

Minutes of the Open Meeting on July 21-22, 2009

**U.S. Environmental Protection Agency
Science Advisory Board**

**Environmental Engineering Committee (EEC)
Summary Minutes of the Consultation on
Aging Water Infrastructure Research Initiative**

Committee: Environmental Engineering Committee (EEC) of the U.S. Environmental Protection Agency's (EPA) Science Advisory Board (SAB)

Committee Members: See Committee Roster – Attachment 1

Date and Time: Tuesday, July 21, 2009, 8:30 A.M. – 4:30 P.M.; and Wednesday, July 22, 2009, 8:00 A.M. – 12:15 P.M.

Location: Kingsgate Marriott Conference Hotel at the University of Cincinnati; 151 Goodman Drive, Cincinnati, Ohio, 45219

Attendees:

Chair: Dr. David A. Dzombak

Committee Members: Dr. Viney Aneja
Dr. John C. Crittenden (July 21 only)
Dr. Cindy M. Lee
Dr. Reid Lifset
Dr. James R. Mihelcic
Dr. Horace Moo-Young
Dr. Catherine Peters
Dr. Mark Rood
Dr. John R. Smith

Consultants to EEC Mr. John Colbert
Mr. Larry Jaworski
Mr. Larry Johnson
Ms. Liliana Maldonado
Mr. Michael Selna
Dr. Vanessa Speight
Dr. Michael K. Stenstrom

EPA SAB Staff: Edward Hanlon, Designated Federal Officer
Dr. Vanessa Vu, Director, EPA Science Advisory
Board Staff Office

EPA Presenters: Dr. Thomas Speth, Acting Division Director, EPA's
Office of Research and Development (ORD),
National Risk Management Research Laboratory
(NRMRL), Water Supply and Water Resources
Division (WSWRD)

Dan Murray, EPA/ORD/NRMRL/WSWRD

Ari Selvakumar, EPA/ORD/NRMRL/WSWRD,
Urban Watershed Management Branch

Rich Field, EPA/ORD/NRMRL/WSWRD, Urban
Watershed Management Branch

Darren Lytle, EPA/ORD/NRMRL/WSWRD,
Treatment Technology Evaluation Branch

Other Participants: Dr. Sally Guterrez, Director, EPA/ORD/NRMRL

Jeff Young, EPA/ORD/NRMRL/WSWRD

Anthony Tafuri, EPA/ORD/NRMRL

Michelle Latham, EPA/ORD/NRMRL/WSWRD

Public: See Attachment 9, Public Attendance.

Purpose: The purpose of the meeting was to consult with the Agency's Office of Research and Development (ORD) to consult with the SAB EEC on its development of the Aging Water Infrastructure Research Initiative. In particular, ORD requested EEC to provide advice on whether ORD's Aging Water Research is appropriately focused, or should it be refined, and whether ORD is collaborating with appropriate research partners and stakeholders. EEC addressed each of the five charge questions, and included additional comments beyond those responding to the charge questions as EEC members felt was appropriate. See Meeting Agenda - Attachment 2.

As discussed further in these minutes, this meeting was a consultation, and as such consensus was not being sought. This meeting was intended to provide individual advice from Committee members.

Materials Available: The agenda, roster, and meeting materials were circulated to the Committee in advance of the meeting. These materials were made available to the public

via the SAB Web site (www.epa.gov/sab) and hard copies were also provided and made available to the public for review at the meeting.

Attachments:

- Attachment 1: Committee Roster
- Attachment 2: Agenda - EEC July 2009 Committee Meeting
- Attachment 3: EPA Charge Questions to the Committee
- Attachment 4: Presentation by Dr. Thomas Speth on Overview of EPA's Aging Drinking Water and Wastewater Infrastructure Research Initiative
- Attachment 5: Presentation by Dan Murray on Condition Assessment Research
- Attachment 6: Presentation by Dr. Ari Selvakumar on System Rehabilitation Research
- Attachment 7: Presentation by Rich Field on Advanced Concepts Research
- Attachment 8: Presentation by Dr. Darren Lytle on Cross-cutting, Integrative Research
- Attachment 9: Public Attendance
- Attachment 10: Federal Register Notice Announcing EEC July 2009 Committee Meeting
- Attachment 11: Public Comments

Meeting Summary

The meeting followed the issues as presented in the meeting agenda (see Attachment 2). The meeting occurred between 8:30 a.m. – 4:30 p.m. on July 21, 2009, and between 8:00 a.m. – 12:15 p.m. on July 22, 2009. The meeting adjourned at 12:15 p.m. on July 21, 2009. A summary of the meeting follows.

July 21, 2009

Opening Statements and Welcome

Mr. Edward Hanlon, the DFO, opened the meeting, noting that the EEC is chartered as a Federal Advisory Committee under the Federal Advisory Committee Act (FACA). He acknowledged the meeting as being open to the public and stated that there were no requests from the public for time to present oral statements. He also noted that minutes of this meeting were being taken to summarize discussions and action items in accordance with requirements under FACA.

Dr. Vanessa Vu, Director of the SAB Staff Office, also welcomed everyone for their attendance. Dr. Vu noted that EEC's efforts were being conducted as a subcommittee under the auspices of the Science Advisory Board. Dr. Vu noted that the Charter SAB Committee will provide comments on the President's budget for ORD for 2010, and that Aging Infrastructure is considered a major environmental challenge, in part since infrastructure significantly affects water quality. Dr. Vu also noted that this is a consultation, and SAB's early advice to ORD helps EPA's technical products and research focus. She also noted that there are times when committee agreement is reached

by the Committee, and it would be helpful to document such agreement. She further noted that the EEC is not obligated to respond to public comments, but please consider those we have received as you deliberate.

The meeting was turned over to the Chair, Dr. Dzombak, Professor in the Department of Civil and Environmental Engineering at Carnegie Mellon University, who noted the Purpose of Meeting: Consultation on Aging Water Infrastructure Research Initiative. Dr. Dzombak noted that this is not an Advisory, where a report seeking consensus would be prepared. Dr. Dzombak summarized the charge questions (Attachment 3), noting that some of the major questions include: a) Is ORD's Aging Water Research appropriately focused, or should it be refined; and b) Is ORD collaborating with appropriate research partners and stakeholders?

Dr. Dzombak noted that expertise was added to EEC: Seven expert consultants were added to augment the EEC (see roster, Attachment 1). Dr. Dzombak noted that the overall committee, including the consultant experts, was selected to provide a balance of perspectives from academia, public utility experience, and industry/consulting. Dr. Dzombak quickly reviewed the agenda, and then requested that EEC members and consultants should first introduce themselves, and then members of audience should introduce themselves.

Dr. Sally Guterrez, Director of ORD/NRMRL, then was introduced. Dr. Guterrez noted that ORD is working to be a leader in research on this topic. Many billions of dollars are being spent on infrastructure. EPA ORD research will help assure that our nation's dollars are well spent.

Dr. Speth, Mr. Murray, Dr. Selvakumar, Mr. Field, and Dr. Lytle then presented their slides (see Attachments 4-8). Regarding formation of a stakeholder group, one member asked whether utilities would be on this group. ORD responded that the group is formed, and utilities are on it, as well as universities, consultants and national and international organizations.

Dr. Speth then outlined his goals for the consultation. He noted that ORD is two years into this project, and is serious about doing it correctly. He noted the AWI research program was planned to be \$7 million/yr for five years, and now it is \$5 million/year for EPA funds, and is following a 3 step process: a) National and Regional condition assessments; b) State of the Technology Reports; and c) Demonstration Projects. He noted that while the 2007 ORD Research Plan identified a number of high level research projects, only a limited number of them were carried through, and that while ORD could not cover all 26 active research projects in their presentations that morning, ORD would like SAB feedback and guidance on all of the 26 ongoing research projects.

