Memo

Ohio River Valley Water Sanitation Commission
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Since 1948
Improving Water Quality in the Ohio River for over 75 Years

DATE: May 22, 2025

TO: Technical Committee

Scott Mandirola, WV, Chair	David Pfeifer, USEPA Region 5
Scott Twait, IL	Jeff Frey, USGS
Gabrielle Ghreichi, IN	**Ex Officio**
Katie McKone, KY	Kathy Beckett, CIAC
Damianos Skaros, NY	Cheri Budzynski, PIAC
Melinda Harris, OH	Betsy Mallison Bialosky, Chair, PIACO
Kevin Halloran, PA	Reese Johnson, Chair, POTW
Jeffrey Hurst, VA	Heather Hulton VanTassel, Chair, WOAC
Erich Emery, USACE	Chris Bobay, Chair, WUAC
LTJG Connor Sullivan, USCG	Sam Dinkins, Executive Director

SUBJECT: Announcement of 238th Technical Committee Meeting, June 10-11, 2025, Morgantown Marriott at Waterfront Place, Morgantown, WV, and Virtual Meeting

FROM: Jason Heath, P.E., BCEE

Scott Mandirola, Technical Committee Chair, wishes to welcome everyone to the 238th meeting of the Technical Committee, which will take place at the Morgantown Marriott at Waterfront Place, Morgantown, West Virginia, and virtually, on Tuesday, June 10, from 1:00-5:00 P.M. (ET), and Wednesday, June 11, from 8:00 A.M. to noon.

There will be a field trip on Tuesday afternoon to the Richard Mine AMD treatment facility (112 Pass Creek Lane in Morgantown). Lunch will be available at noon on Tuesday, followed by a presentation at 1P.M., then travel to the Richard facility at 1:45P.M., and return to the hotel no later than 5:00P.M. The facility is located approximately fifteen minutes from the hotel, and we are planning to carpool.

Approximately one week prior to the meetings, Technical Committee members, Commissioners, ORSANCO staff, and registrants will receive an email that includes detailed information and instructions on how to participate virtually. Those planning to attend in person can still expect to receive this email. For virtual participation with the TEC meeting, TEC members do not need to register; however, members of the public and other interested parties will be required to register to attend virtually by Monday, June 9. To register, please visit www.orsanco.org/registration and submit the registration form. A link to register will also be available on www.orsanco.org under the "News" section.

The Technical Committee meeting will be held in conjunction with the 242nd Commission meeting being held on Thursday, June 12, also in-person as well as virtual.

Notes on TEC agenda items are as follows:

Tuesday, June 10

1:00 - 5:00 P.M. West Virginia Water Research Institute and Rare Earth Element and Critical Material Recovery: Field Trip to Richard Mine AMD Treatment Facility

Dr. Paul Ziemkiewicz, Director, West Virginia Water Research Institute, will provide an overview of the WVWRI and its programs, at the hotel, prior to leaving for the field trip. Shiela Vukovich, WVDEP, will lead the Richard Mine AMD treatment facility tour. The presentation by Dr. Ziemkiewicz, will be at the hotel at 1 P.M., followed by leaving for the tour at 1:45 P.M., and returning to the hotel by 5 P.M.

The Richard Mine AMD Treatment Plant was constructed and is operated by the WVDEP Office of Abandoned Mine Lands and Reclamation and went online in April 2024. The facility treats an average of 400 gallons per minute of acid mine drainage from the abandoned Richard Mine and has successfully improved water quality in the lower Deckers Creek watershed. The facility is designed to support recovery of rare earth elements from the AMD wastewater. Commercial viability of REE recovery from the Richard AMD is being studied by the West Virginia Water Research Institute. The Richard Plant is located at 112 Pass Creek Lane, Morgantown, WV.

Wednesday, June 11, 8:00 A.M. - Noon

Item 1: Minutes of the 237th Technical Committee Meeting
Draft minutes of the 237th Technical Committee meeting are attached. Chair Mandirola will ask TEC members for revisions or approval of the minutes.

Item 2: Executive Director's Report
Executive Director Dinkins will report on selected items.

Item 3: Technical Committee Member Roundtable Reports
TEC members are invited to report on water quality issues of importance to their organization. Members are encouraged to provide staff with a written summary after the meeting in order to facilitate accurate meeting minutes.

Item 4: Applied Science to Improve Invasive Carp Management in the Ohio River
Dr. Brent Murry, with Davis College, WVU, will present on the following:
Invasive carp are being actively managed by state and federal agencies throughout the Ohio River, but uncertainties limit many management alternatives. Like most invasive species situations, invasive carp management currently lacks defined targets and goals. Researchers at West Virginia University are engaged in multiple projects to address some of the most critical information gaps. This presentation will highlight individual research projects around three dominant themes (1) quantification of invasive carp ecological impacts, (2) assessment of habitat conditions that may limit/promote spread, and (3) development of management tools to (a) determine monitoring effort needed to detect carp presence and track changes in abundance and (b) establish harvest and restoration targets. Both sets of tools are intended to support decision-making, increase accountability, and justification of management effort.

Item 5: ORSANCO Monitoring Strategy Review

The Monitoring Strategy Committee met on April 9, 2025, to review a draft Monitoring Strategy document and future monitoring priorities. The committee met multiple times over the past two years in developing these priorities and reviewing the draft monitoring strategy document (attached). All comments have been incorporated into the draft strategy, and TEC will be asked to recommend that the Commission endorse the document for public release.

Item 7: Source Water Protection and Emergency Response Programs Update

Lila Ziolkowski, ORSANCO staff, will present an overview of current events occurring within Source Water and Emergency Response programs.

Item 8: Biological Programs Update

Ryan Argo, staff, will review the final assessments for the 2024 Ohio River probabilistic surveys of the Montgomery and Newburgh pools. Tentative plans for the upcoming field season including routine biological monitoring, fish tissue collections, and special projects will also be detailed.

Item 9: Water Quality Monitoring Programs Update

Greg Youngstrom, ORSANCO staff, will provide an update on ORSANCO's HAB Monitoring, Response and Communications Plan as well as updates on monitoring programs. Updates on several special projects including installation of oil-in-water sensors with the Cleveland Water Alliance will also be provided.

238th Technical Committee Meeting
Morgantown Marriott at Waterfront Place
Morgantown, WV
June 10-11, 2025
Beginning at 1:00 P.M. (ET)
Chair Scott Mandirola, Presiding

TECHNICAL COMMITTEE MEETING AGENDA

CHAIR'S WELCOME AND ROLL CALL (Tuesday, June 10, 2025, 1:00 P.M.)

West Virginia Water Research Institute and Rare Earth Element and Critical Material Recovery: Field Trip to Richard Mine AMD Treatment Facility (Tuesday, June 10, 2025, 1:00-5:00 P.M.)
Dr. Paul Ziemkiewicz, Director, West Virginia Water Research Institute
Sheila Vukovich, WVDEP

1:00 P.M. Pre-field trip presentation on the Richard Mine AMD Treatment facility and overview of the West Virginia Water Research Institute (at hotel)

1:45 P.M. Carpool to Richard Mine (112 Pass Creek Lane, Morgantown, 15 minutes from hotel)

2:00 P.M. Richard Mine AMD Treatment Facility Tour

5:00 P.M. Return to Hotel

ACTION ITEMS AND REPORTS (Wednesday, June 11, 2025, 8:00 A.M. – Noon)

1. Action on Minutes of 237th Technical Committee Meeting – Chair Mandirola *
2. Executive Director's Report – Sam Dinkins, staff
3. Technical Committee Member Roundtable Reports
4. Applied Science to Improve Invasive Carp Management in the Ohio River - Dr. Brent Murry, Davis College, West Virginia University
5. ORSANCO Monitoring Strategy Review – Jason Heath, staff *
6. Source Water Protection and Emergency Response Programs Update – Lila Ziolkowski, staff
7. Biological Programs Update – Ryan Argo, staff
8. Water Quality Monitoring Programs Update – Greg Youngstrom, staff

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OTHER BUSINESS

- Comments by Guests
- Announcement of Upcoming Meetings
  October 7-9, 2025 – Covington, KY

ADJOURNMENT (NOON)

*Attachment

Agenda Item 1
238th Technical Committee Meeting
June 11-12, 2025
Morgantown, WV

MINUTES
237th Meeting of the Technical Committee
Embassy Suites Riverfront
Covington, KY
February 11-12, 2025
Chair Scott Mandirola, Presiding

Call to Order

The 237th meeting of the ORSANCO Technical Committee was called to order by Chair Scott Mandirola, at 1:00 p.m. on Tuesday, February 11, 2025. Eight states, three federal agencies, and all six advisory committees were represented (Roster of Attendance see page 14). Chair Mandirola welcomed all to ORSANCO's dual in-person and virtual meeting of the Technical Committee.

Minutes of 236th Committee Meeting

ACTION: Motion passed to accept the minutes of the 236th Technical Committee meeting.

Executive Director's Report

Director Dinkins reported on ORSANCO's reorganization resulting from Richard Harrison's departure and Sam Dinkins' promotion to director. The technical staff is now distributed among three groups: biological programs under Ryan Argo, ODS and emergency response programs under Lila Ziolkowski, and water quality under Greg Youngstrom. Jenny Coldiron, Director of Finance and Administration, left and is being replaced by Bob Wehmeier. Biologisits Ryan Hudson and Bridget Borrowdale have left and are replaced by Erin Linko, formerly a Biological Program Intern.

Ohio River Water Quality Update: 2024 Water Quality Conditions

ORSANCO staff discussed 2024 monitoring activities and observations on water quality of the Ohio River and major tributaries. Flows were generally below long term average flows. In general, it was a typical year for Ohio River water quality. Criteria exceedances varied for parameters including E. coli and fecal coliform, temperature, dissolved oxygen, iron, and mercury. There was a localized, Microcystis HAB event, on the Ohio River in Louisville, which generated a Recreational Public Health Advisory.

Update on Proteus Real-Time Bacteria Monitoring

Stacey Cochran presented an update on the status of the real-time Bacteria Monitoring Pilot Project which was funded by a WV 604b grant. This project is evaluating whether a real-time monitor for E. coli bacteria is viable for the Ohio River. Work was completed over the 2024 Contact Recreation Season to collect real-time readings with the Proteus instrument, along with water samples being analyzed for E. coli in the lab. The Proteus company is currently working on an algorithm for the data collected during the 2024 season, which is necessary to translate tryptophan readings to E. coli concentrations. ORSANCO was awarded a continuation of our WV604b grant for FY2025 and will add the Fluidion ALERT One instrument to this Pilot Project. This instrument collects in situ water samples and analyzes for E. coli. A summary report of the comparison of all three methods (Colilert, Proteus, and Fluidion ALERT One) will be generated after the 2025 season data has been collected and evaluated.

Update on Ohio River HABs Research and Monitoring through the ORSANCO, EPA-ORD, and Neptune and Company Partnership

Chris Nietch, USEPA-ORD, provided an update on partnership facilitated research activities since the Ohio River HABs risk characterization tool was brought online during the 2022 bloom season. R&D completed since then has included the implementation of a 14-day ahead HABs occurrence forecast, an update of the original scripts used to produce the web application, an exploratory analysis to bring remotely sensed data related to HABs into the risk characterization, and sampling campaigns designed to help evaluate the underpinning hypothesis to the original HABs risk model, assess newer analytical methods, and to survey the extent to which benthic cyanobacteria may pose risk to river water quality and safety. This work is providing valuable research on Ohio River HABs processes and application to Ohio River risk characterization and predictive modeling.

Analysis of Long-term Temporal Trends of the Ohio River and Major Tributaries

ORSANCO Environmental Scientist, Riley Lanfear, detailed plans to complete a temporal trends analysis of Ohio River water quality parameters. She highlighted methods and findings from similar analyses completed in prior decades using ORSANCO data. The new analysis will incorporate these prior methods, like the Seasonal Kendall test, in addition to more modern regression techniques. The results of these trends analysis will be shared with TEC at future meetings.

Biological Programs Update

Biological staff (Rob Tewes, Erin Linko, and Ryan Argo for Ryan Hudson) provided a summary of the content reviewed by the Biological Water Quality Subcommittee during their January meeting, including preliminary fish index scores, staff participation in National Rivers and Streams Assessment surveys, and plans for the 2025 field season. Aquatic Biologist, Ryan Hudson also reviewed an investigation into functional diversity measures and their potential for use in assessing Ohio River fish populations. ORSANCO staff presented results from the 2024 field season including probabilistic surveys of Montgomery and Newburgh pools, the conclusion of the 2023-2024 cycle of National Rivers and Streams Assessment surveys, and preliminary results from those assessments and special studies.

Source Water Protection and Emergency Response Programs Update

Lila Ziolkowski, ORSANCO staff, reported that ORSANCO was awarded congressionally directed spending funding through Senator Sherrod Brown in the amount of $688,000 to procure two new GCMS systems for Ohio based Organics Detection Systems (ODS) sites and procure a portable GCMS unit for use in rapid response surveillance instances to support Emergency Response and other source water response initiatives. Remaining funds will be used for integration into existing ODS network data management platform and to support creating a new spills notification database and platform to streamline communications and disseminate spills related information. There were no emergency response actions from ORSANCO, other than routine notification protocols, since the last Technical Committee meeting.

Monitoring Strategy

Jason Heath, ORSANCO staff, presented results of work by the Monitoring Strategy Committee to develop priorities for future monitoring initiatives, as well as a revised monitoring strategy document. This committee has been very active over the last two years, is well attended, and provides valuable input on ORSANCO's monitoring programs. Higher priority monitoring initiatives include PFAS, HEX Chromium, river-wide bacteria monitoring, plastics monitoring, mussel surveys, metals on tributaries, and addition of fish contaminants parameters following EPA's new guidance. A draft Monitoring Strategy was reviewed by the committee and has been submitted to EPA Region 5. The Monitoring Strategy Committee will continue to meet on a regular basis to continue discussions on priorities and monitoring programs.

New Draft National Recommended Criteria for PFAS

The USEPA recently issued draft National Recommended Human Health Criteria for three PFAS constituents, including PFOS, PFOA, and PFBS. Jason Heath, ORSANCO staff, provided an overview of the draft criteria, and how they compare to ORSANCO's 2021 Ohio River PFAS survey. Ohio River concentrations of PFOS and PFOA from the 2021 survey were generally above the draft National Recommended Criteria, while all PFBS concentrations were well below the criteria. The draft National Recommended Criteria are currently out for public comment.

Ohio River Basin Restoration Initiative
Jordan Lubetkin, with National Wildlife Federation, discussed the status of the Ohio River Basin Restoration Initiative and Restoration Plan, emphasizing the need for a federal program to support the region's restoration efforts. He outlined the plan's goals, including demonstrating the need for restoration, securing investment, and starting to see results. Jordan also mentioned the plan's focus on community-driven priorities and the involvement of tribal conservation and clean water priorities. The plan is currently in its finalization stage, with the aim of presenting it to Congress for potential investment.

He also discussed the limitations and challenges of the current plan, including data accessibility and the vastness of the region. He highlighted the difficulty in quantifying costs for certain aspects, such as habitat restoration and flood prevention. He also emphasized the importance of coordination across the 14 states, and the need for adaptive management programs. He outlined the overall report recommendations, including establishing a national higher river program, supporting tribal conservation and clean water priorities, engaging communities, and preventing additional harm. He also discussed the recommendations for each of the nine issue areas, such as water infrastructure, non-point source pollution, hydrologic modification, and habitat and species conservation. He concluded by emphasizing the need for increased investment, monitoring, and research to effectively implement the plan.

The plan is upcoming for public comment, which will be released by June. The plan aims to foster collaboration and partnerships among stakeholders to achieve shared goals. The plan is not a binding document and is intended to be a case statement for federal funding for the Ohio River Basin. Jordan also addressed concerns about the length of the original report, stating that they have edited it to be more concise and focused on the facts.

Member Updates and Interstate Water Quality Issues

Illinois
Scott Twait reported the following:

Triennial Review

An InterGovernmental Agreement (IGA) for the evaluating the Recreational Use in several waterbodies in the Chicagoland area has been executed. The University of Illinois will be doing surveys to determine the recreational use that is happening in the Chicago Sanitary and Ship Canal, Bubbly Creek, and the Brandon Pool section of the Des Plaines River this summer at access points to these waterbodies. The recreational survey is being completed to determine the recreational use as part of the triennial review.

Nutrient Loss Reduction Strategy

The Agency is working with National Great Rivers Research and Education Center (NGRREC) to develop a NLRS website that will include dashboards and interactive maps. The Agency hopes to have that completed by the end of 2025. The dashboards will be updated annually and will replace our traditional Biennial Reports.

PFAS Permit Progress

As of 2/30/25 the NPDES permit program is issuing permits that have PFAS monitoring requirements (quarterly) and requirements for BMPs/PMPs. The count includes the major municipal, major industrial, as well as the minor industrial facilities within the targeted industrial SIC codes.

- NPDES permit issued with PFAS requirements:
  - 15 Municipal
  - 18 Industrial
- NPDES permits on public notice:
  - 15 Municipal
  - 13 Industrial

Plan is still to add both monitoring and BMP requirements to the permits as they come in for renewal.

TOC vs. DOC

USEPA is moving toward using DOC in the equations to determine the toxicity of metals in some of the newer criteria. Our monitoring group has collected decades worth of TOC data, but to prepare for this, we had asked our monitoring group to also collect DOC over a year ago. We recently analyzed the data we have on lakes and streams. A separate analysis of the lake data did not show a strong relationship between TOC and DOC. However, the analysis of our stream data shows a very strong correlation between both parameters. We are now trying to decide if we can discontinue sampling for DOC, since our analysis shows that they are equivalent in our streams.

Critical Mussel Habitat

The Fish and Wildlife Service (FWS) is proposing to list large portions of several rivers as critical habitat for three mussel species in Illinois. The FWS are proposing to list critical habitat to protect the Sheepnose mussel (portion of the Kankakee River), Snuffbox mussel (portion of the Embarras River), and Spectaclecase (portion of the Mississippi River). This notice was published in the Federal Register on December 13, 2024. The document citation is: 89 FR 101100. It is a FWS listing under the Endangered Species Act. The FWS is asking for comments including any probable economic impacts and whether any specific areas should be considered for exclusion. The comment period ends February 11, 2025.

Indiana

Gabrielle Ghreichi reported the following:

Water Quality Standards

- We are working on our 2024 WQS review priorities list. We are considering adopting EPA's 2018 aluminum criteria, adopting aquatic life criteria for a few pesticides and biocides, updating Indiana's human health criteria derivation methodology in both the Downstate and Great Lakes part of our WQS rules, and are also re-evaluating our limited use designated use streams. Our public hearing to solicit feedback on list of priorities will be on December 11, 2024. The public hearing will be part of the Environmental Rules Board meeting that takes place on December 11, 2024.
- Aquatic Life methodology rulemaking update: IDEM is getting close to finalizing proposed rulemaking language for this rulemaking. IDEM is working to adopt the Great Lakes aquatic life methodology state-wide.
- U.S. EPA reviewed the Indiana 2024 303(d) List of Impaired Waters and issued a partial approval on May 17, 2024. In its partial approval, U.S. EPA concluded that IDEM's 303(d) list is not fully consistent with the requirements of Section 303(d) of the Clean Water Act and EPA's implementing regulations based on IDEM's decision to not list several waterbodies for certain metal pollutants. U.S EPA initiated a 30-day public comment period for their changes, which ended on July 16, 2024. No comments were received, and U.S. EPA issued a final action on the Indiana 2024 303(d) list on September 11, 2024. That information is available on our website: IDEM 2024 303(d) List
- N-STEPS nutrients project with EPA and TetraTech is moving along. We are working on evaluating all our nutrients-related water chemistry data, fish, macroinvertebrates and diatom datasets to evaluate potential relationships between nutrient levels and aquatic life impacts. IDEM will use this study to potentially re-examine how it assesses the impact of elevated nutrients on Indiana's warm water aquatic life use.

PFAS in Drinking Water

- Update on PFAS DW Sampling Project Phase 4 (Surface water sampling of water bodies containing drinking water intakes):
    - IDEM received an Emerging Contaminants Grant extension to study PFAS in Indiana surface water bodies that are used for drinking water
    - Initial samples were collected near the surface water intakes
    - 32 Surface Water Systems and a total of 44 intakes
    - 3 systems had PFOS or PFOA detects above Drinking Water MCLs for finished drinking water
    - Resamples have been collected and we are waiting for results.
    - Coordinating with OLQ to locate potential causes of detections above Drinking Water MCLs
    - All PFAS sample results will be posted on our IDEM website at https://www.in.gov/idem/resources/nonrule-policies/per-and-polyfluoroalkyl-substances-pfas/

Watershed Assessment and Planning

- In October, IDEM will finish sampling for the special project titled "Farmers Helping Hellbenders Initiative" in the Blue River and Indian Creek watersheds in the Ohio River basin. Water chemistry was collected monthly for 1 year, pesticides (including neonicotinoids) sampled monthly through October, and macroinvertebrates sampled once July - August. The sampling was conducted in collaboration with Purdue University and the Natural Resources Conservation Service's (NRCS) Regional Conservation Partnership Program (RCPP),
- IDEM's Fish Tissue program is wrapping up sampling in the Lower Wabash River Basin (from Lafayette to the confluence with the Ohio River). In 2025, the Ohio River Basin tributaries will be sampled. For more information or specific requests please reach out to Tim Fields (TFields@idem.in.gov).
- NPS Management Plan: Submitted a final draft to EPA. Updates to through 2029. No major changes to monitoring components; NPS Plan impacts our 319 funding, not our 205j funding, which is being used to fund ORSANCO monitoring from IDEM's end.
- IDEM and ORSANCO had an overlapping site on the Tippecanoe River upstream of SR 18 that was sampled this summer for the National Rivers and Streams Assessment (ORSANCO) and the Stream Regional Monitoring Network (IDEM). Dylan Brown (IDEM) worked with Ryan Hudson (ORSANCO) to coordinate sampling, so the events took place at least two weeks apart. IDEM conducted fall sampling for macroinvertebrates and fish community on September 3rd.
- IDEM finished probabilistic monitoring in the Upper Wabash River Basin for 2024 and will be sampling in the Lower Wabash River Basin for 2025. Probabilistic monitoring includes sampling at 38 sites for water quality (3 events spring, summer, and fall), *E. coli* (once a week for 5 consecutive weeks), diatoms, macroinvertebrate, and fish communities. IDEM is currently in the 5th cycle of probabilistic monitoring in the State of Indiana.

Kentucky

Katie McKone reported the following:

General

Public notices are now available in a viewer. Currently, the Division has 35 activities at public notice, ranging in activity type from 401 certifications, KPDES sanitary and industrial renewals, and a general permit renewal.

Kentucky's Water Health Portal, which displays 305(b) assessment results, waters designated as outstanding state resource waters, and EPA-approved TMDLs, has been enhanced to display HUC12s with 319 funded implementation, load reduction estimates for nitrogen, phosphorus, sediment, and E. coli, and watershed plans. We are in the process of finalizing updates to Chapter 4, which includes water withdrawal permits, design criteria for dams, and water supply plan requirements.

The Division has developed the Monthly Kentucky Water Resource Report, which is updated each month on the 15th. Our goal is to create a repository of data that looks and tracks rainfall, groundwater levels, lake levels, and other climate related events during each month.

In celebration of the 50th Anniversary of the Safe Drinking Water Act, the Division created a Regionalization of Public Water Systems in Kentucky viewer. We hope it will show our communities how hard we have worked to make our drinking water systems more reliable, sustainable and safe. More information is available at the provided link.

