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**MID-CYCLE REVIEW OF THE OFFICE OF  
RESEARCH AND DEVELOPMENT'S  
DRINKING WATER RESEARCH PROGRAM  
AT THE  
U.S. ENVIRONMENTAL PROTECTION  
AGENCY**

**Final Report**

**Office of Research and Development  
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August 20, 2007

*BOSC Drinking Water Research Mid-Cycle Review Report*

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## I. SUMMARY

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### Background

The U.S. Environmental Protection Agency's (EPA's) Office of Research and Development (ORD) enlists the Board of Scientific Counselors (BOSC) to conduct independent expert reviews of ORD's environmental research programs every 4 to 5 years. Mid-cycle reviews, scheduled midway through the review cycle, are a critical step in this process. Narrower in focus than the in-depth technical evaluation that constitutes a full program review, the objectives of a mid-cycle review are to gauge the program's progress and to offer advice and feedback with respect to future direction and performance and accountability.

A six-member BOSC Subcommittee completed a full review of the Drinking Water Research Program (DWRP) during a public meeting, June 21-23, 2005, in Cincinnati, Ohio. This culminated in an October 27, 2005, BOSC report<sup>1</sup> which was transmitted to ORD on December 14, 2005. The ORD response<sup>2</sup> to the report, prepared by the then acting National Program Director (NPD) for Drinking Water, was transmitted to the BOSC on May 30, 2006.

Five members of the original DWRP BOSC Review Subcommittee were enlisted for a mid-cycle progress review culminating in a public meeting held May 23, 2007, in Newport, Rhode Island. The charge questions to the Mid-Cycle Subcommittee are reiterated as follows:

- ✧ Do the currently planned revisions to the Drinking Water Research Program adequately address the 2005 BOSC program review recommendations?
- ✧ Does the proposed structure for the revised Drinking Water Multi-Year Plan (DW MYP) provide a coherent framework for addressing priority research needs?
- ✧ How meaningful are the performance metrics tested by the program (client survey, bibliometric analysis) for assessing the impacts of ORD's research (i.e., scientific accomplishments, regulatory decisions, improved protection of public health, etc.) and can you suggest alternative metrics?
- ✧ What advice can the BOSC provide pertaining to the approach used to integrate topics such as infrastructure sustainability, climate change, and water reuse into the overall research program?
- ✧ Please rate the progress made by the Drinking Water Research Program in moving the program forward in response to the BOSC review of 2005 as exceptional, exceeds expectations, meets expectations (formerly satisfactory), or not satisfactory.

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<sup>1</sup> <http://www.epa.gov/OSP/bosc/pdf/dw0510rpt.pdf>

<sup>2</sup> <http://www.epa.gov/OSP/bosc/pdf/dw0605resp.pdf>

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For this last question, the BOSC Mid-Cycle Subcommittee was asked to assign a qualitative score that reflects the extent to which the program is making progress in moving the program forward in response to the previous BOSC review.

The Subcommittee focused its attention on the ORD response<sup>2</sup> to the original BOSC review report, additional background information, a public conference call with the now permanent NPD, a DWRP progress update prepared by the DWRP Steering Committee, and ORD presentations at the public mid-cycle review meeting held in Newport, Rhode Island. The basic findings of the mid-cycle review are summarized in the next section.

### **Findings**

The Mid-Cycle Review Subcommittee is very supportive and favorably impressed with the DWRP revisions of the Long-Term Goals (LTGs) and the formation of five Multi-Year Plan (MYP) thematic areas to direct research critical to the regulatory drivers of the LTGs. Previously, there was significant concern that collapsing three LTGs to two shortchanged certain critical research topics such as Source Water Protection or Water Distribution Systems. Now these topics are joined with Assessment Tools, Water Treatment and Residuals, and Water Use Health Outcomes to constitute the five thematic areas circumscribing Risk Characterization (LTG 1) and Risk Management (LTG 2) research of the DWRP. This is viewed as a logical structure that allows the DWRP to focus on statutory requirements such as the “6 year rule” (i.e., the Safe Drinking Water Act [SDWA] requirement that EPA review each National Primary Drinking Water Regulation at least once every 6 years and revise it as appropriate) or the Contaminant Candidate List (CCL) with the flexibility to address emerging drinking water research issues, for example, nanotechnology.

