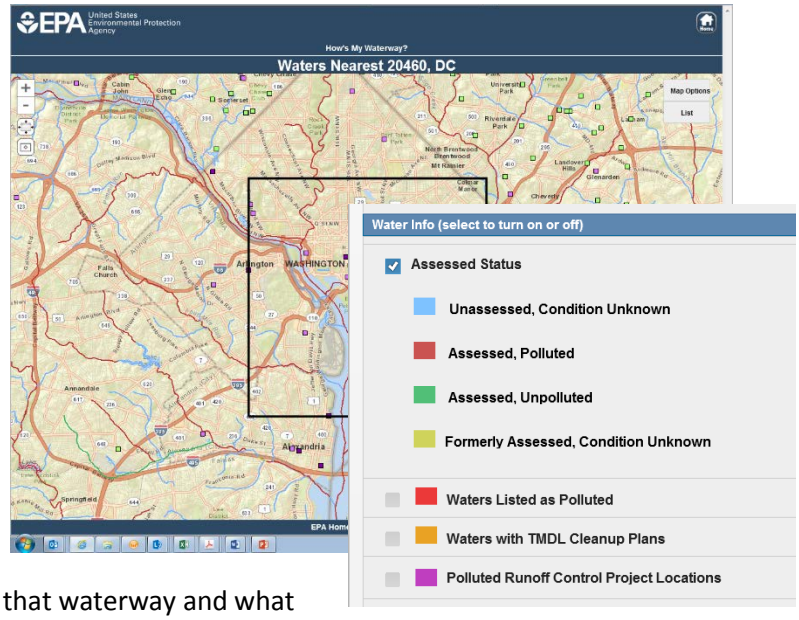
- EPA's DMR Pollutant Loading Tool website helps the public determine who is discharging, what pollutants they are discharging and how much, and where they are discharging. The tool calculates pollutant loadings from permit and DMR data from EPA's Integrated Compliance Information System for the National Pollutant Discharge Elimination System (ICIS-NPDES). Data are available from the year 2007 to the present. Pollutant loadings are presented as pounds per year and as toxic-weighted pounds per year to account for variations in toxicity among pollutants. The tool ranks dischargers, industries, and watersheds based on pollutant mass and toxicity, and presents "top ten" lists to help the public determine which discharges are important, which facilities and industries are producing these discharges, and which watersheds are impacted. The tool also includes wastewater pollutant discharge data from EPA's Toxics Release Inventory (TRI). Users can search TRI data to find the facilities with the largest pollutant

discharges to surface waters or sewage treatment plants. Users can also compare the DMR data search results against TRI data search results and vice versa. See https://cfpub.epa.gov/dmr/.

- EPA and USGS's Water Quality Portal: EPA and the United States Geological Survey (USGS) co-developed the Water Quality Portal to provide a single, user-friendly Web interface to water quality data collected by federal, state, and tribal agencies and other water partners. It combines physical, chemical, and biological water quality data from multiple data sources at one location and presents the data using a common nomenclature known as the Water Quality Exchange (WQX). Since its April 2012 launch, the Portal has received thousands of visitors and delivered millions of water quality records. In addition, a third source has been added to the Portal: the U.S. Department of Agriculture's Agricultural Research Service STEWARDS database, making 168 new sites and over one million new watershed research records available. The web platform also enables use on any phone, tablet, or desktop. See http://www.waterqualitydata.us/.

- EPA's "How's My Waterway" application and website helps people find information on the condition of local water bodies from their smart phone, tablet, or desktop computer. The program uses Global Positioning System (GPS) technology or a user-entered zip code or city name to identify nearby waterways as unpolluted, polluted, or unassessed. Once a specific lake, river, or stream is selected, the site provides information on the type of pollution reported for that waterway and what has been done by EPA and the states to reduce it, along with simple descriptions of each type of water pollutant, including pollutant type, likely sources, and potential health risks. A map-oriented version of "How's My Waterway" was specifically designed for museum kiosks, displays, and touch screens. See https://watersgeo.epa.gov/mywaterway/.

EPA's "How's My Waterway" website.



State Websites that Provide NPDES Permit and Enforcement Information

- AL's web posting of permits and related documents: Alabama Department of Environmental Management (ADEM)'s eFile system allows the public and other stakeholders to freely access documents that exist in electronic format in ADEM's document management system. The system has over one million documents available for the public to search, including permits, inspection reports, complaints, compliance reports, and enforcement actions. See http://app.adem.alabama.gov/eFile/.

- FL's web posting of permits and related documents: Florida Department of Environmental Protection uses OCULUS, an electronic document management system, to allow for public access to records associated with the State's waste, water, and air programs, including Florida's NPDES program. Documents available for searching include administrative files, enforcement correspondence, permits, SWPPs, and sampling results. See http://depedms.dep.state.fl.us/Oculus/servlet/login.

- NY's web posting of permits and related documents: NYSDEC posts online issued State Pollutant Discharge Elimination System (SPDES) Individual and Multi-Sector General Permits and other facility documents organized geographically according to the DEC Regions. Documents available at https://www.dropbox.com/sh/hz3spt98h4d88ue/AADmNLcYxcpZQFeWUNAxGMi9a?dl=0.

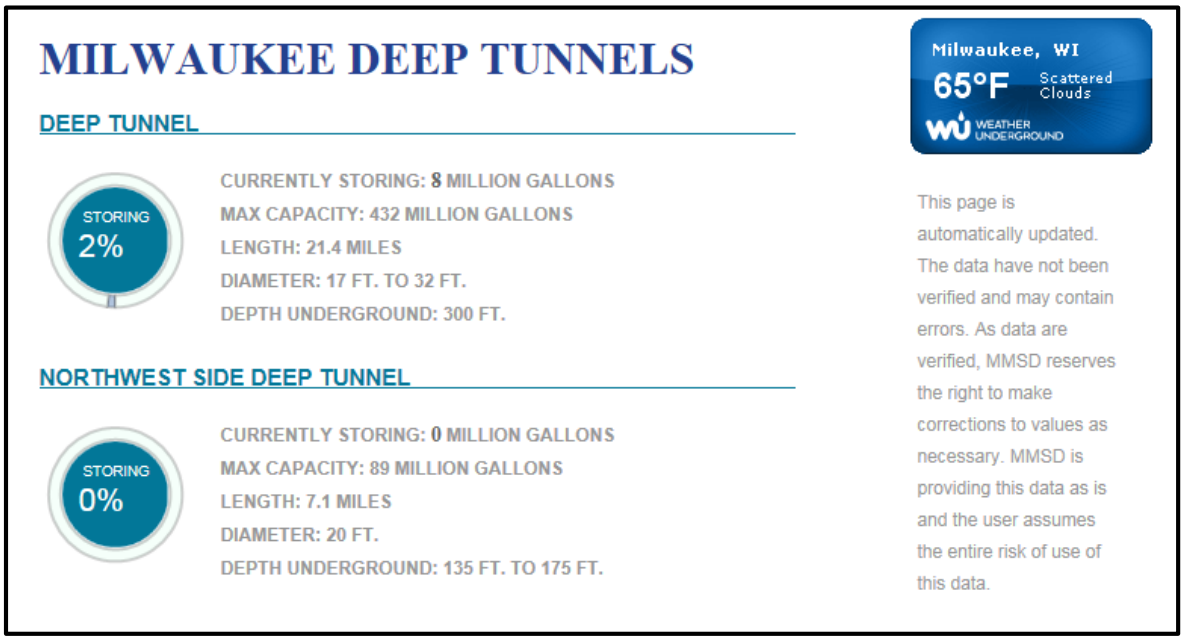
- WA's web posting of permits and related documents: Washington State Department of Ecology maintains a Water Quality Permitting and Reporting Information System (PARIS), which contains information on water quality permits, inspections, enforcement actions, and discharge monitoring data. Both NPDES and State Waste Discharge permits are included in the database. See http://www.ecy.wa.gov/programs/wq/permits/paris/paris.html.