Dr. Speth noted ORD is starting demonstration projects now, and that the recent Cooperative Agreement between EPA, WRF and WERF will help identify appropriate linkages for EPA. He noted that ORD has tried to identify impacts on the nation, and how to define an impact, in two key areas: a) Interacting with program offices and impacting regulators. ORD cannot change regulatory requirements, but can provide guidance to OW and OWM. B) Can assist the water and wastewater industry; can save utilities money and effort.

Mr. Hanlon asked whether there were any oral public comments; no members of the public requested to make oral comments.

Dr. Dzombak requested a moment of silence for Dr. G. V. Loganathan from Virginia Tech, who is cited in ORD's Research Plan. Dr. Dzombak noted that Dr. Loganathan died in the Virginia Tech shootings of about two years ago, and that it was a tribute to his legacy that his work is still helping us as we move forward in resolving Aging Water Infrastructure issues.

Discussion on Charge Questions:

As indicated in the meeting agenda, discussion was organized by charge question. The following summarizes key points organized by charge question that were made by members of the Committee during the meeting. A more detailed description of these key points is provided in Dr. Dzombak's individual comments which are attached to the Committee's letter sent to the EPA Administrator on September 1, 2009. After discussion of the charge questions, Dr. Dzombak asked the Committee whether these points accurately described Committee members' most important comments associated with each charge question. The Committee members agreed that these accurately summarized their key points.

Some additional comments made by several Committee members are also included which provide further details on Committee discussion for each charge question. Specific comments from individual EEC members are attached to the Committee's letter sent to the EPA Administrator on September 1, 2009.

Charge Question 1: Comments on major goals of aging water infrastructure program, including: a) whether program is focused appropriately on major water infrastructure technical issues, and b) what refinements could improve program effectiveness.

Charge Question 2: Are the research focus areas (condition assessment, system rehabilitation, advanced concepts, and innovative treatment technologies) and the related cross-cutting research likely to result in tangible impacts that will support the program goals? Do the program activities and projects appropriately support the current program goals or are additional activities or projects necessary?

During the meeting, Dr. Dzombak captured the following key points that were made by members of the Committee regarding charge questions 1 and 2. The Committee members agreed that these accurately summarized their key points:

a) The goals of the Aging Water Initiative (AWI) research program are clearly stated, and the research focus areas are appropriate and well oriented toward achieving the program goals. The cost of addressing AWI issues over the next twenty years is more than several hundred billion dollars, and the AWI technology research and development (R&D) budget of approximately \$5 million/year to address these issues is very modest. To best utilize scarce R&D resources to achieve safe water supply and effective wastewater management at a significantly reduced cost, it is important that efforts in the AWI program be leveraged as much as possible. Also, the AWI research program should be planned and conducted with an eye toward creating initiatives that can live on after the program concludes.

b) Demonstration projects offer a good opportunity for integration of technological, economic and social components required for successful assessment, rehabilitation, and upgrading of water infrastructure. One way to encourage integration is to develop a roadmap or decision tool to be used by respective stakeholders and decision makers so that the most cost-effective Total Water Management approach is developed for a particular situation.

c) The AWI program leaders are strongly encouraged to aim for water infrastructure transformation and not just repair of 20th century systems. As a nation, we should take advantage of investments in AWI assessment and rehabilitation work, and look for opportunities to implement truly innovative, transforming approaches in order to help move us to a new 21st century water infrastructure. A clear strategic focus is needed for the AWI program to help guide the nation's AWI industry towards these goals. The strategic focus could articulate whether the goals for wastewater and stormwater management are primarily to continue to enhance the central treatment system approach and fix/upgrade the current piping infrastructure, or whether the goals are primarily to begin to look at greener approaches for management of these systems. EPA should develop measures to help gauge the degree to which innovative and cross-cutting technologies are being adopted. In addition, technical staff at utilities need information on reasonable expected AWI costs, costs vs. benefits of new technologies, and other resources that would help convince their management to support AWI maintenance programs.

d) Much related work has been done or is ongoing at water and wastewater utilities, other government agencies, and other programs within EPA. It is very important that ORD not repeat such work and that ORD's AWI research program build on and leverage these activities, particularly those involving full-scale demonstration, to efficiently use limited resources and enhance national impact. ORD should try to collect and disseminate data on ongoing or completed large-scale projects, and is encouraged to develop accessible databases of demonstrated AWI case studies, technologies and tools that improve cost effectiveness of AWI operation and maintenance.

e) AWI leadership should identify target audiences for the various activities and projects of the program in order to provide the best opportunity for education and information transfer to the practitioner so that program activities will have national impact.

- In response, ORD noted that:
 - ORD is seeing new AWI issues arise since the AWI research plan was developed two years ago, and new priorities from the new EPA Administrator.
 - ORD is establishing the vision piece associated with EPA's AWI research.
 - ORD sees Total Water Management as an asset management piece. ORD's vision could be to get communities to move towards a Total Water Management approach.

- ORD agrees on the Committee's suggestions regarding outreach, particularly regarding training and use of webinars.

Some Additional Comments Made by Committee Members Regarding Charge Question 1:

Several EEC members noted the following regarding Charge Question 1:

- EPA is doing an excellent job in characterizing issues and identifying research needs:
 - The categories outlined by ORD are the right categories, and ORD framed/organized the issues well.
 - The research emphasis on advanced concepts is noteworthy.
- Regarding funding issues:
 - AWI issues are primarily an economic, financial problem. In 20 years, an estimated \$500 billion gap in funding between AWI needs and available dollars are projected. Utilities are pushing to make better economic decisions. It is unclear whether and how the \$500 billion shortfall will be addressed. It is skeptical that we will have such funding in 20 years based on the direction the wastewater collection/treatment industry is headed.
 - Regarding leveraging and efficiently applying funds:
 - The research projects have tried admirably to achieve good leveraging of funds particularly regarding its sustainability research.
 - The national and international outreach efforts are excellent.
 - EPA will fall flat if it does not leverage other organizations to develop and disseminate AWI information.
 - In response, ORD noted:
 - Life cycle analyses (LCA) are being conducted to show that EPA is 'getting its money's worth' out of the research projects.
- Regarding achieving goals through dissemination of information:
 - ORD should research how to best get AWI research information to practitioners.
 - While EPA conference presentations and peer-reviewed publications are great, EPA needs to go to a higher level to disseminate information. Options on how to do this include:
 - Putting manuals on a training circuit. WERF, WEF, American Water Works Association can assist on this. The WEF track is expensive
 - One day seminars are excellent. ORD could work with WEF and AWWA and others to set up/run these seminars around the country.
 - It would be very helpful if ORD prepared a compendium of existing practices (e.g., the blue book approach). WEF could help set this up, and there are many willing volunteers at the state and local level who would be very willing to help on this.
 - It would be helpful if ORD prepared a package of CDs that would train utilities.
 - In response, ORD noted:

- ORD will develop AWI guidance and methodologies, and this will help address outreach needs.
- ORD agrees with developing a training circuit for AWI research topics.
- ORD wants to do more, but really cannot do more with limited in-house staff, so ORD may try to make connections with others on how to ‘spread the word’ on products produced through the AWI research program.
- Generally, ORD cannot replicate the ‘blue book’ approach that ORD took in years past. However, this approach might work for green technology.
- Regarding demonstrations, ORD had good success regarding arsenic treatment systems. ORD went to 50 communities and received great feedback from them, which significantly helped ORD’s efforts in researching arsenic treatment technologies. ORD also held yearly workshops for municipalities on treating arsenic.
- The current AWI program has grown out of ORD’s 1970’s wet weather flow research program. ORD marketed the wet weather flow research based on full-scale studies. ORD is trying to take that approach to address AWI issues.

