U.S. ENVIRONMENTAL PROTECTION AGENCY

OFFICE OF INSPECTOR GENERAL

Improving EPA research programs
Ensuring clean and safe water

EPA's Safe and Sustainable Water Resources Research Program Is Delivering Timely and Relevant Data to the Office of Water

Report No. 18-P-0151 **April 9, 2018**

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Abbreviations

EPA	U.S. Environmental Protection Agency
FY	Fiscal Year
OIG	Office of Inspector General
ORD	Office of Research and Development
OW	Office of Water
SSWR	Safe and Sustainable Water Resources
U.S.C.	United States Code

Cover photos: *Left:* Simulated stream, dosing and pumping systems at EPA's Cincinnati Lab. *Right:* EPA employee sampling filtered water for assessment of filter efficacy. (EPA photos)

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U.S. Environmental Protection Agency
Office of Inspector General

18-P-0151
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At a Glance

EPA's Safe and Sustainable Water Resources Research Program Is Delivering Timely and Relevant Data to the Office of Water

Why We Did This Project

We conducted this audit to determine whether the U.S. Environmental Protection Agency (EPA) Office of Research and Development's (ORD's) Safe and Sustainable Water Resources (SSWR) research program is delivering timely and relevant research data and tools to the Office of Water (OW), and whether the OW uses those research results to protect America's waters.

The ORD is the scientific research arm of the EPA; the ORD's research helps provide the underpinning of science and technology for the agency. Within the ORD, there are six National Research Programs, one of which is the SSWR. The research programs are designed to meet the needs of EPA partner offices such as the OW.

This report addresses the following:

- *Improving EPA research programs.*
- *Ensuring clean and safe water.*

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Listing of OIG reports.

What We Found

ORD SSWR research products were generally delivered in a timely fashion. Based on our audit of ORD information, we found that 100 percent of SSWR research products were completed by the ORD's expected date during fiscal year 2016.

The ORD's SSWR research program delivers timely and relevant research to the OW that is used to protect America's waters.

In addition, the OW indicated that SSWR research products were relevant. We found that the OW and regional water divisions developed a cross-office research planning infrastructure that includes an OW Executive Committee for Research and an OW Research Coordination Team. The OW also released a National Water Program Research Strategy to identify and document research, science and technology needs that was updated in October 2015. According to OW office directors and members of the OW Research Coordination Team, the ORD conducts and provides relevant research for OW offices that meets OW needs. SSWR research products we looked at have been or will be used to protect America's waters.

We concluded that the ORD and OW have processes in place to plan and conduct timely and relevant research, and that research is used to support OW and regional efforts to protect America's waters. Therefore, we make no recommendations.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

THE INSPECTOR GENERAL

April 9, 2018

MEMORANDUM

SUBJECT: EPA's Safe and Sustainable Water Resources Research Program Is Delivering Timely and Relevant Data to the Office of Water
Report No. 18-P-0151

FROM: Arthur A. Elkins Jr.

TO: Jennifer Orme-Zavaleta, Principal Deputy Assistant Administrator for Science
Office of Research and Development

This is our report on the subject audit conducted by the Office of Inspector General (OIG) of the U.S. Environmental Protection Agency (EPA). The project number for this audit was OPE-FY17-0021. This report represents the opinion of the OIG and does not necessarily represent the final EPA position.

You are not required to respond to this report because this report contains no recommendations. However, if you submit a response, it will be posted on the OIG's website, along with our memorandum commenting on your response. Your response should be provided as an Adobe PDF file that complies with the accessibility requirements of Section 508 of the Rehabilitation Act of 1973, as amended. The final response should not contain data that you do not want to be released to the public; if your response contains such data, you should identify the data for redaction or removal along with corresponding justification.

We will post this report to our website at www.epa.gov/oig.

cc: David P. Ross, Assistant Administrator for Water

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Appendices

Purpose

The purpose of this audit was to determine whether the U.S. Environmental Protection Agency (EPA) Office of Research and Development's (ORD)'s Safe and Sustainable Water Resources (SSWR) research program was delivering timely and relevant research data and tools to the Office of Water (OW), and whether the OW uses those research results to protect America's waters.

Background

The ORD is the scientific research arm of the EPA; the ORD's research helps provide the underpinning of science and technology for the agency. Within the ORD, there are six National Research Programs, one of which is the SSWR. The research programs are designed to meet the needs of EPA partner offices such as the OW.