- LA's web posting of DMRs: Louisiana Department of Environmental Quality's (DEQ) Electronic Document Management System is an electronic repository of official records that have been created or received by DEQ. Through this system, the public can access electronic versions of all discharge monitoring reports (DMRs) submitted to the State. Available at http://edms.deq.louisiana.gov/app/doc/querydef.aspx.

- Web posting of IDDE: Arecibo, Puerto Rico posts its storm water management plan and its Illicit Discharge Detection and Elimination (IDDE) on its website, as well as post-construction information, general storm water information, and maintaining a storm water blog section. See http://129.121.2.208/~munareci/web/programa-ms4/.

State Websites that Provide Information about Water Quality Issues

- Milwaukee's real-time monitoring and display: Milwaukee Metropolitan Sewerage District (MMSD) uses a real-time monitoring system to integrate rain gauges with its CSO monitoring. MMSD also developed a public website to display this information, which is updated every 3-5 minutes. See http://www.mmsd.com/weather/weather-center.

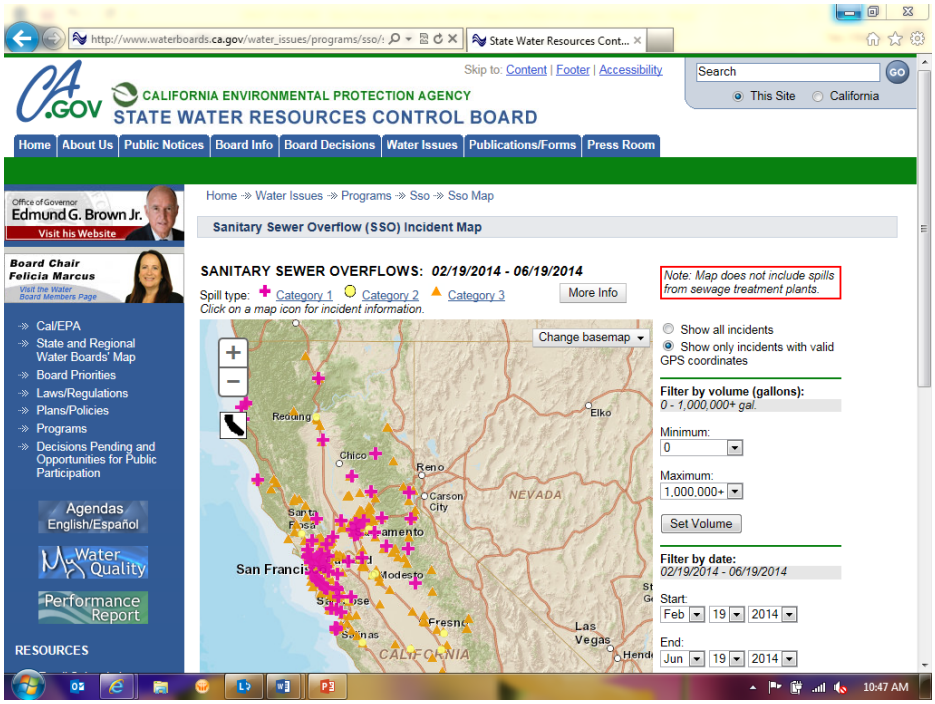


- CT's map of CSOs and sewage spills: Connecticut's two-part Public Act: "An Act Concerning The Public's Right to Know of a Sewage Spill" requires the Connecticut Department of Energy and Environmental Protection (DEEP) to 1) provide a map indicating the combined sewer overflows anticipated to occur during certain storm events, and 2) to post notice of unanticipated sewage spills and waters of the state that have chronic and persistent sewage contamination that represents a threat to public health. DEEP has met the first part of the Act with a website map that currently shows CSOs and is in the process of expanding this map to all bypasses. The State is also developing software to make the communications between municipalities and the website interactive, e.g., by having forms with checks to ensure completeness and providing for an automatic email to the State to review and follow up on any reported bypasses. DEEP's CSO map is available at http://www.ct.gov/deep/cwp/view.asp?a=2719&q=525758&deepNav_GID=1654. See Appendix for more details.

- NY's map of CSOs: New York posts Excel files to its website listing all daily reports of untreated and partially treated sewage overflows from POTWs and POSSs that reach surface water bodies, helping the public to avoid contact with these waterbodies. To address wet weather CSO discharges, NYSDEC hosts a CSO Wet Weather Advisory web page of all CSO outfall locations in New York, including information about the receiving waterbody and CSO events. Available at http://www.dec.ny.gov/maps/nyscsoslink.kmz (requires Google Earth to be installed on your computer to view).

- Everett's map of CSOs and real-time monitoring: The City of Everett, Washington monitors its 13 CSO outfalls in real time and posts information about the status of the CSOs online. A live feed displays data on a map showing the status of each CSO. The colors show whether a CSO is currently overflowing, if there was a CSO overflow in the last 24 hours, if the CSO is not overflowing, or if there is no telemetry data available. City of Everett staff reviews all CSO data on a regular basis to determine if and when a CSO has actually occurred. The confirmed CSO events are included in the City's annual CSO report. See https://everettwa.gov/1089/CSO-Real-Time-Overflow-Monitoring.

- CA's map of SSOs: California's State Water Resources Control Board maps SSO overflows in the state of California. The website allows users to search based on: 1) volume of flow; 2) date, local agency, county, street address, specific regional water board office; or 3) all incidents or just those incidents with valid GPS coordinates. (Note that the map does not include overflows from the treatment plant portion of the systems.) See http://www.waterboards.ca.gov/water_issues/programs/sso/sso_map/sso_pub.shtml.



- SC's map of watershed data: South Carolina Department of Health and Environmental Control (DHEC)'s S.C. Watershed Atlas is an interactive online map that provides a searchable, customizable view of watershed data across the state and is designed to provide enhanced access to timely information from DHEC's water programs in a GIS format. The online map application includes more than 90 data layers representing the agency's water program, including: permits such as MS4s, TMDLs, advisories, dams, floodplains, Municipal Separate Storm Sewers, National Wetland Inventory, Public Water Supply, water quality assessments, watershed boundaries, and more. See http://gis.dhec.sc.gov/watersheds/.

Electronic Reporting in the NPDES Program

What are the Benefits of Electronic Reporting?

Electronic reporting is rapidly replacing paper reports and creating many new opportunities beyond simply streamlining the transfer of information. Electronic reporting reduces costs associated with paper reporting and provides regulators with more complete and timely data, allowing more effective prioritization of monitoring and enforcement actions, as illustrated by the Ohio e-reporting example below. Electronic reporting typically entails use of an electronic "smart" form or web tool that guides the regulated entity through the reporting process. Simply emailing reports is not true electronic reporting.