It is noted that the research matrix, five thematic areas across two LTGs, is very comprehensive and therefore, ambitious. Given resource constraints, there is a critical need for prioritizing specific research programs, marshalling the necessary funding through interagency collaborations and other mechanisms, and developing implementation strategies for components of the broad agenda.

It also is noted that the MYP has yet to be finalized, but the LTGs have received ORD and Office of Management and Budget (OMB) tentative approval and this should facilitate approval of the MYP.

In general, it appears that as of this review, the DWRP has been very responsive to the majority of the concerns and comments expressed in the 2005 BOSC program review. The ORD response<sup>2</sup> to the BOSC program review report was comprehensive yet somewhat incomplete. This problem was largely corrected following revisions to the LTGs and the inclusion of expanded responses to the BOSC report in the update report prepared by the DWRP Steering Committee. Any remaining Subcommittee concerns were dealt with very effectively by the NPD in the interim between the public conference call and the face-to-face review presentations at the meeting in Newport.

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At the time of the BOSC 2005 program review, the position of NPD was filled at an acting level by Dr. Greg Sayles. Although Dr. Sayles was doing a very commendable job as the Acting NPD, the Subcommittee thought the DWRP ultimately needed the stability of a permanent NPD.

At the time of the mid-cycle review, Dr. Audrey Levine had assumed the role of permanent NPD for Drinking Water. The Mid-Cycle Review Subcommittee is pleased to see that the NPD issue is resolved, and that the NPD has actively pushed to revise the LTGs and to gain acceptance of the MYP.

### **Recommendations**

The Mid-Cycle Subcommittee looks forward to an active and resourceful approach by the NPD to secure sufficient resources to mount and maintain an active research program. It is expected that a resource analysis matrix will need to be developed to strategically prioritize and secure funding for the broad elements of the thematic research agenda. The analysis will likely include intramural funding, targeted STAR grant solicitations, collaborative partnerships with other programs and agencies, and perhaps even reinvesting ORD derived royalties or federal fines and levies.

It is clear that the MYP has been delayed by more than 1 year and that it is still months away from a final embodiment. Whereas the MYP may not need to be in place until 2008, long-term strategic planning would benefit from having the MYP available sooner rather than later. Finalizing the MYP should be an imperative and should be accomplished as soon as possible.

As indicated above, strategic planning remains an issue and should be pursued at several levels including: (1) research prioritization, (2) resource procurement and allocation in an era of declining budgets, (3) maintaining and promoting a leadership agenda, and (4) integration of emerging environmental concerns such as climate change, sequestration, nanotechnology, and water reuse as they impinge upon drinking water quantity, quality, and safety.

The bibliometric and client analysis and surveys are works in progress and deserve further investigation, refinement, and application. Some of these considerations include: (1) discriminating the contributions of Science To Achieve Results (STAR) Program researchers as separate from EPA staff, (2) determining whether indices of high publication citation rate or impact factor are equivalent among disciplines and organizations, or (3) client diversity beyond program offices.

It remains somewhat unclear that internal communication among investigators, collaborators, and among programs and centers is as effective or transparent as it could or should be. It also was unclear how individual performance and award evaluations are carried out consistently across programs, centers, and laboratories, although Agency-wide guidelines exist. Intra-agency communication and evaluation procedures are difficult areas to evaluate and the DWRP and ORD should facilitate vehicles of communication and clarity on these topics. The manner in which these topics are dealt with within ORD also should be effectively communicated to future program reviewers.

## **Qualitative Evaluation**

The Drinking Water Mid-Cycle Subcommittee members unanimously agree that the DWRP **exceeds expectations** in meeting its goals, its science is more than competent and of high quality, its products are timely, and that its milestones are largely met. Any exceptions to this general finding and evaluation are due to the transition in installing a new NPD, reformulation of LTGs in response to the 2005 BOSC program review, and subsequent changes in planning and approval of the MYP based on the new LTGs and thematic research agenda. The Subcommittee hopes that the revised LTGs can transcend any future NPD leadership changes and that the program will continue to excel.