Charge Question 2(a): Comment on whether research on *condition assessment* will result in tangible outputs and outcomes that will support Aging Water Infrastructure Research Program goals

Several members of the EEC noted the following regarding Charge Question 2(A):

- Overall, the Research plan and projects were well written and organized. EPA is doing a great job on sewer condition assessment research.
- ORD should be complimented for its plans to develop a toolbox related to AWI issues. State of the Science information will be helpful to utilities.
- A significant overarching issue was that there was a need for better integration of the research projects, and recommended that ORD identify a large roadmap that will identify technologies with a high likelihood of success.
- It would be helpful if tools could be developed to help identify locations of buried infrastructure, prevent infiltration, assess and remedy internal and external piping corrosion (particularly regarding force mains), and conduct condition assessment work. It would also be helpful to have a database of utility and pipe failures that utilities could access. A national database that collects/disseminates utility information regarding their relevant experiences/issues on pipe breaks would be very helpful to utilities that are making decisions on pipe replacement and new pipe technologies.

- It is unclear whether a national data collection effort is occurring to support ORD's multi-scale research assessment. Utilities are making decisions on pipe replacement and new pipe technologies because pipes are breaking.
 - In response, ORD noted that it was working with 17 communities across the US to identify condition assessment of their systems and to develop databases.
- While ORD is collecting significant amounts of condition assessment data, it would be helpful to apply more computational resources towards data mining and data analysis. ORD should consider use of cyber-infrastructure tools and web-based databases to mine and analyze data. EPA should consider developing their own tools especially for small communities. Tools developed by EPA would be authoritative, calibrated, and tested.
 - In response, ORD noted it was reviewing a variety of tools to assist on condition assessment, including CDM's CAMP tool (Comprehensive Assessment Management Program), and HDR's tool. ORD also noted they were uncertain whether EPA will develop its own tool, or refer to another tool. Regarding the cooperative agreement with WERF, a simple tool would be taking VA Tech data and assessing it. ORD will also try to do this work in-house, in order to maintain its expertise in this area.
- It is unclear where data for the AWI research projects was coming from. Geographic areas with lots of rain, or limited rain, have differing effects due to manhole infiltration.
- Regarding sequential vs. parallel approaches, ORD should consider not waiting to start the 3rd phase of research work. For example, concrete vs. corrosion research project could begin now.
- A number of technologies that are being assessed/researched at Universities could be applied to AWI problems.
- The majority of AWI problems are on private property, which presents unique issues.
- We need AWI research targeted towards small community systems.
 - Larger utilities can assess risk associated with its pipes and system using a utility-specific rating system, then adjust the capital budget. It is unclear whether smaller utilities have the funding to do this effort. ORD should consider developing a standard rating system for data collection since the data could then be assessed/utilized under some standard methodology.
- Regarding inflow and infiltration (I&I):
 - Infiltration prevention research will be helpful
 - ORD is not addressing smoke sensors to assess inflow, and inflow can overflow the infrastructure. Smoke is a quick way to identify leaks, and identify improvements. Suggest adding smoke testing to ORD's research projects. MWRA also assesses I&I through ultrasound.
- Regarding cyber-infrastructure, the energy 'smart grid' approach could be applied to AWI for drinking water (e.g., to identify leaks).
 - In response, ORD noted that the Total Water Management approach identifies how to manage water in small communities for water and

- wastewater systems. The ORD Louisville project is working on ‘real’ control of systems and inconsistent rainfall areas within a grid area.
- Forecasting tools for condition assessment work will help
 - Ultrasonic tools to identify leaks would be helpful. MWRA used this; research that correlates leaks to sources would be helpful.
 - Nanotechnology technology and embedded sensors research is big at universities. Example of promising research includes using sewer buoys to float down sewers, and harvesting them at the end of lines.
 - Could sensors be developed that identify toxicity or corrosion more readily?
 - Infrared technology has not been successful in the LA Sewer District; sonar is being used in a limited way, and sensory equipment is being applied.
 - Regarding forensic sewer models, it is better to identify an early warning system (e.g., that would detect exposed rebar within the sewers).
 - Regarding microbial research, it is difficult to see how small communities would apply these research results.
 - A more direct approach towards assessing sewer conditions is to measure Crown pH. This is easy to identify, and technologies are available that would allow operators to identify acidic conditions.
 - At LA County sewer district, a project on sewer crown corrosion with Cal Tech and USC was promising. Also, sulfur oxidizing organism research will be useful. Microbial technologies to identify sewer corrosion in sewers is promising.
 - K curves for pipe failure would be helpful.
 - ORD asked whether utilities see a role for EPA regarding operation and maintenance and cleaning systems. One Committee member noted that the LA Sewer District sprays MgOH slurry into sewers using a robot. This results in a coating or crown on the sewer that lasts a year, and the LA Sewer District found this approach to be the least cost approach towards protection of sewers from deterioration.
 - Regarding software and decision tools:
 - EPA is in a position to dream big. It is unclear whether the focus is to prove whether a technology works or identify the best tools.
 - Economic analyses associated with life cycle analyses (LCA) are almost always wrong. They estimate 20 years, but the systems last 80-100 years. Don't do 20 yr. LCA if systems last 100 yrs.
 - While GIS is an established technology, many small cities, and some big cities, have difficulty in using GIS to maintain their technologies.
 - Retiring members of facilities is an issue; folks with a long history at the facility are being lost.
 - AWI problems can be addressed if individual utilities implemented a rate structure that will maintain the system.
 - Pleased to see peer-reviewed publications by EPA. These are difficult to find; suggest putting them on a website.
 - The ability to transfer technology is policy driven. We need to see how policy drivers integrate into utilities.
 - Utilities and private practitioners should leverage with small business.

- Recommend that annual inspections occur on AWI systems.
- Is EPA working with DOD, especially CERTA and OSDD programs, and also working with NASA regarding remote sensing? DOT has a lot of research on road materials that could relate to pipes.
 - In response, ORD noted it is trying to leverage with other Agencies. DOT is involved on ORD's pipeline research; ORD is discussing cross-over technologies with DOT and NASA. EPA has been talking with DOD on green technologies, and linking with Wright Patterson Air Force Base on corrosion research.

Charge Question 2(b): Comment on whether research on *system rehabilitation* will result in tangible outputs and outcomes that will support Aging Water Infrastructure Research Program goals

Several EEC members noted the following:

- Much of the research proposed by ORD has a short-term outlook (i.e., 10-20 years). For a 21st century approach, we should span beyond cost, safety and risk. We should consider local issues, such as site conditions, water and energy utilization, and cultural topics. We should also consider life-cycle analysis (LCA) of the system, and consider applying LCA as a performance criteria especially associated with materials for piping, lining and grouting.
- EPA should set up a web page where vendors could upload information to EPA.
- Research on system rehabilitation is a very fast changing technology. In addition to technology reviews, ORD should ask technology vendors/industries for information on the status of research on system rehabilitation.
- ORD should consider having greater geographic locational diversity for the projects. We should consider demonstration locations in coastal areas, and in areas needing water conservation.
- Many utilities have great experience with sewer lining, and have moved into the demonstration phase. They could provide EPA with information on their experiences using their sewer lining technologies.
- In addition to pipes, manhole and pump station rehabilitation can substantially reduce the costs of the system. Manhole coatings in particular should be investigated.
- ORD should identify better ways to disseminate information it generates on this topic.