On September 24, 2015, EPA finalized the NPDES Electronic Reporting Rule, which requires regulated entities and state and federal regulators to use existing, available information technology to electronically report data required by the NPDES permit program instead of filing written paper reports. The rule makes Electronic DMRs (eDMRs) standard for all NPDES permits that require DMRs. It takes advantage of advances in information technology, expands EPA efforts to provide meaningful data to the public, and supports the EPA-wide effort to move from paper to electronic reporting. States will realize a significant reduction in reporting burden and cost savings due to electronic reporting from facilities rather than having to enter paper reporting into data systems. The final rule will make facility-specific information, such as inspection and enforcement history, pollutant monitoring results, and other data required by permits accessible to the public through EPA's website. For more information on the proposed rule, see https://www.epa.gov/compliance/final-national-pollutant-discharge-elimination-system-npdes-electronic-reporting-rule.

Many states have already implemented eDMR systems for some or all compliance reporting, and many have eNOI systems as well. In Ohio, for instance, an eDMR system was implemented in 2007. By 2011, 100% of Ohio's NPDES permit holders were reporting electronically. According to interviews and data collection conducted by Ohio EPA, electronic reporting of NPDES DMRs produced significant efficiency savings of both time and resources, in addition to increasing data quality. The application makes data submission and correction easier. The eDMR application automatically reviews submitted information and flags any data that does not fit within defined parameters of the field or specific ranges. This flagged data is automatically summarized and sent to the permit holder, who is then able to correct errors made during submission, and resubmit the DMR.

Electronic reporting has improved Ohio EPA's ability to monitor and enforce CWA compliance. The automated compliance checks reduced errors by 90% per month, leaving Ohio EPA with more accurate and robust data. Ohio EPA saw a decrease in sample frequency violations. Ohio has also received positive feedback from the regulated community. Simultaneously, as the need for data entry and error checking diminished, Ohio EPA was able to move almost five full-time personnel away from those tasks and into other types of work. Ohio EPA has expanded electronic reporting through its eBusiness Center to air pollution, drinking water, solid and hazardous waste, and water/wastewater operator exams.

Electronic Reporting in Rules, Permits, and Settlements

EPA issued a new policy statement on electronic reporting in September 2013 providing:

> "We are establishing a new Agency-wide policy on e-reporting that specifies in developing new regulations that we will start with the assumption that reporting will be electronic and not paper based. And we will use shared services to do this to the maximum extent

possible. This Policy Statement is one important step forward in the Agency's larger E-Enterprise for the Environment Initiative."

While e-reporting reduces paper transaction costs associated with creating, mailing, entering, and error correction, it also necessitates new efforts to create the necessary tools to assist the regulated source in submitting quality reports and software to accept the electronic submittals.

Electronic Reporting Examples

The following examples show EPA and state tools for accepting electronic reporting submittals, as well as examples of permit requirements for NPDES regulated entities to report electronically.

Examples of EPA tools for Regulated Entities to Report Electronically

- EPA's NPDES Electronic Reporting Tool (NeT) is a tool suite developed by EPA to facilitate direct electronic submittal of data by the regulated community. It uses commercial "off-the-shelf" software and can support diverse form and data submission formats.

- EPA's NetDMR is a national tool for NPDES permittees to submit DMRs electronically via a secure Internet application to EPA through the National Environmental Information Exchange Network. NetDMR allows participants to discontinue mailing in hard copy forms to meet reporting requirements under 40 CFR 122.41 and 403.12. NetDMR was developed under an EPA grant by a consortium of states coordinated by the Environmental Council of States (ECOS), EPA, and led by Texas. NetDMR provides a generic, open standards-based, CROMERR-approved eDMR system. The application can be implemented by U.S. EPA, by a state, or by any other organization with the authority to accept DMRs. See https://netdmr.epa.gov/netdmr/public/home.htm.

Examples of State Tools for Regulated Entities to Report Electronically

- MI's electronic permitting system for water: Michigan Department of Environmental Quality's MiWaters is a web-based permitting and compliance database. MiWaters establishes a streamlined electronic permitting process for NPDES, storm water, groundwater discharge, aquatic nuisance control, Part 41 construction, and land and water interface permits. It also includes electronic reporting of untreated or partially treated sanitary wastewater. Under this system:
    - Permit applications can be submitted electronically.
    - Validation and feedback is provided to permittees to help detect and prevent errors prior to submittal.
    - All permit-required submittals are submitted electronically.
    - Wastewater treatment plants can manage biosolids application sites online.
    - Near real-time notifications are provided to the permittee of any violations determined by the system or by staff, providing permittees with an early "heads up" and opportunity to correct problems.

  See www.mi.gov/miwaters.

- WI's electronic permitting system: Wisconsin's DNR Switchboard is a secure e-business portal which allows individuals to apply for wastewater permits online and electronically report monitoring forms, including DMRs, for facilities regulated under the Wisconsin Pollutant Discharge Elimination System program. See http://dnr.wi.gov/topic/Switchboard/.

- VT's electronic reporting and real time notice of sewage overflows and incidents: Vermont Department of Environmental Conservation (DEC)'s website allows POTW operators to electronically self-report any sewage release that reaches waters of the State, which are then viewable by the public in real time. The public can also subscribe to receive email or text notifications when new public alerts, sewer overflow and release incident reports, or unpermitted discharges are reported. See http://dec.vermont.gov/watershed/wastewater/discharge-notifications.

- CA's e-reporting tool: California's Storm Water Multiple Application and Report Tracking System (SMARTS) is an online tool to assist dischargers in submitting their NOIs, NOTs, No Exposure Certifications, and annual reports. The system also allows the regional and state staff to process and track the discharger-submitted documents. See https://smarts.waterboards.ca.gov/smarts/faces/SwSmartsLogin.xhtml.

- AL's e-reporting tool: Alabama's Electronic Environmental (E2) DMR Reporting System Program provides a web-enabled E2 reporting system for wastewater facilities to streamline the management of DMRs and SSO reports required under ADEM's wastewater regulation program. The E2 DMR and SSO system provide wastewater facilities with an alternative way to submit DMR and SSO data and allow ADEM to electronically validate the data, acknowledge receipt, and upload data to the state's central wastewater database. ADEM offers this electronic reporting to its regulated facilities and participation is required in most formal enforcement actions and in all NPDES permits as they are issued or re-issued. See https://e2.adem.alabama.gov/NPDES.

- OH's e-reporting tool: (see description above, under "What are the Benefits of Electronic Reporting," and Appendix for more details). See http://www.epa.ohio.gov/dsw/edmr/eDMR.aspx.

Permit Requirements for Regulated Entities to Report Electronically

- Vessel General Permit (VGP) requires vessel owners/operators to submit all NOIs, Notices of Termination (NOTs), annual reports, and DMRs electronically, unless EPA grants the owner/operator a report-specific waiver from electronic reporting. This limited waiver is available, for example, if the owner/operator has issues regarding computer access or they are located in an area that is underserved by broadband access. Information submitted electronically is publicly available and downloadable through an EPA-maintained online search tool for the permit. More information on the VGP and the electronic reporting system are available at www.epa.gov/npdes/vessels. See Appendix for more details.

- Multi-Sector General Permit (MSGP) requires most submittals under the permit to be submitted via EPA's NeT or NetDMR. Waivers based on limited computer availability or capability would only be granted on a one-submittal basis, i.e., the next submittal must be electronic unless the permittee applies for and receives an additional waiver. See Appendix for more details.