## **II. CHARGE QUESTION # 1:**

### **Do the currently planned revisions to the drinking water research program (DWRP) adequately address the 2005 BOSC program review recommendations?**

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A primary focus of the DWRP is to provide support for the SDWA's statutory requirements. The draft revised goals adequately address the 2005 BOSC program review recommendations and provide a structure that allows for a more integrated and comprehensive approach to research related to drinking water and focuses on outcomes versus outputs. The major revision accomplished at the time of the mid-cycle review was in the area of program design, one of the 2005 charge questions. The LTGs were revised to focus on Risk Characterization (LTG 1) and Risk Management (LTG 2). These two LTGs are organized around five theme areas that encompass research needs in relation to the water cycle from water resources (source water) to water use and health outcomes. The restructuring directly addressed the BOSC recommendations regarding concerns about the LTGs at the time of the 2005 review. The Mid-Cycle Subcommittee believes the revised LTGs should promote a more logical and integrated approach to DW research questions.

The DWRP has permanently filled the position of NPD. Under the new director, the proposed LTGs were reviewed and discussed across the DWRP with input from the Office of Water (OW). Tentative OMB approval of the new LTGs was received in May 2007. The detailed MYP was not available at the time of the mid-cycle review because this plan was moving through the OMB approval process, which includes final approval of the new LTGs. The MYP is anticipated in July 2007. Although the DWRP expected to complete the MYP by the time of this mid-cycle review, the Subcommittee agreed with the NPD that it was prudent and most efficient to wait for OMB approval. In the 2005 program review, the BOSC had recommended that a clear mission statement be developed and this it should be done in conjunction with the detailed MYP.

Other recommendations that came out of the 2005 program review included the development of a clear research plan to address source water protection, water reuse, and distribution systems. With the restructuring of the LTGs around the five themes, these important research areas should now be better addressed. The manner in which the LTGs were redefined and structured to include the five thematic areas will provide for a much more flexible, integrated, and responsive research program. The new structure creates a logical flow and natural integration that becomes transparent yet provides a great deal of focus to the scientific aspects of the program. In other words, the benefits of and approach to the science is not impeded by an unwieldy construct. This restructuring addressed many of the concerns expressed by the BOSC in the 2005 recommendations.

The program's revised goals are logical and inclusive. The goals and themes are excellent and lead to the formulation of the Annual Performance Goals (APGs) and Annual Performance Measures (APMs). The achievement of the goals can be better judged when the APMs and APGs have been defined. One has to constantly be reminded of the overall goals as the APMs



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and APGs are determined. In that regard, a conceptual model could include the following considerations:

1. The need for certain tasks to be accomplished through an extramural program because resident expertise does not exist within ORD and there is no long-term need for such expertise.
2. Limitations on financial resources often will dictate the need for partnerships and leveraging of funds. Recognition of this need should occur early and the ground work for the partnerships explored well in advance of the needed research results.
3. Goals and measures should be appropriately benchmarked against the results of other outstanding organizations doing similar work.
4. A transparent, well thought-out strategy for distribution of resources should be developed.

The BOSC 2005 program review report recommended leveraging of DWRP research through more extensive partnering with other government agencies and other parties. In the response to the recommendations, ORD acknowledged that diminishing resources will make in-kind contributions important in future collaborations. It should be acknowledged that this also will diminish the strength of ORD's role in such research. At the mid-cycle review, progress on developing new partnerships was described in general terms but was not quantified in terms of changes since the 2005 review. The Subcommittee learned that staff performance evaluation includes emphasis on collaborations and partnerships in addition to standard scientific evaluation (e.g., publications, leadership positions in professional organizations, leading workshops and symposia); thus, partnering continues to be an area of emphasis within the DWRP. The Subcommittee believes this emphasis is appropriate.

Some issues related to scientific leadership are still unresolved. The 2005 BOSC report suggested that the DWRP articulate its goal about a strategy for achieving scientific research leadership. Materials presented for the mid-cycle review did not address this issue. An aspect that has been addressed but needs a broader, more consistent application is how the elements of scientific leadership are fostered.

Ongoing and planned interactions with other agencies, and, indeed, within EPA, to leverage resources are good. More are needed, however. Relationships need to be fostered that will lead to future collaborations. This takes time and they should be focused upon as a long-term outcome.

Regarding internal collaborations, there appears to be awareness of the activities of other groups and an appreciation for how these activities can be synergistic. The Subcommittee is unconvinced, however, as to the extent to which this communication has filtered down to the scientific staff. This is a difficult challenge for any organization and requires that the interactions at the director level include regular discussions about current and embryonic research projects and plans in their respective organizations.