> "Water resources are threatened by a host of complex and far-reaching challenges—from naturally-occurring contaminants, to those resulting from human activity, to the demands of a rapidly increasing population. ... EPA's research in the SSWR program focuses on delivering the science needed to provide safe and sustainable drinking water, recreational waters, and healthy aquatic ecosystems."
>
> *- Science for a Sustainable Future*
> *EPA Research Program Overview 2012 - 2016*

Each of the ORD's research programs has a Strategic Research Action Plan that outlines planned and ongoing research. The most recent ORD SSWR action plan[1] details the approach to achieve the EPA's efforts to protect America's waters. According to the action plan, "SSWR's scientific results and innovative technologies will support EPA's mandate to protect the chemical, physical, and biological integrity of the Nation's waters and to ensure safe drinking water and water systems." ORD SSWR staff told us the action plan was developed in partnership with the OW and the EPA regions. The 2012 action plan was also reviewed by the EPA's Board of Scientific Counselors and the Science Advisory Board to demonstrate how planned research supports the EPA program office and regional needs for decision making to protect human health and the environment. In fiscal year (FY) 2017, the SSWR operating budget was $106.3 million.

Responsible Offices

The ORD holds primary responsibility for performing research on relevant water issues. The OW is responsible for implementing water programs. Together, the ORD and OW disseminate research results to the public.

[1] Safe and Sustainable Water Resources Strategic Research Action Plan 2016–2019.

Scope and Methodology

We conducted this performance audit from August 2017 to March 2018 in accordance with generally accepted government auditing standards. Those standards require that we obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objective. We believe the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objective.

To address our objective, we reviewed the SSWR Strategic Research Action Plans for 2012–2016 and 2016–2019, the OW's National Water Program Research Strategies dated September 2009 and October 2015, the Clean Water Act (33 U.S.C. §1251 et seq.), the Safe Drinking Water Act (42 U.S.C. §300f et seq.), and previous EPA Office of Inspector General (OIG) and U.S. Government Accountability Office reports.

To assess research timeliness and relevance, we reviewed the following:

Timeliness: The ORD defines research timeliness as the delivery of products and outputs in the timeframe necessary to support agency decisions to achieve outcomes. To determine product timeliness, we spoke with OW directors and staff, as well as selected regional staff, to gain their perspectives on whether research data and tools were timely and met program needs. Additionally, we obtained three sources of information for data on ORD SSWR research:

- A measure that the ORD SSWR uses to track completion for the EPA's Annual Performance Report; this measure tracks the percentage of planned research products completed on time.
- ORD SSWR Product Delivery Webinars on completed products for FYs 2013–2016; the webinars include information on the timeliness of research products and outputs.
- Reports from the Research Management System; we analyzed these reports to determine the approximate percentages of research products completed by the expected completion date.

Relevance: The ORD defines research relevance as the degree to which a project aligns with the EPA's mission to protect human health and the environment. To determine research relevance, we spoke with OW directors and staff, and selected regional staff, to gain their perspectives on whether research data and tools were relevant and met program needs. We reviewed the OW's National Water Program Research Strategy, along with the most recent SSWR Strategic Research Action Plan, to verify that OW research needs were met.

To determine whether the OW uses ORD research results to protect America's waters, we spoke with OW directors and staff, and selected regional staff. For this audit, we adopted the ORD's definition of product to analyze research data and tools. The ORD defines products as deliverables that result from a specific research task, and may consist of journal articles, test results or models.

We used the ORD's Research Management System to generate a list of research products with completion dates during FYs 2015 through 2017 and confirmed the list's completeness with SSWR staff.[2] The Research Management System provides a comprehensive view of ORD research to keep its partners updated on research commitments and planned future work. We selected a non-statistical random sample of 10 ORD SSWR research products and obtained information from the OW and regional recipients, as well as other staff, to gain their perspectives on whether the research was timely, relevant and used. Appendix A provides further description of the 10 products.

Results

We found that the ORD's SSWR research program was delivering timely and relevant research data and tools to the OW. Further, we found that research from the products in our sample have been used or will be used to protect America's waters.

ORD Provides Timely Research for OW

SSWR research products were generally delivered in a timely fashion. Based on the ORD's information, we found that 100 percent of research products were completed by the ORD's expected date during FY 2016. According to the lead for the OW's Research Coordination Team, if research is delayed, the OW is notified by the ORD of changes and the ORD and OW work together to renegotiate new dates. According to OW office directors and staff, the ORD provides timely research for its water research needs. One director said that, historically, the ORD faced timeliness challenges for "hot" issues but is now providing timely research to the OW. The lead for OW's Research Coordination Team also said that the majority of the time the OW gets data when it is needed, particularly if the research is in response to a court order.

