2019-2020 Report on

Toxics Reduction in State Waters

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

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https://www.deq.virginia.gov/water/water-quality/monitoring/toxics-report.

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Glossary of Acronyms, Abbreviations and Technical Terms

Ambient Monitoring	The monitoring of physical and chemical characteristics within the Commonwealth's rivers, streams, lakes and estuaries. Ambient monitoring and assessment characterize ecological stressors and evaluate their potential impact on aquatic organisms and other wildlife, and on human health and recreational use of Virginia's waters.
AMD	Acid Mine Drainage
AOC	Area(s) of Concern
AQ	Project Code for the Ambient Monitoring Program
Aroclor	Aroclor is a PCB mixture produced from approximately 1930 to 1979.
ALU	Aquatic Life Designated Use
AW	Project Code for the Ambient Watershed Monitoring Program
B4B	Businesses for the Bay Program
BDE	Bromated diphenyl ether
B-IBI	Benthic Index of Biotic Integrity
BN	Project Code for Chesapeake Bay Non Tidal Network Monitoring
BTU	British Thermal Unit - the amount of energy required to increase the temperature of one pound of water by one degree Fahrenheit, at normal atmospheric pressure
C2	Project Code for the Coastal Probabilistic Program
CARITAS	Churches Around Richmond Involved To Assure Shelter
CB	Project Code for Chesapeake Bay Water Quality and Habitat Monitoring
CBP	Chesapeake Bay Program
CEDS	Comprehensive Environmental Data System
CIMS	CBP Information Management System
CL	Project Code for the Clinch River Special Study
CM	Project Code for Citizen Monitoring requests performed by DEQ
Compliance Monitoring	The monitoring of in-pipe concentrations of permitted discharges, which is one element in the prevention of contamination by toxics. Compliance monitoring evaluates whether or not the concentrations of potential pollutants in industrial, municipal or other permitted discharges are within the allowable limits specified in their permits.
CPMI	Coastal Plain Macroinvertebrate Index – used to evaluate the health of freshwater benthic communities in the Coastal Plain Region of Virginia.
CVs	Consensus-Based Sediment Quality Guidelines – critical values for contaminants in freshwater sediment (replace freshwater use of previously utilized ER-L and ER-M values intended for assessment of estuarine and marine sediments; MacDonald et al. 2000). See also PEC, below.
CWA	Federal Clean Water Act (1983) that first described the scope and purpose of water quality standards and defined the authority and responsibility of EPA and the various states in relation to the requirements for, submission of, and establishment of such standards.
DCLS	Division of Consolidated Laboratory Services of the Virginia Department of General Services (DGS)
DEQ	Department of Environmental Quality
DGS	Department of General Services

DM	Project Code for the Dominion Virginia City Hybrid Energy Center
DMR	Discharge Monitoring Report
DR	Project Code for the Dan River Fly Ash Spill special study
EDAS	Ecological Data Application System (database)
EEC	Extreme Effects Concentration – the concentration of a contaminant above which adverse effects to sediment-dwelling organisms frequently or always occur.
ELG	Effluent Limitation Guidelines
ELVS	End of Life Vehicle Solutions – corporation created by the automotive industry to promote the industry's environmental efforts in recyclability, education and outreach, and the proper management of substances of concern.
EMAP	Environmental Monitoring and Assessment Program – EPA
EMS	Environmental Management System
EPCRA	Emergency Planning and Community Right-to-Know Act
ER-L	Effects Range-Low
ER-M	Effects Range-Moderate
EPA	Environmental Protection Agency
FI	Project Code for Facility Inspections
FP	Project Code for Freshwater Probabilistic Monitoring
FT	Project Code for the Fish Tissue and Sediment Program
FY	Fiscal year
GW	Project Code for Groundwater Characterization Monitoring
HG	Project Code for the South River-South Fork of the Shenandoah River 100 Year Mercury Study
IBI	Index of Biological Integrity
ICPRB	Interstate Commission for the Potomac River Basin
IM	Project Code for Post TMDL Implementation Monitoring
IR	Program Code for Incident Response Monitoring
IR	"Integrated Report" – abbreviation for the 305(b)/303(d) Water Quality Integrated Assessment Report
IRIS	Integrated Risk Information System
KM	Project Code for Kepone Monitoring
LB	Project Code for Lafayette River Bacteriological Sampling
MAIA	Mid-Atlantic Integrated Assessment carried out by the EPA Environmental Monitoring and Assessment Program (EMAP)
MEC	Midrange Effect Concentration – the concentration of a contaminant above which adverse effects to sediment-dwelling organisms frequently occur.
MGD	Millions of Gallons per Day
Microgram	(µg or ug) One millionth of a gram
MonPlan	Annual Water Quality Monitoring Plan
MY	Monitoring Year
Nanogram	(ng) One billionth of a gram
NARS	National Aquatic Resources Survey
NCCA	National Coastal Condition Assessment
NELAP	National Ecological Laboratory Accreditation Program
NOAA	National Oceanic and Atmospheric Administration
NPEP	National Partnership for Environmental Priorities
NPS	Non-Point Source (pollution)
NRDAR	Natural Resource Damage Assessment and Restoration (Department of the Interior)

OCP	Organo-chlorinated Pesticide(s)
OE	Project Code for Observed Effects monitoring (3C Waters with Observed Effects / Insufficient Data)
OEE	Office of Environmental Education
OPP	Organo-phosphorylated Pesticide
OPP or OP2	Office of Pollution Prevention
PA	Project Code for Probabilistic Ambient Monthly Physical and Chemical Monitoring
PAH	Polycyclic Aromatic Hydrocarbon
PBTs	Persistent Bioaccumulative Toxics – toxic substances that accumulate (bio-concentrate) and persist in the tissues of living organisms.
PC	Project Code for Pollution Complaint Investigation/Spill containment (PREP)
PCB	Polychlorinated biphenyl
PE	Project Code for the Potomac Embayment Network
PEC	Consensus-based *Probable Effects Concentrations* for chemical contaminants in freshwater sediments (MacDonald et al. 2000). See also CV, above.
PF	Project Code for the Pfiesteria Special Study (Inactive)
Picogram	(pg) One trillionth of a gram
PMP	Pollutant Minimalization Plan is an iterative plan with a programmed schedule and final goal for the reduction (minimalization) of toxic discharge (*e.g.*, in particular PCBs) from a permitted point source. It supplants the necessity of establishing a reduced, fixed numerical limit which may be impossible to attain for a permitted discharge.
POTW	Publicly Owned Treatment Works
P2 or PP	Pollution Prevention Program
ProbMon	Probabilistic Monitoring Program
PT	Project Code for Probabilistic Targeted Stress Stations
QA	Quality Assurance – also the Project Code for Quality Assurance monitoring/sampling
QAPP	Quality Assurance Program and Project Plan
QC	Quality Control
RB	Project Code for Benthic Biological Monitoring
RBP	Rapid Bioassessment Protocol
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RL	Project Code for (Regional Lakes) Reservoir Monitoring
SCI	Stream Condition Index - used to evaluate the health of freshwater benthic communities of upland streams based on their macroinvertebrate community.
SFY	State Fiscal Year (July 1 – June 30)
SH	Project Code for the Shenandoah Fish Disease Task Force (inactive)
SIC	Standard Industrial Classification
SOP	Standard Operating Procedure
SPMD	Semi-Permeable Membrane Device
SS	Generic Project Code for Special Studies
STORET	EPA's legacy national ecological database
SV	Screening Value
SWMU	Solid Waste Management Unit(s)
TBT	Tributyltin
TEC	Threshold Effect Concentration – the concentration of a contaminant below which adverse effects to sediment-dwelling organisms are unlikely to occur.
TM	Project Code for the TMDL Program monitoring

TMDL	Total Maximum Daily Load
TMP	Toxics Management Program
TMR	Toxics Management Regulation
TOC	Toxics of Concern
TR	Project Code for the Ambient Trend Program
TRE	Toxics Reduction Evaluation
TRI	Toxic Release Inventory - The Toxics Release Inventory documents the total quantities of EPA-listed toxic compounds that are released annually (to the waters, the air and the land) by permitted facilities within the Commonwealth. Changes in the quantities of toxics released are indicative of the effectiveness of pollution prevention programs, but are not an adequate or representative measure of environmental impact or impairment.
TRISW	Toxics Reduction in State Waters (report)
TSV	Tissue Screening Value – risk-based screening values used by DEQ and VDH for evaluating fish-tissues for human consumption.
TW	Project Code for Waters of Concern monitoring
USGS	United States Geological Survey
VCPMI	Virginia Coastal Plain Macroinvertebrate Index
VISE	Virginia Information Source for Energy (Website)
VDH	Virginia Department of Health
VEEP	Virginia Environmental Excellence Program
VELAP	Virginia Environmental Laboratory Accreditation Program
VERC	Virginia Emergency Response Council
VIMS	Virginia Institute of Marine Science
VMN	Virginia Mentoring Network
VPDES	Virginia Pollutant Discharge Elimination System
VPI	Virginia Polytechnic Institute and State University
VSCI	Virginia Stream Condition Index is used to evaluate the health of freshwater benthic communities in the Piedmont and Mountainous Regions of Virginia.
WET	Whole Effluent Toxicity
WQBEL	Water Quality Based Effluent Limitation
WQM	Water Quality Monitoring
WQMA	Office of Water Quality Monitoring and Assessment
WQS	Water Quality Standard(s)
WQX	Water Quality Exchange is EPA's new generation water quality information storage database, which has replaced the legacy STORET database.
WTPs	Water Treatment Plants
WWTPs	Wastewater Treatment Plants

1. Introduction

The Virginia Department of Environmental Quality (DEQ), on behalf of the State Water Control Board, submits a Toxics Reduction in State Waters (Toxics) Report to the Governor and designated committees of the Virginia General Assembly by January 1st of each odd-numbered year, in accordance with § 62.1-44.17:3 of the Code of Virginia. Submission of this 2021 report was delayed due to the Covid-19 pandemic.

The Report: Toxics Reduction in State Waters

The primary objective of the Toxics Report is to document the state's commitment to improving water quality, more specifically in relation to chemical contamination which may induce toxic effects on aquatic life, other wildlife or on human health.

This commitment includes the following actions:

1. The prevention of contamination of the Commonwealth's waters by toxics,
2. The persistent monitoring of those waters for the presence of toxics, and
3. The implementation of remedial measures to reduce and/or eliminate toxics found in the state's waters.