Nutrient Related

DOW continues to advance its work outlined in the Kentucky Nutrient Reduction Strategy. DOW issued its first KPDES discharge permit to a POTW with requirements for a nutrient reduction optimization study in October 2024. The nutrient optimization study will allow the POTW to identify the best combination of nutrient reduction strategies for its specific treatment system. DOW has identified over 90 POTWs on which to require nutrient optimization studies and will continue to evaluate and implement these requirements upon renewal of the facilities KPDES permits.

A HAB Recreational Advisory remains in effect for Carpenters Lake in Owensboro, which was initially reported on September 25th, 2024. Total microcystins was below detection limit in samples collected on 2/4.

The Division has a 604(b)-funded project involving Beargrass Creek that will be coordinated by MSD with USGS to look at point source and NPS nutrient inputs that contribute to seasonal HABs that appear around the mouth of Beargrass Creek and adjacent of Towhead Island. This project is part of our overall nutrient reduction strategy, and Josiah Frey is coordinating the project for the division.

We expect to publish a 2024 Nutrient Reduction Strategy Biennial Report before our next TEC meeting. The best way to stay informed is to join the distribution list for the Division's nutrient newsletter.

PFAS Related

Last year, the Division designated additional staff to increase our outreach on PFAS in wastewater. We wanted to assist permitted entities to prepare and plan for potential future regulations relating to PFAS discharges and meet the requirements of the Senate Joint Resolution 149 that called us to provide consultation and guidance on best management practices relating to PFAS discharges. We've sampled 7-8 WWTPs so far for PFAS in wastewater and/or biosolids and have several more that are interested. We are looking at some additional SOP updates relating to this type of sampling.

At Cynthiana Municipal Water Works, the Cabinet is installing an intake pump and making improvements (under a declared emergency) in order to provide an alternate water source for the water system due to PFAS concentrations in their primary source that seem to be flow dependent (low flow). Another project of interest is connecting the City of South Shore to Portsmouth, Ohio, which is in progress. The boring that extends under the Ohio River is partially complete. The $16M project depends on awarded BIL funding that is currently under review at the federal level.

Ohio

Melinda Harris reported on the following items:

Water Quality Monitoring and Assessment

Planning for 2025 field season in underway. We plan to conduct a biological and water quality survey in the Licking River Watershed.

Large River PFAS Sampling

PFAS sampling of 29 large rivers at 149 sites across the state occurred in 2023&2024 for comparison to USEPA's aquatic life criteria. Ohio EPA is currently working on a summary of the data and interactive map.

- Of the 40 compounds included in Method 1633, 9 were detected in the water column at 80% of the sampling locations
- Water column concentrations are similar to those reported by ORSANCO and neighboring states.

Water Quality Standards

Working on variance rule, stream nutrient assessment procedure, antidegradation and aquatic life criteria updates

Pennsylvania

Kevin Halloran reported on the following:

1. Triennial Review of Water Quality Standards proposed rulemaking published in the PA Bulletin in October 2023.
   PADEP presented the draft final-form rulemaking to the Agricultural Advisory Board (AAB) in April and the Water Resources Advisory Committee (WRAC) in May. WRAC voted to support the final-form rulemaking to the Environmental Quality Board (EQB).

   PADEP is scheduled to present the final-form rulemaking to the EQB at its March 11, 2025 meeting. Rulemaking documents and related materials will be made available to the public on the EQB's website approximately 2 weeks prior to the March 11th meeting. If approved by the EQB, the regulation will be submitted to the Independent Regulatory Review Commission (IRRC) for final review and action.

17 new or updated WQ Criteria
- 14 Human Health (HH) 1,4 – Dioxane, 2,4-D, Chloroform, Barium, Boron, Methyl ethyl ketone, 1,2,3-trichloropropane, 1,2,4-trimethylbenzene, 1,3,5- trimethylbenzene, Xylene, Acetone, Formaldehyde, Metolachlor, Resorcinol
- 3 Aquatic Life (AL) Cadmium (updated), Carbaryl (new), Tributyltin (TBT) (new) Minor definition revisions.

2. DEP presented a proposed rulemaking for stream re-designations to the EQB in September. The EQB adopted the proposed regulations relating to Class A Stream Redesignations. These amendments were published in the Pennsylvania Bulletin on February 1, 2025, to solicit public comment. A virtual public hearing will be held at 2 p.m. on March 13, 2025. The official public comment period will conclude on March 18, 2025. Additional information regarding this proposed rulemaking, the stream redesignation process and the stream evaluation reports are available on the PADEP web site.

3. PADEP presented the draft final-form rulemaking for some updates to our site-specific water quality criteria regulations (Chapter 93, section 93.8d) to the Water Resources Advisory Committee (WRAC) in May and to the Agricultural Advisory Board (AAB) in June. WRAC voted to support presentation of the final-form rulemaking to the EQB, and PADEP expects to present this rulemaking to the EQB in 2022.

4. PFAS update: all community public water suppliers are sampling, started putting sampling requirements in NPDES permits.

5. ALCOSAN update. Completed most of the new headworks. Submitted permits applications for Ohio River tunnel, plan to start this spring.

Virginia
Jeffrey Hurst reported the following:

Quick update on Hurricane recovery efforts. We are currently in the waterway debris management phase to restore hydraulic capacity in some of our hardest hit areas of SW Virginia. These efforts are being led by our Dept. of Emergency Management and FEMA, in coordination with Virginia DEQ and our other natural resource agency partners within the Commonwealth. All wastewater treatment plants have been back online for several months now, but some are still operating at reduced capacity.

Selenium Update - DEQ held a public comment period between October 7 and December 6, 2024, for the recommended selenium criteria for protection of aquatic life for four specific streams, and their tributaries, in Buchanan County, within the Big Sandy watershed. A public hearing was held in the on November 14, 2024, in Buchanan County. At the upcoming March 2025 State Water Control Board (Board) meeting, DEQ intends to ask the Board to adopt final amendments to the Virginia Water Quality Standards (WQS) regulation (9 VAC 25-260) to include a site-specific freshwater aquatic life selenium criterion for several tributaries to Knox Creek in Buchanan County. More information is available on the Virginia Regulatory Town Hall website. https://townhall.virginia.gov/l/ViewAction.cfm?actionid=6387

Virginia is currently within our regular Legislative Session, which is scheduled to conclude on February 22, 2025. We are currently tracking a number of proposed environmental regulations at this time, and I'll plan to have a more complete update for the Summer 2025 ORSANCO meeting.

The Virginia Dept. of Environmental Quality (DEQ) approved a Notice of Intended Award (NOIA) on December 6, 2024 and posted to the DEQ Nonpoint Source Funding website. The public comment period ended January 17, 2025. DEQ intends to award approximately $1.5 million of Federal Section 319 (h) funding for Seven Watershed Improvement Projects. The grant awards are to support projects that will advance goals and milestones within implantation and watershed-based plans. Three of the seven projects are in Southwest Virginia and within the Ohio River basin. They include the Knox and Pawpaw Creek watersheds ($244,392), South Fork Holston River (almost $300,000), and the Guest River ($94,709). DEQ expects to issue contracts stemming from this Notice of Intended Award (NOIA) around October 2025, subject to the availability of Federal 319(h) funds. The next opportunity to apply for CWA 319(h) funding will be coming up again in late May/early June 2025.

And finally, I would just like to mention that Virginia DEQ's 2025 Ambient Water Quality monitoring plan will be released later this month. We have almost 100 monitoring stations planned this season, specifically within Virginia's section of the Ohio River basin for this upcoming monitoring season.

West Virginia
Scott Mandirola reported the following:

Upcoming Legislative Session starts tomorrow, February 12.

Rules for 2025 session
WQS triennial review proposal for the 2025 47CSR2
- E Coli is being proposed for change from fecal
- Addition of an alternative aquatic life use based on the completion of a UAA
- Addition of 7 HH criteria currently not in the rule. 54 of the 96 2015 EPA updates were included in the last TR, these 7 new parameters are currently in permits because there is RP based on the NPDES permitting guidelines for the particular Industrial Codes.

NPDES Fee rule is being updated 47CSR26
- 75% increase, hasn't been increased for Industrial permits since 1999, municipalities since 1992.
- If no fee increase the program will runout of money by August 2025.

Air rules
- 5 rules are being updated to incorporate new federal requirements (IBR)

Haz waste Rule
- One rule being updated to incorporate new federal requirements (IBR)

DEP has 3 legislative changes for session being proposed.
1 - NPDES fee cap removal
2 - Haz waste fee sunsets and needs to be extended
3 - Remove sunset on the design build pilot program

Permit action
- Chemours reissuance for Washington works facility is in, the company is modifying the application currently
- Chemours has been issued a second permit for a second PFA production line which has been in production since September 1. Three carbon bed treatment is required on this line to achieve 99.999 percent removal for GenX and PFOA .

PFAS Protection Act status
- USGS contract testing 106 additional finished water sources, results should be back shortly.
- WV has received a 1 million dollar grant from EPA to do public outreach for emerging pollutants in disadvantaged communities (PFAS). It has been awarded 3 virtual and one in person meeting have been held for planning with the participating NGO'S. The first outreach meeting in the communities should be held shortly
- Reporting of PFAS use by industries completed on 12/31/23. The 6 industries that have reported the use or manufacture of PFAS compounds have had their permits modified to include quarterly monitoring for PFAS, as per the Act.

DEP has received UIC Class VI primacy from EPA.

New York
Damianos Skaros reported the following:

I'd like to thank the ORSANCO board for the many accomplishment and ongoing efforts the organization continues to perform. As we look towards the year ahead, New York State continues to actively pursue and invest in a variety of environmental initiatives which promote and protect our many resources. While based within the headwaters of the ORSANCO watershed, we are a proud member of this organization. A few of the many efforts

which New York State has promoted are highlighted in this report:

Water Quality Improvement Project (WQIP) Program - NYSDEC
The New York Water Quality Improvement Project (WQIP) program is a competitive reimbursement grant initiative which funds projects that address documented water quality impairments or protect a drinking water source. This highly successful program has been instrumental in funding the design and implementation of a variety of water quality projects throughout NYS. The program has worked to fund projects ranging from improvements to wastewater infrastructure to salt storage structures, to streambank stabilization projects.

In 2024, this highly competitive program and others similar ones, have resulted in over $13.5 million being granted by New York State to projects within the Allegany Watershed. The WQIP program within New York will continue again in 2025, helping to fund water quality improvement projects throughout New York State.

Nutrient Guidance Values - NYSDEC
In December of 2024, NYSDEC released new water quality guidance values (GVs) that will advance the State's regulation of the nutrient phosphorus in ambient
freshwaters. The intent of these new GVs is to protect human health and aquatic life in waterbodies throughout New York and the Allegany Watershed. The public comment period on the new values extends through February 24, 2025.

Septic System Replacement Fund | Environmental Facilities Corporation
New York State's Septic System Replacement Fund Program, which focuses on improving water quality by providing funds to counties to help homeowners replace cesspools and septic systems that are adversely impacting designated waterbodies will continue into 2025; with both Chautauqua and Allegany Counties participating in the program. This effort will continue to improve water quality in key waterbodies
throughout the watershed.

Chautauqua Lake Internal Loading Studies
New York State Department of Environmental Conservation (NYSDEC) has initiated an internal loading study of Chautauqua Lake, which is designed to better understand the phosphorus sources and loadings within the system. By fully understanding Chautauqua's nutrient system, efforts to improve water quality, reduce harmful algal blooms, and promote ecosystem health can be better
strategized.

US Geological Survey
Jeff Frey reported the following:

Stream gages

- No changes additions or losses of stream gages for Ohio-Kentucky-Indiana (OKI), West Virginia-Virginia (WV-VA), Pennsylvania (PA), and New York (NY) Water Science Centers

There are new cameras associated at several Ohio River Basin stream gages:

- McAlpine L&D site in Louisville https://waterdata.usgs.gov/monitoring-location/03293551/#dataTypeId=continuous-00065-0&period=P7D&showMedian=false
- Jenkins, KY which is also a LoCAS emergency alert system mentioned at the last meeting https://waterdata.usgs.gov/monitoring-location/371016082381001/#dataTypeId=continuous-00065-0&period=P7D&showMedian=false
- Soon at Cincinnati on the Ohio River (link not available yet).
- https://apps.usgs.gov/hivis/ is the site you can see cameras at gages across the nation.

Key meetings

- ***Jun 23-26: Barge safety meeting in DC*** with key cooperators to potentially identify ways USGS streamgages could be leveraged to improve barge safety on the Ohio River (Pete Cinotto will attend)

Reports

Harmful Algal Blooms (HABs)

- Zhang, C., McIntosh, K.D., Sienkiewicz, N., **Stelzer, E.A.**, Graham, J.L., Lu, J., 2024, **qPCR-based phytoplankton abundance and chlorophyll a: A multi-year study in twelve large freshwater rivers across the United States**: Science of The Total Environment, v. 954, 19 p., https://doi.org/10.1016/j.scitotenv.2024.175067 (September 19, 2024)
- Gorney, R.M., Nystrom, E.A., Stouder, M.D., St. Amand, A.E., Sauve, C., Clark, D., **Stelzer, E.A.**, Givens, C.E., Graham, J.L., 2024, **An evaluation of cyanobacterial occurrence and bloom development in Adirondack lakes**: Lake and Reservoir Management, published online 5 Nov 2024, 17 p., https://doi.org/10.1080/10402381.2024.2406283 (November 5, 2024)

Water Hazards

- **Ostheimer, C.J., and Whitehead, M.T.**, 2024, **Flood-inundation maps for the Cuyahoga River in and near Independence, Ohio, 2024:** U.S. Geological Survey Scientific Investigations Report 2024–5122, 16 p., https://doi.org/10.3133/sir20245122
- **Whitehead, M.T., and Ostheimer, C.J., 2024, Flood-inundation maps for the Cuyahoga River at Jaite, Ohio, 2024:** U.S. Geological Survey Scientific Investigations Report 2024–5115, 12 p., https://doi.org/10.3133/sir20245115.
- **VonIns, B.L., and Koltun, G.F.**, 2024, **Low-flow statistics computed for streamflow gages and methods for estimating selected low-flow statistics for ungaged stream locations in Ohio, water years 1975–2020 (ver. 1.1, October 2024)**: U.S. Geological Survey Scientific Investigations Report 2024–5075, 37 p., https://doi.org/10.3133/sir20245075.

PFAS

- **McAdoo, M.A., Connock, G.T., and Messinger, T., 2022, Occurrence of per- and polyfluoroalkyl substances and inorganic analytes in groundwater and surface water used as sources for public water supply in West Virginia: U.S. Geological Survey Scientific Investigations Report 2022–5067, 37 p.,** *https://doi.org/10.3133/sir20225067.*
- And here is a link to the ***WVVA WSC*** PFAS website that shows all sample locations and describes both completed and ongoing studies: PFAS Sampling Locations

Water Quality

- Conaway, C.H., **Baker, N.T.**, Brown, C.J., Green, C.T., and Kent, D.B., 2025, **Prioritizing US Geological Survey science on salinization and salinity in candidate and selected priority river basins**: Environmental Monitoring and Assessment, v. 197, article 59, 31 p., https://doi.org/10.1007/s10661-024-13264-z
- Hubbard, L.E., **Stelzer, E.A.,** Poulson, R.L., Kolpin, D.W., Szablewski, C.M., and Givens, C.E., 2024, **Development of a large-volume concentration method to recover infectious avian influenza virus from the aquatic environment: Viruses, v. 16, no. 12, published 10 Dec 2024, 14 p., https://doi.org/10.3390/v16121898.**
- **Hanrahan, B. R.**, King, K. W., Rumora, K. R., & Stinner, J. H. (2024). **Nitrogen balances and losses in conservation cropping systems across a tile-drained landscape in Ohio, United States**. *Journal of Soil and Water Conservation*, *79*(3), 145–154. https://doi.org/10.2489/jswc.2024.00055

Water use and availability

- Luukkonen, C.L., Buchwald, C.A., **Martin, G.R.,** and Johnson Mckee, A.E., 2024, **Data and knowledge gaps of a water bottling facility inventory and select water-use dataset, United States:** U.S. Geological Survey Scientific Investigations Report 2024–5106, 41 p., https://doi.org/10.3133/sir20245106.
- Stets, E.G., Archer, A.A., Degnan, J.R., Erickson, M.L., Gorski, G., Medalie, L., and Scholl, M.A., 2025, **The National integrated water availability assessment, water years 2010–20**, chap. A of U.S. Geological Survey Integrated Water Availability Assessment—2010–20: U.S. Geological Survey Professional Paper 1894–A, 24 p., https://doi.org/ 10.3133/pp1894A
  This professional paper is a multichapter report that assesses water availability in the United States for water years 2010–20.
- Integrated Water Availability Assessments | U.S. Geological Survey

GIS

- Annual NLCD (National Land Cover Database)—The next generation of land cover mapping | U.S. Geological Survey

Industry Advisory Committee
Kathy Beckett reported the following:

The committee has been communicating regularly via emails, but elected not to meet in advance of this meeting. There has been a fair amount of transition issues that are impacting the regulated community, as you might guess through the change of various administrations. We will be deciding to meet later before the next meeting in June. We will have an additional report to you at that time. The committee applauds the monitoring strategy work that is ongoing and finds extraordinarily valuable the PFAS characterization of the Ohio River. This is a significant policy issue and regulatory dilemma that industry is trying to prepare for as to how best to manage the industry.

The Committee recommends dropping the chemical adjective because this industry group is more than chemical. It has been discussed that the name doesn't match the context of this committee so we recommend it be updated.

Finally, the committee applauds the heavy lifting of the Strategic Communications Plan and looks with interest at the 501 of the organization. Often times the industry has a number of grant funding opportunities that are limited to 501c3 and we see an opportunity for synergy there. So we be looking into the future to see if we can find ways to collaborate.

Power Industry Advisory Committee
Cheri Budzynski reported the following:

Petition for Review – In light of the new administration, the DOJ has requested an abeyance to these challenges subject to review.

ELG – Fifth Circuit
Legacy CCR Rule – DC Circuit

Public Information Advisory Committee
Betsy Mallison Bialosky reported the following:

PIACO met in late January and again this week to review the new strategic communications plan that Annette Shumard debuted yesterday at the Roundtable. PIACO has spent considerable time over the last year in discussing this communication plan and providing input into various outreach strategies. We acknowledge and salute Annette's efforts to get the plan done. It was no small feat and we are behind it 100 percent.

We believe that the communications plan will bring consistency and improvement to ORSANCO's reputation. The plan includes the formation of a new Task Force that will combine the efforts and knowledge of our partners, stakeholders and river communities to help spread the word about ORSANCO's activities and expertise. We also believe there is a wealth of information to be mined from the technical committee and its efforts should be actively interwined with the efforts of the Task Force and communications efforts.

PIACO will continue to work with the communications staff to review and refine this communications strategies as time goes along and look forward to its implementation.

Watershed Organization Advisory Committee
Heather Hulton VanTassel reported the following:

Thank you for the time and consideration when it comes to hearing from the Watershed Organizations across the Ohio River Basin.

We would like to thank ORSANCO for expanding their focus on plastics and PFAS as emerging contaminants and increasing efforts around those contaminants. The Watershed Organizations across the basin would like ORSANCO to consider reaching out to those organizations conducting plastics, PFAS, or other novel contaminant work to amplify and utilize the work and data of those organizations when monitoring funds are limited. Our data could also be used to help support ORSANCO's efforts to seek additional funds to expand their monitoring.

As a collective, we will continue to advocate for the Ohio River Basin Restoration Plan and federal designation. We would like to emphasize the importance of recognizing the threats and challenges of our basin, including legacy and current industrial pollution in our watersheds. While it can be politically challenging to bring light to these ongoing pollution sources, we cannot come together as a watershed to resolve these issues without first addressing the problem. The Ohio River Basin is worth restoring and protecting, and addressing industrial pollution is a necessary step towards progress.

We also recognize the uncertainty when it comes to federal funding at this time. We encourage ORSANCO to continue to put efforts towards environmental justice in their monitoring and educational efforts across the basin. Additionally, there are organizations still working on environmental justice issues, and we encourage ORSANCO to utilize those organizations as resources during this time.
Thank you for your time and consideration of these comments from the Watershed Organizations Advisory Committee.

Water Users Advisory Committee
Chris Bobay reported the following:

The Water Users committee last met on January 28 and 29, 2025, in Wilder, KY.

Source Water Protection/Spill Response
Water Users remain focused on source water protection and emergency response efforts. Consider this: during our time together this week, we had two reported incidents, a diesel tanker spill near Pittsburg and styrene barge collision near Paducah. This underscores the importance of the ODS network and the critical role ORSANCO plays in supporting the drinking water community in spill notification and response.

ODS Network
ORSANCO staff and ODS sites reported no river VOC detections in the past quarter. A few of the ODS sites reported operational issues due to cold weather and freezing sample lines. ORSANCO staff updated the Committee on the status of the CDS grant to fund improvements of the ODS network which include two new GCMS installations and 1 portable GCMS to support field activities, as well as enhancements to data management and notifications within the network. We commend ORSANCO staff for their work to secure this funding and look forward to supporting them on implementation in 2025.

Emerging Contaminants
Water Users also remain focused on emerging contaminants, in particular those that have potential to threaten the quality of drinking water supplies, or those that are otherwise challenging to treat and remove effectively through conventional means. During our last committee meeting, we devoted a good portion of our agenda to the topic of micro- and nanoplastics. We invited national experts to present on the state of science with respect to analytical methods and instrumentation and emerging standards for classification and numeration of different plastics. Additionally, many of our members are actively involved in national research on method development and are working to understand challenges associated with the separation and quantification of plastics in water samples. Note: a 2024 NAS study on nanoplastics found that bottled water contained 20,000 particles per liter, orders of magnitude more than tap water.

PFAS Update
We also remain laser focused on PFAS. Committee members discussed recent PFAS trends from routine samples collected at drinking water intakes. Recent Ohio River GenX trends are very concerning and, if unmitigated, could threaten water system compliance with the new PFAS MCLs. I shared these results with the Technical Committee yesterday and would invite all of you to view that presentation. I've had some very constructive and encouraging discussions with many of you about this over the past few days and look forward to working with you to explore opportunities for additional protections for drinking water systems, including notification of permit exceedances and additional sampling. Water Users expect there to be further updates on this important issue which we will be monitoring closely over the coming months.

The Committee will meet again on May 20 and 21, 2025. This will be a joint meeting with the POTW committee.

POTW Advisory Committee
Reese Johnson reported the following:

The most recent POTW Advisory Committee Meeting was held on Thursday, January 23, 2025. ORSANCO hosted a virtual meeting and representatives from SD1 of Northern Kentucky, Cincinnati MSD, and Louisville MSD participated virtually.

The committee's main agenda item was to hear the details of a demonstration project for low-cost water quality sensors with internet access points that ORSANCO is working on with the Cleveland Water Alliance and Limno-Tech. Ed Verhamme from Limnotech and Ebie Holst from Cleveland Water Alliance presented an overview of their work. They have built a network of sensors and gateways to collect data on water quality parameters such as chlorophyll, dissolved oxygen, and temperature. The data is used by utilities, research institutions, and recreational users. The team also discussed their work on oil and chemical spill detection and response, with a focus on identifying high-risk areas and deploying sensors to monitor for hydrocarbons. The Cleveland Water Alliance has an open innovation challenge to promote the development of new sensor technologies with the goal of creating a smart, connected sandbox for IoT technologies to improve water quality monitoring and disaster response. The presentation led to a discussion about the deployment of water quality monitoring devices on the Ohio River, particularly in the Cincinnati/Northern KY region. The initial timeline for the project has a deadline of June 30th for the deployment of devices. We discussed the potential for raising funds to continue the project beyond this deadline, as well as the potential for expanding the project to include more stakeholders. Cincinnati MSD has followed-up already to explore joining the collaboration with the addition of a water quality sensor near the mouth of the Mill Creek into the Ohio River and ORSANCO staff asked about current monitoring technology for E. coli. The presenters responded that they are still searching for a hardy device for natural environments and all agreed on the challenge of finding a real-time E. coli sensor.