Charge Question 2(c): Comment on whether research on *advanced concepts and innovative treatment technologies* will result in tangible outputs and outcomes that will support Aging Water Infrastructure Research Program goals.

Several EEC members noted the following:

- Scope of *advanced concepts and innovative treatment technologies* research
 - ORD's program is small relative to the challenge.

- In response, ORD noted that the AWI topic is a tremendous challenge, and ORD has relatively small funding to address such a big issue.
 - ORD is attacking the most important and critical issues.
 - Regarding EPA's role in reclamation and renewal technologies: It is unclear whether communities or utilities are doing research on aging water infrastructure. ORD has a key role, and can be seen as a facilitator.
 - It is unclear whether ORD's program is transformative enough. For example, innovative resource recovery could be considered.
 - ORD's research efforts are wonderful, but it is confusing to see that we are building a legacy of the 1970's and '80's. We need regulations and policy to provide incentives for innovative technologies.
- Regarding Total Water Management:
 - Dual lines are a good approach towards reducing water demand.
 - EPA can have a role in assessing the safety of reclaimed water. However, even if reclaimed water can be treated to better quality than drinking water, people will not drink it. EPA has a role in addressing this issue.
 - In response, ORD noted that these are good suggestions and ORD will consider incorporating them.
- Project-Specific Comments:
 - Regarding the LID project, this work is occurring in Cincinnati, Kansas City and Edison NJ. These are all similar climates. ORD should think geographically to allow application of test results across the USA.
 - In response, ORD noted it developed models that input climate, soil, and other data that will fit a watershed no matter the location, with the intent was to have universal application. However, ORD noted that effort is not belittling the need for having good demonstration site data as input to the model, and that there is a lot of money dedicated towards generating good demonstration site data.

Charge Question 2(d): Comment on whether the *cross-cutting, integrative research* on water infrastructure will result in tangible outputs and outcomes that will support Aging Infrastructure Research Program goals

Several EEC members noted the following:

- ORD should research how to manage data better.
- Project scale-up is an issue (e.g., bench to pilot to full-scale studies). Project cost, timing and acceptability is key. For communities with ongoing reuse, this issue will not matter.
- It might be helpful if ORD considered partnering with others to help leverage the work that is being conducted.
 - The public comments from Dr. Rose indicate some interesting ongoing international AWI research projects.
 - Europe is having significant AWI problems and has much experience in addressing such problems, particularly in complex, urban environments.

July 22, 2009

Charge Question 3: Comment on whether the following research approach is appropriately designed in sequence to meet program goals: a) national and regional assessments, b) analyze “state of the technology,” and c) move “state of the technology” forward through demonstration of innovation.

During the meeting, Dr. Dzombak captured the following key points that were made by members of the Committee regarding charge question 3. The Committee members agreed that these accurately summarized their key points:

- a) The sequencing approach is well thought out and appropriate in relation to the program goals. ORD and the AWI program should continue to think about opportunities for parallel work as efforts move into demonstration phase, such as the ongoing evaluation of the state of technology.
- b) Pilot tests should be conducted before full-scale demonstration tests are undertaken. This will enable the most productive use of demonstration project funding, and will help ensure the best chance of success for promising technologies.
- c) EPA is uniquely positioned to meet a significant national need with respect to water infrastructure renewal. EPA’s efforts can include synthesis of data and information already being collected or could be voluntarily generated by utilities, communities, and private organizations on the pilot and full-scale performance of materials, treatment processes, conveyance systems, technologies, and other aspects of the AWI program.
- d) For work done in all phases of the AWI research program, the delivery of the products should be designed so that they can be updated or augmented in the future where feasible.
- e) ORD should maintain contact with States and EPA Regional offices, particularly the water permit writers, to learn about water infrastructure experiences and needs in different parts of the nation and to share AWI information and data on a continuous basis.

Some Additional Comments Made by Committee Members Regarding Charge Question 3:

Several EEC members noted the following:

- Overall approach:
 - ORD’s sequential research strategy is well conceived, coherent, well prepared, and supportable.
 - Utilities are making decisions now on how to address their AWI issues, and much of the information that ORD is working on will be very helpful to them.

- Regarding national and regional assessments:
 - ORD’s national assessments should identify the benefits of research, improvements in performance levels, and reductions in costs for asset replacement due to that research. Doing this would help achieve ‘buy-in’ by communities/utilities across the country to the AWI concepts being put forward by ORD.
- Regarding “state of the technology” Reports:
 - ORD’s state of technology reports are nearing completion. Suggest proceeding in parallel rather than in series with demonstration projects.
 - ORD should produce reports that take advantage of case studies. ORD should screen results of pilot studies, then use that data to identify future demonstration projects.
 - A key issue is gathering information from utilities where technologies have worked, and disseminating that information to utilities. For example, if two or three utilities say a particular water treatment technology works, that information would be helpful to a utility. The utility would first test it, then apply it at their facility if it works.
 - Suggest that ORD create an ‘off-ramp’ between state of the technology reports and full-scale demonstration projects. After state of the technology reports, ORD should prepare manuals, conduct webinars and training, and place information on the internet to gather information that would inform decisions on what technologies should be demonstrated.
 - In response, ORD noted that:
 - ORD’s Edison NJ laboratory is conducting pilot-scale projects first before moving forward.
 - ORD received recommendations/information on July 20, 2009 from Europe’s ‘state of the technology’, through ORD’s ‘new concepts’ program.
 - ORD recently attended several new technology forums in the United Kingdom and France. Most attendees were from Europe. ORD is sorting out information gathered at these forums.
- Regarding demonstration of innovation:
 - It is good to see that ORD is leveraging both pilot- and full-scale demonstration projects.
 - Regarding pilot- vs. full-scale research: While full-scale research is important, and is almost a ‘must’ for utilities; pilot studies remain very important.
 - For a number of ORD’s ongoing demonstration projects, there were already full-scale demonstrations occurring somewhere. Demonstration projects should only fill gaps where there is no ongoing or previous full-scale work. For example, full-scale wastewater treatment and reuse technology projects are already occurring in California and Florida. Full-scale sewer rehabilitation technology projects are already occurring in California.
 - Utilities try to conduct field demonstrations. The effectiveness of ORD’s field demonstrations is significantly tied to how well ORD

- picks good projects to demonstrate, designs the project, gathers data, and informs the public of the results.
- The Palm Beach County, Florida Utility used pilot tests from three different types of industry/treatment technology, before selecting one to demonstrate at full-scale.
 - Many full-scale tests do not succeed. It is very important to make sure pilot studies are ready to be tested at full-scale.
 - ORD's full-scale demonstration efforts are an excellent method for developing research. Utilities will not select an approach until it first sees full-scale results from somewhere across the nation.
 - In response, ORD noted that:
 - Regarding parallel projects and bringing together all analyses, this is a good idea that is worth trying. When dealing with leveraged partners/projects, it becomes messy to accomplish.

Charge Question 4: Comment on whether ORD is collaborating with appropriate research partners, and whether other potential partners should be engaged with.