- General Permit for Offshore Subcategory of the Oil and Gas Extraction Point Source Category for the Western Portion of the Outer Continental Shelf of the Gulf of Mexico requires all DMRs to be submitted electronically through NetDMR and all NOIs to be filed electronically using NeT. See Appendix for more details.

- EPA Region 10's NPDES permits for the Cities of Grace, New Meadows, and Payette, Idaho allow the permittee to submit monitoring data and other reports in either hard copy or through NetDMR. The City of Payette permit only allows paper reporting for six months after the effective date of the permit. After six months, the permittee must submit monitoring data and other reports electronically through NetDMR. See Appendix for more details.

- City of Chelsea, Massachusetts' permit allows the permittee to submit monitoring data and other reports in either hard copy or through NetDMR for the first year after issuance of the permit. After the first year, the permittee must submit electronically unless it can demonstrate a reasonable basis which would preclude it from doing so. See Appendix for more details.

> ➢ Innovations from Other Environmental Programs:
>
> The Greenhouse Gas Reporting Program is a Clean Air Act program that requires over 8,000 facilities across 40 industry types to monitor GHG data, including emissions, and report them to EPA on an annual basis. Facilities use an electronic system to calculate and submit their data to EPA, which runs real-time checks for common mistakes. If a potential mistake is detected, EPA sends the reporter an electronic message prompting corrections within a 45-day verification period. The electronic system also runs thousands of post-submission verification checks on the reports to flag potential errors for EPA staff to further investigate as appropriate. In 2014, EPA began publicly flagging facilities with unresolved errors or ones that did not provide a valid reason for an absent report, and their facility pages contained cautionary text about the errors. This improved data transparency and accountability.

Examples of Electronic Tools for Reporting and Tracking Issues

- App for submitting pictures of local waterways: California State Water Resources Control Board's "Creek Watch" is an iPhone application developed by IBM that enables members of the public to help regulators monitor thousands of miles of creeks and streams in their local watershed. Participants use the Creek Watch app to take and upload pictures of their local waterway and report how much water and trash they see. IBM's research lab aggregates the data and shares it with regional water boards to help them track pollution and manage water resources. All data is shown on a map and table on a publicly accessible website. The app is available for download at http://creekwatch.researchlabs.ibm.com/.

- App to report water quality concerns or issues: To raise awareness and promote community engagement in a local watershed, the Jordan River Commission, Salt Lake County, and the Center for Documentary Expression and Art developed an innovative outreach program funded by EPA's Urban Waters Small Grants Program. This project offers a technology-based approach to interpretation and turns the Jordan River Parkway into a nature center without walls. With a smartphone, participants can use the web app to map the Jordan River trail and identify "interpretive stops" that provide photographs, stories, poetry, as well as educational information about native trees, water quality, community destinations, and Jordan River history. Moreover, people can alert officials about maintenance or water quality concerns by using the "Report an Issue" button on the website. See http://www.myjordanriver.org/.

- Web site for submitting citizen complaints related to stormwater: Arecibo, Puerto Rico has developed an interactive IDDE information tool which allows the general public to ask questions and comment on the IDDE as well as a Construction Stormwater Pollution Reporting Events interactive section which allows for the submittal of citizen complaints. See http://municipioarecibo.maps.arcgis.com/apps/GeoForm/index.html?appid=33b9439597b046478f8f6f3b1fcc576f.

- App for photographing potential cyanobacteria blooms: EPA Region 1's New England Regional Laboratory has established a cyanobacteria monitoring and "bloom watch" program and associated workgroup to collaboratively establish a uniform and consistent regional approach to monitoring cyanobacteria. As part of these efforts, a smartphone app is in product to assist in identifying the "dirty dozen" top toxin producing cyanobacteria in New England. The app provides users with instructions on how to take photos of potential cyanobacteria bloom and to submit an official bloom report to the appropriate state agencies. The app is available at http://cyanos.org/bloomwatch.

- AL's electronic complaint system: Alabama's eComplaint system allows members of the public to electronically submit and track complaints through this system (even anonymously). The system allows complainants to provide detailed information, such as uploaded pictures, and the system quickly routes the complaint to the appropriate media department for response. The public can also search complaints received by the ADEM and what actions have been taken. See http://app.adem.alabama.gov/complaints/submission.aspx.

- AR's mobile app for complaints: Arkansas has a mobile app that allows users to report environmental hazards in real time and provide feedback directly to state inspectors, such as location, driving directions, and GPS-tagged photos. The app is available from app stores or at https://www.adeq.state.ar.us/home/about/website/apps.aspx. People in areas without cell service can save a complaint and submit it when they regain cell service. If users provide contact information, ADEQ sends a confirmation email. Inspectors follow up on all complaints, which also can be submitted online, in person, or by phone.

- App for tracking SSOs: The City of Baltimore's SSO Reporting Mobile Application allows City staff to quickly enter data and pictures associated with an SSO event on an iPad or other mobile device. An electronic form is then populated with this data and emailed to a predefined distribution list. The ability to report SSOs in the field allows for improved accuracy and real-time record keeping.

- App for mapping illicit discharges: The City of Baltimore's Pollution Source Tracking Mobile Application allows City investigators to map discovered illicit discharges to storm drains and streams, and to store data collected using the iPad or other mobile device. The application also allows staff to view GIS layers of the City and historical investigation data.

Advanced Monitoring in the NPDES Program

What are the Benefits of Advanced Monitoring?

Advanced monitoring refers to a broad range of sampling and analytic equipment, systems, techniques, practices, and technologies for better detecting and measuring pollution. Advanced monitoring includes 1) monitors that can measure discharges from a particular source and 2) those that monitor pollutants in the ambient environment.

Advanced monitoring technology generally fits into one or more of these categories:

- Monitors pollutants on a real-time or near real-time basis, often without lengthy lag times for laboratory analysis;
- Less expensive, easier to use, or more mobile compared to technologies currently in widespread use;
- Can provide data of acceptable quality and/or in greater quantity that is more complete or easier to interpret for a specific purpose;
- Is an existing technology but used in a new way to provide better information on pollutants, pollution sources, or environmental conditions.

Advanced monitoring can provide communities and individuals with real-time information about pollution that affects them.[12] Advanced monitoring technologies have also been used by regulators and communities to better identify significant pollution and noncompliance problems.[13] For instance, up- and downstream monitoring have been used to increase environmental stewardship and accountability, and could one day reduce the risk of violations and allow for quicker response to discharges or spills affecting water quality.

Due to differences in the reliability of sensor technologies, some monitors could be more useful for screening potential areas of concern rather than for compliance monitoring. Traditionally, the cost of installing and maintaining continuous monitoring sensors has been high when compared to traditional, intermittent sampling. However, as the technology drops in price, the scope of projects that are considered cost-efficient broadens. In addition, new tools are being developed by both governmental and private entities to communicate, analyze, and display the data gathered by these technologies.

EPA Region 6 is testing use of Continuous Surface Water Quality Monitoring Systems to promote pollution prevention, track compliance with settlements, and improve environmental conditions, particularly in remote areas. These systems consist of monitoring devices which include an automated wireless notification system which can send live data to a monitoring website, provide real-time status, and alert the company and regulator when a pre-set concentration threshold has been exceeded.