### **III. CHARGE QUESTION # 2:**

#### **Does the proposed structure for the revised DW MYP provide a coherent framework for addressing priority research needs?**

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The proposed structure will follow from the revised and much improved LTGs, thereby providing a coherent framework for addressing priority research areas. A detailed MYP, however, was not available at the time of this mid-cycle review. Specific strategies need to be developed for important research areas such as climate change, nanotechnology, and water reuse.

Planning for the revised MYP integrated the 6 year review, the CCL process, and emerging issues. The Research Coordination Team (RCT) composed of the NPD and representatives from ORD and OW are involved in research planning and progress updates. The research teams involving ORD and OW will focus research on thematic areas of source water, treatment, distribution systems, and water use, with integrated research perspectives. The STAR Program encourages emerging and innovative research by soliciting open-ended Requests for Applications (RFAs) associated with drinking water. Such STAR solicitations, however, are continually at risk because of funding limitations and cutbacks. The ORD intramural research program also has the capability to conduct timely research on new, unanticipated priority research needs. Ongoing collaboration of the DWRP with the Water Quality Research Program, Homeland Security Research Program, and other federal agencies such as the Centers for Disease Control and Prevention (CDC), U.S. Geological Survey (USGS), and other organizations such as the American Water Works Research Foundation, the Water Environment Research Foundation, or the National Water Research Institute also may provide information to fill research needs and facilitate the achievement of performance goals while leveraging resources.

#### **IV. CHARGE QUESTION # 3:**

**How meaningful are the performance metrics tested by the program (client survey, bibliometric analysis) for assessing the impacts of ORD's research (i.e., scientific accomplishments, regulatory decisions, improved protection of public health, etc.) and can you suggest alternative metrics?**

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Overall, the performance metrics provide a good starting point for measuring the impacts of the DWRP's activities. The metrics themselves are consistent with those in use at other organizations. They should be uniformly integrated into annual performance reviews at all levels so that everyone is aligned with the Agency goals.

The bibliometric analysis appears to be a quite useful method for assessing the impacts of ORD's research. The approach presented at the mid-cycle review was sufficiently detailed and showed that more than one-fifth of the DWRP publications are highly cited papers. Although this approach is useful to quantify the quantity and quality of peer-reviewed publications being produced from the DWRP, caution must be taken to not place too much emphasis on publications and impact factors. Many of the DWRP products such as new EPA analytic methods are widely used but not easily quantified by a bibliometric analysis. The parameters specified (highly cited papers, overall citations, high impact journals, hot papers, highly cited authors) are good. Reference values need to be established to permit comparisons across groups at EPA, across other federal agencies, and the scientific community at large. Simple Web searches can generate citation indices and weighting factors used to evaluate the productivity and strength of research output. Like universities, however, the use of such metrics by the Agency needs to be balanced by recognition of differential relevance across fields, disciplines, professions, and organizations. The creation of uniform metrics also will permit tracking of program progress over time. It is not clear, however, as to the level of time or resources needed to accomplish this and while the Subcommittee realizes it could be valuable, excessive resource investment is discouraged.

The client document analysis requires some additional thought. For example, as presented, it only measures when research results from the DWRP were utilized by OW for a variety of documents ranging from regulations to methods. Other considerations include how the results were used, what percentage of the outputs were utilized, and for what types of documents were they used. For example, it was only through the question and answer discussion that it became apparent that a small percentage of the research results published in 2000 were utilized during the next 7 years (22% of 167 were cited by EPA). The issue of timing of use of DWRP publications related to the timing of regulatory decisions makes this approach to evaluating performance complex and somewhat less useful. Alternative methods of assessing client use of DWRP publications may prove be more appropriate. Additional approaches could include alternative literature searching mechanisms, but a more fruitful approach may be to place greater emphasis on communication of DWRP results to the client and to simultaneously obtain feedback from the client about how DWRP products are used or could be more useful. The client survey that was pilot-tested provides one mechanism for obtaining feedback and may continue to be a useful approach. Are there internal uses of the outputs that can be identified and quantified? It is important to determine the overlap of the client document analysis with

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citations from the bibliometric analysis, because many of the publications will likely serve different audiences. This would be consistent with the DWRP's role to be scientific leaders and support the needs of its clients. These and other ongoing efforts to facilitate and improve communication with the client were briefly described and the Subcommittee believes these are on track and should be encouraged.