Although the reduction of toxics in the state's waters is primarily the responsibility of DEQ, various other agencies and organizations participate in the process, including the Virginia Department of Conservation and Recreation (DCR), the Virginia Department of Health (VDH), the Environmental Protection Agency's (EPA) Interstate Chesapeake Bay Program Office (CBPO), and the U.S. Geological Survey (USGS). This report summarizes the results of current activities directed toward toxics reduction and provides guidance on how to access further resources and information on specific subjects. DEQ submitted the first Toxics Report in January 1998. The January 1999 report provided basic background information related to the report's objectives and a basic model for its continued evolution. The current, twentieth Toxics Report (January 2021) provides a summary of the toxics-related prevention, monitoring and remediation activities of the previous two State Fiscal Years (SFY) and contains tables of both raw data and statistical summaries of SFY19 and SFY20 monitoring results (July 1 2018-June 30-2020). For programs with time lags between data collection and reporting periods, the most recent information available was used.

Historical summaries of results from 1997 through the present are available on the agency's website at https://www.deq.virginia.gov/water/water-quality/monitoring.

Functional Definitions: Toxics, Toxicity,

The Code of Virginia (Chapter 3.1, Title 62.1, § 62.1-44.17:2) defines toxics or toxic substance as "any agent or material listed by the USEPA Administrator pursuant to § 307(a) of the Clean Water Act and those substances on the 'toxics of concern' list of the Chesapeake Bay Program as of January 1, 1997." It further defines toxicity as "the inherent potential or capacity of a material to cause adverse effects on a living organism, including acute or chronic effects on aquatic life, detrimental effects on human health or other adverse environmental effects." This definition is rather broad, since an excess or even a deficit of many non-toxic substances can also cause adverse effects, both acute and chronic, on living organisms. This report consequently restricts the definition of toxicity to include only those substances that are directly and chemically detrimental to living organisms when they are in excess. Direct chemical

effects would exclude the physical effects of excess sedimentation or the indirect effects of nutrient enrichment, for example, both of which would also be detrimental to aquatic life. Furthermore, the concept of "other adverse environmental effects" must be defined in biological terms, since toxicity can only be observed, described, and quantified in relation to living organisms. The classification of chemical substances (i.e., a material) within the category of toxics (i.e., those that cause toxicity) is always based on the observed effects of their presence on specific living organisms. In fact, the concept of excess itself is defined in terms of the concentrations at or above which living organisms experience detrimental effects. Toxicity varies considerably among chemical substances and can increase or decrease (synergism and antagonism) in the environment based on interactions within pollutant mixtures. Generally toxicity is a function of chemical concentration or dose, and duration of exposure time. Species, life stage, and environmental variables (e.g., temperature, hardness, organic carbon) can impact toxicity in addition to dose and exposure time. The Federal Clean Water Act (CWA) defined the responsibility of the Environmental Protection Agency in identifying the critical concentrations at which distinct chemical substances begin to elicit a specified degree of deleterious effect, and establishing the associated water quality criteria that the states adapt as water quality standards to identify impaired waters.

Federal Water Quality Criteria

The CWA first described the scope and purpose of water quality standards and defined the authority and responsibility of EPA and the various states in relation to the requirements for, submission of, and establishment of, such standards. Since then, EPA has published various lists of toxic materials for which the movement, use, and/or release into the environment must be documented or for which concentrations in the environment must be monitored and their effects assessed and subsequently controlled. EPA reviews the results of published studies (both academic and commercial) and conducts its own research to determine what concentrations of chemical substances are detrimental to aquatic life, other wildlife and human health, and to what degree. Based on the results of this evaluation, water quality criteria may be established for freshwater, saltwater, or drinking water, identifying the concentrations that induce direct chronic or acute toxic effects on aquatic life, subsequent poisonous effects on wildlife or humans, or long term carcinogenic (cancer producing) effects on human health.

On December 22, 1992, the EPA published in the Federal Register a comprehensive list of 126 chemical substances for which it had established water quality criteria related to aquatic life in freshwater and saltwater and/or to human health risks. Subsequent studies often (1) identified additional toxics for which criteria were established, or (2) resulted in the establishment of new criteria for previously defined toxics. The list has been repeatedly modified during the ensuing years. On June 22, 2016, President Obama signed the Frank R. Lautenberg Chemical Safety for the 21st Century Act, which updated the Toxic Substances Control Act. Additional modifications of existing criteria, as well as the establishment of criteria for new substances, continue to update the EPA list and help maintain or improve the quality of the nation's waters.

Supplemental Information:

EPA provides its most recent complete list of nationally recommended water quality criteria for both priority (P) and non-priority (NP) toxic pollutants in electronic form on the EPA website at: https://www.epa.gov/wqc.

For information about updates to the Toxic Substances Control Act, please visit: https://www.epa.gov/laws-regulations.

Detailed information on recent updates concerning Aquatic Life may be found at: https://www.epa.gov/wqc/national-recommended-water-quality-criteria-aquatic-life-criteria-table

Virginia's Water Quality Standards – WQS

Once federal water quality criteria have been established for a chemical substance, it is the responsibility of the individual states to establish water quality standards that are protective of the designated use(s) assigned to each body of water in each state's laws and regulations. The most common designated uses include the support of aquatic life, other wildlife, fish consumption, shellfish consumption, human primary contact (swimming) or secondary contact (fishing, boating) recreation, and public water supplies (where applicable). The Commonwealth of Virginia has established and periodically revises water quality standards, which EPA reviews and must approve prior to their application. These standards are set forth at 9VAC25-260 (Virginia Administrative Code Title 9. Environment, Agency 25. State Water Control Board, Chapter 260). Virginia's designated uses are recreational uses, e.g., swimming and boating; the propagation and growth of a balanced, indigenous population of aquatic life, including game fish, which might reasonably be expected to inhabit them; wildlife; and the production of edible and marketable natural resources, e.g., fish and shellfish.

The most recent revisions to the Water Quality Standards Regulation included amendments to 94 human health criteria, which represent specific levels of chemicals or conditions in a water body that are not expected to cause adverse effects to human health due to water or fish tissue ingestion. The amendments were based on EPA's nationally recommended criteria updates issued in 2015, which reflected the latest scientific information and EPA policies, including revised body weight, drinking water intake, health toxicity values, fish consumption rate, bioaccumulation factors, and relative source contributions. EPA has approved Virginia's human health criteria amendments and they became effective on October 21, 2020. These criteria will be used in water quality assessments in the 2022 Water Quality Assessment Integrated Report.

Virginia's Water Quality Standards are available online at: https://law.lis.virginia.gov/admincode/title9/agency25/chapter260/.

Federal Reporting Requirements

In addition to the biennial 305(b)/303(d) Water Quality Integrated Report, federal law requires reporting procedures for the production, movement, storage, use, and release of many of these toxic substances. These procedures, as well as Virginia's annual Toxics Release Inventory (TRI) Report, are discussed more fully in Chapter 3.

DEQ's activities directed toward the reduction of toxics in state waters fall into three general categories: the prevention of toxic inputs to the Commonwealth's waters, the monitoring for toxics in water, sediment and fish tissues, and the implementation of remediation activities to reduce or eliminate toxics found in the state's waters.

2. Activities Directed toward the Prevention of Toxic Inputs

The primary prevention activities carried out by DEQ may be characterized as regulatory, non-regulatory, and educational. The non-regulatory programs of the Office of Pollution Prevention (OPP)

encourage industries, commercial enterprises, governmental and private facilities throughout the Commonwealth to establish Environmental Management Plans (EMPs) to minimize the use of hazardous materials, and to maximize the recycling of wastes and the use of "green products and services." This program, and two special programs associated with toxics, the Chesapeake Bay Program Toxic Contaminants Workgroup and the Salt Management Strategy (SaMS) initiative, are discussed in this section. The regulatory Virginia Pollutant Discharge Elimination System (VPDES) is discussed below, in Section 3.

DEQ's Pollution Prevention Program (P2)

DEQ's Office of Pollution Prevention (OPP) contributes to the reduction of toxics in the state's waters through its multimedia (i.e., air, water, and waste) non-regulatory Pollution Prevention (P2) Program. The P2 Program focuses primarily on the reducing resource consumption and the generation of solid waste. This reduces the movement, use, and release of toxic materials. This focus reduces toxics in products, processes and waste streams.

The annual Pollution Prevention Report, submitted to the Governor and the General Assembly in December of each year, describes OPP's activities for the year. The calendar year 2018 and 2019 reports summarize the pollution prevention strategies developed and implemented by the Virginia OPP over the past two calendar years. A few of these are briefly summarized below.

The 2020 report is available online at:
https://rga.lis.virginia.gov/Published/2020/RD566.

For additional information contact Meghann Quinn at Meghann.Quinn@DEQ.Virginia.gov.

Virginia Environmental Excellence Program (VEEP)

VEEP is a program focused on encouraging individual facilities and organizations (e.g., governments and universities) to employ environmentally sound practices to go beyond minimum environmental compliance requirements. VEEP has two distinct Tracks. There is a facility-based Environmental Management System (EMS) Track that has three tiers which are based on a facility's progress in developing and implementing an environmental management system. An EMS is a formal plan for adopting, implementing and documenting environmentally responsible practices. There is also an organization-based Sustainability Partners (SP) Track that encourages organizations to make environmental sustainability part of their culture through leadership, innovation, and continual improvement, but does not require an EMS. Efficient water use and water quality are major focus areas for VEEP, though not all members have achieved measureable results in these areas. Some pertinent VEEP successes include:

In 2019 VEEP members reported the following for calendar year 2018:

- Nutrient discharges to water were reduced by 866,666 pounds
- Hazardous waste disposed was reduced by 168.3 tons
- Non-hazardous waste disposed was reduced by 16,348.5 tons

In 2020 members reported the following for calendar year 2019:

- Virgin water use decreased by 2,209,837 gallons

- The total amount of water recycled was 136,096,386 gallons
- Green House Gas Emissions were reduced by 3,739 tons
- Suspended solids were reduced by 13,953 pounds

Virginia provides performance-based permit fee discounts for VEEP member facilities (depending on the tier of membership), including 5-10% discounts for hazardous waste reduction, 10-20% for solid waste reduction, and 2-5% for reduction of water use and release. In 2018, 2019 and 2020 VEEP facilities received total permit fee discounts of $144,895.00, $190,444.00, and $136,253.00 respectively

Virginia Green Travel

Virginia Green is the Commonwealth's voluntary initiative to promote pollution prevention (P2) practices across all sectors of the tourism industry. Participating tourism businesses and organizations voluntarily commit to engage in P2 practices in the areas of waste reduction, water and energy conservation, and in the support of green events and meetings. Virginia Green's network exceeds 1,900 facilities and events. In the past 2 years, over 215 partners have re-certified and over 60 new partners have joined. Coordination of the application review process, marketing, and promotion is done by DEQ's partners, the Virginia Green Travel Alliance (VGTA); the Virginia Tourism Corporation; and the Virginia Restaurant, Lodging, and Travel Association. OPP provides technical resources, oversees development of programmatic guidance and establishes the certification standards. This includes the development of a Sustainable Event Guide and promoting programs like EPA's Safer Choice. In addition, OPP is expanding its ability to provide technical assistance to individual tourism businesses when possible. The Virginia Green Travel program hosts an annual conference and runs an awards competition to help educate and motivate members.