In addition, EPA is involved with several efforts to promote innovative technology in various aspects of the water program:

- EPA's OW and Office of Research and Development (ORD) worked with the Alliance for Coastal Technologies to sponsor a Nutrient Sensor Challenge to help accelerate the development and deployment of affordable nutrient sensors for water, including local watersheds, drinking water facilities, and wastewater systems. Sensors eligible for this competition will cost less than $5,000 to purchase, be deployable for three

➢ Innovations from Other Environmental Programs:

The Massachusetts Department of Environmental Protection (MassDEP) uses aerial photography to track areas of wetlands loss. MassDEP's Wetlands Loss Mapping Project has accurately located and mapped wetlands using an innovative GIS-based computer program and a wetlands mapping database. By comparing changes over time, these maps can identify wetlands that have been filled. This effort has developed reliable and verifiable data on location, acreage, and causes of wetlands loss beyond what permitting records reveal. MassDEP believes that a decline in acreage of wetland loss can be attributed in part to increased efforts to publicize the ability to capture wetland losses through aerial photography and in part to tough enforcement actions for confirmed substantive violations found through wetlands loss mapping.

[12] While there are differences between monitoring air and water pollution, some of the applications of advances in air pollution monitoring may be instructive for the NPDES program. See Snyder, Emily G., et al., *The Changing Paradigm of Air Pollution Monitoring*, 47 Env. Sci. & Tech. 20, 11369-77 (2013), *available at* http://pubs.acs.org/doi/pdf/10.1021/es4022602.

[13] See, e.g., O'Rourke, D. & Macey, G., *Community Environmental Policing: Assessing New Strategies of Public Participation in Environmental Regulation*, Association for Public Policy Analysis and Management, Vol. 22, No. 3, 383-414 (2003), *available at* http://nature.berkeley.edu/orourke/PDF/CEP-JPAM.pdf.

months without maintenance, and be ready for the commercial market by 2017. This effort is being hosted by the Challenging Nutrients Coalition, with the coordination of the White House Office of Science and Technology Policy. See http://www.act-us.info/nutrients-challenge/.

- EPA has supported the creation of 13 Water Technology Innovation Clusters across the country, who are leading the nation in water technology innovations through regional collaboration among businesses, government, research institutions, and others. See https://www.epa.gov/clusters-program.
- On December 2, 2014, ORD also hosted an EPA Technology Innovation Showcase and Collaboration and Technology Transfer Seminar in Cincinnati, Ohio. The goals of the event were to: 1) feature new water technology coming out of the water cluster research program and other EPA technologies; 2) continue to draw attention to the OW Technology Innovation Blueprint; and 3) educate potential collaborators and EPA staff about opportunities to collaborate and how to get started. For an agenda of the event, see https://www.epa.gov/sites/production/files/2014-11/documents/innovateshowcase_agenda.pdf.

When used by regulated entities in combination with permit requirements with monitoring, advanced monitoring can more effectively prevent and reduce pollutant discharges, or—even better—identify pollutant discharges before they become violations, often while making operations more efficient. For certain industry sectors with remote unmanned sites, such as some oil and gas disposal and production sites, using instream monitoring can help reduce accidental discharges of brine or produced wastewaters from tanks, batteries, flow lines, vessels, and retention berms. Some monitors, like conductivity detectors, are relatively inexpensive and stable. These technologies provide an option for a company to work cooperatively with regulators to reduce environmental impacts to tributaries, creeks, rivers, and lakes before expensive environmental damage is done.

Advanced Monitoring in Rules, Permits, and Settlements

NPDES Regulations, at 40 CFR 122.48, require state and EPA permit writers to "specify required monitoring including the type, intervals, and frequency sufficient to yield data which are representative of the monitored activity, including, when appropriate, continuous monitoring." Currently, permit writers can employ continuous monitoring technologies for flow, temperature, and pH for purposes of determining permit compliance. For instance, since 2001, EPA Region 1 has issued a number of permits with continuous monitoring requirements for temperature where there are cooling water considerations, such as from an industrial facility or a nuclear power plant. Many of these permits also have continuous monitoring requirements for flow and pH. See Appendix for more details. Although continuous monitoring technology exists for other parameters, such as total organic carbon, specific conductivity, residual chlorine, fluoride, and dissolved oxygen, these technologies are not currently approved for compliance monitoring purposes. As these technologies become approved by EPA for NPDES compliance monitoring, they can be incorporated into permits as appropriate.

The analytical methods which NPDES and Industrial User permittees may use for compliance monitoring appear in 40 CFR Part 136.[14] Where required, continuous monitoring methods must meet the quality assurance and quality control specifications of 40 CFR Part 136. A list of approved CWA methods can be found on EPA's website at https://water.epa.gov/scitech/methods/cwa/methods_index.cfm and includes an approved method for continuous pH measurement of drinking, surface, and saline waters as well as domestic and industrial wastewaters:

EXCERPTED FROM TABLE IB—LIST OF APPROVED INORGANIC TEST PROCEDURES

Parameter	Methodology	EPA	Standard methods	ASTM	USGS/AOAC/Other
28. Hydrogen ion (pH), pH units	Electrometric measurement		4500-H^+ B-2000	D1293-99 (A or B)	973.41, I-1586-85.
	Automated electrode	150.2 (Dec. 1982)			See footnote, I-2587-85.

When advanced monitoring techniques have been used, a number of technical and practical challenges associated with this emerging area of technology remain:

- Are the sensors appropriate for their intended purpose with regard to accuracy, reliability, and overall quality?
- How should appropriate quality control operations and metrics be incorporated into compliance monitoring?
- Do the sensors require regular operation, maintenance, and/or calibration? For example, if a sensor is located at a remote or unmanned location, should there be a regular schedule of operation and maintenance to ensure all monitors are in working order and properly calibrated?
- How should data be integrated that originates from multiple sensors (which may have different quality levels) or from multiple parties (e.g., government versus citizen)?
- How will the public and regulators use data generated by the sensors in a way to protect human health?
- What will the reporting requirements or approaches be for data obtained through advanced monitoring techniques?

Advanced Monitoring Examples

The advanced monitoring examples below include such technologies as improved water quality sensor technology, remote sensing, and satellite imagery.

Examples of Advanced Monitoring Requirements in NPDES Permits and Orders

- Permit with continuous flow and temperature monitoring: EPA Region 10 has issued several NPDES permits in Idaho (the Cities of Grace, New Meadows, and Payette) requiring continuous

[14] *Available at* http://www.ecfr.gov/cgi-bin/text-idx?SID=37cec60f72b6d3b0a50b86bfc4313c43&mc=true&node=se40.23.136_13&rgn=div8.

flow and temperature monitoring for effluent and continuous temperature monitoring for surface water. See Appendix for more details.

- Permit with automatic flow monitoring: City of Seattle, Washington NPDES permit requires the city to monitor all permitted outfalls with operating automatic flow monitoring equipment for discharge location, discharge duration, discharge volume, and weather-related information (precipitation and storm duration). See Appendix for more details.

- Permit with increased and real-time monitoring as part of water quality study: Logan International Airport stormwater permit requires Massport to monitor the outfalls that drain the runways and the perimeter roadway. During winter storm events, the permit requires Massport to sample the drainage from the runways and the perimeters for ethylene glycol, propylene glycol, biochemical oxygen demand, chemical oxygen demand, total ammonia nitrogen, and two toxic additives to deicing agents, nonylphenol and tolyltriazole. The permit also requires whole effluent toxicity testing, in order to help determine whether the discharge causes, has the reasonable potential to cause, or contributes to an excursion above a numeric or narrative criterion for whole effluent toxicity. In addition, Massport is required to perform real-time continuous monitoring of the airport's outfalls during a deicing episode, for parameters including temperature, dissolved oxygen, and conductivity, to be representative of a storm event discharge from each outfall. See Appendix for more details.