## **V. CHARGE QUESTION # 4:**

**What advice can the BOSC provide pertaining to the approach used to integrate topics such as infrastructure sustainability, climate change, and water reuse into the overall research program?**

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Leveraging DWRP resources by cooperative agreements and collaborations will be key to development of these important research areas. There are apparent areas of overlap with Department of Energy research needs (carbon sequestration related to climate change) and Homeland Security (infrastructure sustainability). Funding from these and other agencies should be encouraged and this collaboration will benefit the missions of all agencies. DWRP research staff expertise and experience could be crucial to the timely development of these important research areas.

The draft revised MYP provides for a more integrated approach to drinking water research that integrates infrastructure sustainability, climate change, and water reuse. The thematic areas of source water, treatment and residuals, distribution system and storage, and water use crosscut both LTG 1 and LTG 2. The proposed all inclusive approach in the revised MYP also will allow flexibility in setting priorities as dictated by programmatic needs.

Goals need to be established for each of the programs as well as a timeframe over which each goal should be achieved to forward the Agency's mission. Once actions are planned, the overlap among the topics can be determined. The overlaps in actions might suggest efficiencies that can be integrated into the program. From the optimized approach, resources can be planned. Careful analysis of the needs associated with the integrated elements can serve as a basis for re-evaluating the activities, and hence progress, as the resources available change.

**VI. CHARGE QUESTION # 5:**

**Please rate the progress made by the DWRP in moving the program forward in response to the BOSC review of 2005.**

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Overall, the progress made by the DWRP **exceeds expectations** with respect to the quality of the science and general progress accomplished in the timeframe between the BOSC 2005 program review report and this mid-cycle review (approximately 16 months). Progress to achieving milestones and on the development of the MYP was delayed because of the timeline for hiring an NPD and time needed for the OMB review process of the revised LTGs. These delays were understandable and with these important accomplishments completed, there was evidence presented at the mid-cycle review that substantial progress was made in response to the majority of the BOSC 2005 program review recommendations.

## VII. APPENDICES

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### Appendix A: Subcommittee Charge

02/27/07

#### DRINKING WATER MID-CYCLE SUBCOMMITTEE CHARGE May 23, 2007

**1.0 Objectives.** The objectives of this mid-cycle review are:

- to evaluate the progress made by the Office of Research and Development's (ORD's) Drinking Water Research Program relative to the commitments it made following its last review (June 21 – June 23, 2005), and
- to obtain advice and feedback on issues related to the future directions of the research program and performance and accountability.

**2.0 Background Information.** Independent expert review is used extensively in industry, federal agencies, Congressional committees, and academia. The National Academy of Science has recommended this approach for evaluating federal research programs.<sup>3</sup>

For the Agency's environmental research programs, periodic independent reviews are conducted at intervals of four or five years to characterize research progress, to identify when clients are applying research to strengthen environmental decisions, and to evaluate client feedback about the research. Mid-cycle evaluations are an important part of this program review process. Scheduled midway through the review cycle, these independent assessments give ORD an opportunity to gauge the program's progress relative to the commitments it made following its last review.

For the upcoming mid-cycle review, the Drinking Water Research Program has prepared a progress report that will provide the context for our discussions during the meeting. The report outlines the changes implemented by the program in response to the major recommendations from its 2005 review. The Drinking Water Research Program also has revised its Multi-Year Plan. The plan lays out the context, and presents a time line, for research on the two long-term goals: 1) Support SDWA mandated revisions and rule implementation, and 2) Source to Tap – Assessing and Managing Risks. These documents are pertinent to the draft charge questions.

This review is not intended to be the in-depth technical evaluation of a full program review. Presentation time will be minimized in favor of discussion.

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<sup>3</sup> Evaluating Federal Research Programs: Research and the Government Performance and Results Act, National Research Council, 1999.