For more information visit:

https://www.deq.virginia.gov/get-involved/pollution-prevention/virginia-green

Mercury Reduction

OPP provides extensive information on mercury reduction through best management practices associated with mercury in schools, fluorescent lights containing mercury, and dental amalgams.

Case Studies

OPP has compiled a set of pollution prevention case studies that show real world examples and identify technologies and techniques that have been successful. These examples showcase the effectiveness of pollution prevention projects by quantifying pollution reduction, cost savings and other benefits. The entities highlighted in the success stories have improved environmental performance by going above and beyond the industry standard.

For more information visit:
https://www.deq.virginia.gov/get-involved/pollution-prevention/case-studies

Executive Order 77: Virginia Leading By Example to Reduce Plastic Pollution and Solid Waste

Executive Order (EO) 77 was signed by Governor Northam on March 23, 2021. The goal of the EO is to eliminate most single-use plastics at state agencies, colleges and universities by imposing a near-term ban on several common disposable plastics and requiring the phase-out of other single use items by 2025. The cessation of use applies to disposable plastic bags, single-use plastic and polystyrene food

service containers, single-use disposable plastic straws and cutlery, and single-use plastic water bottles. Over a four-year period, agencies must eliminate the buying, selling, or distribution of all non-medical single-use plastic and expanded polystyrene objects with objects that are reusable, compostable or recyclable. The last element of EO 77 is broader waste reduction through agency plans that identify additional needs and opportunities for reducing all solid waste from agency operations. The purpose of these actions is to reduce plastic pollution and eliminate the need for new solid waste disposal facilities in Virginia.

With the signing of the EO, OPP's ongoing greening of government efforts shifted to assisting executive branch state agencies and institutions with implementation. DEQ developed guidance and a Plastic Pollution and Solid Waste Reduction Plan template for state agencies and institutions to use to comply with EO 77. In addition to the guidance and template, OPP hosted numerous EO 77 webinars to get feedback and answer questions from stakeholders. Numerous meetings with individual agencies were also held over the summer of 2021, and DEQ developed EO 77-specific web content with guidance and resources to raise public awareness about the EO. In addition to facilitating implementation of the EO throughout the state, OPP has taken a leadership role in ensuring that DEQ is in compliance with the order by engaging the agency's internal Environmental Management System Team.

Chesapeake Bay Program

EPA's Chesapeake Bay Program hosts a Toxic Contaminants Workgroup on which DEQ staff collaborate and contribute. The main objectives of the workgroup are toxics research, policy and prevention in Chesapeake Bay.

Specific policies and objectives are described in the Toxic Contaminants Policy and Prevention Outcome Management Strategy 2015–2025 which can be found here: https://www.chesapeakebay.net/documents/22048/toxic_contaminanats_policy_and_prevention_management_strategy_v3.pdf.

Salt Management Strategy (SaMS)

The SaMS is an initiative aimed at proactively addressing an emerging water quality concern in the Northern Virginia Region associated with chloride (salt) products used during winter storm events. The SaMS will also provide a framework for implementing the Accotink Creek chloride Total Maximum Daily Load (TMDL) study. The effort is expected to provide a clearer understanding of the costs and benefits of improved chloride (salt) application in snow and ice management and also promote improvements in best management practices (BMPs) to more efficiently and effectively apply these products.

The broad goals of the SaMS effort are to: (1) prepare a strategy capable of achieving the target chloride loads identified in the Accotink Creek TMDL and that is relevant to the broader surrounding region, and (2) foster collaboration among all stakeholder groups involved in winter deicing/anti-icing activities to encourage long-term support for improved practices that protect public safety and lessen environmental, infrastructure and public health effects. To accomplish these goals, the SaMS development process plans to:

1) Develop a suite of salt-related BMPs.
2) Produce a guiding document that outlines all aspects of the issue (environment, infrastructure, health, and cost) and provide resources for addressing those issues.
3) Develop a comprehensive public education and outreach campaign.

4) Explore all possible funding opportunities to assist in implementation of salt-related BMPs.
5) Develop options for effectiveness monitoring.
6) Organize options for reporting and tracking salt usage.

Based on implementation initiatives and experiences in Minnesota and other states such as New Hampshire, this form of BMP implementation holds the promise of improving water quality while saving costs and maintaining public safety. DEQ's SaMS development process began in January 2018 and is planned for completion in early 2021. The final product of the SaMS development phase will be a comprehensive resource called the SaMS Toolkit, which houses all of the recommendations, resources, and other information developed or complied by stakeholders since development began in 2018. Following the development of the SaMS Toolkit, SaMS will move into an adaptive, stakeholder-driven implementation phase.

More information on the SaMS development process is available on the agency's website here: https://www.deq.virginia.gov/water/water-quality/tmdl-development/salt-management-strategy-development

3. Permitted Dischargers & Compliance Monitoring

Virginia Pollutant Discharge Elimination System (VPDES) Permit Program

The Virginia Pollutant Discharge Elimination System (VPDES) permit program requires that concentration limits be established for all potentially toxic substances in permitted discharges from industrial, institutional, and/or municipal wastewater treatment facilities to ensure that Virginia's water quality standards are not violated in the water bodies receiving such discharges. Permit limits are set so that discharges do not exceed Virginia's water quality standards for the pollutants being released in the receiving stream. In SFY19 and SFY20 860 facilities held permits to discharge toxics into Virginia waters through 2,633 outfalls (**Table 1**). In almost all cases one permit was issued per facility.

Table 1. Facilities discharging toxics with active permits falling within SFY19 and or SFY20. Number of outfalls by SFY for each facility can be found in Appendix 1-Tab 4.

Facilities	Permits	Outfalls	Renewals
860	863	2633	292

Appendix 1 of this report lists facilities that currently have, or have applied for, permits that limit the quantity or concentration of discharged toxics within the SFY19-SFY20 data window. The geographic locations, discharge-receiving streams and watershed are also included in **Appendix 1** for each facility and outfall. It is important to note that the coordinates of each outfall are usually fixed to the facility location and should only be used for spatial analysis at coarse resolutions. Facilities with authorization to continue their discharges without a formal permit renewal (i.e. Administrative Continuances) were also included in **Appendix 1**- Tab 2. Several facilities had permits expiring during the SFY19- SFY20 data window (**Table 2**). The full list of toxic parameters in permitted discharges can be found in **Appendix 2**.

Table 2 Count of facilities with permits expiring during SFY19 (after 07/01/2018 and on or before 06/30/2019) or SFY20 (07/01/2019 and on or before 06/30/2020).

Year Effective	Year Permit Expires	Fiscal Year Permit Expires	Facilities	Permits
2013	2018	SFY19	14	14
2014	2019	SFY19	19	19
2014	2019	SFY20	13	13
2015	2019	SFY20	4	4
2015	2020	SFY20	26	26
2016	2020	SFY20	1	1

The number of outfalls for each facility (and or permit number) varies between facilities. Airports, military bases and power stations have the most outfalls discharging toxics (**Table 3**).

Table 3. Top 10 facilities arranged in descending order by number of outfalls with active permits within the SFY19- SFY20 data window. Facility locations can be found in Appendix 1.

Facility	Permit No.	Number of Outfalls
Norfolk International Airport	VA0089737	56
General Dynamics NASSCO-Norfolk - Ligon Facility	VA0073091	44
US Navy - Joint Expeditionary Base - Little Creek	VA0079928	39
Dominion Energy - Bath County Power Station	VA0053317	27
US NASA - Wallops Flight Facility - Main Base	VA0024457	25
Dominion - North Anna Power Station	VA0052451	23
US Army - Radford Army Ammunition Plant	VA0000248	21
BAE Systems Norfolk Ship Repair Inc	VA0004383	18
GP Big Island LLC	VA0003026	16
Claytor Hydroelectric Plant	VA0087084	15

In SFY19-SFY20 there were 25 facilities with 578 outfalls under Administrative Continuances, indicating that they received authorization to continue their discharges without a formal permit renewal. Large facilities such as military bases and power stations with Administrative Continuances generally have the most outfalls per permit. The top 10 Administrative Continuance facilities ranked by number of outfalls account for over 94% of all outfalls in the program.

Table 4. Top 10 facilities with administrative continuances arranged in descending order by number of outfalls.

Facility	Number of Outfalls
US Navy - Naval Station Norfolk	239
Huntington Ingalls Incorporated - NN Ship bldg. Div.	178
Dominion - Yorktown Power Station	32
Dominion - Chesapeake Energy Center	22
HRSD - Atlantic Sewage Treatment Plant	16
Dominion - Possum Point Power Station	15

APCO - Glen Lyn	13
WestRock CP LLC – Hopewell	11
Goodyear Tire and Rubber Co – Danville	10
Dominion - AltaVista Power Station	8

During SFY19 and SFY20, 499 facilities with 3,212 outfalls had one or more toxics limits in their permits and submitted Discharge Monitoring Reports (DMRs) (**Table 5**). The effective limits (when specified) and reporting frequencies for toxics may vary, depending upon the chemical parameters involved. In some years, a permit may be modified, reissued, or adjusted in terms of the current limits within the past year. 294 facilities renewed permits at one or more outfalls during the period (see columns B and column D in **Appendix 1**). The current toxics parameters included in each permit, along with their limits and required DMR frequencies, are also listed in **Appendix 2**.

Table 5. Count of facilities, permits, and Discharge Monitoring Reports (DMR) by fiscal year.

Fiscal Year	Facilities	Permits	DMRs
SFY19	262	264	1659
SFY20	237	238	1553

In SFY19-SFY20 153 total exceedances were reported for violations of average concentration and or maximum concentration discharges of a toxic contaminant (**Table 6**). Zinc and Copper compounds accounted for 70% of the toxic contaminants for which exceedances were reported (**Table 6**). The compliance results of each permitted facility's DMRs during the period are reported in **Appendix 3.**

Table 6. Summary of permit limit exceedances by fiscal year, analyte and exceedance type.

Fiscal Year	Analyte	Average Concentration Exceedance	Max Concentration Exceedance	Total Exceedances by Analyte	Total Exceedances
SFY19	CHROMIUM, TOTAL RECOVERABLE	1	3	4	65
	COPPER, TOTAL RECOVERABLE	15	16	31	
	NAPHTHALENE (AS C10H8)	0	2	2	
	ZINC, TOTAL (AS ZN)	1	0	1	
	ZINC, TOTAL RECOVERABLE	13	14	27	
SFY20	COPPER, TOTAL (AS CU)	0	1	1	88
	COPPER, TOTAL RECOVERABLE	23	25	48	
	ETHYLBENZENE	0	1	1	
	ZINC, TOTAL (AS ZN)	1	1	2	
	ZINC, TOTAL RECOVERABLE	18	18	36	

Virginia Toxics Release Inventory

Under the provisions of Section 313 of the Emergency Planning and Community Right-to-Know Act (EPCRA), also known as SARA Title III, Virginia manufacturing and federal government facilities that release certain chemicals to the air, water, or land, or that transfer these chemicals for off-site treatment, disposal, recycling, or energy recovery, are required to submit reports to EPA. This information is reported on Form R - Toxic Chemical Release Inventory Reporting Form and is collectively referred to as the Toxic Release Inventory (TRI). Although the Report itself is a "hindsight" monitoring tool, the intent of the program is to minimize the quantity, movement, and disposal of toxic materials.