Our second agenda item was an update on ORSANCO's Water Quality Monitoring Program. ORSANCO staff member Stacey Cochran gave a quick update on the Proteus water quality monitoring sonde pilot study. She shared that they had completed all 35 rounds of sampling for the pilot study and were waiting for an update of the algorithm from the manufacturer, as the initial attempts to correlate the data were weak. A full report-out was provided separately at the TEC meeting. ORSANCO also purchased a Fluidion, a new technology for water sampling, and planned to run it side by side with the Proteus. It has its pros and cons, but the search for an effective E.coli sensor continues in earnest.

Finally, in preparation for our next POTW Advisory Committee meeting, which we are planning to hold jointly with the Water Users Advisory Committee in May 2025, we members discussed our experience with PFAS sampling to date. Both Cincinnati MSD and Louisville MSD have done some proactive testing to explore the presence of PFAS in their wastewater, and SD1 of NKY will be collecting samples from their collection system soon. So, we are beginning to get a picture of what PFAS regulation could impact at our plants, and look forward to discussing this in more depth with our colleagues at our upcoming joint meeting.

Next Technical Committee Meetings
The next Technical Committee meeting will be June 10-11, 2025, in Morgantown, West Virginia.

Comments by Guests
There were no comments by guests.

Adjournment
The 237th meeting of the ORSANCO Technical Committee was adjourned by Proxy Commissioner Mandirola at 11:47 a.m. on Wednesday, February 11, 2025.

Approved:

_____
Proxy Commissioner Scott Mandirola

Roster of Attendance

Technical Committee

Chairman	Commissioner Scott Mandirola
Illinois	Scott Twait
Indiana	Gabrielle Ghreichi
Kentucky	Katie McKone
New York	Damianos Skaros (virtual)
Ohio	Melinda Harris (virtual)
Pennsylvania	Kevin Halloran (virtual)
Virginia	Jeffrey Hurst
West Virginia	Scott Mandirola
US Army Corps of Engineers	Erich Emery (virtual)
US Coast Guard	TEC representative not present
US Environmental Protection Agency	David Pfeifer (virtual)
US Geological Survey	Jeff Frey (virtual)
Chemical Industry Advisory Committee	Kathy Beckett
Power Industry Advisory Committee	Cheri Budzynski
Public Interest Advisory Committee	Betsy Mallison Bialosky (virtual)
POTW Advisory Committee	Reese Johnson
Water Users Advisory Committee	Chris Bobay
Watershed Organizations Advisory Committee	Heather Hulton VanTassel (virtual)
ORSANCO Chief Engineer	Samuel Dinkins
Staff Liaison	Jason Heath

Commissioners/Proxies

Douglas Conroe, George Elmaraghy, David Flannery, Toby Frevert, Sarah Jon Gaddis (virtual), Bruce Herschlag (virtual), John Hoopingarner, James Jennings, John Kupke, John Lyons (virtual), Ron Potesta (virtual), Lou Wallace (virtual), Mike Wilson (virtual)

Staff

Ryan Argo, Bridget Borrowdale, Alexis Brandenburg, Elizabeth Burton, Nick Callahan, Daniel Cleves, Stacey Cochran, Sam Dinkins, Tracey Edmonds (virtual), Nick Guthier (virtual), Emilee Harmeling (virtual), Jason Heath, Riley Lanfear, Erin Linko, Annette Shumard, Adam Scott, Rob Tewes, Rachel Toney, Jamie Tsiominas, Greg Youngstrom, Lila Ziolkowski

Guests

Duke Adams (virtual)	PA DEP
Yetunde Agbesola	Illinois EPA
Scott Bessler	Metropolitan Sewer District of Greater Cincinnati
Frank Borsuk (virtual)	US EPA
Karina Bynum (virtual)	Tennessee Department of Environment and Conservation
MSTC Michael Callinan	US Coast Guard MSD Cincinnati
Pete Cinotto (virtual)	USGS
Melissa Conner (virtual)	
Jim Gibson	SD1
Peter Goodmann	Louisville Water Company
Jim Goodrich (virtual)	US EPA
Ed Hammer (virtual)	US EPA
Richard Harrison	Northern Kentucky Water District
John Hirschfield (virtual)	Westlake Corporation
MST1 Jean Jimenez-Sosa	US Coast Guard MSD Cincinnati
Rayna Laiosa (virtual)	The Chemours Company
James Lazorchak (virtual)	USEPA
Jordan Lubetkin	National Wildlife Federation
John Lyons	Strand Associates
Christopher Nietch	US EPA
MST2 Will Quinby	US Coast Guard MSD Cincinnati
Nick Reif	KY Division of Water
Charlise Robinson (virtual)	WV Rivers

Guests (continued)

Suresh Sharma (virtual)	
Ryan Sherman (virtual)	Illinois EPA
Diane Tancl (virtual)	US EPA
Daymond Talley (virtual)	Louisville MSD
Jeff Thomas	EPRI
Matt Thompson (virtual)	
Nicole Tremblay (virtual)	Louisville Water Company
Jit Weir (virtual)	IDEM
Bruce Whitteberry (virtual)	Greater Cincinnati Water Works
MST2 Tabitha Woolery	US Coast Guard MSD Cincinnati

OHIO RIVER VALLEY WATER SANITATION COMMISSION

Technical Committee Meeting
Agenda Item 5 Attachment
June 10-11, 2025

OHIO RIVER WATER QUALITY

MONITORING NETWORK AND ASSESSMENT STRATEGY

Draft Revision- March, 2025

Ohio River Valley Water Sanitation Commission

5735 Kellogg Avenue, Cincinnati, OH 45230

Table of Contents

1.0 INTRODUCTION

1.1 The Ohio River Valley Water Sanitation Commission

In 1948, the Ohio River Valley Sanitation Compact was signed by eight states -- Illinois, Indiana, Kentucky, New York, Ohio, Pennsylvania, Virginia, and West Virginia -- with the approval of the U.S. Congress. In doing so, these states pledged to work together for control and prevention of pollution in the waters they share. The Compact authorized the governing body it created, the Ohio River Valley Water Sanitation Commission (ORSANCO), to coordinate efforts to improve the quality of surface waters within the Compact District and promulgate rules and regulations as necessary for the abatement and prevention of water pollution in the District. The Commission consists of three representatives from each state, appointed by their respective governors, and three representatives of the federal government appointed by the President. The Commissioners establish the policies and programs of the Commission and employ a staff to administer and carry out these programs. Funding for the operation of the Commission and its programs comes from the eight states in proportion to their land area and population within the Compact District, and from the federal government in the form of a grant administered by the U.S. Environmental Protection Agency under Section 106 of the Federal Clean Water Act.

1.2 The Ohio River Valley Water Sanitation Compact

The Compact pledges the states to place and maintain the waters of the Ohio River Valley Water Sanitation District in a satisfactory, sanitary condition, available for safe use as public and industrial water supplies (after reasonable treatment), suitable for recreational activities, capable of maintaining fish and other aquatic life, and acceptable for other legitimate uses (fish consumption). Activities to achieve these objectives are set forth each year in a Program Plan which describes the tasks to be conducted during the coming year. The Commission's program is designed to achieve the Compact's objectives in a cooperative manner with those state and federal agencies having concurrent responsibilities for water pollution control.

The Ohio River Valley Water Sanitation Compact is the Commission’s sole authorizing document. While the Compact does not specifically address water quality monitoring, fulfillment of several of its directives requires monitoring and assessment, including:

- Article I pledges the states to work cooperatively to achieve and maintain water quality conditions suitable for beneficial uses.
- Article VI establishes the principal that wastes discharged in one state shall not injuriously affect the waters of another state.
- Article VI further states that the quality of intrastate waters shall be at least equal to that of the interstate water at the point of confluence.
- Article VIII directs the Commission to survey the District to determine water pollution problems.

1.3 Ohio River Basin Description

The Ohio River Basin encompasses portions of 14 states in an area of more than 200,000 square miles, which constitutes greater than five percent of the total United States land mass. The Ohio River is 981 miles long and flows through or borders six states -- Illinois, Indiana, Kentucky, Ohio, Pennsylvania and West Virginia. More than 25 million people reside in the Ohio River Basin, or approximately 10 percent of the total U.S. population.

The Ohio River conjoins with the upper Mississippi River at Cairo, IL and provides approximately two-thirds of the total flow of the Mississippi River at the confluence. As such, the Ohio River watershed may have an influence on water quality of the lower Mississippi River, and subsequently the Gulf of Mexico. Although water quality degradation has been identified in these regions, water quality management programs for the Ohio River have not considered the entire watershed as a source of pollution to the lower Mississippi River. Water quality improvements in the Ohio River watershed may be expected to have a positive impact on downstream water quality including that of the lower Mississippi River and Gulf of Mexico.

The Ohio River is a major, multi-use river. There are thirty-one drinking water utilities serving approximately five million people that use the Ohio River as a source. At the same time, there are approximately 570 permitted discharges to the Ohio River, including twenty-seven coal-fired electric generating plants and 177 municipal sewage treatment plants. In addition, there are ten hydropower plants on the Ohio River, and the entire river is used extensively for the transport of bulk commodities, as well as recreation. There are many festivals that take place along the river every year. Given these important attributes, it is clear that protection and improvement of the water quality of this great resource are vital to the health and economic prosperity of the region and the nation.

1.4 Purpose and Objectives

The purpose of this document is to clearly articulate each of ORSANCO's monitoring programs and establish recommendations for future monitoring programs. This is necessary to provide documentation as to how ORSANCO's water quality monitoring programs assist it and its member states in managing the water resources in the Ohio River Basin, and primarily the Ohio River. The document should prove useful as a resource in identifying past and present water quality studies, both ongoing and special studies, so that readers may gain an understanding of what data is available that may be of interest. In addition, ORSANCO will use the document to facilitate a review and generate recommendations from its member states and other partners, for the enhancement of its monitoring programs.

1.5 US EPA's Water Monitoring Strategy Framework

The following outlines U.S. EPA's Elements of a State Water Monitoring and Assessment Program (2003) that will be addressed in this document:

1.5.1 Monitoring Program Strategy

The State has a comprehensive monitoring program strategy that serves all water quality management needs and addresses all State water, including all waterbody types (e.g., streams, rivers, lakes, Great Lakes, reservoirs, estuaries, coastal areas, wetlands, and groundwater). The monitoring program strategy is a long-term implementation plan and should include a timeline, not to exceed ten years, for completing implementation of the strategy. It is important that the strategy be comprehensive in scope and identify the technical issues and resource needs that are currently impediments to an adequate monitoring program. The State's monitoring strategy should contain or reference a description of how the monitoring program elements described in the remainder of this document will be achieved.

1.5.2 Monitoring Objectives

The State has identified monitoring objectives critical to the design of a monitoring program that is efficient and effective in generating data that serve its management decision needs.

1.5.3 Monitoring Design

The State has an approach and rationale for selection of monitoring designs and sample sites that best serve its monitoring objectives. The State monitoring program will likely integrate several monitoring designs (e.g., fixed station, intensive and screening-level monitoring, rotating basin, judgmental and probability design) to meet the full range of decision needs. The State monitoring design should include probability-based networks (at the watershed or state-level) that support statistically valid inferences about the condition of all State water types, over time. EPA expects the State to use the most efficient combination of monitoring designs to meet its objectives.

1.5.4 Core and Supplemental Water Quality Indicators

Because limited resources affect the design of water quality monitoring programs, the State should use a tiered approach to monitoring that includes a core set of baseline indicators selected to represent each applicable designated use, plus supplemental indicators selected according to site-specific or project-specific decision criteria.

1.5.5 Quality Assurance

Quality Management Plans (QMP) and Quality Assurance Project Plans (QAPP) are developed, maintained, and peer reviewed in accordance with EPA policy to ensure the scientific validity of monitoring and laboratory activities (ORSANCO 2020 QMP – submitted to USEPA Region V with this document).

1.5.6 Data Management

The State uses an accessible electronic data system for water quality, fish tissue, toxicity, sediment chemistry, habitat, and biological data (following appropriate metadata and State/Federal geo-locational standards) with timely data entry and public access.

1.5.7 Data Analysis/Assessment

The State has a methodology for assessing attainment of water quality standards based on analysis of various types of data (chemical, physical, biological, land use) from various sources, for all waterbody types and all State waters. The methodology should describe how existing and

available data and information relevant to applicable water quality standards, including both core and supplemental indicators, will be compiled and analyzed to make attainment decisions about State waters. The methodology describes how the state integrates its primary data – collected specifically for making attainment decisions according to a State QAPP – with data from secondary sources, collected for a variety of purposes under a variety of quality control practices. (Secondary data could include, for example, volunteer monitoring data or discharge monitoring reports.) The methodology should:

• Identify the required or likely sources of existing and available data and information and procedures for collecting or assembling it;
• Describe or reference requirements relating to data quality and representativeness, such as analytical precision, temporal and geographical representation, and metadata documentation needs;
• Include or reference procedures for evaluating the quality of datasets; and
• Explain data reduction procedures (e.g., statistical analyses) appropriate for comparing data to applicable water quality standards.

1.5.8 Reporting

The state produces timely and complete water quality reports and lists.

1.5.9 Programmatic Evaluation

The state, in consultation with its EPA Region, conducts periodic reviews of each aspect of its monitoring program to determine how well the program serves its water quality decision needs for all State waters, including all waterbody types.

1.5.10 General Support and Infrastructure Planning

The State identifies current and future monitoring resources it needs to fully implement its monitoring program strategy.

2.0 MONITORING PROGRAM STRATEGY

The monitoring program strategy is intended to describe how ORSANCO implements its monitoring programs that serves the Ohio River Valley Water Sanitation Compact and the needs of its member states. ORSANCO's monitoring programs are designed to meet each of following Compact requirements:

- Article I pledges the states to work cooperatively to achieve and maintain water quality conditions suitable for beneficial uses.
- Article VI establishes the principal that wastes discharged in one state shall not injuriously affect the waters of another state.
- Article VI further states that the quality of intrastate waters shall be at least equal to that of the interstate water at the point of confluence.
- Article VIII directs the Commission to survey the District to determine water pollution problems.

In addition to Compact requirements, ORSANCO's monitoring programs fill the following needs:

- Define water resource conditions. Determine attainment of designated uses biennially (305b Report).
- Identify existing and emerging problems (does water quality pose ecological or human health risk?).
- Provide basis for designing water quality management strategies.
- Provide information for evaluating program effectiveness.
- Identify water quality trends.
- Develop and evaluate large river methods.
- Provide information for water quality standards development.
- Provide data for states' NPDES permitting.

ORSANCO conducts monitoring in three categories (biological, water quality, and monitoring for source water protection (Organics detection System) Biological community monitoring including fish population and macroinvertebrate community surveys, provides for a direct measure of aquatic life health. Fish tissue contaminants monitoring is for the protection of human health from fish consumption. These programs are primarily for 305b use attainment assessments, problem identification, nutrient criteria development, large river methods development,

Water quality programs include bimonthly and clean metals monitoring, recreational bacteria monitoring (for E. coli bacteria), algae/nutrients, HABs detection system, interrogation of dissolved oxygen and temperature data, and supplemental monitoring for mercury. These programs are used for 305b use attainment assessments, trends, problem identification (does water quality pose ecological or human health risk?) , support of states' NPDES permitting programs, and source water assessment and protection.

The Organics Detection System is the third category of monitoring which is for spills detection and source water protection and assessment. This monitoring falls into the category of problem identification.

Table 2.1 below is a summary table of parameters by monitoring program and designated uses.

2.1 Core and Supplemental Water Quality Indicators

								Biological		
Program:	**Bi-Monthly**	**Contact Recreation**	**Algae/ Nutrients**	**Dissolved Oxygen**	**Dissolved Metals**	**HABs**	**ODS**	**Fish Population**	**Macro-invertebrate**	**Fish Tissue**
Recommended Core Indicators										
Aquatic Life and Wildlife										
Condition of Biological communities								X	X	X
Dissolved Oxygen	X	X		X				X		
Temperature	X	X		X				X		
Conductivity	X	X						X		
pH	X	X						X		
Habitat Assessment								X		
Flow	X									
Nutrients	X		X							
Landscape conditions										
Supplemental										
Ambient toxicity										
Sediment toxicity										
Other chemicals										
Health of organisms								X	X	
Recreation										
Pathogen indicators		X								
Nuisance plant growth			X			X				
Flow	X									
Nutrients	X		X			X				
Total Chlorophyll			X			X				
Landscape conditions										
Microcystin						X				
Phycocyanin						X				
Supplemental										
Other chemicals										
Hazardous chemicals					X		X			
Aesthetics										
Nutrients						X				

Core and Supplemental Water Quality Indicators (continued)

								Biological		
Program:	**Bi-Monthly**	**Contact Recreation**	**Algae/ Nutrients**	**Dissolved Oxygen**	**Dissolved Metals**	**HABs**	**ODS**	**Fish Population**	**Macro-invertebrate**	**Fish Tissue**
Drinking Water										
Pfas										
Trace metals					X					
Pathogens		X								
Nitrates	X		X							
Salinity										
Sediments/TDS	X		X							
Flow	X									
Landscape conditions										
Total Chlorophyll						X				
Microcystin						X				
Phycocyanin						X				
Supplemental										
VOCs							X			
Hydrophylic pesticides							X			
Nutrients						X				
Other chemicals							X			
Fish/Shellfish Consumption										
Pfas										X
Pathogens										
Mercury										X
Chlordane										X
DDT										
PCBs										X
Landscape conditions										
Supplemental										
Other chemicals										

3.0 Monitoring Strategies of Individual Water Quality Monitoring Programs

The following section outlines monitoring objectives, monitoring design, water quality indicators, quality assurance, data management, data analysis/assessment and reporting.

3.1 Bimonthly Sampling

3.1.1 General Description

Bimonthly (once every two months) surface water grab samples are collected by ORSANCO staff and contract personnel from 16 main stem stations and 16 tributaries. Samples are collected as close to mid-stream as possible, using lock chamber walls and bridges and are analyzed for 16 conventional pollutants.

3.1.2 Monitoring Objectives

1) Assess attainment of designated uses for Biennial 305b assessment.
2) Long-term Trends Analyses.
3) Provide data on background conditions for state NPDES permit writers.
4) Problem Identification.

3.1.3 Monitoring Design

Ohio River locations were selected based on access to the main flow in the river so that sampling can be conducted by one sampler without a boat, and to provide broad geographic coverage. As a result, all Ohio River sampling stations are at lock and dam structures. An additional benefit of sampling at lock and dam structures is that samples reflect the upper and lower boundaries of pools, allowing for an evaluation of data on a pool-by-pool basis. Samples are grab samples, approximately one meter below surface, collected with a discrete water sampler. They are collected from the upstream end of the lock walls.

Sampling is also conducted on sixteen large tributaries to the Ohio River for the purpose of determining constituent inputs to the Ohio River, as well as the other monitoring objectives. Sampling sites are selected for land-based access to the river in locations closest to the Ohio River but not under the influence of the Ohio River.

This monitoring network was established in the late 70's. Parameters were selected at that time to reflect current water quality monitoring practices but have been updated over time to include additional pollutants of concern while dropping others that were no longer applicable. Budget constraints are always a consideration and is a primary reason why sampling frequency has been reduced over time to once every other month.

3.1.4 Core & Supplemental Parameters

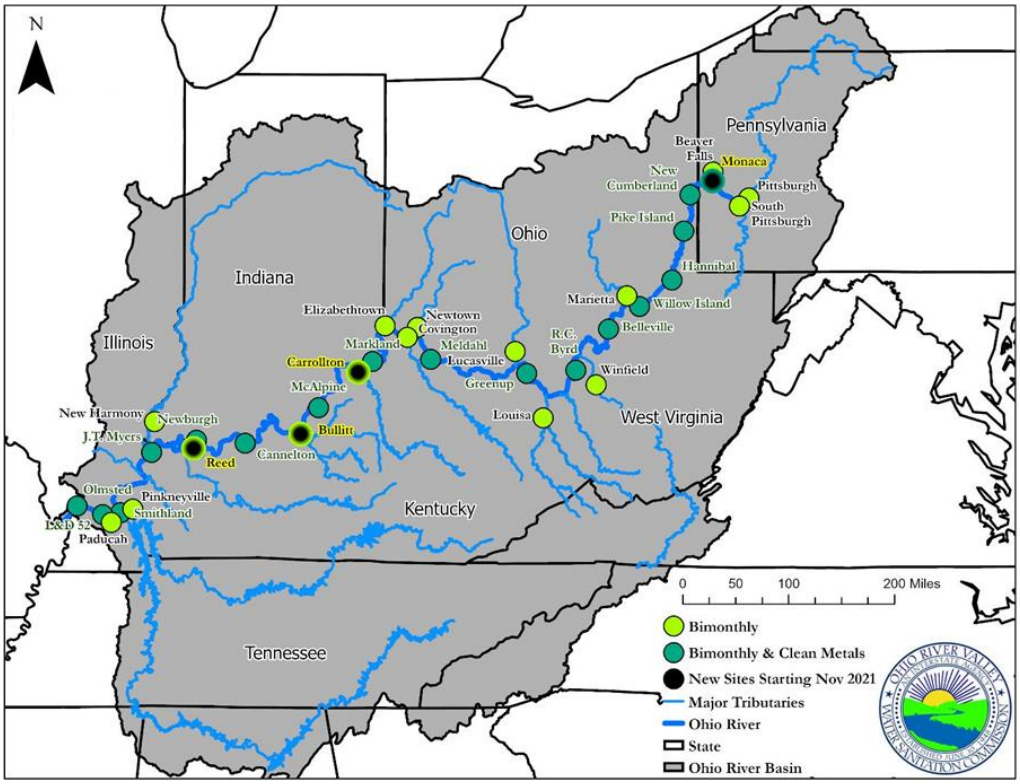
Bimonthly Sampling Program: 6 Samples/Year

Stations	Nutrients, Major Ions	Symbol	Method Number	Reporting Limit
16 Ohio River stations 16 major tributaries	Ammonia Nitrogen	NH3-N	350.1	0.1 mg/L
	Biochemical Oxygen Demand	BOD	SM5210B	2.0 mg/L
	Bromide	Br-	300	0.2 mg/L
	Chloride	Cl-	300	0.5 mg/L
	Dissolved Organic Carbon	DOC	5310C-11	1.0 mg/L
	Hardness	Hardness	M2340 B	1.0 mg/L
	Nitrate-Nitrite Nitrogen	NO2-NO3-N	SM4500-NO3-F	0.05 mg/L
	Orthophosphate	OrthoP	SM4500P-F	0.4 mg/L
	Phenols	Phenols	420.2	0.002 ug/L
	Sulfate	SO4	375.4	5.0 mg/L
	Total Dissolved Solids	TDS	M2540-C	25.0 mg/L
	Total Kjeldahl Nitrogen	TKN	E351.2	0.5 mg/L
	Total Organic Carbon	TOC	M5310-C	1.0 mg/L
	Total Phosphorus	TP	E365.3	0.01 mg/L

3.1.5 Bimonthly Sampling Locations

ID	Monitoring Site Name	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	Ohio River Mile Point*	Program Names	River	River Mile**
1	Pittsburgh	40.48611	-79.90343	0.0	Bimonthly	Allegheny	-7.4
2	South Pittsburgh	40.41	-79.95417	0.0	Bimonthly	Monongahela	-4.5
3	Beaver Falls	40.76333	-80.31528	25.4	Bimonthly	Beaver	-5.3
53	Monaca	40.68466	-80.31326	26.3	Clean Metals/Bimonthly	Ohio	26.3
4	New Cumberland	40.527943	-80.627747	54.4	Clean Metals/Bimonthly	Ohio	54.4
5	Pike Island	40.150052	-80.701073	84.2	Clean Metals/Bimonthly	Ohio	84.2
6	Hannibal	39.667328	-80.865365	126.4	Clean Metals/Bimonthly	Ohio	126.4
7	Willow Island	39.360856	-81.319326	161.8	Clean Metals/Bimonthly	Ohio	161.8
8	Marietta	39.419953	-81.463075	172.2	Bimonthly	Muskingum	-0.8
9	Belleville	39.119296	-81.742472	203.9	Clean Metals/Bimonthly	Ohio	203.9
10	Winfield	38.524927	-81.912449	265.7	Bimonthly	Kanawha	-31.1
11	R.C. Byrd	38.682101	-82.188032	279.2	Clean Metals/Bimonthly	Ohio	279.2
12	Louisa	38.17111	-82.63472	317.1	Bimonthly	Big Sandy	-20.3
13	Greenup	38.646191	-82.860468	341.0	Clean Metals/Bimonthly	Ohio	341.0
14	Lucasville	38.88111	-83.0175	356.5	Bimonthly	Scioto	-15.0
15	Meldahl	38.79648	-84.170135	436.2	Clean Metals/Bimonthly	Ohio	436.2
16	Newtown	39.137107	-84.353146	464.1	Bimonthly	Little Miami	-7.5
17	Covington	39.031589	-84.490343	470.2	Bimonthly	Licking	-4.5
19	Elizabethtown	39.153232	-84.795370	491.1	Bimonthly	Great Miami	-5.2
20	Markland	38.774649	-84.963841	531.5	Clean Metals/Bimonthly	Ohio	531.5
54	Carrollton	38.65868	-85.1448	545.8	Bimonthly	Kentucky	-4.1
42	McAlpine	38.282297	-85.781754	606.8	Clean Metals/Bimonthly	Ohio	600.6
55	Bullitt	37.99927	-85.93984	629.8	Bimonthly	Salt	-0.8
23	Cannelton	37.900069	-86.704879	720.7	Clean Metals/Bimonthly	Ohio	720.7
25	Newburgh	37.930722	-87.371583	776.0	Clean Metals/Bimonthly	Ohio	776.0
56	Reed	37.857858	-87.408934	784.2	Bimonthly	Green	-8.7
26	J.T. Myers	37.793209	-87.990196	846.0	Clean Metals/Bimonthly	Ohio	846.0
44	New Harmony	38.131392	-87.942796	848.0	Bimonthly	Wabash	-51.5
28	Smithland	37.165941	-88.43053	918.5	Clean Metals/Bimonthly	Ohio	918.5
29	Pinkneyville	37.18569	-88.24021	920.4	Bimonthly	Cumberland	-16.0
30	Paducah	37.04028	-88.53389	934.5	Bimonthly	Tennessee	-6.0
31	L&D 52***	37.12583	-88.65167	938.9	Clean Metals/Bimonthly	Ohio	938.9
51	Olmsted	37.184081	-89.064011	946.8	Clean Metals/Bimonthly	Ohio	946.8

Figure 3.1.5. Sampling Location Map



* Lock & Dam 52 (L&D 52) is not currently budgeted or scheduled for routine sampling due to access restriction during demolition of the decommissioned structure. The site is retained for potential collection should nearby access be available in the future.