EPA summer intern aligns and installs a stream flow sensor. (EPA photo)

[2] During this review, we did not audit the controls for the Research Management System, as we determined that we did not need to evaluate the effectiveness of the system's controls to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our objective.

OW Indicates That ORD Provides It With Relevant Research

The OW indicated that SSWR research products were relevant. In 2007, the OW saw the need to prioritize its research needs from the ORD. The OW and the regional water divisions developed a cross-office research planning infrastructure that includes two principal organizational units—the OW Executive Committee for Research and the OW Research Coordination Team:

- **Executive Committee for Research:** This committee is responsible for promoting coordinated and collaborative research activities and planning within the water program and between the program and its research partners. The committee includes the OW Deputy Assistant Administrator, the four OW office directors, and the water division director from the lead region for water.

- **Research Coordination Team:** This team presents needs and priorities for each of the OW's headquarters offices and the regional water divisions to ORD and other research partners. The team includes members from each OW office as well as from the lead region.

In 2009, the OW released a National Water Program Research Strategy to identify and document research, science and technology needs. This strategy was updated in October 2015. We compared the OW's National Water Program Research Strategy with the most recent SSWR Strategic Research Action Plan and found that areas the OW wants researched are included.

EPA employee draws sample from a Distribution System Simulator. (EPA photo)

According to OW office directors and members of the OW Research Coordination Team, ORD conducts and provides relevant research for OW offices that meets OW needs. One OW director said that the ORD "absolutely" conducts and provides relevant research to the OW. Another OW director highlighted particular research of relevance to the OW by providing the following information:

- ORD conducted research of watershed connectivity to streams and rivers.

- The OW requested, and the ORD conducted, a nationwide, statistically valid study to determine the conditions of the nation's waters.

- The ORD supported the development of a science document used in the Bristol Bay (Alaska) watershed assessment. The ORD developed a watershed assessment baseline of environmental conditions and resources present in the area.

OW Reports That It Is Using SSWR Products

SSWR research products were being used by the OW. One OW office director said that the office takes prioritization of research very seriously and would not request research unless the office intended to use it. Based on the sample of 10 ORD SSWR research products selected, we found that all 10 of the products have been or will be used by the agency to protect America's waters. We verified research citations or distribution for the 10 products, and Table 1 summarizes OW and regional staff responses. Appendix A provides a description of the SSWR products delivered to the OW.

Table 1: Summary of OW and regional staff responses

Were the sample products *timely*?	Were the sample products *relevant*?	Were the sample products *used or anticipated to be used*?
8 of 10 Yes*	10 of 10 Yes	10 of 10 Yes

Source: Analysis of OIG information request.

* OW and regional staff could not speak to timeliness for two products as they were not closely involved in this phase of research. Both products were listed as being completed by the expected date in the ORD's Research Management System.

Conclusion

The ORD and OW have processes in place to plan and conduct timely and relevant research, and that research is used to support OW and regional efforts to protect America's waters. As such, we make no recommendations in this report.

Agency Response and OIG Evaluation

On March 15, 2018, the ORD and OW both provided oral responses and agreed with our report.

Appendix A

OIG Selected Sample of SSWR Products

Completion date	Product title	Research description	Research use as reported by OW/regional staff
FY 2015	Watershed modeling tools for the effects of agricultural conservation practices/best management practices on stream hydrology and water quality.	This product consists of a wetland nutrient model and risk-based watershed management tools. The wetland nutrient model is useful for gaining new insights on important biogeochemical and physical processes interactions, and can be used for the assessment of the efficacy of treatment wetlands and to inform management decisions. It can also be used to predict time series of greenhouse gas emissions such as methane and nitrogen. For risk-based watershed management, a stand-alone computer code with GUI (Graphical User Interface) has been developed and is being modified for the estimation of a composite measure of watershed health and associated uncertainty. A web-based decision support tool is currently under development for watershed-scale R-R-V (Reliability, Resilience and Vulnerability) analysis and assessment of a composite measure of watershed health in the Upper Mississippi Watershed, Maumee River Basin and Ohio River Basin.	The research for this product was a building block that helped answer larger research questions. The OW program staff involved with this research product are no longer with the agency. We confirmed that this research was used in multiple journal articles and is available for use online.
FY 2015	Region 2 RARE: importance of ribbed mussels for salt marsh climate adaptation and water quality management in Atlantic estuaries.	This product is a technical report produced in collaboration with the Partnership for the Delaware Estuary. It reports the results of a study that demonstrates that ribbed mussels directly and indirectly contribute to the health and resilience of salt marshes through diverse physical, chemical and biological linkages with the vascular plant community. Ribbed mussels also can contribute substantially to the maintenance and enhancement of water quality in areas where mussels are abundant. Given the substantial ecosystem services contributed by ribbed mussels, protection and restoration strategies aimed at optimizing mussel population biomass should therefore be given greater consideration by managers and restoration practitioners who are focused on protecting water quality and coastal wetlands.	This product is being used to inform National Estuary Program Comprehensive Conservation and Management Plans as well as in trainings, workshops and conference presentations to inform stakeholders and restoration practitioners on the research findings and application to tidal marsh restoration. We confirmed that the research appears on the Partnership for the Delaware Estuary website and was distributed.