This summary of the Toxics Release Inventory (TRI) includes the most recent reports: the 2017 TRI Report published March 2019, and the 2018 TRI Report published March 2020.The number of reporting facilities only increased by 1 from 422 in 2017 to 423 in 2018. Individual reports decreased by 6 from 1328 in 2017 to 1322 in 2018 (**Table 7**).

Table 7. Count of facilities, submitted reports, and total chemical classes for the previous three TRI publicly available reports.

Calendar Year	Reports	Facilities	Chemical Categories
2016	1345	434	153
2017	1328	422	138
2018	1322	423	139

Releases to surface waters within the boundaries of the facilities have decreased consistently from 2016-2018 both in pounds released, and as a percent of total releases (i.e. air, water, land) (**Table 8**).

Table 8. Reported on-site releases of TRI chemicals to surface waters 2016-2018.

Calendar Year	Million lbs.	% Water Releases
2016	13.57	38.87%
2017	11.29	37.07%
2018	9.14	32.35%

The top ten chemicals and/or classes of chemicals released each year are summarized in **Table 9** below along with the relative changes in the quantities released between 2017 and 2018. The top ten chemicals or chemical categories contributed approximately 97% of the total releases to water in each of the two years. The top ten chemicals were the same in both years, with the exception being Naphthalene and Acetaldehyde making the top 10 list in 2017 and not in 2018. Likewise, Copper and Lead made the top 10 in 2018 but not in 2017.

Nitrate compounds, which are typically of more concern because of nutrient enrichment rather than for direct toxicity, constituted approximately 10.9 million pounds (97.2%) of the total release of TRI chemicals in 2017 and 8.8 million pounds (96.3%) in 2018. This was followed by ammonia, another nitrogen compound, with approximately 0.093 million pounds (0.82%) in 2017 and 0.075 million pounds (0.82%) in 2018. The industrial wastewater treatment process is the largest source of surface water pollution from nitrate compounds.

Additional information on specific groups of chemicals and the quantities and other details of their releases is available in the original reports (see link below for these and previous years' reports). The next Virginia TRI report, summarizing toxic releases for calendar year 2019, will be available in March 2021.

Table 9. Top ten TRI Chemicals released to water on-site in calendar years 2017 and 2018. Chemicals are sorted in descending order based on 2018 releases.

Chemical	2017		2018		% Change
	Million lbs.	%	Million lbs.	%	
Nitrate Compounds	10.98	97.25	8.81	96.50	-0.75
Manganese & Mn compounds	0.087	0.77	0.095	1.04	0.27
Ammonia	0.093	0.82	0.075	0.82	0.00
Cyclohexanol	0.02	0.18	0.031	0.34	0.16
Dimethylamine	0.023	0.20	0.024	0.26	0.06
Barium and Ba compounds	0.007	0.06	0.019	0.21	0.15
Zinc & Zn compounds	0.021	0.19	0.014	0.15	-0.03
Methanol	0.011	0.10	0.012	0.13	0.03
Copper & Cu compounds			0.009	0.10	
Lead & Pb compounds			0.008	0.09	
Naphthalene	0.021	0.19			
Acetaldehyde	0.005	0.04			
Other	0.023	0.20	0.033	0.36	0.16
Sum	11.291	100	9.13	100	

Supplemental Information:

The most recent Virginia TRI Reports are available here:
https://www.deq.virginia.gov/home/showdocument?id=8172 .

TRI Search Plus is an interactive web application hosted by EPA. Virginia's TRI data is available through this application which can be queried by facility and watershed.
https://edap.epa.gov/public/extensions/TRISearchPlus/TRISearchPlus.html.

Additional sources of information on the TRI: Community Right-to-Know, including the access and use of TRI data and fact sheets for individual states, are available on EPA's website at: http://www.epa.gov/tri.

4. Ambient Monitoring

Samples analyzed for toxics were collected for an assortment of 21 different annual monitoring programs, TMDLs, and Special Studies. Depending on the experimental design and research objectives toxics were analyzed in water column, sediment, and fish tissue samples. The vast majority of DEQ samples collected and analyzed for toxics were water column samples (**Appendix 6**). Parameters broadly include metals, nitrogen compounds (e.g., nitrate, nitrate, ammonia), sulfates, chlorides, pesticides, PAHs and PCBs.

The 2020 Water Quality Monitoring Plan

The Annual Monitoring Plan provides a complete list of the ambient WQM stations that will be actively sampled during the corresponding calendar year and the types of samples that will be collected at each. This include samples for all parameters in addition to the toxic substances that were included in this report. The DEQ monitoring year corresponds to the calendar year in order to synchronize various ambient monitoring program schedules with one another, with the ecological and water year cycles, and with the assessment window or monitoring period considered for each 305(b)/303(d) Water Quality Assessment Integrated Report (Chapter 5).

The 2020 Water Quality Monitoring Plan and previous plans are available here: https://www.deq.virginia.gov/water/water-quality/monitoring.

Monitoring Toxics in the Water Column (excluding PCBs)

831 unique monitoring stations were sampled for toxic substances through 21 different DEQ monitoring programs within the July 1, 2018-June 30, 2020 window. The top 5 DEQ programs ranked by number of stations monitoring for toxics in the water column account for over 72% of the total stations (**Table 10**). Within the SFY19 and SFY20 window, 48,438 water column data points were obtained for one of 129 different parameters mostly consisting of total and dissolved trace metals, nitrogen compounds and organochlorides (**Appendix 4**) for the full list of water column parameters). PCBs collected in the water column and toxics measured in sediment or fish tissue are described in other sections below. Program codes and descriptions for all water column samples are in **Appendix 5**. A spreadsheet of water column results for all parameters (excluding PCBs) including the Station ID, watershed name, and coordinates for every monitoring station can be found in **Appendix 6**. Water column metals samples are assessed against Virginia's Water Quality Standards during the biennial 305(b)/303(d) water quality assessment. The data presented in this report will be assessed as part of the 2022 Water Quality Assessment.

Table 10. Top 5 programs ranked by number of stations sampling in SFY19 and or SFY20 for toxic parameters in the water column. Code descriptions for each program or study are in Appendix 5. .

DEQ Program Code	Number of toxics monitoring stations	DEQ Program Description
RL	150	Reservoir Monitoring (Regional Lakes)
TM	140	TMDL Activities
FP	107	Ambient Freshwater Probabilistic Monitoring
C2	102	Coastal Probabilistic Monitoring Program
TR	102	Trend Monitoring Program

Monitoring PCBs for TMDLs and Special Studies

Sediment and/or water samples were analyzed for PCBs at 100 different monitoring stations in SFY19 and SFY20. This information is used in the development of TMDLs to address waters listed as impaired due to fish consumption advisories. A total of 175 PCB samples were taken the majority of which were whole PCB water samples (**Table 11**). The location and results for each monitoring station where PCB sampling occurred in SFY19-SFY20 can be found in **Appendix 7**. Narrative overviews of each individual PCB TMDL and Special Study can be found below in Chapter 6.

Table 11. Count of PCB monitoring stations and samples for each matrix type.

Sample Matrix	PCB Stations	PCB Samples
Sediment	16	16
Water (dissolved)	6	10
Water (whole)	99	143

Monitoring for Fish Tissue Contamination

During the 2018 and 2019 monitoring seasons, DEQ conducted fish tissue monitoring for Total PCBs and 17 metal analytes (**Table 16**) at 104 monitoring stations. Fish were collected at routine annual statewide (Routine Statewide) sites to support multiple Special Studies and TMDLs, and for a National Fish and Wildlife Foundation (NFWF) grant funded project to sample selected sites in the Dan River and Roanoke River watersheds (**Table 12**).

The routine statewide TMDL follow up collections were concentrated primarily within watersheds of the York River (e.g., Mattaponi, Pamunkey), and the small coastal streams and tributaries of the Chesapeake Bay (e.g., Piankatank, Mobjack). Samples were also collected from special follow up sites on the Maury River (smallmouth bass), upper James River (carp), Potomac River (northern snakehead) as requested by the VDH, as well as selected special study sites in embayments of the Potomac River (see narratives in Chapter 6). Collections for the NFWF project were performed at sites located on the Dan River, Roanoke River, Smith Mountain Lake, Leesville Lake, J. H. Kerr Reservoir and Lake Gaston Sample site locations. Sample results for Total PCBs and metals in fish tissue can be found in **Appendix 8** and **Appendix 9** respectively.

Following receipt and review of fish tissue data, DEQ shares the data with the Virginia Department of Health (VDH), posts results on the DEQ website, and issues formal announcements of the availability of fish tissue data in the Virginia Town Hall and Virginia Register of Regulations. VDH is responsible for issuing Fish Consumption Advisories and Restrictions for Virginia Waterways based upon its review of fish tissue results. During this reporting cycle, VDH issued two press releases announcing updates to fish consumption advisories:

- In October 2019, VDH issued a press release announcing the addition of a new species, blue catfish, to the existing mercury advisory in the Nottoway River.
- In October 2020, VDH expanded the Upper James River PCB fish consumption advisory and added common carp as the species of concern.

Table 12. Number of sites and samples analyzed in 2018 and 2019 for routine statewide fish tissue monitoring, and on behalf of the National Fish and Wildlife Foundation grant.

Year	Project	Sample Sites	No. Fish Samples (Total PCBs)	No. Fish Samples (Metals)
2018	NFWF	13	65	65
	Routine Statewide	39	147	175

2019	NFWF	14	66	65
	Routine Statewide	38	149	175

Total PCBs in Fish Tissue

Eating contaminated fish is the most significant pathway for PCB uptake in humans. All fish tissue data are evaluated by the Virginia Department of Health (VDH) and could result in the agency lifting current fish consumption advisories or in the issuing of new ones. For consumption advisories based on Total PCB concentrations, exceedances of VDH screening values are considered when setting advisories (**Table 13**).