3.1.6 Quality Assurance

ORSANCO has an approved Quality Management Plan and a QAPP for this monitoring program that is updated annually.

3.1.7 Data Management

Data are entered into an in-house MS Access database and the Water Quality Portal.

3.1.8 Data Analysis/Assessment

Every two years ORSANCO completes a 305b assessment for the Ohio River where monitoring results are compared against criteria to determine the status of designated uses. The river is assessed for aquatic life, water supply, contact recreation, and fish consumption. ORSANCO has completed long-term trends analysis of the data in the past and is in the process of establishing a trends analysis schedule for all monitored datasets. In addition, ORSANCO reviews the data for special concerns, such as evaluating the nutrients data associated with the 2015 Ohio River HABs event.

3.1.9 Reporting

Individual sample results are reported in a semiannual format which can be found on the ORSANCO website. Five years of data are reported in the Biennial Assessment of Ohio River Water Quality Conditions. The long-term temporal trends analysis in concentration and load is compiled into a report and available on the website. The 305b Report can also be found on the website.

3.2 Clean Metals Sampling

3.2.1 General Description

ORSANCO uses a clean metals sampling techniques to minimize or eliminate contamination of samples by metallic sampling equipment. Dissolved and total recoverable metals samples are collected side by side in order to identify relationships between the results. Sampling is conducted every two months at all 16 Ohio River main stem Bimonthly Sampling sites.

3.2.2 Monitoring Objectives

1) Assess attainment of designated uses for Biennial 305b assessment.
2) Long-term Trends Analyses.
3) Provide data on background conditions for state NPDES permit writers.
4) Problem Identification.
5) Development of dissolved-total metals translators for permitting purposes.

3.2.3 Monitoring Design

Ohio River locations were selected to coincide with bimonthly sampling locations at 16mainstem sites. Sampling stations are located at lock and dam structures to allow for land-based access to the main flow in the river. An additional benefit of sampling at lock and dam structures is that samples reflect the upper and lower boundaries of pools, allowing for an evaluation of data on a pool-by-pool basis. Samples are collected using bridge bottles designed and supplied by the Virginia State laboratory. The purpose of the bridge bottle (and the entire sampling technique) is to prevent the sample from atmospheric contamination. Below surface samples are collected using the submerged bridge bottles. Consult the QAPP for greater details on the sample collection technique. Like bimonthly monitoring, samples are collected from the upstream end of the lock walls. Metals samples are collected at the same time as bimonthly samples.

Dissolved and total metals are analyzed from the same water sample. Dissolved samples are filtered in the field. The full suite of metals along with mercury are analyzed. See below for parameters and locations.

3.2.4 Core and Supplemental Water Quality Indicators *(Dissolved reporting limits shown)*

Parameter	Symbol	Method #	Reporting Limit	Unit
Aluminum	Al	USEPA 200.7	1	ug/l
Antimony	Sb	USEPA 1638/200.8	0.5	ug/l
Arsenic	As	USEPA 1638/200.8	0.1	ug/l
Barium	Ba	USEPA 200.7	10	ug/l
Beryllium	Be	USEPA 1638/200.8	1	ug/l
Cadmium	Cd	USEPA 1638/200.8	0.1	ug/l
Calcium	Ca	USEPA 200.7	0.5	mg/l
Chromium	Cr	USEPA 1638/200.8	0.5	ug/l
Copper	Cu	USEPA 1638/200.8	0.1	ug/l
Hardness	Hardness	USEPA 200.7		mg/l
Iron	Fe	USEPA 200.7	50	ug/l

Lead	Pb	USEPA 1638/200.8	0.1	ug/l
Magnesium	Mg	USEPA 200.7	0.5	mg/l
Manganese	Mn	USEPA 200.7	0.1	ug/l
Parameter	Symbol	Method #	Reporting Limit	Unit
Mercury	Hg	USEPA 245.7	1.5	ng/l
Nickel	Ni	USEPA 1638/200.8	0.1	ug/l
Potassium	K	USEPA 200.7	0.5	mg/l
Selenium	Se	USEPA 1638/200.8	0.5	ug/l
Silver	Ag	USEPA 1638/200.8	0.1	ug/l
Sodium	Na	USEPA 200.7	0.5	mg/L
Strontium	Sr	USEPA 200.7	1	ug/L
Thallium	Tl	USEPA 1638/200.8	0.1	ug/l
Zinc	Zn	USEPA 1638/200.8	1	ug/l
Fixed Suspended Solids	FSS	USDOI/USGS I-3766-85	3	mg/l
Total Suspended Solids	TSS	USDOI/USGS I-3765-85	3	mg/l
Volatile Suspended Solids	VSS	USDOI/USGS I-3767-85	3	mg/l

3.2.5 Sampling Locations

Monitoring Site Name	River	Ohio River Mile Point	Storet ID
Monaca	Ohio	26.3	OR954.7M
New Cumberland	Ohio	54.4	OR926.6M
Pike Island	Ohio	84.2	OR896.8M
Hannibal	Ohio	126.4	OR8546M
Willow Island	Ohio	161.8	OR8192M
Belleville	Ohio	203.9	OR7771M
R.C. Byrd	Ohio	279.2	OR7018M
Greenup	Ohio	341.0	OR640M
Meldahl	Ohio	436.2	OR544.8M
Markland	Ohio	531.5	OR4495M
McAlpine	Ohio	606.8	OR374.2M
Cannelton	Ohio	720.7	OR2603M
Newburgh	Ohio	776.0	OR204.9M
J.T. Myers	Ohio	846.0	OR1350M
Smithland	Ohio	918.5	OR62.5M
Olmsted	Ohio	964.8	OR964.8M

See Figure 3.1.5 for a map of sampling locations.

3.2.6 Quality Assurance

ORSANCO has an approved Quality Management Plan and a QAPP for this monitoring program that is updated annually.

3.2.7 Data Management

Data are entered into an in-house MS Access database and the Water Quality Portal.

3.2.8 Data Analysis/Assessment

Every two years ORSANCO completes a 305b assessment for the Ohio River where monitoring results are compared against criteria to determine the status of designated uses. The river is assessed for aquatic life, water supply, contact recreation, and fish consumption. From time to time, ORSANCO completes a formal long-term trends analysis of the data. In addition, ORSANCO continually reviews the data for allowing the development of additional dissolved metals translators.

3.2.9 Reporting

Data are made available in a semi-annual format through the ORSANCO web site. In addition, every two years the data are published in the 305(b) report. From time to time, the data are also used in a long-term trends analyses and report.

3.3 Contact Recreation Sampling (Bacteria)

3.3.1 General Description

At 13 Ohio River sites in six urban areas with large numbers of combined sewer overflows (CSOs), five water column grab samples are collected monthly during the recreational season (from April through October). The five samples are distributed uniformly over the month at each station and are collected approximately 12 inches below the water surface, with some station collection points near shore and others at midstream. Surface water is collected to assess the portion of the water contacted most frequently during recreational activities. Sites are located upstream and downstream of the CSO system outfalls. Samples are analyzed for *E. coli* at laboratories in the vicinity of the sampling locations. Fecal coliform was eliminated from all sample sites beginning in 2017 due to budgetary constraints. ORSANCO has established stream criteria for both *E.coli* and Fecal Coliform which are indicators of waste from humans and other warm-blooded animals.

3.3.2 Monitoring Objectives

1) Determine the suitability of the Ohio River for contact recreational use on an ongoing basis.
2) Determine contact recreational use impairment for 305b reporting.
3) Long-term trends.
4) Identification of improvements brought about by CSO controls.
5) Report to local health departments so that they can advise the general public concerning the suitability of the river for contact recreation.
6) Evaluate the impacts of bacterial inputs from sources downstream of urban areas with large numbers of combined sewer overflows (CSOs).

3.3.3 Monitoring Design

This monitoring program was designed to assess the attainment of the contact recreational use and to monitor for improvements in the six largest CSO communities along the Ohio River. These six urban areas might be expected to represent worst-case scenarios on the Ohio River for bacteria levels. Sampling is conducted upstream and downstream of the CSO system in each of the six

communities. Samples are collected at locations along the shoreline that provide some access to full river flows. With the exception of Cincinnati, which is sampled by ORSANCO staff, sampling is conducted using outside contract assistance. Many of the limitations of this monitoring program are driven by budgetary issues.

3.3.4 Core and Supplemental Water Quality Indicators

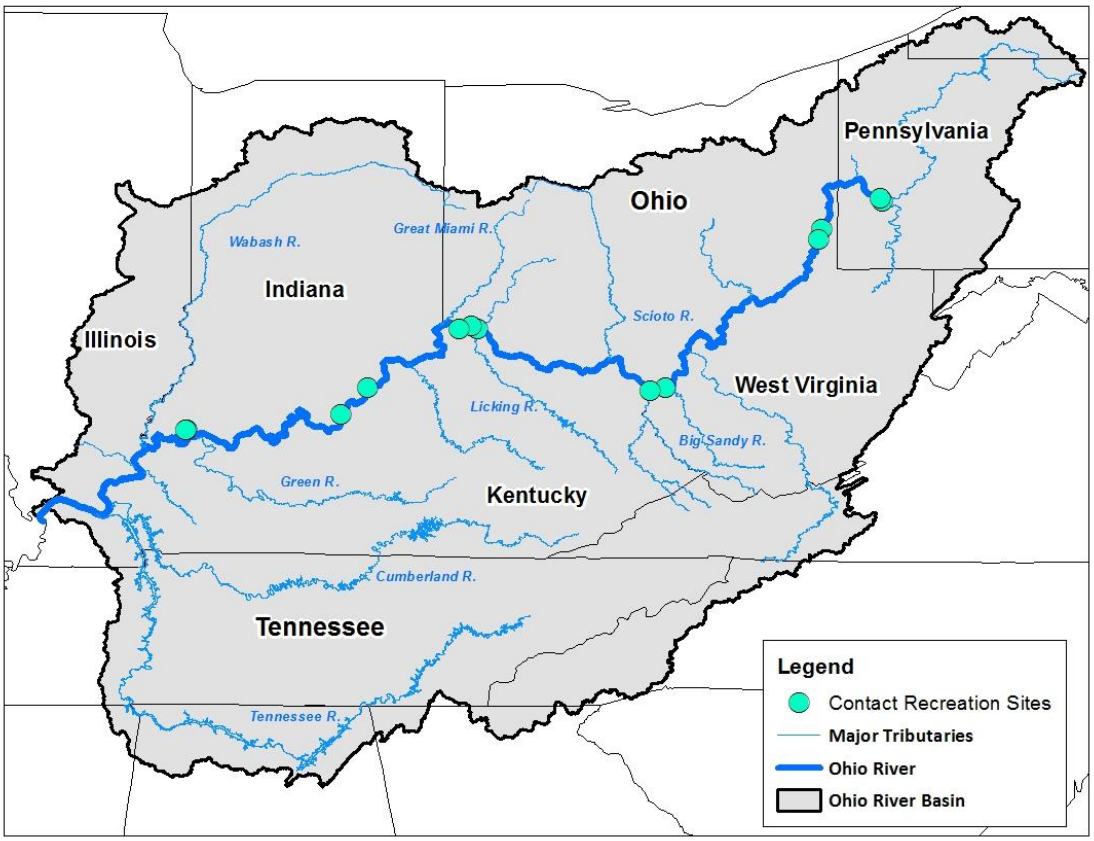
Indicator	Years Collected
E. coli	2001 – Present
Fecal Coliform	1992 – 2017
Enterococcus	2009 – 2015

E. coli is collected at all locations and is the current primary indicator.

3.3.5 Sampling Locations

Station	River	Mile	States
Pittsburgh Upper	Ohio	1.4 Mid	PA
Pittsburgh Lower	Ohio	4.3 Mid	PA
Wheeling Upper	Ohio	86.8	OH-WV
Wheeling Lower	Ohio	92.8	OH-WV
Huntington Upper	Ohio	305.1	OH-WV
Huntington Lower	Ohio	314.8	OH-WV
Cincinnati Upper	Ohio	462.6	OH-KY
Cincinnati Mid	Ohio	470.0	OH-KY
Cincinnati Lower	Ohio	477.5	OH-KY
Louisville Upper	Ohio	594.0	KY-IN
Louisville Lower	Ohio	608.7	KY-IN
Evansville Upper	Ohio	791.5	KY-IN
Evansville Lower	Ohio	793.7	KY-IN

Figure 3.3.5 Sampling Location Map



3.3.6 Quality Assurance

ORSANCO has an approved Quality Management Plan and a QAPP for this monitoring program that is updated annually.

3.3.7 Data Management

Data are entered into an in-house MS Access database and the Water Quality Portal.

3.3.8 Data Analysis/Assessment

Data are compared against criteria to determine contact recreation use attainment for the 305b biennial assessment. These sites have been monitored since 1992. A long-term trends assessment of these data was finalized in 2019. Additionally, because stations in each city are located upstream and downstream of the CSO systems, the data are being assessed to see if CSO control are being effective.

3.3.9 Reporting

Data are provided weekly on the ORSANCO website, monthly to state agencies through *Quality Updates*, and to various other entities.

3.4 Dissolved Oxygen/Temperature Interrogation

3.4.1 General Description

ORSANCO interrogates and electronically downloads dissolved oxygen and temperature data from 12 locations. None of these monitoring stations are owned or operated by ORSANCO. Individual operators are identified in the sampling location table below. *In situ* (continuous) monitors record hourly data and are owned and operated by the United States Geological Survey (one location), US Army Corps of Engineers (two locations), hydropower operators (eight locations), and one coal-fired power plant operator. Data for one 24-hour period are electronically downloaded on a daily basis and compared to ORSANCO's criteria for the protection of aquatic life.

3.4.2 Monitoring Objectives

1) Determine the suitability of the Ohio River to sustain aquatic life based on dissolved oxygen and temperature indicators at 12 locations.
2) Determine the need to modify hydropower operations to maximize dam re-aeration potential.

3.4.3 Monitoring Design

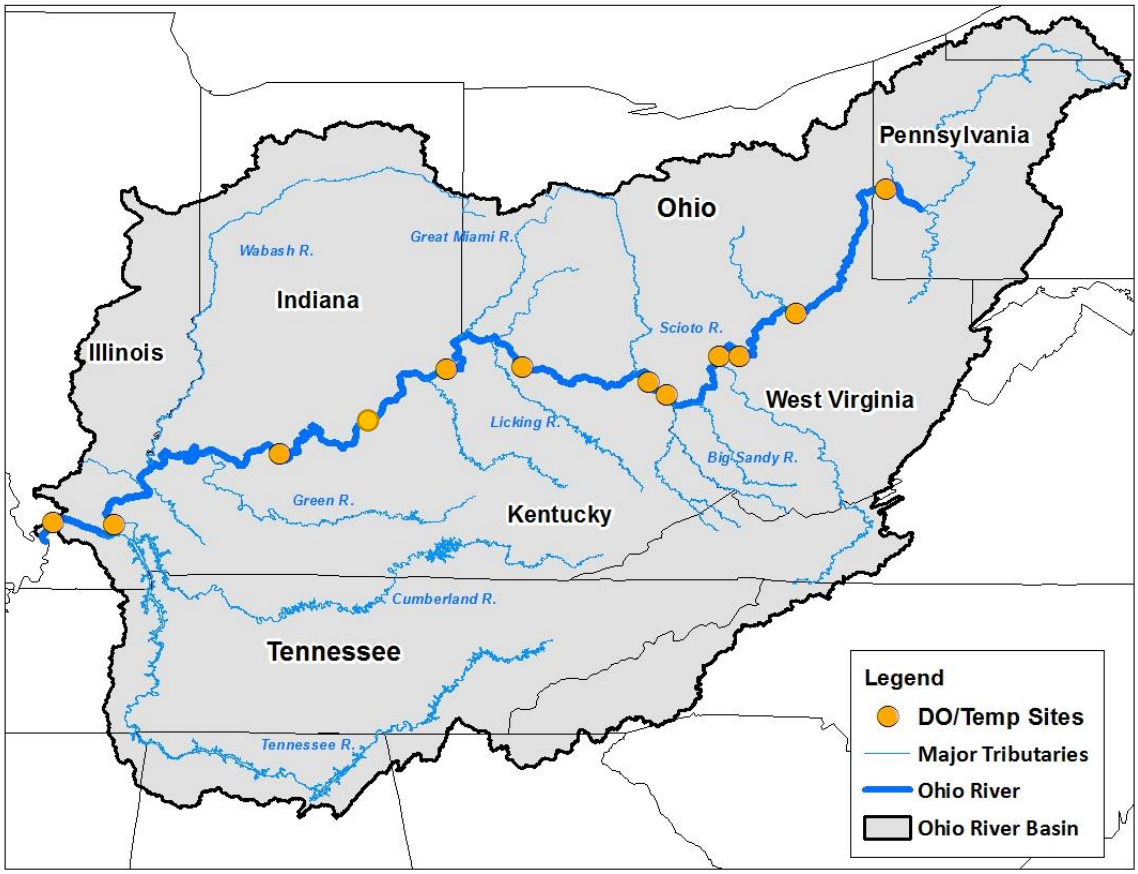
ORSANCO has on its books a 1988 policy titled, "Policy on Dissolved Oxygen Monitoring Requirements For Ohio River Hydroelectric Power Generating Facilities." This policy requires continuous monitoring of dissolved oxygen at representative locations above and below the facility as appropriate, with data available to ORSANCO through remote interrogations. It also calls for provisions in the facility design and operation to allow maintenance of the full aeration potential of the dam during critical conditions.

As a result of the above policy, many hydropower facilities operate continuous monitors for dissolved oxygen (and usually temperature) and provide that data to ORSANCO. The data is used, in turn, to support the policy and 305b assessments of aquatic life use attainment. Locations and data availability are contingent on the presence of monitors operated by outside agencies. Data are usually generated during the summer months.

3.4.4 Sampling Locations

Station	Operator	Parameter	Mile
Montgomery	USACOE	DO/Temperature	31.7
Willow Island	American Municipal Power Hydro	DO/Temperature	161.7
Racine	American Electric Power Hydro	DO/Temperature	237.5
Kyger	American Electric Power	DO/Temperature	260.0
Ironton	USGS	DO/Temperature	325.0
Greenup	City of Hamilton/Ohio Power Co. Hydro	DO/Temperature	341.0
Meldahl	American Municipal Power Hydro	DO/Temperature	436.2
Markland	Duke Hydro	DO/Temperature	531.5
McAlpine	Louisville Gas and Electric Hydro	DO/Temperature	606.8
Cannelton	American Municipal Power Hydro	DO/Temperature	720.7
Smithland	American Municipal Power Hydro	DO/Temperature	919.0
Olmsted	USACOE	DO/Temperature	964.4

Figure 3.4.4 Dissolved Oxygen & Temperature Sampling Location Map



3.4.5 Quality Assurance

Since all data is generated by outside entities, quality assurance is not within ORSANCO's control. However, ORSANCO staff reviews the data daily and calls the operators when monitors are obviously generating erroneous data. ORSANCO's policy for external data use is detailed in Appendix D of the 2020 ORSANCO Quality Management Plan (submitted to USEPA Region V with this document).

3.4.6 Data Analysis/Assessment

Dissolved oxygen and temperature are compared against criteria for the protection of aquatic life to identify problems/concerns.

3.4.7 Data Management

Data are entered into an in-house MS Access database.

3.4.8 Reporting

Each day during the standard work week, the 24-hour period data is summarized to provide daily maximum, minimum and average readings for temperature and D.O. Information is provided monthly to state agencies through *Quality Updates* and is also available on the ORSANCO website. Five years of data are summarized in the 305b report.

3.5 HABs Monitoring Network

3.5.1 General Description

Datasondes are placed at four Locks and Dams to monitor for algal growth. The datasondes measure chlorophyll *a*, phycocyanin, pH, temperature, conductivity, dissolved oxygen and turbidity in 30 minute intervals. In addition, water samples are collected twice per month at these locations. These samples are analyzed for nutrients, DOC, TSS, algal toxins, and algal enumeration. ORSANCO uses the USEPA Ohio River HAB risk model to prioritize any additional sampling, outside of these four locations, as necessary. Currently the datasondes are at Pike Island L&D (near Wheeling, WV), Meldahl L&D (near Cincinnati, OH), Markland L&D (between Cincinnati, OH and Louisville, KY), and Newburgh L&D (near Evansville, IN).