During the meeting, Dr. Dzombak captured the following key points that were made by members of the Committee regarding charge question 4. The Committee members agreed that these accurately summarized their key points:

- a) The range and diversity of partnerships established in the AWI program is impressive. These commendable partnerships have clearly been developed with careful thought, and will benefit the program and extend its impact.
- b) ORD should consider ways to strengthen its ties to State transportation agencies, Non-Government Organizations, the Association of Environmental Engineering and Science Professors, and other programs and offices within EPA (e.g., EPA's Environmental Technology Verification (ETV) Program, ORD's Sustainable Technology Division (STD), the Office of Water (OW), and the Office of Enforcement and Compliance Assistance (OECA)). The prioritization and definition of specific and tangible goals for each partnership would help maximize the reach of the AWI research program.
- c) There has been little research funding available from federal agencies, industry, or private foundations for water and wastewater infrastructure and conveyance systems over the past 20 years. A sustained program for research in the area of water infrastructure will provide a reservoir of expertise in academia, and assist in the development of innovative technology in this field.

Some Additional Comments Made by Committee Members Regarding Charge Question 4:

Several EEC members noted the following:

- ORD is commended for its extensive collaborative and leveraging efforts on AWI research.
- Suggestions for additional potential AWI research partners:
 - Federal agencies including:
 - U.S. Department of Agriculture (USDA)
 - U.S. Department of Energy (DOE)
 - U.S. Department of Homeland Security (DHS)
 - U.S. Bureau of Reclamation
 - U.S. Army Corps of Engineers
 - U.S. National Park Service have historically verified technology. Park superintendents conducted research, and conducted excellent public outreach and partnered with local universities.
 - U.S. Department of Defense (DOD) research on gas/petroleum and sewer pipes, particularly research on non-invasive technologies.
 - U.S. Department of Transportation (DOT) has ‘wear and tear’ information on exposed facilities, and has conducted research on leak detection.
 - Federal Aviation Administration (FAA) conducts fuel tank research that may help address AWI issues, particularly regarding self-treatment technologies.
 - Oak Ridge National Laboratory may be able to conduct research related to AWI using their own funding.
 - Dr. Aruf Gamoli’s Division at the Oak Ridge National Laboratory has conducted useful research related to the effects of climate change on water resources. His group is receiving research funding from NOAA.
 - EPA’s enforcement work offers opportunities for research. Some Consent Decrees with utilities may include requirements for innovation and research.
 - Agricultural organizations including:
 - U.S. Department of Agriculture (USDA)
 - Agriculture Water Quality Alliance (AWQA).
 - Rural Water Association (conducts activities on water reuse).
 - Social Science Association of America, and American Society of Agronomy, both conduct water reclamation, sequestration, and land use research and applications.
 - Stormwater organizations including:
 - Stormwater partners at State and local roads departments (since such organizations maintain catch basins). Since stormwater may be going to wastewater systems and may be permitted, state and local wastewater organizations may be appropriate.
 - American Public Works Association (APWA)

- Regional and local flood protection agencies/authorities
- CALTRAN and other transportation and stormwater agencies.
- Other organizations including:
 - National Science Foundation (NSF)
 - NSF's EFRI Awards. For example, UC Berkeley is conducting AWI-related work.
 - NSF WATERS Network, particularly regarding work on sensors (e.g., the River-Net project on the Hudson River)
 - Australian Research Council
 - Western and eastern Australia has experienced severe drought years ago, and the cistern industry flourished there. Australia could be tapped for information on cisterns.
 - State and Federal policymakers and regulators. A real driver for AWI technologies may be enforcement offices of States and EPA.
 - U.S. Building Council could generate information on energy costs and water runoff data.
 - The Association of Environmental Engineering and Science Professors (AESP) can help address communication issues. AESP members in this room can assist ORD on this.
 - American Petroleum Institute, National Energy Laboratory in West Virginia, and Electric Power Research Institute have all conducted significant remote sensing technology research, and have information on identifying pipe locations.
 - *ICE* (Instrumentation, and Control Engineering organization)
 - U.S. Gas Industry has conducted a large amount of pipe research. They apply technologies using anodes and cathodes.
 - American Society of Testing and Materials (ASTM) and the Small Business Innovation Research (SBIR) program offers partnership opportunities.
 - National Institute of Standards and Technology (NIST)
 - NGO Advocacy Groups can provide information, and it might be helpful to bring such groups 'to the table' on AWI research.
 - U.S. Green Builders organization
 - Global Water Research Coalition is an excellent organization that focuses primarily on European urban water issues.
 - Advocacy Groups may assist by providing information on a cross-national level.
 - Intergovernmental Panel on Climate Change (IPCC)
 - Builders and developers. For example, some of the AWI work at ORD's Edison laboratory is already being conducted by British Petroleum (BP).
 - Manufacturers also have green groups. It might be helpful to engage/partner with manufacturers and suppliers, since they sell green materials/equipment such as infiltration materials/bricks (e.g., Wal-Mart). Wal-Mart has made a large funding commitment towards green buildings.

- Japan Sewer Works
 - Institute of Electrical and Electronics Engineers (IEEE) for remote sensing technologies
 - Underground utility organizations
 - Computer Vision companies
 - Computer scientists and engineers
 - AWI supercomputer work conducted at the University of Illinois; University of San Diego
 - Arizona State University and University of Arizona's AWI research programs (these universities received some EFRI awards).
- In response, ORD noted that:
- ORD is coordinating with the Australian Research Council to make sure ORD is aware of work they are doing.
 - ORD is working with vendors and manufacturers to conduct free or low cost demonstration projects.
 - ORD is working with EPA's office of water to coordinate on policy and regulatory issues that affect AWI.
 - EPA's OECA office is keeping aware of research that is occurring (particularly work associated with the Kansas City Consent Decree).
 - ORD is coordinating with ASCE, and has worked with CALTRAN (who is very anxious to work with EPA).
 - The APWA had six AWI projects years ago, and it will be helpful to reconnect with these folks. Bob Carr at APWA is an AWI contact who ORD has worked with.
 - The American Petroleum Industry has several instrument associations, and ORD's Rich Field attended several forums developed by API.
 - Regarding NGOs, ORD has not done a lot of work with them, but Dr. Tom Speth has been talking with the ORD/NRMRL/STE Division on how society would best adopt use of AWI technologies. Tom's Division has been working to identify cities in the Midwest that ORD could work with on AWI issues (primarily cities with CSO issues).
 - Regarding enforcement, ORD is working with OECA, regional enforcement groups, and U.S. Department of Justice (DOJ) on AWI issues. ORD's AWI program is working with cities that have agreed-upon compliance schedules, or communities that are in active negotiations with EPA (e.g., Cleveland). These negotiations are sensitive.
 - Regarding Federal/State regulators, ORD developed a Memorandum of Understanding (MOU) with the Association of State and Interstate Water Pollution Control Administrators (ASIWPCA), and Dan attends annual ASIWPCA meetings. A major goal of the MOU is to identify state-level research needs.

Charge Question 5: Comment on whether ORD is engaged with appropriate stakeholders to attain Aging Infrastructure Research Program goals and to transfer results to appropriate users.