In 2018 only 2.4% of the total fish samples exceeded the upper VDH threshold of 500 ppb Total PCBS and likewise only 2.3% of the total fish samples exceeded the upper VDH threshold in 2019. Tabb Creek (site 7-TBC000.60 off Worley Rd. near Langley Air Force Base) had 2 fish composite samples of Gizzard Shad (5 fish in each composite) exceed the highest VDH Total PCB consumption screening value of 500 ppb (**Appendix 8**). Samples are usually composites of multiple fish of the same species and similar size class. With larger species such as Carp and Flathead Catfish a single fish is analyzed more frequently than a composite. Benthopelagic (i.e., bottom dwelling) fish often accumulate PCBs in higher concentrations than pelagic (i.e., open-water) fish (**Table 14**).

DEQ compares fish tissue data against screening values during the biennial 305(b)/303(d) water quality assessment discussed in Section 6 below. In addition, the Virginia Department of Health (VDH) is responsible for issuing Fish Consumption Advisories and Restrictions for Virginia Waterways based upon the results from the DEQ Fish Tissue and Sediment Monitoring Program and other sources. Fish tissue advisories are also considered in the 305(b)/303(d) water quality assessment. Based on the PCB concentrations observed in samples collected by DEQ in 2018 and 2019, VDH issued a consumption advisory for Common Carp from the Upper James River, effective October 13, 2020. VDH advised the consumption of no more than two meals a month of carp taken from the head of the James River near Iron Gate (at the confluence of Jackson River and Cowpasture River) to Balcony Falls Dam downstream of Glasgow (near the Maury River).

Table 13. Count of fish tissue screening values exceedances for Total PCBs compared against DEQ (20 ppb) and VDH (Lower = 100 ppb, Upper = 500 ppb) thresholds. Exceedances for each year include both Routine Statewide and NFWF sites. DEQ's new screening value for Total PCBs (18 ppb) will be applied to the 2022 Integrated Report.

Year	PCB Concentration Range (ppb)	Exceedances	Percent of Total Samples
2018	>20 & ≤ 100	54	25.5
	>100 & ≤ 500	20	9.4
	> 500	5	2.4
2019	>20 & ≤ 100	49	22.8
	>100 & ≤ 500	18	8.4
	> 500	5	2.3

Table 14. Number of fish samples by species that exceeded VDH lower screening value (100 ppb) for Total PCBS. Number of samples are summed for 2018 and 2019.

Species	No. Samples
Carp	10
Gizzard Shad	8
Flathead Catfish	6
Blue Catfish	6
Channel Catfish	2
Golden Redhorse Sucker	2
Atlantic Croaker	1
Freshwater Drum	1
Striped Bass	1
Walleye	1

Total PCBs in Sediment

In 2018 and 2019 the fish tissue monitoring program also collected sediment samples that were analyzed for Total PCBs (**Appendix 10**). Screening Values (SVs) identify the range of concentrations that are likely to cause adverse effects in benthic communities. Virginia primarily uses two screening value classes to characterize sediments during the 305(b)/303(d) water quality assessment process: consensus-based Probable Effects Concentrations (PECs) for freshwater sediments and Effects Range Median (ER-M) concentrations for estuarine and marine sediments. Screening values for Total PCBs and other contaminants can be found in DEQ's 2020 Water Quality Assessment Guidance Manual and are consistent with NOAA's Screening Quick Reference Tables (see links below). PCBs were detected in 12 of the samples and the most notable site was Tabb Creek where 495 ppb of Total PCBs was measured in the sediment. Tabb Creek was the only sample to exceed the Effects Range Median (180 ppb) and the screening value which indicates a high probability of causing adverse effects to benthic organisms (**Table 15**).

Table 15. Count of Total PCB sediment samples and exceedances of Effects Range Median (ER-M and Probable Effects Concentrations (PEC) screening values. Tabb Creek is the lone exceedance for ER-M.

Year	PCB Samples	PCB Stations	PCBs Detected	ER-M Exceedances	PEC Exceedances
2018	26	26	5 (19.2%)	0	0
2019	24	24	7 (29.2%)	1	0

Metals in Fish Tissue

Arsenic and mercury were the only metals to exceed VDH and/or DEQ screening values in 2018 and 2019 (**Table 17)**. In 2019 43.3% of fish tissue samples exceeded the VDH screening value threshold for arsenic**.** It is important to note that VDH and DEQ screening values are based off of the amount of inorganic (i.e., hazardous) arsenic, whereas DEQ fish tissue results are reported as total arsenic. Generally the proportion of inorganic arsenic is less than 10% of the total arsenic found in fish tissue,

thus rendering the screening values exceptionally protective.[1] Sample results for metals in fish tissue can be found in **Appendix 9**.

Based on mercury concentrations in samples collected by DEQ in 2017 and 2018, VDH issued a new consumption advisory for Blue Catfish taken from the Nottoway River, effective October 10, 2019. VDH advised eating no more than two meals a month of Blue Catfish taken from the Nottoway River from the confluence with the Blackwater River at the Virginia-North Carolina state line upstream to State Route 619 near Purdy, including Assamoosick Swamp (at tributary to the Nottoway River), Three Creek up to I-95, Rowanty Creek and its tributaries, Hatcher Rum up to I-85, and Arthur Swamp up to I-85.

Table 16. DEQ and VDH screening values (SV) and Practical quantification limit (PQL) for metals. All values are displayed in mg/kg (ppm). Lead is the only metal without a screening value for DEQ or VDH. The old DEQ screening values were applicable in the 2020 Integrated Report and have since been updated. The new screening values will applied for assessments in the 2022 Integrated Report.

Metal	DEQ New SV	DEQ Old SV	VDH SV	PQL
Beryllium	7.2	8	-	0.50
Aluminum	3600	4000	5286	0.50
Vanadium	36	40	-	0.50
Chromium	11	12	4.76	0.50
Manganese	510	560	53	1.00
Nickel	73	80	-	0.50
Copper	36	40	52	0.50
Zinc	1100	1200	1585	1.00
Arsenic	0.24	0.27	0.09	0.50
Selenium	18	20	26	0.50
Silver	18	20	-	0.50
Cadmium	3.6	4	0.53	0.50
Antimony	1.5	1.6	-	0.50
Barium	720	800	-	0.50
Mercury	0.30	0.30	0.50	0.50
Thallium	0.25	0.272	-	0.50
Lead	-	-	-	0.50

Table 17. Fish tissue screening value exceedances for all metals in 2018 and 2019. Screening values for arsenic are based on the amount of inorganic arsenic in fish tissue. Exceedances below were counted against total arsenic in fish tissue and represent overly cautious estimates of human health risk.

Year	Metal	Screening Value (ppm)	Metal Screening Value	Percent of Total

[1] Food and Drug Administration. 1993. Guidance Document for Arsenic in Shellfish. U.S. Department of Health and Human Services, Office of Seafood (HFS-416) 44 pg.

			Exceedances	
2018	Arsenic	DEQ (0.27)	43	17.9
		VDH (0.09)	89	37.1
	Mercury	DEQ (0.30)	43	17.9
		VDH (0.50)	20	8.3
2019	Arsenic	DEQ (0.27)	78	32.5
		VDH (0.09)	104	43.3
	Mercury	DEQ (0.30)	48	20.0
		VDH (0.50)	19	7.9

Fish Tissue Monitoring Supplemental Information

For a more comprehensive explanation of DEQ's fish tissue monitoring program visit: https://www.deq.virginia.gov/water/water-quality/monitoring/fish-tissue-monitoring.

The 2020 Water Quality Assessment Guidance Manual
https://www.deq.virginia.gov/water/water-quality/assessments/wqa-guidance-manual.

To search an interactive table of waters with current VDH fish consumption advisories visit: https://www.vdh.virginia.gov/environmental-health/public-health-toxicology/fish-consumption-advisory/.

To view an interactive map of waters with current VDH fish consumption advisories visit: https://virginiahealth.maps.arcgis.com/apps/webappviewer/index.html?id=9ac625009b224f818268c3fdd4e5cb9d.

NOAA Screening Quick Reference Tables
https://response.restoration.noaa.gov/sites/default/files/SQuiRTs.pdf.

Estuarine Probabilistic Monitoring

Each July 1-October 1 DEQ's estuarine probabilistic monitoring program collects sediment from 50 monitoring stations to be analyzed for PCBs, PAHs, metals, and pesticides (**Table 18**). Approximately 125 toxic analytes are measured from each sediment sample (**Appendix 12**). In 2017 and 2019, eight additional stations were assessed through the estuarine probabilistic monitoring program for the Potomac Embayments special study (see Chapter 6). The Station ID and location of each station can be found in **Appendix 13**. Sediment chemistry results from 2018 and 2019 including Potomac Embayment sites are in **Appendix 14**.

Table 18. Count of monitoring stations and monitoring events for the estuarine probabilistic monitoring program. The 8 additional stations in 2019 are for the Potomac Embayments special study.

Calendar Year	No. Monitoring Events	No. Monitoring Stations
2018	55	50

2019	63	58

Weight-of-Evidence Assessments

Virginia does not have numeric criteria or sediment standards for which to assess sediment and alternatively uses a weight-of-evidence (WOE) based approach to evaluate estuarine waters during the biennial 305(b)/303(d) water quality assessment process. The three lines of evidence in the WOE are sediment chemistry, toxicity testing, and benthic community. In most cases two or more lines of evidence must show adverse effects before the station is listed as impaired in the Water Quality Assessment Integrated Report. Benthic community is weighted most in the WOE because the objective of assessment is to protect the aquatic life designated use.

The estuarine probabilistic monitoring program also samples for metals in the water column at some stations as deemed essential and as budget allows (**Appendix 6**). Water column metals samples from probabilistic stations are assessed against Virginia's Water Quality Standards separately from the weight-of-evidence approach applied to sediment.

Supplemental Information

The 2020 305(b)/303(d) Water Quality Assessment Integrated Report includes assessments of water column metals data, fish tissue data and completed WOE assessments for estuarine probabilistic monitoring data collected 2013-2018. The draft report can be found here:
https://www.deq.virginia.gov/water/water-quality/assessments/integrated-report
A detailed explanation of Virginia's Weight-of-Evidence (WOE) Aquatic Life Use Assessment in Estuarine Waters can be found in Appendix H of the 2020 Water Quality Assessment Guidance Manual
https://www.deq.virginia.gov/water/water-quality/assessments/wqa-guidance-manual

5. The 305(b)/303(d) Water Quality Integrated Assessment Report

Overview

Virginia bases its water quality assessments on the ability of the waters to support the associated designated uses. Designated use support is based on the waters meeting the criteria for each use as defined in the numeric and/or narrative water quality standards as described in the water quality assessment guidance manual that is published ahead of each biennial water quality assessment. During the assessment process, concentrations of toxic contaminants found in surface waters, sediment and fish tissue are evaluated in accordance with the procedures described in the guidance manual to determine the appropriate assessment category for the associated bodies of water. The results of Virginia's water quality assessments are summarized each biennium in a comprehensive report called the Water Quality Assessment Integrated Report (IR).