- Permit with continuous monitoring of DO and temperature as part of Endangered Species Act Requirements: The Middle Rio Grande Watershed Based MS4 Permit requires continuous monitoring of dissolved oxygen and temperature in the North Diversion Channel Embayment and at one location in the Rio Grande downstream of the mouth of the North Diversion Channel to ensure actions required by the permit are not likely to jeopardize the continued existence of any currently listed as endangered or threatened species or adversely affect its critical habitat. See Appendix for more details.

- Settlement with continuous monitoring and web posting: Under an EPA Region 9 settlement with Nevada Department of Transportation (NDOT), NDOT is required to develop a GIS map to help manage the information NDOT collects on its stormwater system. The settlement also requires NDOT to develop and maintain an enhanced stormwater management public website with extensive information on NDOT's stormwater management program. NDOT will also complete a SEP in which NDOT will implement water quality monitoring devices that include technology to provide continuous monitoring and transmit data to a publicly available platform, working with a project planning group to determine the location and type of data to be collected. See Appendix for more details.

- Settlement with use of GIS: City of Memphis, Tennessee's 2012 consent decree requires Memphis to improve its Geographic Information System (GIS) for managing sanitary sewer data. The GIS is anticipated to promote quicker responses and more efficient tracking of overflows and more efficient sanitary sewer maintenance. Memphis must also post all of its CD deliverables on its Document Repository website. See Appendix for more details.

- Settlement with use of GIS: City of Lawrence, Massachusetts 2015 consent decree requires the City to develop a geographical information system (GIS) map of its wastewater collection, storage, and transmission system and MS4, use the GIS system to identify planned and completed work on the wastewater and MS4 systems, and also use the System to identify the location of illicit discharges. Also, the CD requires the City to include in its emergency response plan procedures to make the public aware of SSOs and measures to prevent public access to, and contact with, areas affected by SSOs.

- Settlement with automated samplers and human indicator testing: City of Fort Smith, Arkansas consent decree requires Fort Smith to take samples from its storm water outfalls during dry and wet weather. To ensure the samples are collected during the rain events, automated samplers are required to be purchased and installed, along with protective boxes, actuators, and rain gauges. Quarterly testing must also be performed for a variety of pollutants, including but not limited to, "human indicators" (such as ibuprofen) to determine whether human sewage is entering into the storm water system and discharging through storm water outfalls. See Appendix for more details.

- Settlement with CSO activation monitoring with alerts: City of Harrisburg, Pennsylvania consent decree requires Capital Region Water (CRW) to identify long-term CSO activation monitoring equipment that is suitable for CRW's system. The consent decree requires CRW to develop and conduct a pilot study to evaluate several flow activation technologies. CRW will use the results of this pilot study to determine which technology to implement to send an alert each time a monitored CSO outfall begins discharging. See Appendix for more details.

- Settlement with automatic electronic notifications of limit violations: GSP Management Company consent decree requires implementation of a system whereby the facility manager responsible for environmental compliance receives an electronic notification within 24 hours of an effluent limit violation. See Appendix for more details.

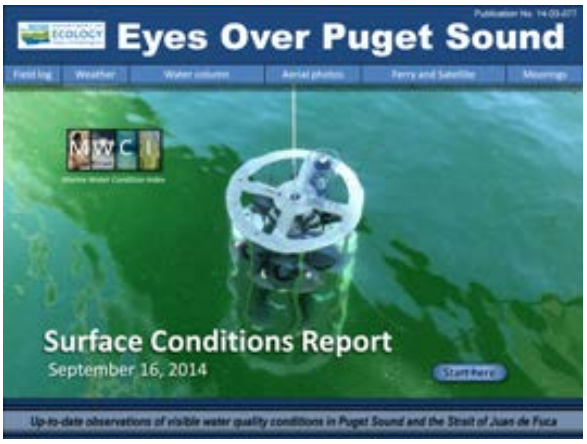
- Settlement with qPCR testing and web posting: San Antonio Water System (SAWS) consent decree requires SAWS to implement a Water Quality Program Plan to detect and quantify the extent of bacterial concentrations in select receiving waters within its service area. The Water Quality Program Plan will measure bacterial concentrations of Escherichia coli (E. coli) and the human Bacteroidales marker using a quantifiable polymerase chain reaction method at designated stormwater outfalls in order to trace exfiltration from the sanitary sewer system. The settlement further requires SAWS to submit all of its reports under the Consent Decree to EPA electronically in a searchable format and post specified EPA-reviewed or-approved plans, reports or other submissions to a Public Document Repository. Each submission shall remain on the website, by link or other accepted method, for at least three years. See Appendix for more details.

Existing Technologies Used in New Way to Provide Better Information on Pollution and Environmental Conditions

- Permit requiring video inspections: Sakonnet Point Club NPDES permit issued by the Rhode Island Department of Environmental Management requires that the permittee conduct underwater video inspections of submerged portions of its outfall to verify the physical integrity

of the outfall. If the video inspection shows evidence of damage to the outfall, additional action may be required. The initial requirement in Sakonnet Point Club's 2009 permit required video inspections every two years; after the videos showed that the outfall was damaged, the permit was modified in 2013 to allow the facility to relocate their discharge and to include a more frequent (annual) video inspection requirement. See Appendix for more details.

- Use of aerial observations: Washington State Department of Ecology (ECY)'s Marine Monitoring Unit conducts a variety of marine observations, including monthly sampling at 37 core monitoring stations. ECY uses a floatplane to cost effectively cover its widely distributed station network and provides aerial photos of Puget Sound water conditions during flight time between stations to document oil sheens, strong algal blooms, and debris, island, and sediment transport near the surface. The aerial information is published two days after collection in a report called "Eyes Over Puget Sound," which combines long-term monitoring data, high-resolution photo observations, satellite images, en route ferry data between Seattle and Victoria, British Columbia, and measurements from moored instruments. This report encourages ECY to optimize resources, increase the timeliness and representativeness of information, and boost the overall relevancy of the program's monitor activity in Puget Sound. See http://www.ecy.wa.gov/programs/eap/mar_wat/surface.html.



- Use of sensors attached to public transportation: Washington State ECY has attached sensors to the Victoria Clipper IV, a private ferry that transits passengers between Seattle and Victoria, British Columbia. The sensors measure phytoplankton concentrations, turbidity, freshwater influence, salinity, and water temperatures during the ferry's twice-daily runs and help ECY and the University of Washington better understand algae blooms, plankton food web interactions, river plumes, and changes over time in Puget Sound. ECY also has sensors attached to the State's public ferries to gather data, another example of finding cost-efficiencies by using existing vessels and partnerships to gather environmental data. See http://www.apl.washington.edu/project/project.php?id=ferries_for_science.

- Canines for tracking illegal dumping: The City of Santa Barbara and the University of California, Santa Barbara used sewage sniffing dogs to test the correlation of canine responses with human-specific waste markers and the use of canines for tracking upstream drain networks, routine watershed reconnaissance, and investigation of illegal dumping by recreational vehicle dwellers. The main advantages of the method are the low cost per sample, real-time results, and the large area that can be covered in one day. The highlight of the City's work was locating a force main leaking into a storm drain.