During the meeting, Dr. Dzombak captured the following key points that were made by members of the Committee regarding charge question 5. The Committee members agreed that these accurately summarized their key points:

- a) The comprehensive communication plan that ORD has developed for the AWI program is impressive. The plan is well formulated and could serve as a model for other programs within ORD.
- b) An aggressive and sustained communication and dissemination program is critical to maximizing the national impact of the AWI program.
- c) The suggested communication program should be designed to address three distinct tasks: (1) get attention for the AWI program; (2) make information accessible and searchable; and (3) encourage adoption of successful and cost effective technologies and practices related to water infrastructure assessment, rehabilitation, and renewal, and receive feedback from users who adopt AWI technologies and practices.
 - To accomplish these tasks and obtain significant national impact for the AWI program, target audiences need to be carefully considered, outreach should tailor the technology transfer to the specific needs of the stakeholder group, and audiences with the greatest potential for advancing technology should be identified and targeted.
 - Dissemination of results to the practice and education communities is important. Online/distance education, workshops, webcasting, podcasting and publishing of success stories in peer reviewed journals are among the suggested mechanisms for ORD to reach its stakeholders.
 - Train-the-trainer programs are needed. Training programs aimed at educating university faculty members and other trainers need to be developed and conducted.
 - The effectiveness of the communication plan and the extent of its reach should be assessed to help improve it on a continuing basis. One approach that can help with such assessment is introduction of two-way communication vehicles to allow collection of feedback from users on what outreach and dissemination approaches are successful and unsuccessful, and what approaches should be pursued.
 - Development of particular objectives and targets for impact in the form of a “roadmap” for the communication effort will help devise enhancements to the communication plan. The AWI program is encouraged to develop these objectives and targets.

Some Additional Comments Made by Committee Members Regarding Charge Question 5:

Several EEC members noted the following:

- Overall approach:
 - EPA did a good job in identifying a strong stakeholder core group; ORD's list of stakeholders is excellent and robust.
 - The appendix on communication outreach was well written and application to any program. The strategies and use of electronic communication were well described.
 - Regarding transfer of information, ORD should produce guidance documents and workshops which are key to practicing engineers.
 - Training and workshops are key; in the 1970's and 1980's ORD did a lot of this; ORD should continue this approach.
 - ORD's 'Blue-Book' approach was very helpful, and it would be valuable to practicing engineers if ORD continued this approach for AWI.
 - Web-based case study information would be useful.
 - Computer-based collection of information would be helpful. For example, the 'copper nick' software can pull information from reservoirs of data.
 - ORD should conduct one-day seminars that are region- or state-based.
 - The training that EPA did in the late 80's-90's on the new hazardous waste and solid waste landfill design regulations was excellent, and ORD should consider replicating how that training was conducted for AWI training.
 - ORD could 'train the trainers' to teach professors on AWI issues. Consider using the AEESP and WERF to develop and conduct such training.
 - ORD should create a roadmap for the direction of the program, which would identify where are we now, where do we want to go, and some milestones/timeframes for such activities.
 - A key question is how to target the message to appropriate stakeholders.
 - For example, water utilities have staff that choose which information to read; however, smaller utilities have limited staff responsible for this task.
 - ORD should be trying to transfer information to stakeholders. Merely placing information on the web will not necessarily transfer information to target audiences. The question is how to engage folks on these topics.
 - The world is awash with information. It is easy to develop electronic notebooks, but difficult to get folks to pay attention to them.
 - Given ORD's limited budget, staff and time, ORD should think about what not to do.
 - In response, ORD noted that:
 - The recent MOU with the Ohio Water Environment Association (an arm of WEF) is a state-level organization that ORD wanted to engage with, to provide outreach to the state and local level.
 - ORD will experiment with 'E-Blasts'; web-based messages, and other forms of electronic communication.

- Regarding the Kansas City project: ORD is developing a communication plan that will be seeking input from the greater Kansas City area. This approach will be used elsewhere.
- Regarding academia and students: The drinking water industry, and corrosion professionals in particular, have a handful of folks that regularly go to meetings and conferences. These folks are concerned that there is not a large community in academia who are working on this topic.
- Regarding 'train the trainer': A question is who are small systems going to for information? They are going to states, and small engineering firms. ORD is paying for one person per state to attend a workshop that will train these folks about ORD's AWI program.
- A key question raised is how do folks get information, and how to these folks want to get information. ORD has asked this question at workshops, AWWA, and in other meetings. The main feedback from folks is that they like receiving information from the web.
- ORD is putting together a You-Tube video, and will be able to point folks to that.
- Regarding academia, Oxford University has a technical communication MS degree, and has great ideas for disseminating information.
- Regarding measuring success: For the arsenic program, ORD surveyed old technologies before developing arsenic demonstration projects. New technologies were initiated based on that survey feedback.
- ORD management delegated the role of communication to NRMRL staff.
- In the August 2009 Civil Engineering Journal, there will be information on communication of information.
- EPA could develop fact sheets; various engineering firms have noted they like receiving those.
- ORD's Kansas City project includes working with a utility to identify more technologies.
- ORD has been communicating with EPA Headquarters for years on a number of AWI topics, including with Office of Water on CSO and SSO issues. ORD has developed a number of key contacts with OW, and thinks it's doing a good job on this front.

Concluding Discussions:

Dr. Speth:

- Thanks to all EEC members for coming to Cincinnati to help ORD on its AWI research program.
- This meeting has been extremely helpful. ORD did not hear anything that it truly objected to over the past two days. It was good to be able to reflect and discuss with experts for the past two days on where the program is and where it should be.
- Ultimately, ORD needs to identify improvements for the AWI program. ORD has made some impacts, and needs to document those impacts in order to assist the US AWI programs and affected community.
- ORD can not get into the policy arena. ORD assists in development of policy by participating on workgroups that write regulations. ORD can not unilaterally change policy.

Dr. Dzombak:

- Thanks to ORD for the opportunity to assist on the AWI research program. If ORD would like to come back to SAB for future assistance in its AWI research program, please feel free to do so.
- Thanks very much to the EEC members and expert consultants who participated on this consultation. This was a great group. You all did your homework, were cooperative, and your comments were very well considered.
- We will prepare a summary letter to the Administrator of about 2-3 pages, and will use our notes to help draft the letter. The draft letter will be sent to the EEC for review. Individual member comments will be attached to the letter.
- Committee members should send Ed Hanlon their written comments by August 5th. The members should organize/write their comments to the charge questions to which they were assigned, and distinguish overarching comments and specific comments. Two pages of comments are fine. We are not necessarily looking for ten pages of comments, but if you would like to do that, that's fine.

Dr. Vanessa Vu:

- The goal is to send the letter to the Administrator by early September, 2009.
- Thanks very much to the EEC members and expert consultants, and to ORD NRMRL laboratory.

Meeting adjourned at 12:15 pm.

Respectfully Submitted:

/S/

Mr. Edward Hanlon
Designated Federal Officer

Certified as True:

/S/

Dr. David A. Dzombak, Chair
Environmental Engineering
Committee

Attachment 1: Committee Roster

**U.S. Environmental Protection Agency
Science Advisory Board
SAB Environmental Engineering Committee (EEC) Augmented to
Provide Consultative Advice on EPA's Aging Drinking Water and
Wastewater Infrastructure Research Initiative**

CHAIR

Dr. David A. Dzombak, Walter J. Blenko Sr. Professor of Environmental Engineering, Department of Civil and Environmental Engineering, Carnegie Mellon University, Pittsburgh PA

MEMBERS

Dr. Viney Aneja, Professor, Department of Marine, Earth, and Atmospheric Sciences, North Carolina State University, Raleigh, NC

Dr. John C. Crittenden, Director of the Brook Byers Institute for Sustainable Systems, Hightower Chair and GRA Eminent Scholar in Sustainable Systems, and Professor of Civil and Environment Engineering, School of Civil and Environmental Engineering, Georgia Institute of Technology, Atlanta, GA

Dr. Cindy M. Lee, Professor, Department of Environmental Engineering and Earth Sciences, Clemson University, Anderson, SC