Completion date	Product title	Research description	Research use as reported by OW/regional staff
FY 2015	An extension of the acute ion toxicity model to address chronic toxicity.	This product is a manuscript that describes results of intensive chronic toxicity testing of major ion salts (comprised of Na, K, Ca, Mg, Cl, SO_4, HCO_3/CO_3) to the cladoceran, *Ceriodaphnia dubia*, a species known to be relatively sensitive to ion enrichment. Results of these tests are compared to previous acute testing using a wide variety of ion salts, mixtures of those salts, and background water chemistries. The ability of a previous acute toxicity model to predict chronic toxicity of mixtures was evaluated.	This product was completed to develop science on the understanding of ions on aquatic life and to support the OW in development of ion toxicity aquatic life criteria. This research is important to the OW for developing water quality criteria for ions, and to support state needs for such criteria. Staff believe this research is being used by a number of parties and said that the OW will apply it in the development of multi-ion model-based aquatic life water quality criteria for ions. We confirmed that a research manuscript is available on the EPA's intranet and that this research was presented in a SSWR 2016 webinar.
FY 2015	Trend analysis of stressors and ecological responses, particularly nutrients, in the Narragansett Bay Watershed.	This product reports on a retrospective approach to understanding the impact of nitrogen inputs to the Narragansett Bay watershed. This was accomplished using limited publicly available long-term datasets, literature information, some field sampling, and analysis of sediment cores from portions of Narragansett Bay. It is not intended to be a comprehensive summary of nutrient enrichment and the management in Narragansett Bay ecosystem, but builds off of a recent published review.	We verified that this product was cited multiple times in the report, *The State of Narragansett Bay and Its Watershed Technical Report*, which is a report for the Narragansett Bay Estuary Program. The Narragansett Bay Estuary Program is one of the Local Estuary Programs in the National Estuary Program.

Completion date	Product title	Research description	Research use as reported by OW/regional staff
FY 2015	Report on describing barriers and opportunities for restoration in urban settings.	The success of urban restoration projects—even those focused primarily on ecological targets—depends on incorporating the findings of social research, though that research is relatively rare. This product attempts to fill that gap by presenting barriers, opportunities and strategies for restoration projects in urban settings. Building from interviews with restoration managers involved in a suite of aquatic restoration projects in Rhode Island, it contributes to the learning axis of adaptive management by identifying and synthesizing the lessons learned from managers' work in urban settings. Researchers then consider how managers can design creative solutions to accomplish restoration goals by thinking more broadly about the multiple social or institutional, biophysical and discursive dimensions of barriers to and opportunities for urban restoration.	The research for this product was a building block that helped answer larger research questions. The OW program staff involved with this research product are no longer with the agency. We confirmed that a submitted manuscript appears on the EPA's website.
FY 2016	Concentrations of polyfluorinated chemicals in drinking water from homes.	Using methods development efforts ongoing within the National Risk Management Research Laboratory, National Exposure Research Laboratory and regional labs, this product reports on laboratory results using a novel method developed for the determination of 14 perfluorinated alkyl acids in small volumes (10 mL) of drinking water. The study demonstrates the applicability of the optimized method, and preliminary information on the quantifiable perfluorinated alkyl acids in the drinking water samples is reported.	This research has not been used to date but OW staff reported it could be used for future Unregulated Contaminant Monitoring Rules. We confirmed that this research was used in a journal article accessible via the EPA's website.