3.5.2 Monitoring Objectives

1) Early warning of Harmful Algal Blooms.
2) Provide data for understanding the conditions that allow HABs to form.
3) Provide temperature and dissolved oxygen data for the 305(b) report.

3.5.3 Monitoring Design

The purpose of this program is early detection of HABs. Ohio River locations were selected based on the occurrence of previous HABs, proximity to large drinking water utilities, and high recreation areas. The lock and dam structures were selected to provide security to the equipment. In addition, algal blooms typically form in slow moving water. Placing the monitors at the upstream end of the lock walls puts them in the location most likely to have high algal growth.

The datasondes are located approximately 1 meter below surface. Samples are grab samples, approximately one meter below surface, collected with a discrete water sampler. They are collected adjacent to the datasondes.

3.5.4 Core & Supplemental Parameters

Sample Method	Sensor/Analyte	Symbol	Method No.	Detection Limit
YSI EXO2 or In-Situ Aquatroll 500 Datasonde	Chlorophyll a	Chl a	599102-01	0.01 RFU
	Phycocyanin	Phyco	599102-01	0.01 RFU
	pH	pH	599706	0.1 units
	Temperature	Temp	599827	0.01°C
	Conductivity	Cond	599827	0.001mS/cm
	Dissolved Oxygen	DO	599100-01	0.1 mg/L
	Turbidity	Turb	599101-01	0.3 FNU
Water Sample	Total Phosphorus	TP	EPA200.7	0.01 mg/L
	Total Kjeldahl Nitrogen	TKN	SM4500-Norg	0.1 mg/L

	Nitrate/Nitrite Nitrogen	N/N-N	SM4500-NO3-F	0.05 mg/L
	Orthophosphate	OP	SM4500-P-E	0.01 mg/L
	Total Suspended Solids	TSS	SM2540D	1 mg/L
	Dissolved Organic Carbon	DOC	SM5310C	0.5 mg/L
	Algal Enumeration	Alg	10200-F.1 & F.2	NA
	Algal Toxins (Microcystin)	Tox	MBio Lightdeck	0.5 ug/L

3.5.5 Sampling Locations

Pike Island Lock and Dam was selected because it is near to where the 2015 HAB event first occurred. The other locations are in areas to provide early warning for water utilities at Cincinnati/Northern Kentucky, Louisville, and Evansville. The sondes at Pike Island and Meldahl can easily be relocated if necessary. The sondes at Markland and Newburgh are part of a 604b project with the State of Indiana and will remain there at least until the grant-funded project ends, or if IDEM wishes us to move them.

3.5.6 Quality Assurance

ORSANCO has an approved Quality Management Plan and a QAPP for this monitoring program that is updated annually.

3.5.7 Data Management

Sampling data are entered into an in-house MS Access database and the Water Quality Portal. Datasonde data is not currently accepted by the Water Quality Portal. This data is kept in-house in Excel files.

3.5.8 Data Analysis/Assessment

Every two years ORSANCO completes a 305b assessment for the Ohio River where monitoring results are compared against criteria to determine the status of designated uses. The river is assessed for aquatic life, water supply, contact recreation, and fish consumption. From time to time, ORSANCO completes a formal long-term trends analysis of the data. In addition, ORSANCO reviews the data for special concerns, such as evaluating the nutrients data associated with the 2015 Ohio River HABs event.

3.5.9 Reporting

Data from the datasondes is available real time on ORSANCO's website. The individual sample results are uploaded to the website as they are produced. Five years of data are reported in the Biennial Assessment of Ohio River Water Quality Conditions. The 305b Report can also be found on the website. In response to recent HAB events, ORSANCO developed a *Harmful Algae Bloom Monitoring, Response and Communication Plan* (submitted with this document to USEPA Region V). This guidance document outlines ORSANCOs actions to monitor, anticipate, identify, and respond to

Harmful Algae Blooms (HAB). The goals of these actions are twofold. First, to allow the States and health departments to manage the Ohio River's use as a source of recreation. Secondly, to allow water utilities to use the Ohio River as a source of safe drinking water.

3.6 Hypoxia Task Force Sampling

3.6.1 General Description

Monthly surface water grab samples are collected by ORSANCO staff and contract personnel from 3 main stem stations 8 tributaries. Samples are collected as close to mid-stream as possible, using lock chamber walls and bridges and are analyzed for nutrients.

3.6.2 Monitoring Objectives

1) Calculate loads – Updated data may be used by USGS in SPARROW model for load estimation.
2) Assess attainment of designated uses for Biennial 305b assessment.
3) Long-term Trends Analyses.
4) Provide data on background conditions for state NPDES permit writers.
5) Problem Identification.

3.6.3 Monitoring Design

The Monitoring Workgroup (MW) of the Hypoxia Task Force identified four locations within the Bimonthly Program network that would be appropriate for estimating annual nutrient loads. The Ohio River Basin States of the Hypoxia Task Force (HTF) identified an additional seven locations that were important to State programs for calculating nutrient loads from these tributaries. These constitute a total of eleven sites that will be sampled for this program.

3.6.4 Core and Supplemental Parameters

Parameter	Analysis	PQL	Normal Observed Value
Nitrate-Nitrite as N, by FIA	SM 4500-NO3F-11	0.05 mg/L	0.44 – 0.9 mg/L
Orthophosphate	EPA 300.0	0.4 mg/L	0 – 0.125 mg/L
Total Kjeldahl Nitrogen	SM 4500-NorgD-11	0.5 mg/L	0.24 – 0.52 mg/L
Total Phosphorus	EPA 200.7	0.01 mg/L	0.03 – 0.09 mg/L

3.6.5 Sampling Locations

River	Location (Mile)	Lat/Long	Rationale
Cumberland	Pinkneyville (16)	37.18573, -88.24003	IDed by MW
Ohio	McAlpine Dam (606.8)	38.28205, -85.78137	IDed by MW
Ohio	Greenup Dam (341.0)	38.64637, -82.86042	IDed by MW
Big Sandy	Louisa (20.3)	38.17108, -82.63474	IDed by MW
Muskingum	Marietta (0.8)	39.420191, -81.462729	Major Tributary (OH); IDed by HTF states for state load calculations
Scioto	Lucasville (15.0)	38.881448, -83.017686	Major Tributary (OH); IDed by HTF states for state load calculations
Wabash	New Harmony (51.5)	38.12990, -87.94262	Major Tributary (IN); IDed by HTF states for state load calculations
Ohio	JT Myers Dam (846.0)	37.79326, -87.99046	Near IN border; IDed by HTF states for state load calculations
Kentucky	Carrolton (4.1)	38.65834, -85.14490	Major Tributary (KY); IDed by HTF states for state load calculations
Great Miami	Elizabethtown (5.2)	39.15315, -84.79523	Major Tributary (OH); IDed by HTF states for state load calculations
Little Miami	Newtown (7.5)	39.13690, -84.35325	Major Tributary (OH); IDed by HTF states for state load calculations

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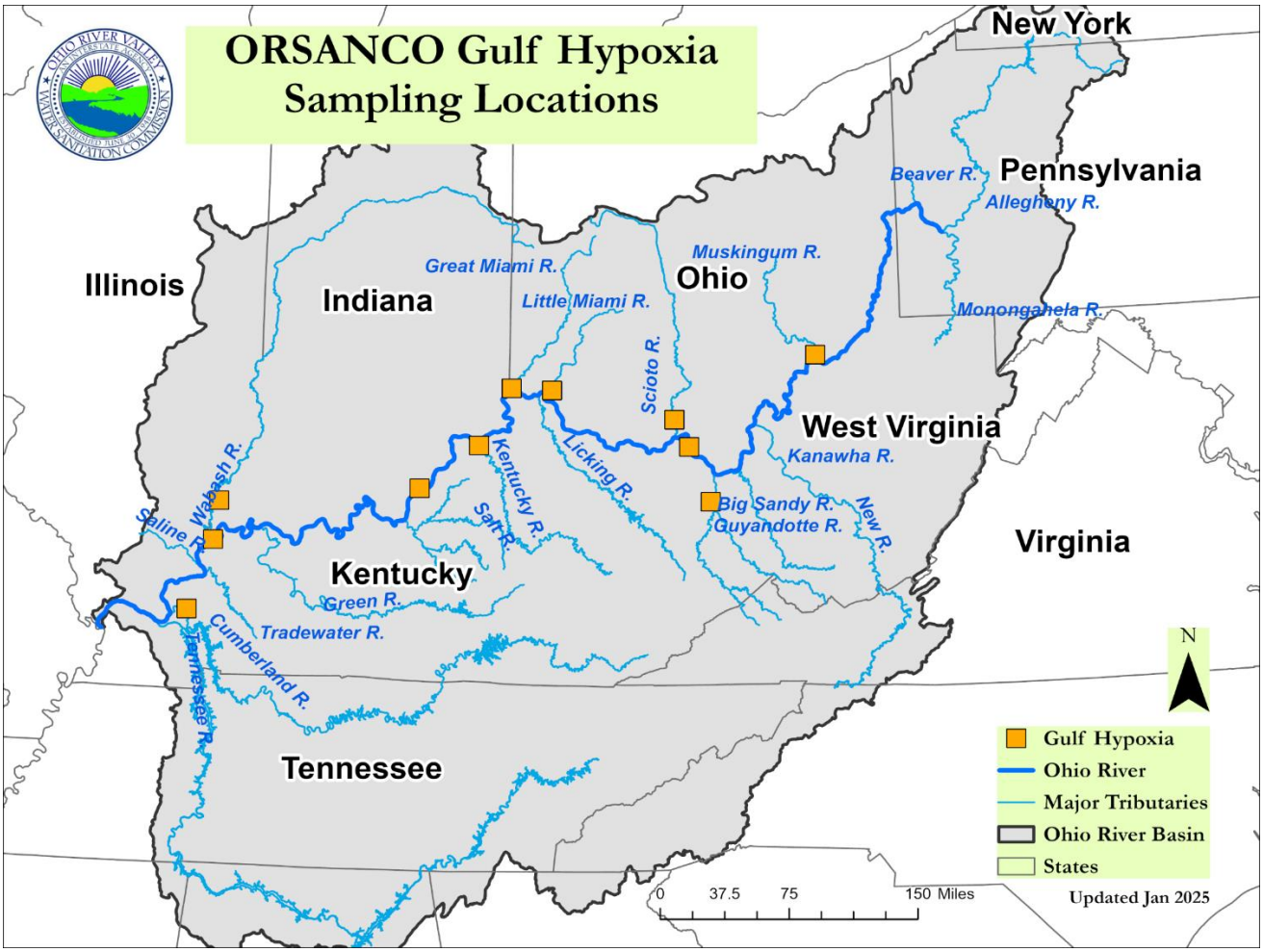


3.6.6 Quality Assurance

ORSANCO has an approved Quality Management Plan and a QAPP for this monitoring program that is updated annually.

3.6.7 Data Management

Data are entered into an in-house MS Access database and the Water Quality Portal.

3.6.8 Data Analysis/Assessment

Every two years ORSANCO completes a 305b assessment for the Ohio River where monitoring results are compared against criteria to determine the status of designated uses. The river is assessed for aquatic life, water supply, contact recreation, and fish consumption. ORSANCO has completed long-term trends analysis of the data in the past and is in the process of establishing a trends analysis schedule for all monitored datasets. In addition, ORSANCO reviews the data for special concerns, such as evaluating the nutrients data associated with the 2015 Ohio River HABs event. The data may be used by the USGS in updating its SPARROW model load estimates for nutrients.

3.6.9 Reporting

Individual sample results are reported in a semiannual format which can be found on the ORSANCO website. Five years of data are reported in the Biennial Assessment of Ohio River Water Quality Conditions. The long-term trends analysis is compiled into a report and available on the website. The 305b Report can also be found on the website.

4.0 Monitoring Strategies of Individual Biological Monitoring Programs

4.1 Fish Population Surveys

4.1.1 General Description

Fish community surveys are conducted annually within three to four rotating navigational pools and at 18 fixed station sites distributed throughout the length of the river; all pools are generally sample at least once every 8 years depending on resources and prioritization of special studies. In each case sampling consists of night-time boat electrofishing surveys at 0.5 km zones (<100' from shore). Each pool survey consists of sampling 15 probabilistically determined zones along with three revisit sites from the previous survey and are generally conducted throughout July, but sampling can occur through the end of October. Fixed station sampling is conducted annually around mid-August. Additionally, a special study may be conducted in lieu of a fourth pool survey in any given year to help better inform annual assessments using existing biological indices.

4.1.2 Monitoring Objectives

1) Determine Temporal Trends
2) Determine Spatial Trends (riverwide or within a pool)
3) Determine Status of Aquatic Life Use Support using modified Ohio River Fish Index (mORFIn)
4) Problem Identification
5) Biological Index Creation and/or Refinement

4.1.3 Monitoring Design

Navigational pools for probabilistic surveys are selected annually based on which pools have not been surveyed most recently. Pools are then narrowed down to three or four based on longitudinal distribution throughout the river (attempting to ensure that at least one pool is sampled in the upper, middle, and lower sections of the river). If the Biological Water Quality ranks a special study as a higher priority than a fourth pool survey in any given year, only three pools may be selected in that sampling season. Special studies are developed according to most critical needs.

Within each pool survey, 15 sites are selected from a draw of 6,250 available, ordered sites, choosing for each survey the next 15 sites in order which have not been sampled or determined to be unsafe for sampling. Given upstream starting points of sites may be shifted up- or downstream up to 500m to allow for safe sampling. If this is not possible, the site may be moved to the opposite bank. If a site is still determined to be unsafe, the next available site (beyond 15) is chosen instead. The three lowest ordered sites sampled in the last survey of a pool are also targeted as revisit sites to better calibrate surveys against one another.

4.1.4 Core and Supplemental Indicators

Fish population metrics and habitat classifications are collected with this program.

4.1.4.a Fish Metrics

Metric	Description
Number of Native Species	Count of all species except hybrids and exotics
Number of Sucker Species	Count of all species in the family Catostomidae
Number of Centrarchid Species	Count of all species in the family Centrarchidae
Number of Great River Species	Count of all species classified as Great River
Number of Pollution Intolerant Species	Count of all species classified as Intolerant
Percent of Individuals as Pollution Tolerant	Percentage of all individuals excluding Gizzard Shad and Emerald Shiner classified as Tolerant
Percent of Individuals as Simple Lithophils	Percentage of all individuals excluding Gizzard Shad and Emerald Shiner classified as Simple Lithophil
Percent of Individuals as Non-native	Percentage of all individuals excluding Gizzard Shad and Emerald Shiner classified as Exotic or Hybrid
Percent Individuals as Detritivores	Percentage of all individuals excluding Gizzard Shad and Emerald Shiner classified as Detritivore
Percent Individuals as Invertivores	Percentage of all individuals excluding Gizzard Shad and Emerald Shiner classified as Invertivore
Percent Individuals as Piscivores	Percentage of all individuals excluding Gizzard Shad and Emerald Shiner classified as Piscivore
Relative Number of DELT Anomalies	Total number of Deformities, Eroded fins, Lesions, and Tumors at each event
Catch Per Unit Effort	Total number of individuals per 500 meter electrofishing event excluding tolerants, exotics, and hybrids

4.1.4.b Habitat Classifications

Habitat Type	Description
A	>81% Boulder, Cobble, Gravel
B	<=81% and >50% Boulder, Cobble, Gravel
C	<=50% Boulder, Cobble, Gravel and <=77% Sand, Fines, Hardpan
D	<=50% Boulder, Cobble, Gravel and >77% Sand, Fines, Hardpan; <65% of zone <6m
E	<=50% Boulder, Cobble, Gravel and >77% Sand, Fines, Hardpan; <65% of zone >6m

4.1.5.a Sampling Locations – Fixed Stations

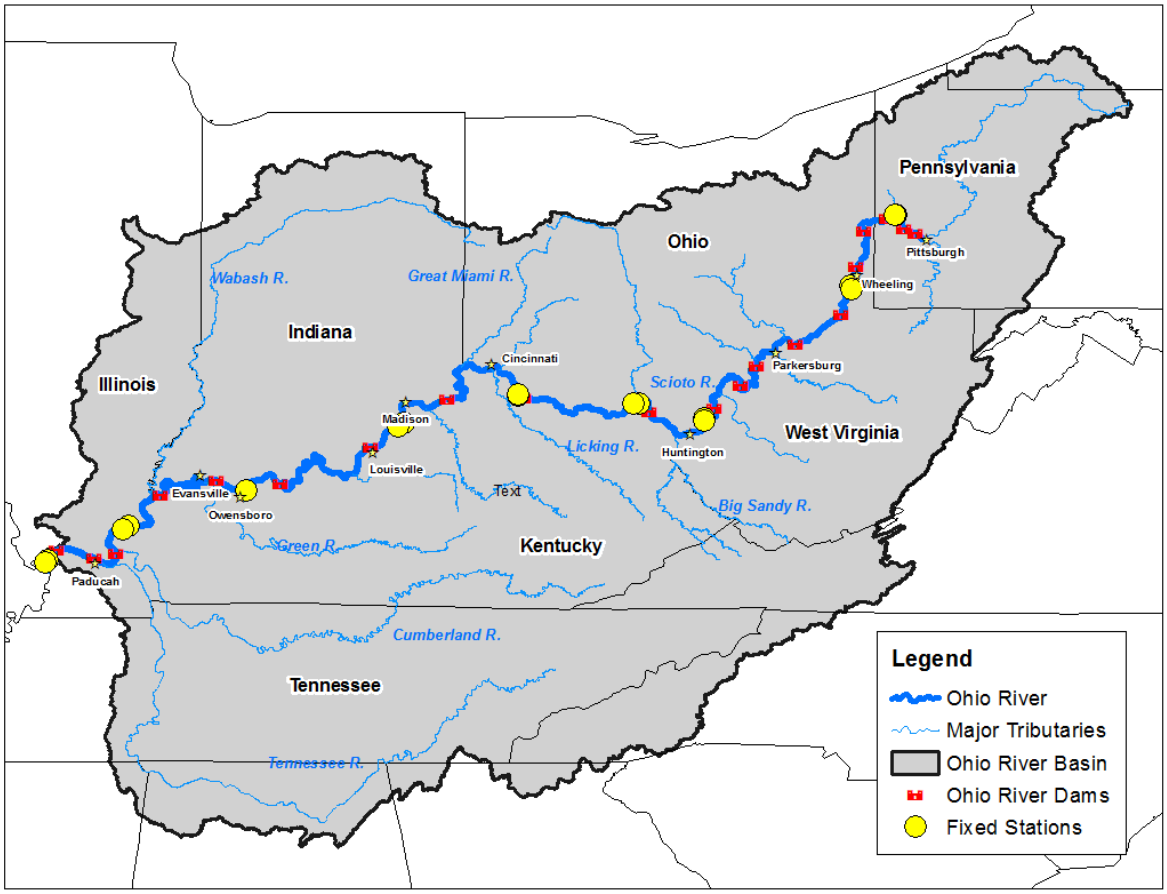
Station	Pool	River Mile	Bank	Latitude	Longitude
FS 1	Montgomery	26.0	LDB	40.69001	80.29407
FS 2	Montgomery	26.3	LDB	40.68778	80.29972

FS 3	Hannibal	99.2	RDB	39.95280	80.76328
FS 4	Hannibal	101.7	RDB	39.91639	80.75556
FS 5	Greenup	292.1	LDB	38.57667	82.28833
FS 6	Greenup	294.1	LDB	38.5475	82.29111
FS 7	Meldahl	354.0	RDB	38.72912	82.97076
FS 8	Meldahl	357.3	RDB	38.72556	83.03
FS 9	Markland	439.5	LDB	38.81267	84.2256
FS 10	Markland	440.0	RDB	38.82161	84.2271
FS 11	McAlpine	575.4	LDB	38.52806	85.41806
FS 12	McAlpine	579.7	RDB	38.49222	85.48056
FS 13	Newburgh	751.5	RDB	37.82528	87.05778
FS 14	Newburgh	751.8	RDB	37.82056	87.06028
FS 15	Smithland	888.3	RDB	37.44917	88.29389
FS 16	Smithland	891.9	RDB	37.41556	88.34556
FS 17	Open Water	974.1	LDB	37.06972	89.15639
FS 18	Open Water	977.5	RDB	37.02722	89.18139

4.1.5.b Sampling Locations – Probabilistic Pool Surveys

Pool/Assessment Unit	River Miles	Past & *Projected* Survey Years
Emsworth Pool	0.0 - 6.2	2007, 2012, 2018, *2027*
Dashields Pool	6.2 - 13.2	2008, 2013, 2021, *2027*
Montgomery Pool	13.2 - 31.7	2006, 2010, 2015, 2024
New Cumberland Pool	31.7 - 54.4	2005, 2011, 2017, 2023
Pike Island Pool	54.4 - 84.2	2007, 2012, 2018, *2026*
Hannibal Pool	84.2 - 126.4	2008, 2013, 2021, *2029*
Willow Island Pool	126.4 - 161.7	2006, 2011, 2016, *2025*
Belleville Pool	161.7 - 203.9	2009, 2014, 2022, *2029*
Racine Pool	203.9 - 237.5	2005, 2010, 2015, *2025*
R.C. Byrd Pool	237.5 - 279.2	2008, 2013, 2019, *2028*
Greenup Pool	279.2 - 341	2006, 2011, 2016, *2026*
Meldahl Pool	341 - 436.2	2007, 2012, 2017, *2026*
Markland Pool	436.2 - 531.5	2005, 2009, 2014, 2021, *2027*
McAlpine Pool	531.5 - 606.8	2009, 2014, 2021, *2027*
Cannelton Pool	606.8 - 720.7	2007, 2011, 2016, 2023
Newburgh Pool	720.7 - 776.1	2007, 2012, 2017, 2024
J.T. Myers Pool	776.1 - 846	2005, 2010, 2015, 2022
Smithland Pool	846 - 918.5	2008, 2013, 2018, *2028*
Olmsted Pool	918.5 - 964.8	2009, 2014, 2022, *2029*
Open Water (partial survey)	964.8 - 981	2009, 2014, 2022, *2029*

Figure 4.1.5 Sampling Location Map – Fixed Stations



4.1.6 Quality Assurance

ORSANCO has an approved Quality Management Plan and a QAPP for this monitoring program that is updated annually.

4.1.7 Data Management

Data are entered into an in-house MS Access database and staff or scheduled to receive training from EPA headquarters to assist with submitting these data to the Water Quality Portal.

4.1.8 Data Analysis/Assessment

Fish index scores are calculated for each sampling site. These scores are averaged for the 15 probabilistic sites within a navigational pool (assessment unit) to determine a single score per pool which is compared to a threshold for determination of attainment for 305(b) reporting purposes. Fixed station data are compared to past results to determine how each single sampling season is affected by environmental factors such as flow. Special study results are used to refine biological indices.

4.1.9 Reporting

Annual Combined Pool Reports are prepared, displaying results from all sampling efforts and raw data are made available annually on the ORSANCO website.