Dr. Reid Lifset, Associate Director of the Industrial Environmental Management Program and Resident Fellow in Industrial Ecology, School of Forestry and Environmental Studies, Yale University, New Haven, CT

Dr. James R. Mihelcic, Professor, Civil and Environmental Engineering, State of Florida 21st Century World Class Scholar, University of South Florida, Tampa, FL

Dr. Horace Moo-Young, Dean and Professor, College of Engineering, Computer Science, and Technology, California State University, Los Angeles, CA

Dr. Catherine A. Peters, Associate Professor, Department of Civil and Environmental Engineering, Princeton University, Princeton, NJ

Dr. Mark Rood, Professor, Department of Civil and Environmental Engineering, University of Illinois, Urbana, IL

Dr. John R. Smith, Division Manager, Environmental Science and Sustainable Technology, Alcoa Inc., Alcoa Center, PA

Consultants

Mr. John Colbert, Manager, Maintenance, Metropolitan Field Operations Department, Massachusetts Water Resources Authority (MWRA), Boston, MA

Mr. Larry Jaworski, Vice President, Black & Veatch Inc., Gaithersburg, MD

Mr. Larry Johnson, Assistant Department Director for the Water Utilities Department, Palm Beach County, West Palm Beach, FL

Ms. Liliana Maldonado, Senior Vice President and Northeast Regional Manager, CH2M Hill Inc., Chantilly, Virginia

Mr. Michael Selna, former Assistant Chief Engineer/General Manager, Los Angeles County Sanitation Districts, Whittier, CA

Dr. Vanessa Speight, Associate, Malcolm Pirnie Inc., Arlington, VA

Dr. Michael K. Stenstrom, Distinguished Professor, Civil and Environmental Engineering Department, University of California at Los Angeles (UCLA)

SCIENCE ADVISORY BOARD STAFF

Mr. Edward Hanlon, Designated Federal Officer, U.S. Environmental Protection Agency, Science Advisory Board Staff, Washington, DC

Attachment 2: Agenda - EEC July 2009 Committee Meeting

**U.S. ENVIRONMENTAL PROTECTION AGENCY
SCIENCE ADVISORY BOARD
Environmental Engineering Committee
Public Meeting
July 21 and 22, 2009
Kingsgate Marriott Conference Hotel at the University of Cincinnati
151 Goodman Drive, Cincinnati, Ohio, 45219**

AGENDA

July 21, 2009

- 8:30 - 8:35 a.m. **Opening Remarks**
Mr. Edward Hanlon, Designated Federal Officer
- 8:35 - 8:40 a.m. **Welcoming Remarks**
Dr. Vanessa Vu, Director, Science Advisory Board
- 8:40 - 8:50 a.m. **Purpose of the Meeting and Review of Agenda**
Dr. David A. Dzombak, Chair
- 8:50 – 10:15 a.m. **Overview of EPA’s Aging Drinking Water and Wastewater
Infrastructure Research Initiative**
Dr. Thomas Speth, Acting Division Director, EPA’s Office of
Research
and Development (ORD), National Risk Management Research
Laboratory (NRMRL), Water Supply and Water Resources
Division
(WSWRD), and other members of EPA/ORD
- 9:05 – 9:20 a.m. Condition assessment research
Dan Murray, EPA/ORD/NRMRL/WSWRD
- 9:20 – 9:35 a.m. System rehabilitation research
Ari Selvakumar, EPA/ORD/NRMRL/WSWRD, Urban Watershed
Management Branch
- 9:35 – 9:50 a.m. Advanced concepts research; innovative treatment technologies
research
Rich Field, EPA/ORD/NRMRL/WSWRD, Urban Watershed
Management Branch

July 21, 2009 (continued)

9:50 – 10:05 a.m. Cross-cutting, integrative research
Darren Lytle, EPA/ORD/NRMRL/WSWRD, Treatment
Technology
Evaluation Branch

10:05 – 10:15 a.m. Goals for consultation from ORD perspective
Dr. Thomas Speth, Acting Division Director,
EPA/ORD/NRMRL/WSWRD

10:15 – 10:30 a.m. **BREAK**

10:30 – 10:45 a.m. **Review of Charge Questions**
Dr. David A. Dzombak and Dr. Thomas Speth

10:45 – 11:00 a.m. **Public Comments**

11:00 – 11:45 a.m. **Committee Discussion – Charge Question 2(a)**
Dr. David A. Dzombak, Chair, and Committee Members

- Charge Question #2(a): Comment on whether research on *condition assessment* will result in tangible outputs and outcomes that will support Aging Infrastructure Research Program goals
 - Charge Question #2(a):
 - Mr. John Colbert
 - Dr. Michael K. Stenstrom
 - Mr. Larry Jaworski
 - Dr. Horace Moo-Young

11:45a.m.–12:45p.m. **LUNCH**

12:45 – 1:30 p.m. **Committee Discussion – Charge Question 2(b)**

- Charge Question #2(b): Comment on whether research on *system rehabilitation* will result in tangible outputs and outcomes that will support Aging Infrastructure Research Program goals
 - Charge Question #2(b):
 - Mr. Larry Johnson
 - Dr. James R. Mihelcic
 - Dr. John C. Crittenden
 - Ms. Liliana Maldonado

July 21, 2009 (continued)

- 1:30 – 2:15 p.m. **Committee Discussion – Charge Question 2(c)**
- Charge Question #2(c): Comment on whether research on *advanced concepts and innovative treatment technologies* will result in tangible outputs and outcomes that will support Aging Infrastructure Research Program goals
 - Charge Question #2(c):
 - Dr. John C. Crittenden
 - Mr. Michael Selna
 - Dr. John R. Smith
 - Dr. Michael K. Stenstrom
- 2:15 – 3:00 p.m. **Committee Discussion – Charge Question 2(d)**
- Charge Question #2(d): Comment on whether the *cross-cutting, integrative research* on water infrastructure will result in tangible outputs and outcomes that will support Aging Infrastructure Research Program goals
 - Charge Question #2(d):
 - Dr. Mark Rood
 - Dr. Vanessa Speight
 - Dr. James R. Mihelcic
 - Dr. Catherine Peters
- 3:00 – 3:15 p.m. **BREAK**
- 3:15 – 4:15 p.m. **Committee Discussion – Charge Question 1**
- Charge Question #1: Comments on major goals of aging water infrastructure program, including: a) whether program is focused appropriately on major water infrastructure technical issues, and b) what refinements could improve program effectiveness.
 - Charge Question #1:
 - Dr. Catherine Peters
 - Mr. Michael Selna
 - Dr. Cindy Lee
 - Ms. Liliana Maldonado
- 4:15 – 4:45 p.m. **Summary and Discussion of Key Points – Charge Questions 1 & 2**
- Dr. David A. Dzombak, Chair, and Committee Members
- 4:45 – 5:00 p.m. **Review of Plan for July 22; Closing Comments**
- Dr. David A. Dzombak, Chair, and Committee Members

July 22, 2009

8:00 – 8:10 a.m.

Reconvening of Meeting

Edward Hanlon, DFO

8:10 – 8:15 a.m.

Review of Agenda for July 22

Dr. David A. Dzombak, Chair

8:15 – 9:15 a.m.

Committee Discussion – Charge Question 3

- Charge Question #3: Comment on whether the following research approach is appropriately designed in sequence to meet program goals: a) national and regional assessments, b) analyze “state of the technology,” and c) move “state of the technology” forward through demonstration of innovation
 - Charge Question #3:
 - Mr. Larry Johnson
 - Dr. Reid Lifset
 - Mr. John Colbert
 - Dr. Mark Rood

9:15 – 10:00 a.m.