EPA, State, and Local Use of Advanced Monitoring for Environmental Assessment

- Remote monitoring and automatic sampler with public posting: Sulphur Bank Mercury Mine (SBMM) Superfund Site in California is monitored and reported under a SWPPP and storm water

monitoring program designed to comply with the statewide industrial stormwater general permit. At SBMM, the flooded Herman Impoundment is a 23-acre, 90-foot deep former open pit mercury mine separated from Clear Lake by an estimated 500,000 – 1,000,000 cubic yards of waste rock known as the Waste Rock Dam. During times of exceptionally high precipitation, the water level in the Herman Impoundment can rise high enough to overtop the Waste Rock Dam. EPA installed remote monitoring equipment and an automatic sampler to provide advance warning of water level rise and to collect a sample immediately if overflow begins. EPA worked with the Army Corps of Engineers to develop a sampling and response plan to establish baseline, pre-event, and overflow conditions, and will further model behavior of a potential overflow once current water quality data are collected from baseline sampling. Remote monitoring information is available at http://stormcentral.waterlog.com/public/usepar9.

- Remote monitoring system with automatic sampling triggered by turbidity: Malibu Creek has a Total Maximum Daily Load (TMDL) requirement for total suspended solids. The Malibu Creek monitoring system established by EPA Region 9 is a multi-year wet weather research project to determine if TSS can be accurately correlated to turbidity. If turbidity and TSS measurements can be correlated, turbidity measurements may be used instead of TSS to determine compliance with Malibu Creek's TMDL more efficiently and protect Malibu Lagoon from further degradation. The Malibu Creek remote monitoring system includes not only the water quality instrumentation, solar panels, and satellite telemetry, but also time-interval water sampling devices. The water sampling devices are automated pumps that are integrated into large tubs filled with up to 24 nested sample bottles. In years past, it was necessary for on-call personnel to physically go to a site at the start of a rain event to turn on the water sampler, which would then run automatically for up to 24 hours, collecting one water sample every hour. With the Malibu Creek set-up, the water sampling system starts automatically when turbidity reaches a designated level.

- Real-time systems monitoring: South Bend, Indiana is using real-time monitoring of its sewer systems to enable more efficient management of the entire sewer line. 110 real-time monitors along the sewer line—36 at CSO sites, 27 along the interceptor that brought wastewater to the treatment plant, 42 along key trunk lines, and 5 at retention basins—allow the City to obtain early warnings of anomalies and resolve many issues before they turn into overflows. Manhole-mounted monitors throughout the City's 500-mile sewer network are connected to data loggers and wireless transmission devices to report on water level and flow every five minutes.

- Thermal imaging of MS4 system: Louisville, Kentucky uses thermal imaging cameras as part of its MS4 Illicit Discharge Detection & Elimination program to aerially identify illicit connections and target sewer issues or suspected leaks. The thermal imaging cameras are able to detect the temperature difference between the conveyance system and possible illicit connections for follow up, saving time and money compared to traditional dry weather screening field exercises.

- Use of citizen monitoring: The Virginia Citizen Water Quality Monitoring Program was established by legislation in 2002. Under this program, the Virginia Department of Environmental Quality (DEQ) provides grants to help fund citizen monitoring equipment, volunteer training, lab analysis of monitoring results, and stream monitoring in locations where DEQ is not currently collecting water quality samples. Virginia DEQ uses the citizen-supplied data

to list and delist impaired waters under section 303(d) of the Clean Water Act, identify sources for total maximum daily load development for waters already listed as impaired, track progress toward the restoration of waters, target waters for future DEQ monitoring, and educate landowners on water quality impacts of land use activities. For more information, see http://www.deq.state.va.us/Programs/Water/WaterQualityInformationTMDLs/WaterQualityMonitoring/CitizenMonitoring.aspx. See Appendix for more details.

- Use of real-time continuous monitoring: The Oregon Department of Agriculture, Oregon Department of Environmental Quality, Tillamook Estuaries Partnership, and Oregon State University are cooperating to develop a water quality monitoring network in the Tillamook River, Oregon. The network employs three bacteria monitoring techniques: microbial source tracking for source determination, traditional water column grab sample E. coli analysis for long term trends, and real-time continuous E. coli monitoring. Real-time E. coli concentrations are provided to a website on a 2-minute interval continuously, providing a large amount of previously unobtainable data that illuminates 24-hour, 7-day-a-week bacterial fluctuations in the watershed.

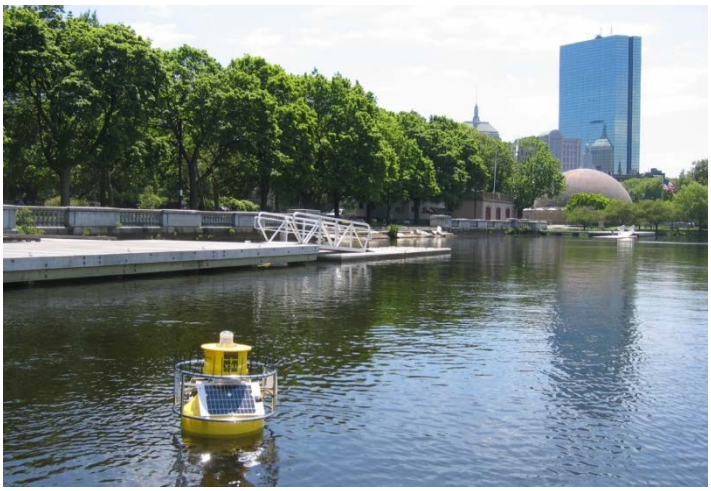
- Use of continuous upstream and downstream monitoring: Washington State ECY Nitrogen Monitoring on Bertrand Creek in the Nooksack Watershed. ECY initiated a three-year project to measure the effectiveness of water quality cleanup and management activities in the Bertrand Creek watershed, a sub-watershed of the Nooksack River in Whatcom County, Washington. The project involves both discrete sampling and continuous monitoring for nitrate and other water quality parameters at upstream and downstream stations. The data will be used to determine the movement (flux), continuous annual loading (yield), and behavior (seasonal patterns) of nitrate concentrations in the creek. Currently, two of these stations are transmitting live data via satellite to ECY's webpage every three hours. See https://fortress.wa.gov/ecy/wrx/wrx/flows/station.asp?sta=01N100#block9 and https://fortress.wa.gov/ecy/wrx/wrx/flows/station.asp?sta=01N060#block11.

- Use of real-time and continuous monitoring network: Cleveland Metroparks is studying the hydrology of the Rocky River headwater streams affected by runoff by utilizing real-time flow and water quality sensors to attain precise, short-interval hydrograph and water quality data. The continuous monitoring network monitors water flow data at six primary headwater streams with similar geology, catchment size, fall, and channel width but of varying hydrologic intactness. The sites include two moderately degraded, two severely degraded, and two reference streams. In addition, four water quality and quantity monitoring stations are installed throughout wetlands in the 2,600 acre Rocky River Reservation, with three sites at inlet locations and one at the outlet. Two additional sites are located at wetland outflows in West Creek Preserve, a 500-acre natural park. Each of these sites is equipped with a flow meter and a multi-parameter sonde with temperature, pH, conductivity, dissolved oxygen, and turbidity probes. Sensors connect to a data logger with real-time cellular telemetry. By comparing the inlet and outlet data, the research team is able to quantify the wetlands' exact levels of water storage and effectiveness at reducing pollutants.