Toxics Impaired Segments

EPA Approved the final 2018 305(b)/303(d) Water Quality Assessment Integrated Report on September 16, 2019. The assessment window for the 2018 IR extended from January 1, 2011 – December 31, 2016. The final 2020 IR is currently under review, and covers data collected between January 1, 2013 through December 31, 2018. The percentage of lakes, rivers and estuaries impaired for toxics remains remarkably unchanged from cycle to cycle (**Table 19**). Some of the toxics-related data summarized or discussed in other sections of this report will be assessed as part of the 2022 IR (data window January 1,

2015– December 31, 2020). The name and location of each toxics impaired segment for 2018 and 2019 cycles can be found in **Appendix 15**. The number of impaired segments for each parameter and cycle is located in **Appendix 16**.

Table 19. Summary of water body length or area impaired for any parameter compared to toxic parameters. Each cycle represents a 6 year data window as explained above. The 2020 cycle results (i.e. 2013-2018) are preliminary.

Cycle	Total Impaired			Impaired for Toxic			% Impaired for Toxic		
	Lake (sq mi)	River (mi)	Estuary (sq mi)	Lake (sq mi)	River (mi)	Estuary (sq mi)	Lake (sq mi)	River (mi)	Estuary (sq mi)
2006	31,820	1,247		24,186	141		76.0	11.3	
2008	30,253	7,025	1,787	25,348	1,304	1,724	83.8	18.6	96.5
2010	96,651	12,101	2,157	85,926	2,830	2,088	88.9	23.4	96.8
2012	94,041	13,127	2,134	85,518	2,828	2,061	90.9	21.5	96.6
2014	94,754	15,677	2,136	86,000	3,657	2,058	90.8	23.3	96.3
2016	93,523	15,282	2,132	86,012	3,669	2,049	92.0	24.0	96.1
2018	95,366	15,553	2,133	87,262	3,744	2,049	91.5	24.1	96.1
2020	94,789	15,871	2,137	88,082	3,680	2,056	92.9	23.2	96.2

The overwhelming majority of the toxic-related impairments are the result of fish consumption advisories for PCBs or Mercury (**Table 20**) accounting for approximately 89% of total segments (**Table 21**). Both of these contaminants are persistent and likely to bioaccumulate in higher concentrations in fish tissues than in the surrounding environment.

Table 20.Top five toxic contaminants by number of impaired segments for the 2018 and 2020 cycles. The full list can be found in Appendix 16.

Toxic Contaminant	2018	2020
PCBs in Fish Tissue	1052	1098
Mercury in Fish Tissue	334	344
PCBs in Water	64	74
Dioxin	21	22
Copper	14	18

Table 21. Number of assessment segments impaired for PCBs or mercury in fish tissue compared to overall number of segments impaired for toxics.

Cycle	No. Toxics Impaired Segments	No. PCB or Hg Fish Tissue Impaired Segments	Percent
2006	87	74	85.1
2008	617	512	83
2010	1443	1343	93.1
2012	1462	1376	94.1

2014	1468	1381	94.1
2016	1446	1358	93.9
2018	1543	1386	89.8
2020	1610	1442	89.6

Toxics Impaired Delistings

No estuarine, river, or lake assessment segments with toxics-related impairments were approved for delisting in the 2018 IR. Preliminary results for the upcoming 2020 IR indicate 3 segments (2 mercury, 1 PCBs) to be delisted for fish consumption advisories from new samples showing decreased contaminant levels (**Appendix 17**). One additional segment impaired for DDE and DDT (VAS-M02R_LOV01A02) will be delisted due to incorrect application of Water Quality Assessment Guidance in 2010. Upon EPA approval the aforementioned segments will be removed from the impaired waters list to better align with the Virginia Department of Health's fish consumption advisories.

Supplemental Information:

The final 2018 Integrated Report and the 2020 draft Integrated Report are available on DEQ's website https://www.deq.virginia.gov/water/water-quality/assessments/integrated-report

6. Total Maximum Daily Loads (TMDLs) and Special Studies

Overview

Total Maximum Daily Loads (TMDLs) pinpoint the maximum pollutant load (i.e. loading capacity) a waterbody can receive and still be in compliance with water quality standards. TMDLs, once implemented, help lower the risk contaminants pose to humans and the ecosystem. Pollution limits, or load allocations (LAs) for nonpoint sources and waste load allocations (WLA) for point sources, are set to meet compliance with the loading capacity identified in the TMDL. To establish the LAs and WLAs for a contaminant such as PCBs, water and sediment samples are collected to quantify PCBs sources and sinks.

The TMDL Program is the primary program for addressing toxics-related impairments in aquatic environments on a watershed scale. TMDLs are prioritized for development based on the national 303(d) Program Vision, which is explained in more detail below. For PCB TMDLs, the implementation process involves permitted dischargers developing Pollutant Minimization Plans (PMPs). PMPs are used to reduce or prevent releases of contaminants into a waterbody in order to achieve effluent quality at or below the applicable water quality standard or TMDL endpoint. Other implementation actions may be possible depending on the PCB sources identified during the TMDL development process.

EPA approved thirty-nine new TMDLs between 2019 and 2020. While most of the TMDLs approved during this period were related to excessive bacterial contamination and/or sedimentation, the New River PCB TMDL was due to an impairment by a toxic contaminant. DEQ currently has TMDL projects underway to address toxics (PCBs) in fish tissue in the upper, middle, and lower James River basins and Lewis Creek (Shenandoah River basin) described below. In addition, DEQ is developing a number of TMDLs for benthic aquatic life use impairments. These impairments may be due to a number of

potential stressors, including toxics. To identify the specific stressors, DEQ performs monitoring to support stressor analyses which are used to select the target pollutant for TMDL development.

Special studies are often initiated independently at the DEQ Regional Office (RO) level in response to locally recognized problems. Often, these regional special studies are related to TMDL development for impaired waters, but they may also be initiated to evaluate new monitoring or analytical methods, or to investigate potential problems with new practices. The TMDL Program is an important component of DEQ's toxics remediation in aquatic environments.

Supplemental Information

Completed TMDLs are available via the search form on the "TMDL Development" link on the DEQ website at:

https://www.deq.virginia.gov/water/water-quality/tmdl-development/approved-tmdls

The list of TMDL priorities is also available on the agency website at:

https://www.deq.virginia.gov/water/water-quality/tmdl-development/tmdls-under-development

Guidance for developing Pollutant Minimization Plans (PMPs) can be found at:

https://www.deq.virginia.gov/water/water-quality/tmdl-development/tmdls-under-development/pcb-tmdls

TMDL and Special Study Narratives

This section includes updates from SFY19-SFY20 to TMDLs and special studies regarding toxics. Raw data for each study can be found by referencing the appendix cited in each narrative.

Mountain Run: PCB TMDL

The Mountain Run impairment extends from the Route 15/29 bridge crossing, near the City of Culpeper, approximately 19 miles downstream to the confluence with the Rappahannock River. This water body was included in the 2004 Virginia Department of Health PCB fish consumption advisory and was first listed with a fish consumption impairment in DEQ's 2006 Integrated Report. The special study monitoring has entailed sampling throughout the watershed to identify potential areas of elevated PCB concentrations in both water column and sediment. In 2017, a review of the existing data was performed to assist with the selection of additional stations around the Culpeper area to target areas of potentially elevated PCB concentrations. Collections of the initial round of samples occurred during April 2018.

During SFY19 and SFY20, DEQ continued collection of data for the upcoming development of a Polychlorinated Biphenyl (PCB) Total Maximum Daily Load (TMDL) for the Mountain Run watershed located in Culpeper County. In July 2018, DEQ completed the sampling program concentrating data collection efforts around the Culpeper area. Base flow water column samples were collected and analyzed for PCBs at twelve (12) stations (**Appendix 7**). Locations were consistent with the targeted sites visited during a high flow event in April 2018, which were placed near potential PCB sources in tributaries as well as the main stem of Mountain Run. Development of a PCB TMDL is scheduled during the 2020-2021 timeframe.

Mountain Run: Benthic Stressor Analysis

DEQ started monitoring the Mountain Run watershed in Culpeper County to collect information in support of preparing a stressor analysis to identify the cause(s) of the benthic impairment in Mountain Run and Jonas Run. Mountain Run was first listed as impaired for the aquatic life use due to poor health in the benthic biological community in the 2008 Integrated Report. The impairment is approximately 19.90 river miles in length and extends from the confluence with the Rappahannock River upstream to the Route 15/29 crossing. Jonas Run, a tributary to Mountain Run, is approximately 3.78 miles in length. It was first listed as impaired for the aquatic life use due to poor health in the benthic biological community in the 2012 Integrated Report.

During SFY19 and SFY20, bimonthly sampling for nutrients and solids were conducted from January 2017 through the end of 2019 on six stations in the watershed: 3-MTN000.59 (trend), 3-MTN005.79, 3-MTN014.88, 3-MTN021.11, 3-MTN027.08, 3-JOA000.80 and 3-FLA001.93. Benthic samples were collected in 2019 at 3-MTN000.59, 3-MTN005.79, 3-MTN014.88 and in 2019 and 2020 at 3-JOA000.80 and 3-FLA001.93 (**Appendix 6**). The sampling for this project will end at the end of 2020. At this time, no clean dissolved metals sampling of the water column have been performed.

Lewis Creek: PCB TMDL

Lewis Creek was listed as impaired for PCBs due to exceedances of the Virginia Department of Health's (VDH) fish consumption threshold in 2004, and the Virginia Department of Environmental Quality's (DEQ) fish tissue-screening value in 2012. The PCB impairment begins near its headwaters and extends downstream 12.53 miles through the City of Staunton to its confluence with Middle River near Verona. Lewis Creek is located in the Potomac River basin. A TMDL study is currently underway to address the impairment and is scheduled for completion in 2021. The field portion of the TMDL study began in 2017. The basis of the study design was to help delineate the spatial distribution of PCBs, to assist in locating possible source areas and to provide information for model development to establish the fate and transport of this group of contaminants.

During SFY19 and SFY20 (i.e. July 1, 2018 until the field study was completed during the fall of 2019) a total of 14 water samples and five (5) sediment samples were collected and analyzed using a low level analytical method (**Appendix 7**).

Elizabeth River and Lower James River: PCB TMDL

The Elizabeth River and lower James River and their tributaries have VDH fish consumption advisories for PCBs, and thus are impaired waters for PCBs. Field studies began in 2009 with numerous monitoring events also taking place in 2010 and 2013. Ambient water samples were collected from locations throughout this section of the watershed during periods of "dry" weather and "wet" weather conditions. A low-level analytical procedure, capable of parts per quadrillion detection level was used to analyze all samples. The results are to be used in support of TMDL development by delineating possible source areas and to provide information for model development to establish the fate and transport of PCBs in the watershed.