**3.0 Draft Charge Questions for ORD's Drinking Water Research Program.** ORD is interested in receiving feedback concerning the following questions:

- Do the currently planned revisions to the Drinking Water Research Program adequately address the 2005 BOSC program review recommendations?
- Does the proposed structure for the revised Drinking Water Multi-Year Plan provide a coherent framework for addressing priority research needs?
- How meaningful are the performance metrics tested by the program (bibliometric analysis, client survey) for assessing the impacts of ORD's research (i.e., scientific accomplishments, regulatory decisions, improved protection of public health, etc.) and can you suggest alternative metrics?
- What advice can the BOSC provide pertaining to the approach used to integrate topics such as infrastructure sustainability, climate change, and water reuse into the overall research program?
- Please rate the progress made by the Drinking Water Research Program in moving the program forward in response to the BOSC review of 2005 as exceptional, exceeds expectations, meets expectations (formerly satisfactory), or not satisfactory.

For this last question, the BOSC Mid-Cycle Subcommittee is being asked to assign a qualitative score that reflects the extent to which the program is making progress in moving the program forward in response to the previous BOSC review. The score should be in the form of one of the adjectives defined below and is intended to promote consistency among BOSC program reviews. The adjectives should be used as part of a narrative summary of the review, so that the context of the rating and the rationale for selecting a particular rating will be transparent. For mid-cycle reviews, the rating should be based on the quality, speed, and success of the program's actions in addressing previous BOSC recommendations. The adjectives to describe progress are:

- **Exceptional:** indicates that the program is meeting all and exceeding some of its goals, both in the quality of the science being produced and the speed at which research result tools and methods are being produced. An exceptional rating also indicates that the program is addressing the right questions to achieve its goals. The review should be specific as to which aspects of the program's performance have been exceptional.
- **Exceeds Expectations:** indicates that the program is meeting all of its goals. It addresses the appropriate scientific questions to meet its goals, and the science is competent or better. It exceeds expectations for either the high quality of the science or for the speed at which work products are being produced and milestones met.
- **Meets Expectations (formerly Satisfactory):** indicates that the program is meeting most of its goals. Programs that meet expectations live up to expectations in terms of addressing the appropriate scientific questions to meet its goals, and work products are being produced and milestones are being reached in a timely manner. The quality of the science being done is competent or better.
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- **Not Satisfactory:** indicates that the program is failing to meet a substantial fraction of its goals, or if meeting them, that the achievement of milestones is significantly delayed, or that the questions being addressed are inappropriate or insufficient to meet the intended purpose. Questionable science is also a reason for rating a program as unsatisfactory for a particular long-term goal. The review should be specific as to which aspects of a program's performance have been inadequate.

### **4.0 Potential Subcommittee Approach for Mid-Cycle Review**

- Hold one (1) administrative call in the month preceding the face-to-face meeting.
  - ▶ allows the subcommittee Chair to make review and writing assignments
- Hold one (1) teleconference call in the month preceding the face-to-face meeting.
  - ▶ allows the ORD to present background and other relevant materials to the subcommittee
  - ▶ allows the subcommittee to ask clarifying questions
- Distribute background materials and documents requested by the subcommittee in advance of the teleconference call.
- Hold a one-day face-to-face meeting for the mid-cycle review.
  - ▶ The meeting will include ORD presentations on program progress and discussions with members of the Drinking Water Mid-Cycle Subcommittee.
  - ▶ The meeting will conclude with the presentation of a draft letter report that addresses all of the charge questions.
- If needed, hold one (1) teleconference call within one month following the face-to-face meeting to finalize the draft letter report.

## **Appendix B: Drinking Water Mid-Cycle Subcommittee**

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## **Appendix C: List of Acronyms**

APG	Annual Performance Goal
APM	Annual Performance Measure
BOSC	Board of Scientific Counselors
CCL	Contaminant Candidate List
CDC	Centers for Disease Control and Prevention
DW	Drinking Water
DWRP	Drinking Water Research Program
DW MYP	Drinking Water Multi-Year Plan
EPA	Environmental Protection Agency
EU	European Union
FACA	Federal Advisory Committee Act
LTG	Long-Term Goal
MYP	Multi-Year Plan
NPD	National Program Director
OMB	Office of Management and Budget
ORD	Office of Research and Development
OW	Office of Water
RCT	Research Coordination Team
RFA	Request for Application
SDWA	Safe Drinking Water Act
STAR	Science To Achieve Results
USGS	U.S. Geological Survey