4.2 Macroinvertebrate Surveys

4.2.1 General Description

Macroinvertebrate community surveys are conducted annually within three to four rotating navigational pools and at 18 fixed station sites distributed throughout the length of the river. In each case sampling is conducted at the same 0.5 km long shoreline zones as the Fish Population program. Each pool survey consists of sampling 15 probabilistically determined zones along with three revisit sites from the previous survey. At these locations, a Hester-Dendy (HD) artificial substrate is placed in about 10' of water, typically at the downstream end of each zone. Six weeks from deployment, HDs are retrieved. Sampling at fixed station sites is conducted annually around mid-August and consists of multi-habitat sweeps/kicks (MH) are performed at six evenly placed transects throughout the zone in 2-3' of water

4.2.2 Monitoring Objectives

1) Determine Temporal Trends
2) Determine Spatial Trends (riverwide or within a pool)
3) Determine Status of Aquatic Life Use Support using the Ohio River Macroinvertebrate Index (ORMIn)
4) Problem Identification

4.2.3 Monitoring Design

Navigational pools for probabilistic surveys are selected annually based on which pools have not been surveyed most recently. Pools are then narrowed down to three or four based on longitudinal distribution throughout the river (attempting to ensure that at least one pool is sampled in the upper, middle, and lower sections of the river). If the Biological Water Quality Subcommittee (BWQSC), comprising mainstem state and federal agency representatives, ranks a special study as a higher priority than a fourth pool survey in any given year, only three pools may be selected in that sampling season. Special studies are developed according to most critical needs.

Within each pool survey, 15 sites are selected from a draw of 6,250 available, ordered sites, choosing for each survey the next 15 sites in order which have not been sampled or determined to be unsafe for sampling. Given upstream starting points of sites may be shifted up- or downstream up to 500m to allow for safe sampling. If this is not possible, the site may be moved to the opposite bank. If a site is still determined to be unsafe, the next available site (beyond 15) is chosen instead. The three lowest ordered sites sampled in the last survey of a pool are also targeted as revisit sites to better calibrate surveys against one another.

4.2.4 Core and Supplemental Indicators

4.2.4.a Macroinvertebrate Multi-metric Index Metrics

Metric	Description
Number of Taxa	Number (No.) of unique taxa
Number of EPT Taxa	No. of taxa that belong to are either the Ephemeroptera, Plecoptera, or Trichoptera orders

Number of Predator Taxa	No. of taxa that are predators
Percent of Taxa as Collector-Gatherers	% of taxa that feed on fine particulate organic matter
Percent of Individuals as Caenids	% of individuals (ind) that belong to the pollution tolerant *Caenidae* family of Ephemeropterans
Percent of Individuals as Odonates	% of ind that belong to the Odonata order
Percent of Individuals as Pollution Intolerant	% of ind intolerant to pollution and habitat degradation
Percent of Individuals as Clingers	% of ind that cling to instream habitat

4.2.4.b Habitat Classifications

Habitat Type	Description
A	>81% Boulder, Cobble, Gravel
B	<=81% and >50% Boulder, Cobble, Gravel
C	<=50% Boulder, Cobble, Gravel and <=77% Sand, Fines, Hardpan
D	<=50% Boulder, Cobble, Gravel and >77% Sand, Fines, Hardpan; <65% of zone <6m
E	<=50% Boulder, Cobble, Gravel and >77% Sand, Fines, Hardpan; <65% of zone >6m

4.2.5.a Sampling Locations – Fixed Stations

Station	Pool	River Mile	Bank	Latitude	Longitude
FS 1	Montgomery	26.0	LDB	40.69001	80.29407
FS 2	Montgomery	26.3	LDB	40.68778	80.29972
FS 3	Hannibal	99.2	RDB	39.95280	80.76328
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FS 7	Meldahl	354.0	RDB	38.72912	82.97076
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FS 10	Markland	440.0	RDB	38.82161	84.2271
FS 11	McAlpine	575.4	LDB	38.52806	85.41806
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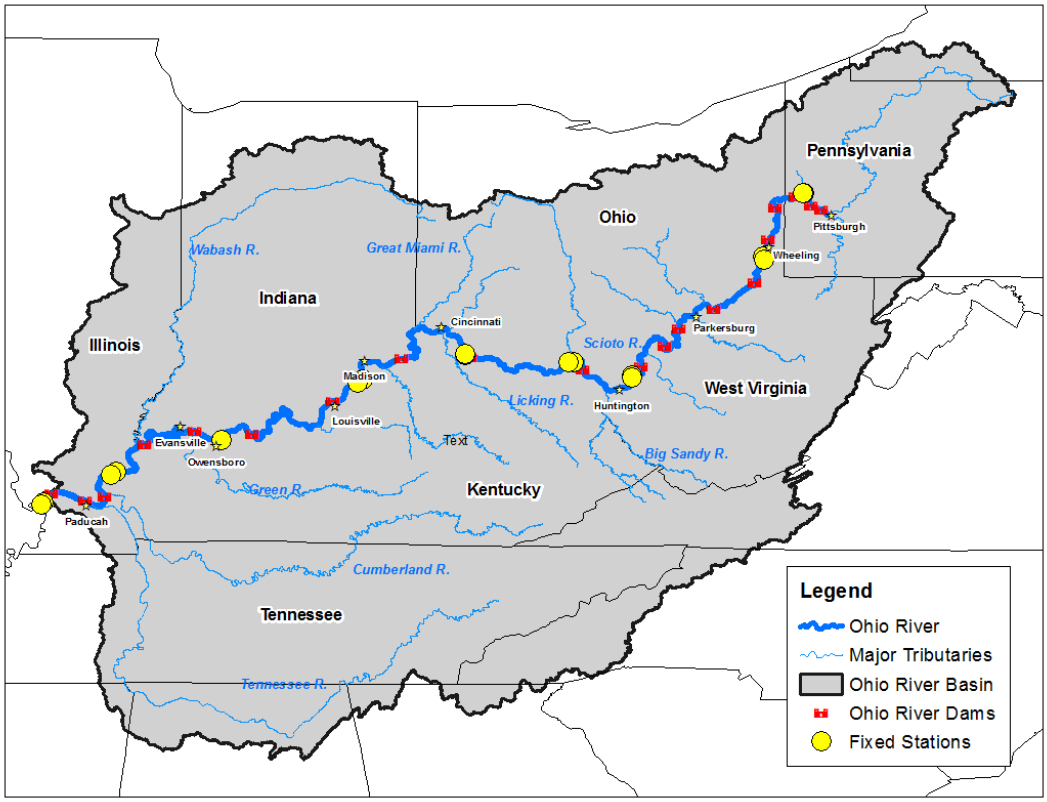
FS 16	Smithland	891.9	RDB	37.41556	88.34556
FS 17	Open Water	974.1	LDB	37.06972	89.15639
FS 18	Open Water	977.5	RDB	37.02722	89.18139

4.2.5.b Sampling Locations – Probabilistic Pool Surveys

Pool/Assessment Unit	River Miles	Past & *Projected* Survey Years
Emsworth Pool	0.0 - 6.2	2007, 2012, 2018, *2027*
Dashields Pool	6.2 - 13.2	2008, 2013, 2021, *2027*
Montgomery Pool	13.2 - 31.7	2006, 2010, 2015, 2024
New Cumberland Pool	31.7 - 54.4	2005, 2011, 2017, 2023
Pike Island Pool	54.4 - 84.2	2007, 2012, 2018, *2026*
Hannibal Pool	84.2 - 126.4	2008, 2013, 2021, *2029*
Willow Island Pool	126.4 - 161.7	2006, 2011, 2016, *2025*
Belleville Pool	161.7 - 203.9	2009, 2014, 2022, *2029*
Racine Pool	203.9 - 237.5	2005, 2010, 2015, *2025*
R.C. Byrd Pool	237.5 - 279.2	2008, 2013, 2019, *2028*
Greenup Pool	279.2 - 341	2006, 2011, 2016, *2026*
Meldahl Pool	341 - 436.2	2007, 2012, 2017, *2026*
Markland Pool	436.2 - 531.5	2005, 2009, 2014, 2021, *2027*
McAlpine Pool	531.5 - 606.8	2009, 2014, 2021, *2027*
Cannelton Pool	606.8 - 720.7	2007, 2011, 2016, 2023
Newburgh Pool	720.7 - 776.1	2007, 2012, 2017, 2024
J.T. Myers Pool	776.1 - 846	2005, 2010, 2015, 2022
Smithland Pool	846 - 918.5	2008, 2013, 2018, *2028*
Olmsted Pool	918.5 - 964.8	2009, 2014, 2022, *2029*
Open Water (partial survey)	964.8 - 981	2009, 2014, 2022, *2029*

Figure 4.3.5 Sample Monitoring Map – Fixed Stations



4.2.6 Quality Assurance

ORSANCO has an approved Quality Management Plan and a QAPP for this monitoring program that is updated annually.

4.2.7 Data Management

Data are entered into an in-house MS Access database and staff or scheduled to receive training from EPA headquarters to assist with submitting these data to the Water Quality Portal.

4.2.8 Data Analysis/Assessment

Macroinvertebrate index scores are calculated for each method (HD or MH) at each sampling site. These scores are averaged for the 15 probabilistic sites within a navigational pool (assessment unit) to determine a single score per pool per method. The average HD index score for each pool is compared to a threshold for determination of attainment for 305(b) reporting purposes. MH index scores are currently only used as needed (i.e., when >5 HD scores are not available for a single pool). Fixed station data are compared to past results to determine how each single sampling season is affected by environmental factors such as flow. Special study results are used to refine biological indices.

4.2.9 Reporting

Annual Combined Pool Reports are prepared, displaying results from all sampling efforts and raw data are made available annually on the ORSANCO website.

4.3 Fish Tissue Analyses

4.3.1 General Description

Thirty to 40 fish tissue (fillet) samples consisting of 1-3 individual fish (3 are preferred) are collected throughout the Ohio River mainstem annually and submitted to a qualified laboratory to be analyzed for a suite of contaminants known to be toxic to human health and known to bioaccumulate. Samples are typically collected in conjunction with routine biological monitoring programs.

4.3.2 Monitoring Objectives

1) Support states' issuance of fish consumption advisories.
2) Support 305(b) fish consumption use decisions.
3) Determine temporal trends.
4) Determine spatial trends.

4.3.3 Monitoring Design

For each of the defined fish consumption advisory (FCA) units of the Ohio River (Unit 1- RMI 0-31.7; Unit 2- RMI 31.8-203.9; Unit 3- RMI 204-846; Unit 4- RMI 846.1-981), an attempt is made each year to collect samples necessary to fill in any FCA data gaps. Analyte compounds are shown in the following Core Parameters table.

In addition, two composite (3-5 fish) samples from the trophic levels detailed in the Targeted Species for 305(b) table below are targeted from the biological program probabilistic survey pools (and other pools as needed) specifically for methylmercury analysis to support 305(b) fish consumption use decisions. Sampling locations are determined annually to ensure a minimum of two trophic level (TL) 3 and two TL 4 samples are collected from each pool five or less years prior to development of each 305(b) report. Trophic Level 2 species are not targeted since they are infrequently caught recreationally and consumed from the Ohio River. Ancillary data include fish species, weight, length, and percent lipids by weight (mass lipids/total fillet mass).

Samples are composited throughout a navigational pool (but not between pools) and can consist of individual fish caught from May 1 to October 31 within a single year. Composites consist of a single species with the smallest fish in the sample being at least 75% of the length of the largest.

4.3.4.a Core Parameters

Parameter	Parameter	Parameter
Cadmium	Chlordanes*	Heptachlor Epoxide*
Lead	DDTs*	Hexachlorobenzene*
Mercury (Total)	Dieldrin*	PCBs (total aroclors)
Methylmercury	Endrin*	PFAS (35 compounds)**
Selenium	Andrin*	

* pesticides analyzed in samples between river mile 0 and 84.2 and for all Channel Catfish
** Added to suite of analytes in 2021

4.3.4.b Targeted Species

Priority	TL 3	TL 4
1	black buffalo	hybrid striper
2	freshwater drum	striped bass
3	bigmouth buffalo	spotted bass
4	redear sunfish	flathead catfish
5	smallmouth buffalo	largemouth bass
6	common carp	sauger
7	blue catfish	white bass
8	channel catfish	smallmouth bass
9	longear sunfish	walleye/saugeye
10	white crappie	
11	black crappie	
12	Bluegill	
13	spotted sucker	
14	silver redhorse	
15	warmouth	

4.3.5 Sampling Locations

Sampling locations for fish contaminants sampling are determined annually based on supporting the needs of several programs and based on where routine electrofishing sampling will be occurring.

- Samples to support 305(b) assessments of the fish consumption use based on mercury are targeted annually from the biological probabilistic pool surveys as well as any other pool that may need new data prior to data analysis for the next biennial report.
- Samples to support Fish Consumption Advisory decisions by the states are also targeted from within the probabilistic pool surveys as well as other electrofishing sampling conducted annually throughout the river such as sampling associated with Life Below the Waterline displays.
- Samples to support special programs or projects are generally site specific and require targeted sampling.

4.3.6 Quality Assurance

ORSANCO has an approved Quality Management Plan and a QAPP for this monitoring program that is updated annually.

4.3.7 Data Management

Raw data are received from the contractual lab responsible for tissue analysis in the form of Microsoft Excel spreadsheets. The raw data are then reviewed by an ORSANCO biologist before being prepared and imported into a Microsoft Access database which is backed up on a regular basis.

4.3.8 Data Analysis/Assessment

Total mercury and PCB data are used annually to compare the most recent 10 years of samples of each species from each FCA unit to thresholds developed using the Ohio River Fish Consumption Advisory Protocol to determine the need for any changes to Ohio River fish consumption advisories. In addition, every two years, the previous five years of methylmercury results are used to assess the fish consumption use of each navigational pool along the river. A consumption weighted-averaging method on a pool-by-pool basis is used for methylmercury fish tissue data.

4.3.9 Reporting

Raw data for all contaminants and summarized PCB and total mercury data in the form of draft advisories are shared with state partners to support consumption advisory issuance by the states. All data are also made available annually on the ORSANCO website. Five years of methylmercury data are reported in the Biennial Assessment of Ohio River Water Quality Conditions.

4.4 Special Biological Studies

4.4.1 Characterization of Submerged Aquatic Vegetation and Associations with Biota

- **Status**: Conducted in 2016 and incorporated into routine efforts beginning in 2017

- **Goal**: To characterize the native and non-native submerged aquatic vegetation (SAV) in the Ohio River and determine the effects of various species on biotic index scores.

- **Impetus**: Since its emergence in the Ohio River around 2008, *Hydrilla verticillata* has continued to increase in density and longitudinal distribution (currently confirmed in 12 of 19 navigational pools). ORSANCO probabilistic sampling has revealed a dramatic shift in fish species composition and macroinvertebrate abundance at both the site and pool levels where *Hydrilla* is abundant. This special study conducted in 2016 revealed associations between *Hydrilla* and several fish species as well as interactions between another invasive plant (Eurasian Watermilfoil) and an invasive fish species (Eastern Banded Killifish).

- **Study Summary**: Additional targeted sampling within a pool of known *Hydrilla* infestation (Willow Island) was conducted in 2016. Specifically, paired fish (electrofishing) and macroinvertebrate sampling (Hester-Dendy and multihabitat kicks) were conducted at sites with similar abiotic conditions (e.g. bank, substrate composition, proximity to known point sources), but differ in presence of *Hydrilla*. A modified version of an EPA approved method of aquatic vegetation collection was used (see Biological Programs QAPP) to identify density of native and exotic vegetation species present at each location. Aside from typical site data collected by ORSANCO, additional data recorded included: continuous temperature and dissolved oxygen, substrate composition, and sestonic nutrients.

- **Conclusion:** Preliminary data analyses from the 2016 study indicated that two species of invasive submerged aquatic vegetation (Hydrilla & Eurasian Watermilfoil) seem to be associated with higher abundances of certain fish species. To gather more data and begin to track densities of these two plants over time, this special study has been incorporated into routine monitoring efforts beginning in 2017.

4.4.2 Impacts of Hydropower to Fish and Macroinvertebrate Communities

- **Status:** Initiated in 2017

- **Goal**: Gather data to estimate impact of lowered dissolved oxygen zones (DO) and other potential stressors associated with hydropower operations on fish and macroinvertebrate communities

- **Impetus**: Many new hydropower facilities are in various stages of development (recent, in progress, planned) at existing locks and dam projects on the mainstem of the Ohio, Allegheny, Monongahela, and other rivers in the basin. Areas of lowered DO at critical periods of the year are documented below these facilities. The associated impacts on fish and macroinvertebrates communities during these periods are currently unknown as are other impacts associated with the facilities.

- **Study Area:** ORSANCO conducted biological sampling as close as safely possible to the expected impacted areas at four (4) projects where hydropower operations currently exist or are under development or planned. Locations included the tailwaters of Allegheny River L&D #2 (baseline data for planned hydropower), Montgomery L&D (baseline data for planned hydropower), Greenup L&D (existing facility), and Cannelton L&D (recently installed facility). Additional fish sampling was conducted at the embayment immediately above the Montgomery L&D due to its designation as a "Special Habitat Area" by the Western Pennsylvania Conservancy and due to its proximity to the proposed hydropower intake.

- **Study Summary**: Standard ORSANCO fish (night-time) and macroinvertebrate (macro) surveys (e.g. 500m shoreline zones) were employed at three back-to-back-to-back zones beginning as close to the hydropower facility (or proposed installation) as safely possible (determined via coordination with lockmasters). Fish data was recorded in 100m increments to allow analysis in the form of 'Traveling Zones' which should provide additional insight into impacts and recovery distance. Hester-Dendy (HD) samplers for macros and continuous DO sensors were placed at the upstream end of each of the three 500m zones and at the downstream end of the zone farthest from the dam. Multi-habitat kicks for macros were conducted at each 100m interval throughout each zone (with data being composited from all 6 intervals for each zone). Continuous DO as well as discrete measurements of DO, pH, conductivity and temperature were recorded at the top of each zone during each visit and discrete DO and temperature sampling was conducted directly below the dam, 500m below, 1000m on the left-descending, right-descending, and mid-channel at the surface, 6 ft deep and 11' ft deep. This is an on-going study completed as resources allow during each season and at the request of our federal and state partners. Individual survey results are presented to the BWQSC.

4.4.3 Fish Community Surveys of Lower Reaches of Direct Ohio River Tributaries

- **Status**: Initiated in 2017

- **Goal**: To augment state water quality and wildlife agency data in the boatable lower reaches of direct tributaries to the Ohio River and explore development of new, or enhancement of existing, biological indices.

- **Impetus**: State agencies have informed ORSANCO staff that meaningful fish assemblage and macroinvertebrate data from the lower reaches of Ohio River tributaries are desired. These interface areas between lower order streams and the Ohio River can be difficult to sample and assign expectation values with established methods and criteria. The primary use of the data would be to fill data gaps in population status and informed assessment tools.

- **Study Summary**: These surveys were conducted in the lower reaches of 2-5 tributaries within each of the three 2017 biological probabilistic pool survey and are scheduled to continue in future years as resources allow. Standard ORSANCO Fish and Macroinvertebrate Survey SOPs were employed (e.g. 500m zones). Daytime electrofishing was used based on river depth at sampling sites. Sites were limited to the boatable section below the first upstream dam or riffle. Ohio River indices will be employed along with other measures of biological health (MIwb, HBI, etc.) to assess the site results.

5.0 Monitoring for Spills Detection

5.1 Organics Detection System (ODS)

5.1.1 General Description

Surface water samples are routinely collected at least daily from raw water supply intakes at 16 facilities on the main stem of the Ohio River and three tributaries. Grab samples are analyzed for volatile organic compounds (VOCs) by Purge and Trap extraction and gas chromatography (GC). There are 3 types of analytical instrumentation used in the ODS. Each GC has either a mass spectrometer detector (MSD), flame ionization detector (FID) or micro argon ionization detector (mAID) detector for compound identification. Each system is calibrated for 30 VOCs that are common to our area, listed in ORSANCO's Pollution Control Standards, or is a contaminant of concern. Additionally, GCMS systems can provide conclusive qualitative ID on "unknown" or uncalibrated contaminants detected and are used for confirmatory analysis. GC(FID) and GC(mAID) identifications are considered presumptive analyses. At most sites, personnel from the participating ODS host sites use analytical instruments owned and maintained by ORSANCO. Some ODS host sites have elected to purchase their own analytical instrumentation, which they operate, maintain, and provide data to ORSANCO. ODS results are quality assured and evaluated. Detections above our threshold criteria of 2ppb are reported by the facility to ORSANCO for follow up action as appropriate. Intake position in the water column varies, (e.g., some intakes are submerged 40 feet or more at mid-stream, while others are located at the surface along the river bank), so careful interpretation of results is warranted. Daily surveillance and monitoring for VOC's has been an effective strategy and safeguard for drinking water utilities for over 40 years.

This program is not intended for compliance monitoring and is supported by state and private funding, and in-kind services.

5.1.2 Monitoring Objectives

- Routinely monitor for the presence or absence of VOC's in source water.
- Use monitoring network to track spills to inform downstream utilities and emergency response agencies.
- Maintain operation of ODS System.
- Foster communication and data sharing among ODS users through training, meetings, and remote system access.

5.1.3 Monitoring Design

Most ODS sites are located at drinking water utilities with the exception of one site located at an chemical manufacturing facility on the Ohio River. Sites are selected to provide good geographic coverage but also to protect downstream drinking water intakes. Sites are selected based on the staffing, resources, and technical capabilities to operate a gas chromatograph, and desire to be part of ORSANCO's network. ODS sites were selected based on the site location and resources to operate the instrumentation. All ODS sites are located near the Ohio River mainstem or on a major tributary of the Ohio River. ODS host sites are distributed up and down the mainstem with the majority of the sites proximal to industrial pollution inputs and sources.

There are three classes of GC that ORSANCO utilizes in its ODS program. They include the Inficon CMS 5000 Process GC (basic data quality), the Thermo Fisher GC/FID (high grade data quality) and the Thermo Fisher GC/MS (most complex, superior grade data quality). The selection of GC type in use at each ODS site was made based on the site location, resources to operate the instrumentation on a daily basis. ODS host site participants that own and maintain their own instrumentation may use comparable instrumentation.

5.1.4 Core and Supplemental Water Quality Indicators

The ODS instrumentation is calibrated for 30 VOCs, including the following, however the GC's can potentially identify many more unknown volatile contaminants.

1,1,1 Trichloroethane	Carbon Tetrachloride
1,1,2 Trichloroethane	Chlorobenzene
1,1,2,2 Tetrachloroethane	Chloroform
1,1 Dichloroethane	cis-1,3 Dichloropropylene
1,1 Dichloroethylene	Dibromochloromethane
1,2 Dichlorobenzene	Ethylbenzene
1,2 Dichloroethane	Hexachlorobutadiene
1,2 Dichloropropane	Methylene Chloride
1,3 Dichlorobenzene	Styrene
1,4 Dichlorobenzene	Tetrachloroethene
Acrylonitrile	Toluene
Benzene	trans-1,2-Dichloroethylene

Bromodichloromethane	trans-1,3-Dichloropropene
Bromoform	Trichloroethylene
Bromomethane	Trichlorofluoromethane

5.1.5 Sampling Locations

Station	River	Mile	Bordering States
Pittsburgh	Allegheny	7.4	PA
South Pittsburgh	Monongahela	4.5	PA
West View	Ohio	5.0	PA
Midland	Ohio	36	PA
Weirton	Ohio	65.2	OH-WV
Wheeling	Ohio	86.8	OH-WV
Parkersburg	Ohio	190.5	OH-WV
Charleston	Elk	1.0	WV
Huntington	Ohio	304.0	OH-WV
Ashland	Ohio	319.7	KY-OH
Portsmouth	Ohio	350.8	KY-OH
California (KY)	Ohio	451.1	KY-OH
Cincinnati	Ohio	462.8	KY-OH
Louisville	Ohio	600.0	IN-KY
Evansville	Ohio	791.5	IN-KY
Paducah	Ohio	935.5	IL-KY

5.1.6 Quality Assurance

ORSANCO has an approved Quality Management Plan and a QAPP for this monitoring program.