During SFY19-SFY20, twenty-six (26) ambient water samples were collected from headwater locations in the Elizabeth River watershed (**Appendix 7**). The recent PCB data will enhance the development of the watershed model in support of the TMDL study. The PCB TMDL is scheduled for completion by 2022.

Elizabeth River Supplemental Information

In 1997, in response to indications of water quality impairment by toxics in the Elizabeth River and its tributaries, DEQ and a group of stakeholders through the non-profit group Elizabeth River Project (ERP) collaborated to produce a comprehensive Water Quality Monitoring plan for the water bodies of concern. Under guidelines included in that plan, a baseline environmental study began in January 1998 with the goal of allowing the future assessment of trends in contaminant concentrations and their effects. Scientists from the Virginia Institute of Marine Science, Old Dominion University, and DEQ worked with representatives from state, federal, and local authorities and other stakeholders to design and conduct the monitoring effort. DEQ continues to monitor for conventional pollutants and nutrients, however, most studies specifically involving toxics and their effects in the Elizabeth River system have been concluded.

The Elizabeth River Project is working to release its 2020 State of the River report card. In addition to water quality parameters the scorecard includes letter grades for biological indices such as benthic community health and cancer rates in fish (i.e. mummichogs). The ongoing research of Dr. Wolfgang Vogelbein at Virginia Institute of Marine Science indicates liver cancer is more prevalent in the mummichogs that live in the most industrialized branches.

For more information on monitoring activities and water quality improvement strategies visit the Elizabeth River Project website http://www.elizabethriver.org.

Middle and Upper tidal James River: PCB TMDL

The middle and upper tidal James River and its tributaries have VDH fish consumption advisories for PCBs, and thus are impaired waters for PCBs. Ambient water samples were collected from locations throughout the watershed during 2009 – 2013 with primary focus on “dry” weather and “wet” weather conditions. Several additional samples were collected during spring 2016 at the Richmond fall line. A low-level analytical procedure, capable of parts per quadrillion detection level was used to analyze all samples. The results are to be used in support of TMDL development by delineating possible source areas and to provide information for model development to establish the fate and transport of PCBs in the watershed.

During SFY19-SFY20, 31 ambient water samples were collected from headwater locations in the middle and upper tidal James River watershed (**Appendix 7**). The recent PCB data will enhance the development of the watershed model in support of the TMDL study. The PCB TMDL is scheduled for completion by 2022.

Bluestone River PCB Source Investigation

The Bluestone River is located in the New River Basin in southwestern Virginia. Currently a Virginia Department of Health fish consumption advisory exists from the Route 460 bridge just south of Bluefield, Virginia downstream to Virginia/West Virginia state line near the town of Yards in Tazewell County, Virginia. This advisory exists for carp, white sucker, rock bass and largemouth bass. Initial TMDL studies to delineate the geographic distribution and possible sources of the PCB contamination were initiated in 2002.

As part of the initial source assessment evaluation in fall of 2005, semi-permeable membrane devices (SPMDs) were deployed during low flow conditions. A PCB report for the Bluestone River in Tazewell County was released by USGS in 2007. The results of this PCB study were also presented at the 7th

Passive Sampling Workshop and Symposium in Reston, Virginia (April 24-26, 2007), which was cosponsored by the Columbia Environmental Research Center, U. S. Geological Survey and DEQ.

These previous investigations resulted in U.S. Environmental Protection Agency (EPA) removal actions at two facilities in West Virginia known to have been releasing PCB contamination (the Lin Electric Site and the former Joy Manufacturing Site, also known as the Route 52 Site). In December 2008, sampling results indicated that the stormwater migrating from the Lin Electric Site was found to contain the highest levels of PCBs compared to other surface water samples collected in the area. Surface water monitoring completed by DEQ since the removal actions indicates that the concentration of PCBs migrating from the Lin Electric Site has steadily declined. However, concentrations of the PCBs detected in the Bluestone River have remained somewhat consistent.

DEQ water sampling during periods of high and low flows in 2017 and 2018 along Whitley Branch, a tributary of the Bluestone River, show improving PCB conditions likely as a result of EPA PCB removal efforts at the Lin Electric site. However, corresponding samples collected along Beaverpond Creek continue to show elevated PCB concentrations.

The Route 52/Joy Electric site property is located just upgradient of the Beacon Cave system. PCB contamination was likely to have been released into the environment by the operators of the former Joy Manufacturing Site resulting in the release of unknown quantities of PCB contaminated oil into the Beacon Cave system. The Beacon Cave system is a karst groundwater system that begins in West Virginia. Groundwater moves rapidly through this system and exits to surface water in Virginia. The still elevated PCB concentrations in Beaverpond Creek suggest that the Beacon Cave system itself could be the current source of the PCB contamination impacting this creek and migrating via surface water to the Bluestone River. There may be an additional unknown source impacting the Beacon Cave System.

TechLaw has been tasked by EPA Region III to collect and analyze water (groundwater and surface water) and sediment/soil samples from the Bluefield Beacon PCB Groundwater Site located in Bluefield, Mercer County, West Virginia. A draft water and soil/sediment work plan was prepared in April 2020 to detail procedures and protocols for collecting the samples and specify analytical parameters. Both the West Virginia Department of Environmental Protection (DEP) and DEQ have identified sampling locations that may provide data to refine DEQ's current understanding of PCB contamination in the area.

During SFY19-SFY20, water samples were collected from Beaverpond Creek within Beacon Cave through a high flow period on September 19, 2018. This event yielded PCB concentrations between 26,666 and 57,182 pg/L (**Appendix 7**). The schedule for the next sampling events is undetermined at this time and is contingent upon human health issues related to the COVID-19 virus and gaining access to conduct sampling at proposed locations. The Biological Systems Engineering Department at Virginia Polytechnic Institute and State University has been contracted to provide support for the development of a PCB TMDL for impaired segments of the Bluestone River and tributaries in southwestern Virginia. Coordinated discussions continue among West Virginia DEP, DEQ, and EPA to address the Bluestone River PCB impairment.

Bluestone River Supplemental Information:

USGS 2007 PCB report for the Bluestone River in Tazewell County
http://pubs.usgs.gov/of/2007/1272/pdf/OFR2007-1272.pdf.

James, Maury, and Jackson Rivers PCB Source Investigation

The non-tidal James River is located in central and west-central Virginia and drains about 16 percent of Virginia from the headwaters to the fall line in Richmond. Within this watershed a total of five river and creek segments have been identified as impaired for PCBs. Two river segments, one on the Maury River and one on the James River, were listed for PCB fish consumption advisories beginning in 2004. Initial TMDL studies to delineate the geographic distribution and possible sources of the contamination were initiated in 2017. This TMDL study involves three DEQ regional offices: Piedmont Regional Office (PRO - Glen Allen), Blue Ridge Regional Office (BRRO – Roanoke), and Valley Regional Office (VRO - Harrisonburg). It impacts the following cities and counties: Albemarle, Alleghany, Amherst, Appomattox, Augusta, Bath, Bedford, Botetourt, Buckingham, Campbell, Chesterfield, Craig, Cumberland, Fluvanna, Giles, Goochland, Greene, Hanover, Henrico, Highland, Louisa, Montgomery, Nelson, Orange, Powhatan, Roanoke, and Rockbridge Buena Vista, Charlottesville, Covington, Lexington, Lynchburg, and Richmond.

During SFY19-SFY20, eighty-seven water samples and 13 sediment samples were collected. The study concluded in June of 2019 with a total of 155 water samples and 26 sediment samples collected since 2017. Results from samples collected during SFY19 and SFY20 can be found in **Appendix 7**. The purpose of this special study is to identify sources of PCBs throughout the TMDL watershed and to provide information on fate and transport of PCBs to assist TMDL model development. TMDL development began in the summer of 2020.

Upper Clinch River: Clinch-Powell Clean Rivers Initiative (CPCRI)

The Clinch-Powell Clean Rivers Initiative (CPCRI) project includes biological, chemical, and land use analytical components conducted concurrently to determine most likely stressors related to mussel declines. The water quality sampling conducted by DEQ and the Tennessee Department of Environment and Conservation (TDEC) and analyses described in this project are critical to the success of the overall research effort. Width and depth integrated samples are being collected at 8 sites on the mainstem Clinch River, 3 in Tennessee and 5 in Virginia plus one site on the Guest River, Virginia. The sites and river miles, miles from the confluence of the Clinch River are: Rt 33 bridge south of Sneedville, TN, RM 177, Kyles Ford, TN, RM 189, Horton Ford, TN, RM 199, Rt. 645 bridge at Craft Mill VA, RM 219, Islandview Cir Bridge Fort Blackmore, VA, RM 227, DUNGANNON RT 65 SINKING CREEK HWY , VA, RM 237, RT. 82 BRIDGE AT CLEVELAND, VA, RM 271, Nash Ford, Rt. 645 Bridge, VA, RM 279, and Guest River Bridge #1058 on Rt. 72 , VA, RM 6.50.

Samples were collected between June 2015 and November 2019. Sample collections were scheduled to occur at times when the flows where at the approximate median (base) conditions. There were 78 parameters collected at each site including nutrients, solids, physical characteristics, total and dissolved metals (Al, As, Cd, Cr, Cu, Fe, Hg, Mn, Ni, Pb, Se, Zn), total anions/cations (Ca, Cl, K, Mg, Na, NO3, SO4). DEQ has now completed water quality sampling on this project. A final report for the CPCRI project is in development. Once finalized, the report will be made available by the United States Department of the Interior. Results from samples collected during SFY19 and SFY20 can be found in **Appendix 6**. Results from all years are publicly available and can be found at https://www.waterqualitydata.us/portal/#organization=21VASWCB&project=15019.CL&mimeType=csv.

South River and South Fork Shenandoah River Mercury

Mercury was used in a manufacturing process at the DuPont plant in Waynesboro, Virginia from 1929 to 1950. Mercury losses and resulting contamination from that process resulted in a legacy problem that continues today. In a 1984 settlement between DuPont and the State Water Control Board a fund was established to support monitoring of water, sediments, and fish tissue in the river system for a projected 100-year period. DEQ manages that fund and conducts this long-term monitoring program. In 2006, DEQ established a full-time position in the Valley Regional Office to focus on this serious environmental issue. The water component of this monitoring effort focuses on concentrations of dissolved and total mercury in the South River and South Fork Shenandoah River. Monitoring through the 1990s rarely identified measurable amounts of mercury in water, due to analytical constraints. With the development of more sensitive techniques ("clean" metals sampling and analyses), quantifiable levels in river water are now routinely recorded (in parts per trillion). Fish sampling for mercury in edible tissue occurs on a 5-year cycle. Findings in 2017 were consistent with previous years, and no changes were made to the current VDH mercury fish consumption advisories for the South River and the South Fork Shenandoah River.