- App to access real-time water quality monitoring: KCWaterBug is a website and app developed by EPA Region 7 with the University of Missouri Kansas City to allow citizens to access

information and data on the lakes and streams in their neighborhoods, from multiple agencies and groups, in one simple location. The app accesses real-time water quality monitoring stations using in-stream probes and satellite telemetry. Data from the stations is transmitted once an hour via satellites to servers at the University, where estimated E. coli concentrations are calculated using turbidity measurements and regression equations for each monitoring location. An hourly average estimated E. coli concentration for twelve streams is calculated and each stream is assigned a color code based on an index tied to health protective levels. The app is free and is available at http://www.kcwaters.org/kcwaterbug.html.

- Real-time monitoring for cyanobacteria posted to the web: EPA's New England Regional Laboratory owns and maintains two buoys in Massachusetts, on the Charles River and on the Mystic River, which have solar-powered water quality sensors that take measurements every 15 minutes and upload the results to a public website. Parameters measured include: temperature, conductivity, pH, dissolved oxygen, turbidity, chlorophyll, and phycocyanin. Phycocyanin measurement is used to estimate the level of cyanobacteria, which results during harmful algae blooms. Data for the Charles River is available at https://www.epa.gov/charlesriver/live-water-quality-data-lower-charles-river; data for the Mystic River is available at https://www.epa.gov/region1/mysticriver/livewaterqualitydata.html.



Third-Party Verification

Properly structured third-party monitoring and verification in rules, permits, and settlements can enhance accountability, improve compliance, and produce better compliance data.[15] Third-party monitoring, when combined with public disclosure, informs the public of the regulated entity's compliance status and enables public responses to noncompliance. Effective third-party verification approaches are structured to ensure that auditors are competent and independent and that audit or inspection criteria are objective and fact-based.[16] For instance, as in the example below, in order to ensure the third party is truly independent, data can be submitted concurrently to the government and not shared in draft with the regulated entity or its counsel for review. This process can build in allowances for correcting sampling or lab errors, while still allowing the regulator to ensure that the facility is not inappropriately influencing the content of the third-party report.

[15] See, e.g., Kunreuther, H., McNulty, P. & Kang, Y., *Improving Environmental Safety Through Third Party Inspection*, Wharton School - U. of Penn. (Oct. 2001).

[16] See Lesley K. McAllister, *Regulation by Third-Party Verification*, 53 B.C. L. REV. 1, 22-23 (2012); and Esther Duflo et al., *Truth-Telling By Third-Party Auditors And The Response of Polluting Firms: Experimental Evidence From India*, 128 Q. J. of Econ. 4 at 1499-1545 (2013).

Third-Party Verification Example

- Settlement with advanced leak detection and independent third party verification: In 2016, EPA settled with Enbridge Energy Limited Partnership and several related Enbridge companies (Enbridge) to resolve claims stemming from 2010 oil spills in Marshall, Michigan and Romeoville, Illinois. The settlement includes an extensive set of specific requirements to prevent spills and enhance leak detection capabilities throughout Enbridge's Lakehead pipeline system - a network of 14 pipelines spanning nearly 2,000 miles across seven states. These requirements include mandating assessment of advanced leak detection and monitoring to prevent future spills such as computational pipeline monitoring technologies that monitor the pressure wave created by different size leaks and ruptures; external leak detection technologies; and aerial-based technologies, including (but not limited to) infrared camera-based systems, laser-based spectroscopy, and flame ionization detection systems. The settlement also provides for an independent third party to verify Enbridge's compliance with the settlement's terms. The independent third party and its personnel must:
    - Have demonstrated experience in pipeline integrity and operations,
    - Not conducted research, development, design, construction, financial, engineering, legal, consulting or any other advisory services for Enbridge within the last three years;
    - Not been involved in the development of Enbridge's control room, leak detection, or pipeline integrity procedures that are the subject of the CD; and
    - Not provide commercial, business or voluntary services to the Enbridge, excluding services provided in its capacity as independent third party, for the life of the CD and for a period of at least three years following termination of the CD.
- In addition, Enbridge will not provide future employment to any of the independent third party's personnel who conducted or otherwise participated in verification services for a period of at least three years following termination of the CD. See Appendix for more details.

Innovative Enforcement

Innovative enforcement combines the lessons learned in implementing Next Generation Compliance with new capabilities in analyzing larger data sets to better identify serious violators, ensure the integrity of electronic reporting, and more effectively and efficiently track compliance with settlements while supporting new approaches to improve compliance.[17]

Innovative State Enforcement Program Examples

- Oregon Expedited Enforcement Orders: Oregon, through rulemaking, has created a process for expedited enforcement orders (EEOs). EEOs are a means of issuing a notice of violation, civil penalty, and compliance order in one two-page document that is expedited because the responsible party can choose to accept the offer to settle their case by signing the EEO and agreeing to pay a lesser penalty than if the notice had gone through the regular enforcement

[17] For a report exploring the use of compliance rate data to drive inspection and targeting decisions, *see* New Jersey Department of Environmental Protection, *Compliance & Enforcement Target and Measure Initiative Final Project Report* (Oct. 2006).

process. Signing and payment of the lower penalty creates a final order by law. Expedited enforcement through EEOs saves time an inspector would spend writing a referral for the Office of Compliance and Enforcement (OCE), the time of both OCE and the inspector in drafting and consulting on the Notice, and subsequent time typically spent on informal meetings, hearings, settlement negotiations, and other enforcement transaction activities.

- New York Law Enforcement Ticketing for SPDES Violations: In 2010, NYSDEC Division of Water partnered with its Division of Law Enforcement (DLE) and Office of the General Counsel to establish a system to increase the compliance rate of construction sites regulated under the State Pollution Discharge Elimination System (SPDES) general permit program. Under this Construction Stormwater Statewide Enforcement Initiative, DLE Environmental Conservation Officers conducted site visits and were authorized to enforce basic compliance matters with the State SPDES program by issuing tickets for violations. In past practice, NYSDEC would first issue a Notice of Violation to the regulated entity to encourage a voluntary return to compliance; if the entity did not return to compliance, then formal enforcement action was warranted. Providing "ticketing" authority was a new first step in this process for some violators. Overall, this initiative resulted in prompt compliance measures as DLE and Department of Water staff observed immediate corrective actions from tickets, on-site discussions, or through additional compliance monitoring activities (e.g., drive-by inspections, phone calls, and site visits).

- Vermont DEC's Environmental Enforcement Officers have the authority to issue Notices of Alleged Violations and field tickets for violations of State environmental regulations. Once an Environmental Enforcement Officer initiates an enforcement action, violators may pay a "settlement" fine in lieu of an appeal.

Additional Resources

For additional information about Next Generation Compliance, see the following documents:

- Cynthia Giles, *Next Generation Compliance*, The Envtl. Forum, Sept.-Oct. 2013, at 22, *available at* https://www.epa.gov/sites/production/files/2014-09/documents/giles-next-gen-article-forum-eli-sept-oct-2013.pdf.

- U.S. EPA, Office of Enforcement and Compliance Assurance, *Use of Next Generation Compliance Tools in Civil Enforcement Settlements* (January 2015), *available at* https://www.epa.gov/sites/production/files/2015-01/documents/memo-nextgen-useinenfsettlements.pdf.

- U.S. EPA, *CAA, RCRA, and Cleanup Compendia of Next Generation Compliance Examples* (September 2016), *available at* https://www.epa.gov/compliance/compendia-next-generation-compliance-examples-water-air-waste-and-cleanup-programs.

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