5.1.7 Data Management

Data are stored at host sites and ORSANCO. The CMS 5000 stores the data on the hard drive of the GC and on the desktop computer located at the site. To view chromatograms and data, SMART IQ, a proprietary application software is required. Data is pulled from the site and stored at ORSANCO HQ. The Thermo GC/FID and GC/MS systems use Chromeleon 7 Application software. This software stores all data files in a proprietary format that can only be read with the Chromeleon 7 software. Data from Chromeleon7 is periodically saved to a backup file. Remote access capability to ODS host sites is provided via ConnectWise. ODS host sites which have purchased and maintained their own instrumentation are responsible for data management protocols according to their facility's guidelines.

5.1.8 Data Analysis/Assessment

The purpose of this system is for spills detection or identification of unusual conditions that may be of concern primarily for drinking water utilities, but also of concern for threats to any of the beneficial uses of the river. Formally, a volatile organic detection of concern is characterized as any detection above 2 ug/L. Practically, ODS operators determine when a detection is outside the normal variation and notify ORSANCO of such occurrences as soon as they are observed.

5.1.9 Reporting

Data summaries on system functionality and detections of concern are provided monthly as part of the monthly report to commissioners and three times annually to the ORSANCO Water Users Advisory Committee (representatives of the water utilities).

5.1.10 Organics Detection System Program Review

ORSANCO, through its Water Users Advisory Committee (WUAC), completed a review of the Organics Detection System (ODS) in 2019 to consider what the next generation of this monitoring system should look like. A number of factors were evaluated including potential contaminants of concern, instrumentation options, and monitoring system design options. The Water Users Advisory Committee's recommendations provide several tiered options for the Commission to use as a replacement strategy guide which considers critical monitoring needs while being mindful of available resources to support the system. The recommended design options ranged from expanding the current system capabilities at two locations to include semi-volatile organic compounds (SVOCs) to reducing the number of gas chromatograph mass spectrometers (GC/MS) supported by the system from nine to a minimum of four GC/MS units. A scoring matrix was also developed to aid in prioritizing GC/MS sites in the event reductions were necessary in the future due to budgetary limitations.

The ODS Next Generation review also identified two areas for additional evaluation. The first was a recommendation that a pilot study be conducted to evaluate the resource (cost and time) implications of adding SVOCs at a limited number of stations. A second pilot study was proposed to evaluate the potential to expand the current VOC analyte list that is routinely run to include up to an additional 10 analytes. Results from these evaluations will help to inform the future design of the ODS monitoring network.

In November 2024, ORSANCO was awarded $688,000 in Congressionally Directed Spending funds through Senator Sherrod Brown to be used to replace aging instrumentation at two Ohio based ODS sites. A portable GCMS unit will also be purchased to enhance emergency response capabilities for rapid response surveillance and monitoring. Funding will be utilized in 2025.

6.0 Additional Ohio River Monitoring Efforts

A multitude of federal and state agencies, academia, and several basin entities conduct and/or support monitoring efforts both on the mainstem and throughout the basin. ORSANCO coordinates with most of these entities, to the extent capable, with the goal of minimizing duplicative efforts

and maximizing the usefulness of our contributions. A selection of these monitoring efforts are detailed below.

- ***Asian Carp*** – Several state agencies have received national funding to facilitate research, commercial take, and tracking of Asian Carp species on the Ohio River and within the basin.
    - These efforts include a passive telemetry network that tracks the movement of tagged individuals.
    - Facilitation of increased commercial harvest and establishment of processing plants throughout the basin.
    - Associated Agencies: USFWS, USGS, Illinois Natural History Survey, Kentucky Dept. of Fish and Wildlife Resources, Indiana DNR, Ohio DNR, West Virginia DNR

- ***Basin Level Organizations***
    - **Ohio River Basin Alliance** (ORBA) – is a collaborative, unified voice of stakeholders for water resource priorities of the Ohio River Basin striving to sustain healthy ecosystems and river communities and vibrant water-dependent economies. (lrh.usace.army.mil/Missions/ORBA/)
        - ORSANCO serves as fiscal sponsor and participates in various alliance committees
    - **Ohio River Basin Fish Habitat Partnership** (ORBFHP) – part of USFWS larger National Fish Habitat Partnership, ORBFHP focuses protection, restoration, and enhancement efforts on priority habitat for fish and mussels in the watersheds of the Ohio River Basin for the benefit of the public (orbfhp.org).
        - ORSANCO has participated in several of the partnership's scientific and steering committees

- ***Continuous and other Water Quality Datasets –*** several governmental and academic entities maintain water quality data sets along the Ohio River mainstem and major tributaries.
    - **Drinking Water Utilities –** Public and private water supply facilities along the Ohio River and major tributary have varying levels of pre and post-treatment monitoring activities for operation and compliance purposes. A recent list of these can be found in ORSANCO's Public Emergency Response Directory (orsanco.org/wp-content/uploads/2019/01/ERD-Public-Copy-2019.pdf)
    - **Marshall University –** Maintains HAB monitors at Greenup and R.C. Byrd Lock and Dams
    - **Murray State University –** Maintains a long-term data set for the Kentucky Lake portion of the Tennessee River (murraystate.edu/wsi/wsi_database.html)
    - **Thomas More University –** Maintains a HAB monitor at their field station
    - **USACE –** The three districts with jurisdiction on the mainstem (Pittsburgh, Huntington, and Louisville) maintain individual water quality and biological monitoring programs

- **USGS –** Maintain remote sensors at multiple USACE projects and some metropolitan areas collecting various water quality parameters (usgs.gov/centers/oki-water/e Tha-tools)

- ***Long-term Biological Datasets* –** several non-governmental entities maintain biological datasets along the Ohio River mainstem and major tributaries (below are a few that ORSANCO has collaborated with in the past).
  - **Ball State University -** Fisheries data for the Wabash River and trends analyses on Ohio River populations (bsu.edu/academics/collegesanddepartments/biology/about/faculty-staff/biofaculty/pyronmark)
  - **Electric Power Research Institute's Ohio River Ecological Research Program –** This program was operational for over 50 years, concluding in 2019. It funded annual fish surveys at coal fired power plants along the Ohio River, generating a robust dataset in the process. It has since been replaced by the Ohio River Basin Ecological Research Interest Group as the number of coal fired plants decreased. (epri.com/research/products/000000003002017229)
  - **Marshall University –** Ohio River fisheries and extensive mussel data from pools near the main campus (science.marshall.edu/jonest)

- **Thomas More University –** Ohio River fisheries data and the Center for Ohio River Research and Education (C.O.R.R.E.) was established in 1998 at the Thomas More Field Station (thomasmore.edu/biology-field-station)

- ***Proteus Instrument Pilot Study*-** RS Hydro has developed new sensor technology using a fluorometer to estimate a variety of parameters. ORSANCO is taking real-time bacteria readings (Total Coliform, Fecal Coliform, and *E.coli*) using the Proteus instrument which uses a tryptophan fluorometer at three locations in the Cincinnati area. Temperature and Turbidity will also be recorded with each sample. Side-by-side comparison samples for Total Coliform, Fecal Coliform, and *E.coli* will be analyzed using the Colilert Method for the sampling duration on April 2024-September 2024. This project was funded through a WV 604b grant.
  - Compare real-time data from the Proteus instrument to fecal coliform and *E. coli* data analyzed by Colilert Method.
  - Determine if the Proteus instrument may be useful as a continuous monitor at Ohio River sampling stations to better inform the public of real-time data.

7.0 Programmatic Evaluation

7.1 Background Information

ORSANCO monitors the Ohio River on behalf of its member states and the USEPA through the Section 106 grant. Most of ORSANCO's activities are guided by committees, including its monitoring programs. ORSANCO's Monitoring Strategy Subcommittee is composed of its member state

agencies, ORSANCO advisory committees, USACE, USEPA, and USGS. The purpose of the Monitoring Strategy Subcommittee is to advise ORSANCO on its monitoring programs. The Monitoring Strategy Subcommittee makes recommendations to the Technical Committee, which in turn, makes recommendations to the Commission on its monitoring programs. Many individuals on the Monitoring Strategy Subcommittee are also Technical Committee members.

For the purposes of advising the Commission on its monitoring programs, the Monitoring Strategy Subcommittee met three times in 2023, and three times in 2024. The results of these meetings is a prioritized list of future monitoring initiatives which may be implemented in the future as resources allow, or as a high level need for information presents itself.

7.2 Identified Monitoring Gaps & Vulnerabilities

The following is a listing of prioritized monitoring gaps and vulnerabilities developed by the Monitoring Strategy Subcommittee. These priorities will be used as resources allow ORSANCO to modify or expand its ambient monitoring efforts. It is intended that the subcommittee will continue to meet on a regular basis and will revise the list and priorities as needed. Priorities may be based on multiple factors including, but not limited to, information needs and program resource requirements. Priorities were established based on committee member input. These priorities may evolve as the Monitoring Strategy Subcommittee continues to meet in the future.

Higher Priorities

- Long-Term Trends Analysis (of Bimonthly/Clean Metals data)
- Include PFAS water sampling in Bimonthly ambient monitoring program
- Ohio River Mussel Surveys and Indicator Development
- Add Hex Chrome to the Suite of Bimonthly Monitoring program constituents.
- Bacteria Monitoring on Tribs/Update Ohio River 305b Impairments
- Plastic Monitoring Program
- Metals Monitoring on Tributaries

Moderate Priorities

- Add New EPA Recommendations on Fish Tissue Contaminants
- Add New Flow Measurement Stations on the Ohio River
- Evaluate Real-Time Bacteria Monitoring Devices (Proteus)
- Complete Bacteria Long-Term Temporal Trends Analysis

Lower Priorities

- PCBs & Dioxin Monitoring to Update 305b
- Water Quality Data Analysis by Flow Regimes

7.2.1 Long Term Trends Analysis of Bimonthly and Clean Metals Data

A long term trends analysis was last completed on these data sets in 2008. Staff is evaluating contemporary statistical methods for completing an updated long term trends analysis, which will be completed in FFY25.

7.2.2 Add PFAS Water Sampling to Routine Ambient Monitoring

Through the Bimonthly ambient monitoring program, samples are collected every other month at sixteen Ohio River mainstem sites and on seventeen tributaries. It is recommended that PFAS be added to this monitoring program as resources allow.

7.2.3 Ohio River Mussel Surveys and Indicator Development

Mussels are an important component of the aquatic ecosystem. ORSANCO does not routinely monitor for mussel populations in the Ohio River, and will strive to collect data for the purposes of evaluating community health and possibly biological community health indices

7.2.4 Add Hexavalent Chromium to the Suite of Bimonthly monitoring program constituents

Some states utilize Hex Chrome in their pollution control management programs, and have recommended that this parameter be added to ORSANCO's routine ambient monitoring program. Staff will evaluate the logistics and resources necessary to complete this.

7.2.5 Bacteria Monitoring on Tribs/Update Ohio River 305b Impairments

Intensive bacteria monitoring surveys of the entire Ohio River mainstem were completed prior to 2010 which resulted in approximately two-thirds of the Ohio River as being listed by states as impaired. Over 100 direct tributaries were included in this effort to provide information for a bacteria TMDL analysis. Much work has been completed on combined sewer overflow (CSO) abatement since that time. Additional surveys should be completed to determine current bacteria impairments on the mainstem and tributaries. The work necessary to update bacteria data river-wide to update 305b assessments, as well as tributaries, is highly resource intensive.

7.2.6 Plastics Monitoring

Very little is known about plastics in the Ohio River and potential impacts on the ecosystem. More research is needed in this area to identify monitoring methods that would contribute to information needs for the Ohio River.

7.2.7 Metals Monitoring on Tributaries

Metals monitoring, both total and dissolved, has been completed bimonthly on the Ohio River for years. While samples exceeding water quality criteria are rare, little is known about the tributaries.

7.2.8 New EPA Recommendations on Fish Tissue Contaminants Sampling

USEPA is recommending a number of contaminants be added to states' fish tissue contaminants monitoring programs, including…

7.2.9 Add New Flow Measurement Stations on the Ohio River

There are very few flow measurement stations on the Ohio River, operated and maintained by the US Geological Survey. The vast majority of flow data for the Ohio River is generated through a community model operated and managed by the National Weather Service and Corps of Engineers. The community model generates flow estimates for the Ohio River daily, but these estimates would greatly benefit from additional measured data.

7.2.10 Evaluate Real-Time Bacteria Monitoring Devices (Proteus)

One of the obstacles to updating river-wide bacteria monitoring is the resource intensive nature of such monitoring. A reliable real-time bacteria monitoring instrument might reduce the resources necessary to complete such a survey. ORSANCO is currently evaluating the Proteus real-time bacteria monitor by sampling side-by-side with traditional bacteria sampling, and will report results when completed.

7.2.11 Complete Bacteria Long-Term Trends Analysis

A lot of work has been completed on CSO and storm water control. It is desirable to investigate whether improvements in Ohio River bacteria levels have resulted for such efforts through a long-term temporal trends analysis. Ohio River bacteria levels are highly variable, making such a trends analysis very challenging in selecting an appropriate statistical analysis.

7.2.12 PCBs/Dioxin Data

The entire Ohio River is listed as impaired for PCBs and dioxins based on water quality data that is approximately fifteen years old. Water sampling and analyses for PCBs and dioxins is very expensive and resource intensive, and was paid for at the time with funds that are no longer available. Without dedicated funding for future collections, assessments will continue to be based upon this old dataset. High volume sampling is necessary to achieve detection levels necessary to determine whether exceedances of water quality criteria are continuing.

7.2.13 Water Quality Data Analysis by Flow Regime

The National Weather Service Ohio River Forecast Center has completed an assessment of changes in stream flows based on climate change models out to the year 2100. Predictions include more extreme droughts and rain events, leading to more flooding and low flows in the Ohio Basin. The objects of this work is to understand how water quality conditions in the future might change in the future based on such an analysis.

7.3 Future Programmatic Considerations

There are a number of fundamental questions regarding ORSANCO's monitoring programs that will need to be continually addressed by the Monitoring Strategy Subcommittee. The Monitoring Strategy Subcommittee will continue to meet on a regular basis to implement this monitoring strategy, as well as some of the following questions as the needs arise:

1) Do ORSANCO's monitoring programs meet the needs of the member states? The USEPA?

2) Should ORSANCO be doing more, less, or different monitoring? Different approaches?

3) Should more targeted sampling to address problems be done?

4) Are ORSANCO's monitoring programs providing an appropriate balance between chemical, biological, and spills monitoring? Between the various beneficial uses of the river?

5) Common to all monitoring programs, is the correct set of indicators being analyzed for?

6) Specific to the bimonthly and clean metals program:
    a. Is grab sampling from lock walls adequate or should samples be collected by the flow-weighted, cross-sectional USGS method which allows for the calculation of mass loading (Equal-Discharge Increment Method).
    b. Is six samples per year enough?
    c. Is tributary sampling necessary (Bimonthly sampling only)?
    d. Should fixed station monitoring be replaced with pool intensive surveys? That coincide with biological pool surveys?

7) For biological programs, should additional indicators be evaluated such as mussels?

8.0 Resource Allocation

ORSANCOs currently has 10 technical staff that work across its various monitoring programs. The monitoring and analytical activities of these staff are funded through federal and state contributions. For example, the table on the following page provides detail of the federal funded monitoring efforts previously detailed in this document along with the cumulative personnel time allocated to each program.

ORSANCO Personnel and Financial Resources for select monitoring programs for FY24

		Bimonthly	Clean	Bacteria	Algae	Supplemental	Fish	Macro	Fish	
	QA / QC		Metals		Nutrients	Monitoring	Population	Studies	Tissue	ODS
Payroll	$16,762	$26,074	$7,236	$33,613	$52,152	$32,754	$70,249	$7,037	$8,338	$103,646
Employee Benefits	$8,216	$12,780	$3,547	$16,475	$25,562	$16,053	$34,432	$3,449	$4,087	$50,797
Staff Travel	$0	$12,771	$3	$2,532	$1,750	$2,202	$8,428	$11,740		$7,554
Commission Travel										
Adv. Comm. Travel										
Supplies	$485	$6,255	$1,487	$3,894	$2,369	$93	$13,409	$5,474		$46,598
Telephone										
Equipment Purchases										$9,960
Mort., Utilities, & Maintenance										
Equipment Repairs and Maintenance										
Printing and Reproduction										
Lab Fees and Delivery		$36,025	$59,975	$15,899	$3,413		$14	$18,690	$5,644	$1,773
Contractual Services					$13,612	$20,419	$52,278			$118,980
SUB-TOTAL - DIRECT EXPENSES	$25,463	$93,905	$72,248	$72,413	$98,858	$71,521	$178,810	$46,390	$18,069	$339,308
Indirect Charges	$16,265	$25,302	$7,021	$32,620	$50,609	$31,784	$68,171	$6,829	$8,092	$100,578
Totals	$41,728	$119,207	$79,269	$105,033	$149,467	$103,305	$246,981	$53,219	$26,161	$439,886

APPENDIX A

COMPLETED SPECIAL MONITORING PROGRAMS

ORSANCO occasionally conducts studies to address special water quality concerns and interstate issues. These studies are short-term investigations normally lasting one to several years. Such studies may be performed and funded in conjunction with the Commission's regular programs, or they may be funded through grants of limited duration to address a special concern. Recent special monitoring programs and their information objectives include:

A-1 Supplemental Monitoring for Mercury

General Description

For several years, resources from Section 106 Supplemental Monitoring funds were directed at several studies designed to help ORSANCO better understand mercury dynamics in the Ohio River. Mercury surveys were completed at four Ohio River mainstem sites and 15 major tributaries to the Ohio River. Each of these surveys involve monthly sampling for one year and involve monitoring for filtered and unfiltered mercury and methylmercury, as well as total suspended solids. Ohio River studies consist of ultra-clean, isokinetic, Equal-Discharge Increment sampling and included two rounds of fish tissue collection during the spring and fall of the water sampling. Fish tissue samples consisted of at least two trophic level (TL) 3 species and at least two TL 4 species in each round and were analyzed for total mercury and methylmercury and included length and weight information. All of these surveys will be used to develop a comprehensive understanding of mercury in the Ohio River. Upon completion of this last lower Ohio River survey, no additional special studies are planned. All of the study results will be used to quantify how much mercury enters the Ohio River from tributaries, what are the methylation characteristics of the Ohio River and tributaries, and what are the mercury bioaccumulation characteristics in fish tissue for the Ohio River sites. This monitoring effort wasretired by the end of 2017 because it has met all of its objective, The program is a special study, it was never intended as an ongoing ambient monitoring program.

Monitoring Objectives

1) Develop annual loads for mercury in the Ohio River and tributaries.
2) Determine the percentage of mercury in the Ohio River resulting from the tributaries.
3) Determine methylation characteristics at four mainstem sites and 15 major tributaries.
4) Estimate bioaccumulation rates (BAFs) for mainstem sites.

Monitoring Design

Ohio River sites were selected for a number of reasons. The first Ohio River site, near Hannibal Lock & Dam, was selected for being downstream of the largest mercury discharge on the Ohio River, PPG Natrium plant (now Axiall Corp). Subsequent to that location, the budget allowed for two additional Ohio River locations. Sites were selected near RC Byrd Lock and Dam and Newburgh Lock & Dam to provide geographic coverage of the river as well as provide and high and low bracketing of the Hannibal site for bioaccumulation rates (average methylmercury fish tissue concentration/average total mercury water concentration) based on historical data from fixed station clean metals

monitoring. Finally, the Smithland site was selected to obtain a downstream total annual mercury loading. Tributaries were selected to obtain mercury loadings form the 15 largest flows to the Ohio River, accounting for approximately 85 percent of the total flow in the Ohio River. Sites on tributaries were selected to allow for land-based sampling while sampling as near the confluence with the Ohio River without being in the mixing zone. Mainstem sites were sampled by boat using the USGS's large-river, isokinetic Equal-Discharge Increment sampling method. Because tributaries are smaller and were sampled by land-based methods, this method was not available for tributaries. So for tributaries, samples were collected at mid-stream, mid-depth.

Surveys were specially focused on mercury, so total and methyl mercury, both filtered and unfiltered are monitored along with total suspended solids since metal strongly attract to solids. Sampling was conducted monthly for one year in order to allow for the development of flow-concentration relationships in order to estimate annual loads for any time period. For the calculation of bioaccumulation factors (BAFs), fish tissue was collected and analyzed for total and methylmercury. Eight samples were collected for each site. Each samples is a three fish composite of right-side fillets. Four samples are trophic level three fish and four samples are trophic level four fish. Four samples are collected in the fall and four in the spring to balance out any seasonal effects.

Core & Supplemental Parameters

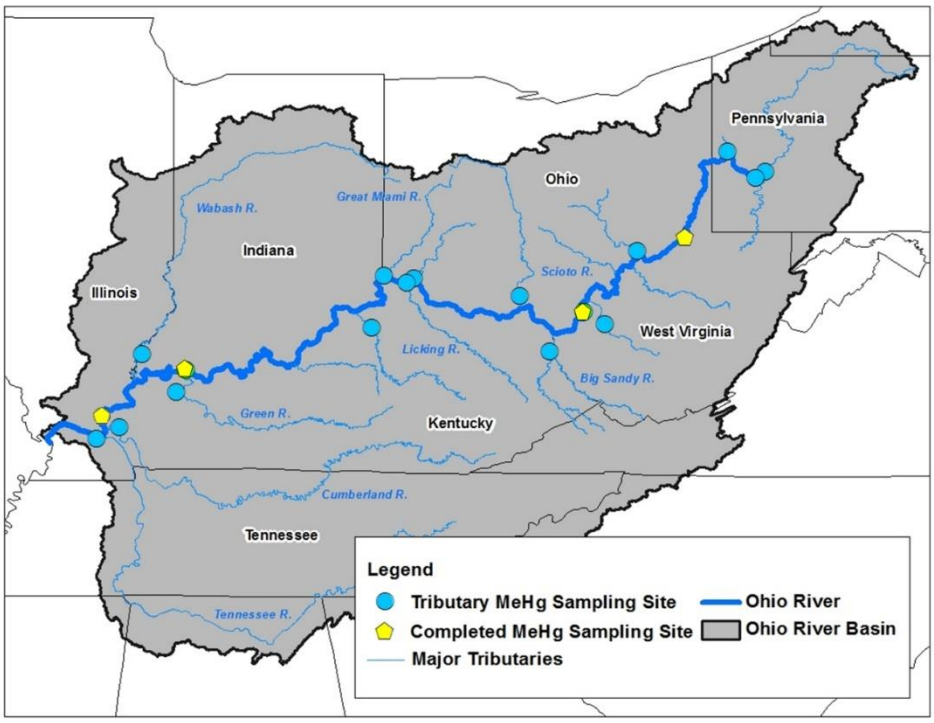
Water Samples	Fish Tissue
Unfiltered Total Mercury	Total Mercury
Unfiltered Methylmercury	Methylmercury
Total Suspended Solids	

Sampling Locations

Station	Ohio River Mile*	River Mile**	Project	Fish Tissue	Timeframe
Allegheny River	0.0	-1.0	Tributary	No	Oct 2015 - Sept 2016
Monongahela River	0.0	-2.0	Tributary	No	Oct 2015 - Sept 2016
Beaver River	25.4	-1.1	Tributary	No	Oct 2015 - Sept 2016
Hannibal L&D	126.4	126.4	BAF	Yes	July 2012 - June 2013
Muskingum River	172.2	-20.5	Tributary	No	Oct 2015 - Sept 2016
Kanawha River	265.7	-38.5	Tributary	No	Oct 2015 - Sept 2016
R.C. Byrd L&D	279.2	279.2	BAF	Yes	June 2015 - May 2016
Big Sandy River	317.1	-2.1	Tributary	No	Oct 2015 - Sept 2016
Scioto River	356.6	-15.0	Tributary	No	Oct 2015 - Sept 2016
Little Miami River	463.5	-7.5	Tributary	No	Oct 2015 - Sept 2016
Licking River	470.2	-3.0	Tributary	No	Oct 2015 - Sept 2016
Great Miami River	491.0	-5.2	Tributary	No	Oct 2015 - Sept 2016
Kentucky River	545.9	-28.5	Tributary	No	Oct 2015 - Sept 2016
Newburgh L&D	776.1	776.1	BAF	Yes	July 2015 - June 2016
Green River	784.2	-9.1	Tributary	No	Oct 2015 - Sept 2016
Wabash River	848.0	-848.0	Tributary	No	Oct 2015 - Sept 2016
Smithland Pool	912.0	912.0	BAF	Yes	Nov 2016 - Oct 2017
Cumberland River	920.5	-16.0	Tributary	No	Oct 2015 - Sept 2016
Tennessee River	933.0	-21.6	Tributary	No	Oct 2015 - Sept 2016

*Ohio River Mile Points for tributary locations show the location of the tributary confluence with the Ohio River
**River mile is shown as a negative number for tributaries and approximates confluence with the Ohio

Sampling Location Map



Quality Assurance

ORSANCO had an approved Quality Management Plan and QAPP for this monitoring program.