During SFY19-SFY20, DEQ staff collected total and dissolved mercury samples from multiple sites on the South River and South Fork Shenandoah River on a bimonthly frequency. Results from samples collected during SFY19 and SFY20 can be found in **Appendix 6**. The 100-year monitoring program was suspended at the end of 2019. DuPont continues to monitor water, fish and other media in support of its remediation efforts and this data is provided to DEQ.

South River and South Fork Supplemental Information:

VDH mercury fish consumption advisories for the South River and the South Fork Shenandoah River are available at: http://www.vdh.virginia.gov/environmental-epidemiology/public-health-toxicology/fish-consumption-advisories/shenandoah-river-basin.

Dan River Coal Ash Spill

On February 2, 2014 Duke Energy's coal ash storage pond failed in Eden, North Carolina releasing 39,000 tons of coal ash into the Dan River. In response, DEQ put together a long term monitoring plan to assess the environmental impacts of the coal ash spill to the Dan River. These monitoring data were used in a basin-wide Natural Resources Damage Assessment and Restoration (NRDAR) process led by the Dan River Natural Resource Trustee Council, a group composed of state and federal natural resources agencies, including DEQ. In 2016, the Council finalized an early-restoration plan and solicited public input on specific projects that Duke Energy could undertake for environmental improvement and enhancement in the Dan River basin.

During SFY19-SFY20, DEQ conducted monthly sampling of dissolved metals in the water column and metals in the sediment at four river stations and two lake stations. Results from water column samples collected during SFY19 and SFY20 can be found in **Appendix 6** and sediment chemistry results can be found in **Appendix 11**. In addition DEQ collected fish tissue at eight locations. Results from fish tissue samples collected during SFY19 and SFY20 can be found in **Appendix 9**.

On September 21, 2020, it was announced that Attorney General Herring, DEQ, the North Carolina Department of Environmental Quality, and the U.S. Fish and Wildlife Service had entered into a consent decree to finalize the restoration plan and environmental assessment related to the Dan River spill. Four projects were selected as meeting these goals and three of those have already been completed as early restoration, including:

- Acquisition and conservation of the Mayo River floodplain and riverbank adding 619 acres to the Mayo River State Parks in North Carolina and Virginia for long-term stewardship (completed).
- Aquatic habitat restoration in the Pigg River via removal of the Power Dam, returning riverine conditions to 2.2 miles, benefitting game fish such as smallmouth bass, and the federally and state listed Roanoke logperch and other nongame fish (completed).
- Establishment of public boat launch facilities on the Dan River (ongoing).
- Improvements to the Abreu Grogan Park in Danville, including new amenities and other improvements that address impacts related to park closure during spill response activities (completed).

Potomac Embayments

The Possum Point Power Station is located near the town of Dumfries in Prince William County, Virginia and the facility's wastewater treatment system was permitted under Virginia Pollutant Discharge Elimination System Permit Number VA0002071. Although the facility ceased burning coal in 2003, potential pollution from five impoundment ponds remains a concern. DEQ monitored water, sediment and fish tissue for toxics in 2017 and 2019. Monitoring results of metals in sediment and metals in the water column in 2019 are in **Appendix 14**, and **Appendix 6** respectively. Fish Tissue results from 2019 will available on DEQ's website in late fall 2020.

Catharpin Creek: Benthic Stressor Analysis

DEQ started monitoring Catharpin Creek in Prince William County to collect information in support of preparing a stressor analysis to identify the cause(s) of the benthic impairment. Catharpin Creek was first listed as impaired for the aquatic life use due to poor health in the benthic biological community in the 2012 Integrated Report. The impairment is approximately 6.81 river miles in length and extends from the confluence with the Little Bull Run upstream to the route 601 crossing. The sampling for this project will be completed at the end of 2020. In February 2020, storm flow clean dissolved metals sampling of the water column was performed once at the following locations: 1aCAA001.18 and 1aCAA007.32. Bimonthly sampling for nutrients and solids were conducted from January 2019 through the end of 2020 on two stations in the watershed: 1aCAA001.18 and 1aCAA007.32. Benthic samples were collected in 2019 and 2020 at 1aCAA001.18 and 1aCAA007.32. Results from water column samples collected during SFY19 and SFY20 can be found in **Appendix 6**

Cub Run: Benthic Stressor Analysis

DEQ started monitoring the Cub Run watershed in Fairfax County to collect information in support of preparing a stressor analysis to identify the cause(s) of the benthic impairment identified for Cub Run, Big Rocky Run, Elklick Run, Flatlick Branch and Little Rocky Run. Cub Run is listed as impaired for not meeting the aquatic life and recreational uses. The aquatic life use impairment is due to poor health in the benthic biological community. The downstream portion of Cub Run was first listed in the 2012 Integrated Report and the upper portion of Cub Run was first listed in the 2016 Integrated Report. The impairment encompasses a 13.23 river mile reach of Cub Run (from the confluence with Bull Run to approximately 13.23 river miles upstream). Four other segments are listed in the Cub Run watershed for not meeting the aquatic life use and are included in this project: Flatlick Branch (3.23 miles), Elklick Run (2.27 miles), Big Rocky Run (4.34 miles) and Little Rocky Run (5.23 miles).

During SFY19-SFY20, base flow clean dissolved metals sampling of the water column was performed once in October 2019 at the following locations: 1aELC001.39, 1aFLL000.88 and 1aBIR000.76. In October 2019, storm flow clean dissolved metals sampling of the water column was performed once at 1aFLL000.88 and 1aBIR000.76. Benthic samples were collected in 2019 at 1aELC001.39, 1aFLL000.88, and 1aBIR000.76 (**Appendix 6**). The sampling for this project was completed the end of 2019.

Sand Branch: Benthic Stressor Analysis

DEQ started monitoring Sand Branch in Fairfax and Loudoun Counties to collect information in support of preparing a stressor analysis to identify the cause(s) of the benthic impairment identified. Sand Branch was first listed as impaired for the aquatic life use due to poor health in the benthic biological community in the 2018 Integrated Report. The impairment is approximately 1.54 river miles in length and extends from the confluence with Cub Run upstream to the headwaters.

During SFY19-SFY20, DEQ conducted base flow clean dissolved metals sampling of the water column once in October 2019 at 1aSAN000.34. Storm flow clean dissolved metals sampling of the water column also was performed once in October 2019 at 1aSAN000.34 (**Appendix 6**). Benthic samples were collected in 2020 at 1aSAN000.34 and 1aSAN001.45.

7. Toxins from Harmful Algae Blooms (HABs)

DEQ serves as a partner agency on the Harmful Algae Bloom (HAB) task force, along with Old Dominion University, Virginia Institute of Marine Science and the lead partner: the Virginia Department of Health (VDH). The HAB task force responds to public complaints, conducts scientific investigations on potential HAB events that inform decisions by VDH on the issuance of health advisories, and provides information to the public on HAB events and their associated health risks. HABs produce toxins which may cause skin, eye, and digestive tract irritation, kidney and liver damage and neurotoxic effects.

In SFY 2019 and 2020, the task force obtained and analyzed a total of 978 samples for cell counts of HAB species. This included 245 samples collected as a result of a reported blooms along with 773 routine monitoring samples from estuarine shellfish growing areas. A total of 233 samples were analyzed for freshwater HAB toxins. This included microcystin and cylindrospermopsin as well as anatoxin-a and saxitoxin (beginning in 2020), for a total of 488 toxin assays. In addition 51 estuarine samples were tested for marine HAB toxins (domoic acid and okadaic acid) during this time period.

HAB task force activities in SFY 2019 and 2020 resulted in the issuance of several HAB notifications, as well as 23 official health advisories on 8 Virginia water bodies; Woodstock Pond (James City County), Lower J.W. Flannagan Reservoir (Russell County), Mint Springs Valley (Albemarle County), Twin Lakes State Park (Prince Edward County), Chickahominy River (Henrico County), Wilcox Lake (Petersburg), and Lake Anna (Spotsylvania, Louisa, and Orange Counties). All advisories were issued in fresh waters and included the use limitation that no swimming should occur.

Harmful Algae Blooms Supplemental Information:

Data from sampling events may be requested from VDH by calling 757-355-5745 or visiting the division's contact page at: https://www.vdh.virginia.gov/environmental-health/environmental-health-services/shellfish-safety/shellfish-division-staff/ .

For more information on HABs and the HAB task force visit: http://www.vdh.virginia.gov/environmental-epidemiology/waterborne-hazards-control/?tab=2.

To report a potential Harmful Algae Bloom visit: http://www.vdh.virginia.gov/environmental-epidemiology/harmful-algal-bloom-online-report-form.

Data from these sampling events and information on the issuance of advisories may be requested by visiting http://www.vdh.virginia.gov/environmental-epidemiology/contact-us/.

HAB map http://www.vdh.virginia.gov/environmental-epidemiology/harmful-algal-blooms-habs/algal-bloomsurveillance-map.

8. Future Initiatives

DEQ has identified several areas for consideration for future monitoring initiatives to address toxics contamination. These include:

- **Emerging contaminants**, such as Per- and Polyfluoroalkyl Substances (PFAS and PFOA), and the role they should play in the agency's monitoring network. In response to information published by the EPA on PFAS and on its efforts to develop regulatory guidelines regarding these compounds, DEQ has established a PFAS working group. In SFY 2019, DEQ collaborated with the Virginia Water Quality Academic Advisory Committee and the Virginia Water Resources Research Center to develop a report reviewing the available information on the sources, occurrences, environmental interactions, and human and ecological health effects of a group of emerging contaminants, including PFAS, other flame retardants, hormones and endocrine disruptors, pharmaceuticals and personal care products, antibiotics and micro- and nano-materials. This report is available at: https://www.vwrrc.vt.edu/wp-content/uploads/2019/10/SR63-2019_Emerging-Contaminants-in-the-Waters-of-Virginia.pdf. DEQ houses information related to the PFAS/PFOA on the agency's website: https://www.deq.virginia.gov/get-involved/the-environment-you/per-and-polyfluoroalkyl-substances-pfas.
- **Expansion of laboratory capabilities** to test and analyze samples from suspected Harmful Algal Blooms (HABs), and **establishing laboratory connections** for and other emerging contaminants, such as PFAS.
- **Establishing additional ambient water quality monitoring** (in-stream, not end-of-pipe) of harmful pollutants including metals and alkaline substances to set more accurate background conditions as a baseline for understanding water quality conditions and as input for permitting decisions.

The attainment of objectives for these new initiatives is dependent upon the availability of increased resources. While the agency received partial funding in SFY22 to support some monitoring initiatives that were previously eliminated, including funding to restore fish tissue and toxicity monitoring as required by WQMIRA, recurring funding is necessary to maintain and address these important initiatives.

References

A cumulative bibliography of general references and publications cited in this and previous Toxics Reports is included in **Appendix 18.**