Completion date	Product title	Research description	Research use as reported by OW/regional staff
FY 2016	Methodologies and findings from analyses of temporal and spatial variability in landscape-scale connectivity of wetlands to streams and lakes.	This product quantifies spatial and temporal variability of wetland-stream and wetland-lake connectivity. Fluctuations in connectivity obtained from empirical observations using field methods and remotely sensed imagery were to be used to quantify intra-annual and inter-annual variability in wetland-stream-lake connectivity, relate temporal variability (climate) to landscape features (e.g., lakes and other permanent water bodies), and validate models of surface water hydrology to improve performance of hydrologic and biological connectivity indicators.	This product included a number of research publications (both published and in preparation) that are used by the agency for a variety of purposes. The publications have helped the Office of Wetlands, Oceans and Watersheds better understand how wetlands are connected to and impact the chemical, physical and biological integrity of larger downstream waters. These publications have helped programmatic staff better understand the functions of these wetlands across ecosystems and on different temporal and spatial scales, including the watershed scale. This research is important to helping the programmatic office in its day-to-day implementation of Clean Water Act programs. In addition, the product can inform the agency as it moves forward with additional rulemaking. Information from this product is also presented in a webinar series to the OW, ORD and regional staff. We confirmed that these trainings and workshops appear on the EPA's intranet.

Completion date	Product title	Research description	Research use as reported by OW/regional staff
FY 2016	Linking watershed and buffer-scale processes to multiscale aquatic nutrient and ecological responses.	This product characterizes readily quantifiable factors to consider (e.g., where nutrient sources are located in the landscape in relation to downstream waters) when targeting and prioritizing areas for nutrient management in highly impacted watersheds. These watersheds are often overlooked in research because of the complexities associated with identifying influential factors on water quality and biotic condition. The research was also conducted at broader spatial scales than traditional small watershed studies. Therefore, the findings represent improved linkages to the scale of management. The overall goal was for the OW and local, state and regional clients to gain an improved understanding of nutrient and biological responses to anthropogenic watershed stressors, specifically for large mixed land cover watersheds.	This product included a number of research publications (both published and in preparation) that are used by the agency for a variety of purposes. The publications have helped the Office of Wetlands, Oceans and Watersheds better understand how wetlands are connected to and impact the chemical, physical and biological integrity of larger downstream waters. These publications have helped programmatic staff better understand the functions of these wetlands across ecosystems and on different temporal and spatial scales, including the watershed scale. This research is important to helping the programmatic office in its day-to-day implementation of Clean Water Act programs. In addition, the product can inform the agency as it moves forward with additional rulemaking. Information from this product is also presented in a webinar series to the OW, ORD and regional staff. We confirmed that these trainings and workshops appear on the EPA's intranet.
FY 2017	Multi-metric marine biotic index (M-AMBI).	This product builds on years of collaborative work between ORD and OW to explore use of M-AMBI as a nationwide coastal benthic index. This product provides multiple approaches for applying this index, as well as regional sensitivity of M-AMBI.	This product has state, national and regional applications. On the state side, the ORD has provided support to a couple of states as they compare M-AMBI to existing state benthic indices. Another state is testing M-AMBI to see how well it assesses waters at the state level. On the national and regional side, the National Coastal Condition Assessment (NCCA) is applying M-AMBI to benthic samples collected during the 2015 NCCA survey (and future NCCA surveys in 2020 and beyond) to assess and compare biological condition of the estuarine waters of the Northeast, Southeast, Gulf of Mexico and West Coast. OW staff reported that the results are expected in the late spring or early summer 2018. We confirmed that a research manuscript is available on the EPA's intranet.

Completion date	Product title	Research description	Research use as reported by OW/regional staff
FY 2017	Performance and utility of national maps of watershed integrity at regional and watershed scales.	This product will be a manuscript internally cleared and submitted to a journal. The paper will describe the performance and utility of national maps of watershed integrity at regional and watershed scales. Knowing the conditions in watersheds is crucial for restoring areas with degraded water quality, as well as protecting healthy waters from emerging problems before expensive damages occur. A national map of watershed integrity provides scientifically sound and consistent data sources, and makes this information public and easily accessible to the wide variety of our partners working toward clean and healthy waters.	The National Rivers and Streams Assessment uses this research for classifying streams/rivers and calculating expected values for physical habitat and biological integrity measures in all 48 contiguous U.S. states. This data has become the agency's standard source of information for those activities. In its current approach, the agency could not assign condition class (good/fair/poor) without this data. We confirmed that a research manuscript is available on EPA's intranet.

Appendix B

Distribution

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