Data Management

Data were entered into appropriate in-house MS Access databases.

Data Analysis/Assessment

Data were analyzed to develop annual mercury loadings at all sites, methylation characteristics at all sites, and calculate bioaccumulation factors at Ohio River sites. Annual mercury loads were calculated by developing a linear regression model of flow versus total mercury for the monthly sample results conducted for one year. Then the model was applied to daily flow values such that a mercury loading can be calculated for any time period, in this case over the Nov. 2015 to Oct. 2016 annual period.

Mercury bioaccumulation factors (BAFs) are also being calculated for mainstem sites. BAFs are basically a ratio of Methylmercury in fish tissue to total mercury in water. An internal draft report describing the data analyses procedures is available upon request. Methylmercury and total mercury in water samples will also be analyzed to investigate differences in methylation between the mainstem and tributary sites.

Reporting

Data and reports are available via ORSANCO's website.

A-2 Watershed Pollution Reduction Program

This program was initiated in 1995 as an ongoing program, which is largely dependent on outside funding. The long-term goal of the program is to generate information relevant to reducing levels of pollutants in the Ohio River, which inhibit its beneficial uses. Resources for this program have been obtained through US EPA, and have enabled the Commission to enhance its monitoring capabilities and provide data and assessment to support development of Total Maximum Daily Loads by US EPA and the states. The initial focus of this program was on dioxins and PCBs; the current emphasis is on monitoring pathogens.

Sampling included in this program:

- High Volume Sampling
- Sediment Sampling
- Atmospheric Deposition Sampling
- River Wide Bacteria Assessment using a Mobile Water Quality Lab

High-Volume Water Sampling

Since 1997, ORSANCO has used a sampling method referred to as high-volume water sampling to detect ultra low levels of dioxins and PCBs. ORSANCO has predominantly used this method for ambient water quality monitoring on the Ohio River and its tributaries. More recently, however, the method has also been applied to monitoring effluent at municipal wastewater treatment plants.

The need for this type of sampling was driven by the fact that current water quality standards in place to protect human health and typical ambient water column concentrations are significantly lower than detection limits achieved through conventional sampling methods. An aqueous sample collected by typical sampling methods and analyzed using EPA Method 1613B could be used to quantify levels of dioxin down to the low parts per quadrillion (ppq) level. Water quality standards, however, are typically two to three orders of magnitude lower than these detection limits. For example, US EPA's recommended ambient water quality criterion for dioxin is 0.005 pg/L TEQ.

The basic principle of high-volume water sampling is to filter a large volume of water (typically 1000 liters) in order collect a sufficient amount of dioxin, such that it can be detected by existing analytical methods. This process is accomplished by first drawing water through glass fiber filters, which separate and collect the suspended solids. The filtered water then passes through stainless steel columns filled with a hydrophobic resin called XAD2 that extracts the dioxin present in the dissolved phase. The filters and columns are then analyzed separately to quantify dioxin levels in both the particulate and dissolved phases.

Sediment Sampling

As part of the Ohio River Watershed Pollutant Reduction Program, ORSANCO has conducted two large-scale sediment surveys for PCBs and dioxin. The purpose of these surveys was to quantify the extent and severity of sediment contamination, and to possibly identify specific

sources to the Ohio River. The first survey, conducted n 2001 and 2002 involved collecting one bottom sediment sample approximately every five miles along the river. Samples were also collected at the mouths of major tributaries and at targeted sites selected based on historical data or type of facility. The second survey, completed in 2003 and 2004, was a follow-up study in which the hot spots identified in the first survey were revisited. In an effort to better characterize the extent of the contamination, one sample was collected at the original location, one from the opposing bank, two samples downstream and two or three samples upstream from the initial site.

The sampling method involved collecting near-shore, bottom sediment samples using a stainless steel, petite ponar. Samples were placed in one-liter glass jars and submitted to a contract laboratory for analysis. All samples were analyzed for 17 dibenzo-dioxin and dibenzo-furan congeners using EPA method 1613B, and for all 209 PCB congeners using EPA method 1668A. Theses sediments were also analyzed for total organic carbon and particle size distribution.

Ambient Air Monitoring

Contaminants in the air enter the Ohio River by way of atmospheric deposition. There are three mechanisms by which ambient air concentrations of contaminants enter the river: wet deposition, dry deposition and net gas exchange. Wet deposition occurs when rain collects particulate contaminants from the air and transports them to the river through precipitation. Dry deposition is simple settling of particulates into the river. Net gas exchange is a balance of absorption (PCB source) into the river and volatilization from the river (PCB sink).

In studies conducted across the United States, atmospheric deposition has been found to be a significant source of pollutants to some watersheds. ORSANCO has used ambient air monitoring in effort to better characterize the potential impacts of atmospheric deposition of PCBs and dioxin within the Ohio River Basin. The air monitoring was conducted in order to quantify ambient air concentrations of dioxins and PCBs, identify possible hot spots of air contamination, and estimate the potential loadings to the Ohio River from atmospheric deposition. Four rounds of sampling were conducted at 18 locations along the Ohio River.

Ambient air samples were collected following USEPA Method TO-9A. The sample collection method involved filtering 325 – 400 cubic meters of air through a quartz filter and polyurethane foam plug (PUF) assembly over a 24-hour period. Two TE-1000 PUF samplers (the equivalent of a PS-1 sampler) were used to collect the samples. Air monitoring was limited to four rounds of sampling at 18 sites due to budgetary constraints. Site selection was based on several factors including 1) presence of nearby facilities reporting air releases of PCBs in TRI database, 2) targeting of urban and industrialized areas with likely dioxin or PCB sources, and 3) selecting sites that provided adequate spatial coverage for the large area to be assessed. Other requirements for specific site selection included the presence of a large flat area to place the samplers with no nearby obstructions to air flow (e.g., tall buildings), access to power to run the equipment, secure location to avoid tampering with the equipment, and 24-hour access was needed by the samplers for periodic checks on the operation of the equipment.

Bacteria Monitoring and Analysis Using Mobile Laboratory

Prior to incorporating bacteria monitoring to the Ohio River Watershed Pollutant Reduction Program in 2003, bacteria data for the Ohio River was only collected in six urban areas. As a result, only a small percentage (18%) of river miles was assessed for compliance with bacteria water quality standards for the Ohio River. In addition, the monitoring data for those areas that were assessed indicated bacteria levels were high enough to cause use impairments for contact recreation. Considering that bacteria data were available for only a small portion of the river, combined with the fact that the monitoring results where available indicated elevated levels of bacteria are present in the Ohio River, there was an obvious need to expand the monitoring effort to the entire length of the Ohio River.

Conducting bacteria monitoring for the entire length of the Ohio River poses some significant challenges. Because of the sheer size of the river combined with the facts that bacteria samples only have a six-hour hold time and much of the river is located in remote areas with no nearby microbiological laboratories, innovative approaches must be employed to complete such a monitoring effort.

In 2003, as part of Phase 8 of the program, ORSANCO purchased a mobile water quality laboratory to facilitate completing large-scale bacteria surveys along the entire length of the Ohio River. This mobile lab is necessary because analytical procedures require bacteria samples to be analyzed within six-hours from time of collection. Since few microbiological laboratories are available for much of the Ohio River, a means to bring the laboratory to the river was required.

The lab is set-up for processing bacteria samples using the Colilert® method for total coliforms and *E. coli*. The Colilert® method is a simplified analytical method developed by IDEXX Laboratories that requires minimal training, provides for quick sample processing, and is relatively inexpensive. On-board the lab are three incubators, an 8000-watt generator, and ample counter-top space for processing approximately 100 samples plus dilutions each day.

The mobile lab unit has successfully been used to complete nine intensive 5-week surveys and numerous tributary surveys. Each intensive survey consists of collecting 3-point cross section samples approximately every five miles. Cross-sections are also conducted downstream of POTWs > 0.5 MGD and at the mouths of major tributaries to the Ohio River. In addition, single grab samples are collected from over 100 minor tributaries. Over the course of one week, approximately one-third of the length of the river is sampled. That same stretch of river is then sampled for five consecutive weeks. From 2003 to 2006, three intensive, 5-week surveys were completed for each segment of the Ohio River (i.e. upper, middle, and lower).
From 2007 through 2012, numerous tributary surveys have also been completed. Over 120 major and minor tributaries have been sampled at least 15 times. In addition, 37 of those sites were sampled an additional 15 times in 2011-2012 to improve tributary loading estimates.

Monitoring Objectives
The long-term goal of ORSANCO's Ohio River Watershed Pollutant Reduction Program is to generate information relevant to reducing levels of significant pollutants, which inhibit the beneficial uses of the waters of the Ohio River Basin. Monitoring objectives include:

1. Determine geographic extent and severity of water quality impacts from targeted pollutants
2. Identify specific sources of contamination
3. Characterize the fate and transport of these pollutants in the riverine system.
4. Quantify pollutant reductions necessary to achieve full beneficial uses.

Data Management
Data for the programs are stored in access databases and available on ORSANCO's website.

A-3 Characterization of Dissolved Solids

General Description
Samples were collected once per week at sixteen locations for a period of approximately one year (55 weeks) starting December 2011 and concluding in December 2012. Monitoring sites were established at drinking water utilities, power plants and other industrial intakes. Eleven sites were at intakes drawing directly from the Ohio River, longitudinally distributed along the entire 981-mile length of the river from Pittsburgh, PA to Cairo, IL. An additional five monitoring locations were established on five tributaries including the Allegheny, Monongahela, Beaver, Muskingum, and Big Sandy Rivers. Specific site selection was based, in part, on available municipal and industrial volunteer study participants. These participants were identified through coordination with ORSANCO's Water Users Advisory Committee (WUAC) and the Commission's Power Industry Advisory Committee (PIAC).

The weekly samples were analyzed for total dissolved solids and a suite of 14 dissolved solids constituent parameters. Analyses were performed by two different laboratories based on parameter. Total dissolved solids and bicarbonate analyses were performed by Pace Analytical Laboratories in Columbus, OH and Indianapolis, IN. The remaining constituent analytes including sulfate, chloride, calcium, magnesium, potassium, sodium, lithium, fluoride, bromide, ammonia, phosphate, nitrate, and nitrite were analyzed in-house by ORSANCO staff using ion chromatography. Basic physical water quality parameters were also measured at the time of collection including temperature, pH, and conductivity.

Monitoring Objectives
The goal of this project was to develop a better understanding of the dynamics of TDS and its constituents in the Ohio River while substantially enhancing the existing data set to characterize TDS levels in the Ohio River and selected tributaries.
The specific project objectives included:

1. Generate sufficient data to define ambient background levels of TDS at selected Ohio River locations.
2. Quantify TDS constituent makeup to document temporal and spatial variability.
3. Evaluate the possible development of site-specific translators to convert commonly collected conductivity measurements to estimate TDS concentrations.
4. Generate data to support possible development of an Ohio River stream criterion for bromide.

Data Management

All analytical results were reviewed for accuracy then archived in Excel spreadsheets. The ion chromatograph results were initially generated in Dionex Chromeleon software and then transferred to Excel files. TDS and bicarbonate results were provided by Pace in an electronic deliverable format and also archived in Excel. Physical parameter data were manually recorded in a sample log and then transcribed to Excel. Daily stream flow data for each sampling event were queried from ORSANCO's Access database of daily modeled flow results from the U.S. Army Corps of Engineer Cascade flow model.

Data Analysis/Assessment

Total dissolved solids concentrations were compared to the Commission's 500 mg/L ambient water quality standard for compliance. Analysis of individual ion constituents was used to characterize the ionic composition of TDS in the Ohio River. TDS was also compared to specific conductance to evaluate the site specific nature of the relationship between these two factors. Bromide concentrations were also compared to trihalomethanes (THMs) in finished water to evaluate the relationship of ambient bromide levels and the formation of THMs during the water treatment process.

Reporting

The results of this project were presented to the Technical Committee and are included in a draft report which will be presented to the Commission for approval in February 2014. Once finalized, the report will be posted on ORSANCO's website.

A-4 Herbicides in the Lower Ohio River Basin

This study was established as a short-term monitoring program designed to determine levels of certain herbicides (atrazine is currently of prime concern) in the Ohio River and major tributary sources. The study was conducted during 1994 and 1995. Objectives of the study were met and long-term monitoring stations have been established at Cairo, IL, Evansville, IN and Louisville, KY. Currently the atrazine levels are published during the months of May-October in the *Quality Update*.

A-5 Volunteer Monitoring

Every year, 10-15 volunteer monitoring groups collect and analyze water samples along the Ohio River and its tributaries in addition to ORSANCO's routine monitoring efforts. These monitoring groups, primarily schools, collect water quality data at least five times each year. Through the use of a HACH Stream Survey kit, provided by ORSANCO, volunteers measure dissolved oxygen, biochemical oxygen demand, pH, water temperature change, E. coli, nitrate, total phosphate, and turbidity. They also report on weather conditions and include habitat descriptions for their site. The results collected by these volunteers are not used in ORSANCO's reports; however, they are submitted electronically to ORSANCO where the data are reviewed by staff. Results are summarized in a biannual report and sent to participants.

A-6 2022-2023 Broad Scan Monitoring

General Description

The Broad Scan Survey (BSS) was completed in September 2023. The purpose of the survey was to analyze parameters which are contained in ORSANCO's Pollution Control Standards, but are not routinely monitored in core monitoring initiatives. PCB's and dibenzofurans, including dioxin, were included in the 2023 study (not analyzed for in 2012) and 40 PFAS contaminants (informational use to enhance understanding of these contaminants). In total, there 97 non-routine parameters were analyzed in addition to the PFAS analytes. This effort was part of a special study project. This survey was a repeat of the 2012 BSS completed in 2013. Similar to the previous survey, two rounds of sampling were completed to capture higher and lower flow ambient water conditions at sampling sites (0192), (0633) and (0912). These sampling sites represented upper, middle, and lower river sections of the Ohio River.

Priority Pollutants that were detected equal to or above the laboratory reporting level, in at least 1 round at, at least one site, included hexavalent chromium, PCB's, and OCDD (a dioxin TEQ). These pollutants were present at or above ORSANCO's current Pollution Control Standard water quality control criteria (2019).

Priority Pollutants which were detected equal to or above the laboratory reporting level, in at least one round of sampling in at least one site, but below ORSANCO's current Pollution Control Standard for water quality control criteria (2019) included chromium III, arsenic, fluoride, asbestos, and radionuclides. These might be considered for inclusion in future monitoring initiatives.

Of the 40 PFAS analytes tested for, PFOA, PFBS, PFOS, HFPO-DA, PFPeA, and PFPHxA were found at low levels, at or above the laboratory reporting level. The largest amount of PFAS found was the GenX dimer acid, HFPO-DA at 8.40 ng/L (ppt) at the upper river site (ORM 192). Five PFAS analytes were present, with estimated concentrations, below the laboratory reporting level. They were PFBA, PFHpA, PFNA, PFDA, and PFHxS. PFAS was collected for informational purposes. Ambient water quality criteria for PFAS have been established by the USEPA and are substantially higher than any detections in the Ohio River.

Staff presented Summary Report at Commission's June Technical Committee meeting with recommendation to consider adding in those parameters for which there were detections of significance to be included in core monitoring programs.

A Summary Report of Findings for the 2023 BroadScan Survey was developed and posted to the Commissions website.

A-7 USEPA National Rivers and Streams Assessment (NRSA) Participation

- **Status**: Fielded survey crews on behalf of Ohio River basin states during four assessment cycles: 2008/09, 2013/14, 2018/19, and 2023/24.

- **Goal**: Per the USEPA: The goal of all National Aquatic Resource Surveys, of which NRSA is one portion, is to provide an assessment of the nation's waterbodies using a random statistical design and standardized sampling protocols.

- **Impetus**: State agencies have various methodologies and assessment endpoints that preclude aggregation at a national level. The NARS were developed to provide a nationally-consistent water quality dataset from which the overall condition of our nation's waterways could be determined.

- **Study Summary**: The data from these surveys are assessed following the completion of each cycle, allowing USEPA and state partners to track the relative condition of these waterbodies. The data are available upon review via the NARS website. Across the four NRSA assessment cycles, ORSANCO staff have completed 264 survey events covering all six states bordering the main stem of the Ohio River. These surveys provide our staff with invaluable experience in rapid ecological assessments and increases their knowledge of the Ohio River basin. The funding associated with completion of these events has allowed the commission to purchase additional field equipment and supported contractual and full-time personnel to benefit our existing monitoring programs.

A-8 Ohio River Ambient PFAS Survey

- **Status**: Field sampling completed in 2021. Report completed 2022. Report is available on ORSANCO's website.

- **Goal**: The goal of this study was to develop baseline, ambient conditions, for 28 PFAS constituents along the length of the Ohio River.

- **Impetus**: This was the first study of its kind for PFAS for the Ohio River. Very little was known about PFAS levels along the entire Ohio River. A baseline survey for PFAS was completed that is repeatable in the future.

- **Study Summary**: The results of this study are available on ORSANCO's website. Twenty Ohio River sites, randomly selected and equally-spaced, were sampled under two separate events.

Samples were analyzed for 28 PFAS compounds. Results from both rounds of sampling indicated the presence of select PFAS analytes at trace levels. More detailed results are available in the report.

A-9 Algae and Nutrient Sampling

General Description

From 1999 to 2013, ORSANCO coordinated an algae monitoring program to address concerns with increased algal blooms and taste and odor problems with Ohio River drinking water. Data on algal composition and abundance were collected at multiple water utilities and other Ohio River locations. Beginning in 2014 a new strategy was implemented in order to begin exploring development of defensible nutrient criteria for the Ohio River. Algae composition and total chlorophyll have been collected along with nutrient parameters and continuous dissolved oxygen (DO) and temperature at all biological program probabilistic survey sites sampled for macroinvertebrates. Grab samples from the water column near a deployed continuous DO and temperature logger in about 3' of water are collected for algae, total chlorophyll, and nutrients three or four times per year (May-October) at the same locations in which macroinvertebrate samplers are deployed. This work concluded in 2021, as data had been successfully collected from each navigational pool of the Ohio River.

Monitoring Objectives

Provide data to examine relationships between nutrients, dissolved oxygen levels, and resulting effects on macroinvertebrate communities. Such relationships could potentially be used for the development of numeric nutrient criteria should distinct relationships be determined. Nutrient levels can cause the growth of algae, which in turn can create changes in dissolved oxygen levels, which ultimately can cause impacts on macroinvertebrates. Data is being collected to quantify causal linkages between nutrient levels and macroinvertebrate metrics.

Monitoring Design

ORSANCO algal and nutrient sampling was conducted at biological sites between 2014-2021. Up to four pools of the Ohio River were sampled annually on a rotation to provide coverage of the entire river over seven years, pending unforeseen delays. Fifteen randomly selected sites were selected in each of three pools scheduled for biological surveys. Hester-Dendy macroinvertebrate samples were deployed in the river for a six-week colonization period. At each of these sites, continuous dissolved oxygen and temperature monitors were also deployed to collect data at regular intervals from approximately July through October. Three to four rounds of water samples were collected in close proximity to each macroinvertebrate Hester-Dendy sampler over the July-October period and were analyzed for nutrients, total chlorophyll, and algae.

Core & Supplemental Parameters

Ammonia	Total Chlorophyll
Nitrate-Nitrite	Algae composition
TKN	DO (30 min intervals)
TP	Temperature (30 min intervals)

Sampling Locations

Pool/Assessment Unit	River Miles	Past Survey Years*
Emsworth Pool	0.0 - 6.2	2018
Dashields Pool	6.2 - 13.2	2021
Montgomery Pool	13.2 - 31.7	2015
New Cumberland Pool	31.7 - 54.4	2017
Pike Island Pool	54.4 - 84.2	2018
Hannibal Pool	84.2 - 126.4	2021
Willow Island Pool	126.4 - 161.7	2016
Belleville Pool	161.7 - 203.9	2014
Racine Pool	203.9 - 237.5	2015
R.C. Byrd Pool	237.5 - 279.2	2019
Greenup Pool	279.2 - 341	2016
Meldahl Pool	341 - 436.2	2017
Markland Pool	436.2 - 531.5	2014
McAlpine Pool	531.5 - 606.8	2014
Cannelton Pool	606.8 - 720.7	2016
Newburgh Pool	720.7 - 776.1	2017
J.T. Myers Pool	776.1 - 846	2015
Smithland Pool	846 - 918.5	2018
Olmsted Pool	918.5 - 964.8	2014

*Locations may be revisited in future assessment cycles as data needs arise.

Quality Assurance

Standard operation procedures contained under the Biological Programs QAPPs were followed regarding sample collection and analyses conducted between 2014-2019. Field blanks and duplicates were collected at two of the fifteen sample sites in each pool, for each round of water sampling.

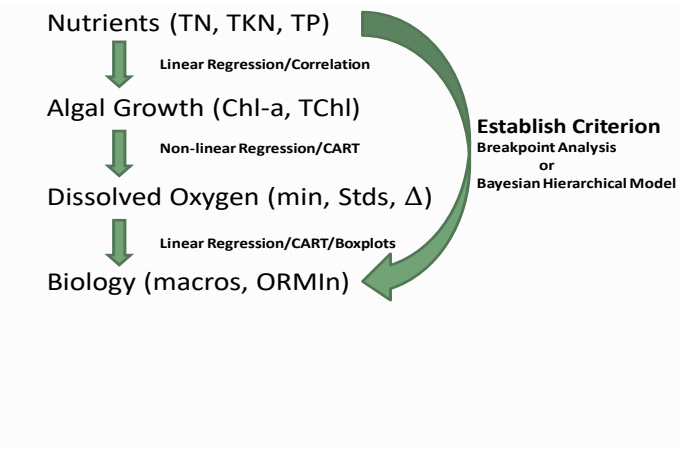
Data Management

Data were entered into appropriate in-house MS Access databases. Continuous D.O. and temperature data are not stored within WQX, while remaining parameters are. Staff is currently working towards putting these data into the Water Quality Portal.

Data Analysis/Assessment

The primary goal of analyzing these data is to identify relationships between nutrients and macroinvertebrate communities for the ultimate purpose of developing recommendations on numeric nutrients criteria. In so doing, ORSANCO is following USEPA's guidance document on "Using Stressor-response Relationships to Derive Numeric Nutrients Criteria.

Describing Data Analysis



Reporting

Progress on this project is reported to ORSANCO's Technical Committee on a regular basis.