Committee Discussion - Charge Question 4

- Charge Question #4: Comment on whether ORD is collaborating with appropriate research partners, and whether other potential partners should engaged with
 - Charge Question #4:
 - Mr. Larry Jaworski
 - Dr. Cindy Lee
 - Dr. Viney Aneja
 - Dr. John R. Smith

10:00 – 10:15 a.m.

BREAK

10:15 – 11:00 a.m.

Committee Discussion – Charge Question 5

- Charge Question #5: Comment on whether ORD is engaged with appropriate stakeholders to attain Aging Infrastructure Research Program goals and to transfer results to appropriate users.
 - Charge Question #5:
 - Dr. Horace Moo-Young
 - Dr. Vanessa Speight
 - Dr. Viney Aneja
 - Dr. Reid Lifset

July 22, 2009 (continued)

- 11:00 – 11:30 a.m. **Summary and Discussion of Key Points –
Charge Questions 3-5**
Dr. David A. Dzombak, Chair, and Committee Members
- 11:30 – 11:50 a.m. **Feedback from EPA ORD Regarding EEC Response to
Charge Questions**
Dr. Thomas Speth, EPA ORD
- 11:50a.m.–12:00p.m. **Summary of the Discussion and Action Items**
Dr. David A. Dzombak, Chair, and Committee Members
- 12:00 p.m. **Adjourn**
Edward Hanlon, DFO

Attachment 3: EPA Charge Questions to the Committee

June 29, 2009

MEMORANDUM

SUBJECT: Consultation on the Aging Water Infrastructure Research Program

FROM: Sally Gutierrez, Director */signed/*
Office of Research and Development
National Risk Management Research Laboratory

TO: Vanessa Vu, Director
Science Advisory Board Staff Office

This is to request that the Science Advisory Board (SAB) Environmental Engineering Committee (EEC) conduct a consultation of the Office of Research and Development's Aging Water Infrastructure Research Program.

Background

In support of EPA's Sustainable Water Infrastructure Initiative, the Office of Research and Development (ORD) initiated a research program in 2007 to improve and evaluate innovative technologies and techniques for reducing the cost and improving the effectiveness of operations, maintenance, and replacement of aging and failing systems for drinking water and wastewater treatment and conveyance. The outputs from this research program are intended to assist EPA's program and Regional offices to implement Clean Water Act and Safe Drinking Water Act requirements; to help States and Tribes meet their programmatic requirements; and to assist utilities to more effectively implement comprehensive management of drinking water and wastewater treatment and conveyance systems, provide reliable service to their customers, and meet their statutory requirements. ORD's 2007 Innovation and Research for Water Infrastructure for the 21st Century Research Plan (600/X-09/003) proposes work relating to infrastructure condition assessment, system rehabilitation, infusion of advanced design and management concepts, and evaluation of innovative treatment technologies. ORD's 2007 Innovation and Research for Water Infrastructure for the 21st Century Research Plan (600/X-09/003) is available on the following web site: <http://www.epa.gov/awi>.

Specific Request

ORD requests that EEC provide advice on whether the program goals, research focus areas, research approach, research partners, and communications and program interactions are properly directed to have a significant national impact of the major

technical issues facing our nation's aging water infrastructure. Specifically, ORD asks that the EEC address the following charge questions:

Consult Charge Questions

1. The two major goals of this program are to:

generate science and engineering to improve and evaluate innovative technologies and techniques to reduce costs and improve operational efficiency, maintenance, and replacement of aging and failing drinking water, wastewater treatment and conveyance systems; and

assist EPA's program and Regional offices, States and Tribes to meet their program requirements, and assist utilities to more effectively implement comprehensive asset management, provide reliable service to their customers, and meet their Clean Water Act and Safe Drinking Water Act requirements

Given these goals, is the program appropriately focused to make a significant national impact on the major technical issues facing our aging water infrastructure? Could the program goals be refined to improve program effectiveness?

2. Are the research focus areas (condition assessment, system rehabilitation, advanced concepts, and innovative treatment technologies) and the related cross-cutting research likely to result in tangible impacts that will support the program goals? Do the program activities and projects appropriately support the current program goals or are additional activities or projects necessary?
3. The sequential research approach of the program is designed to develop national and regional assessments, analyze the "state of the technology", and move the "state of the technology" forward through innovative field demonstrations. Is this sequential research approach appropriate to address the goals of the program? Is the program's concentration on infusing innovation through field demonstrations appropriate?
4. Are we collaborating with the appropriate research partners? Are there other potential partners that we should engage?
5. Through our communication and program interactions, are we engaged with the appropriate stakeholders to understand the research needs in this area, attain the goals of the program and to transfer the research and technology demonstration results to the appropriate users?

If you have any questions about this request, please contact Dr. Thomas Speth, Acting Division Director, Water Supply and Water Resources Division at Speth.thomas@epa.gov or 513-569-7208.

Attachment 4: Presentation by Dr. Thomas Speth on Overview of EPA's Aging Drinking Water and Wastewater Infrastructure Research Initiative

Aging Water Infrastructure Research Program SAB Consultation Innovation & Research for the 21st Century

*Dr. Thomas Speth, Acting Director
Water Supply and Water Resources Division*



National Problem

President Obama has called for water and wastewater infrastructure projects with an investment of \$6 billion

- One of the top national water program priorities
- Anticipating an increase in water and wastewater infrastructure projects as a result of economic stimulus package
- Top priority of the U.S. Conference of Mayors
- Wastewater and drinking water systems rated **D-** by the American Society of Civil Engineers (2009)

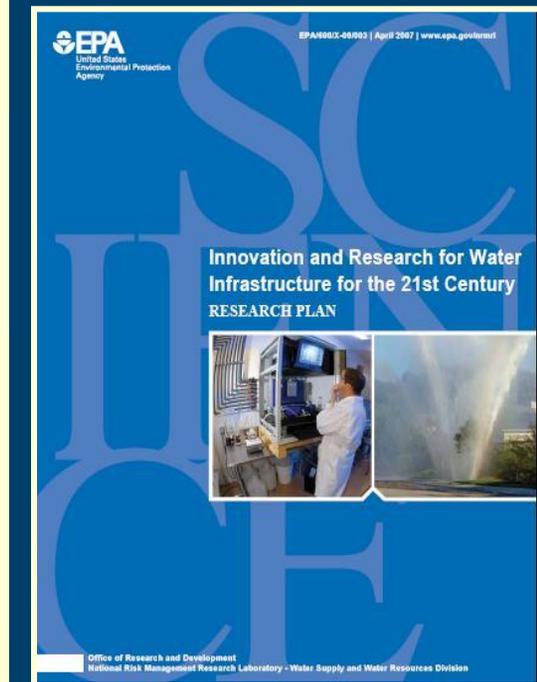


The Infrastructure funding gap could reach beyond \$500 billion in 20 years.

Source	Cost / Year (Billions)		
	Drinking Water	Wastewater	Total
Congressional Budget Office	8	11	19
Water Infrastructure Network	9	9	18
EPA Gap Analysis Report	13	14	27

AWI Research Plan

- **Experts Workshop:** March 2006 - Provided input and established the foundation for the development and focus of this national water infrastructure research initiative.
- **Research Issues Report:** July 2006 - Supported the development of the Research Plan by revealing gaps between research priorities identified by stakeholders and current on-going/planned research.
- **AWI Research Plan:** April 2007 - Externally peer reviewed research plan completed.
- **AWI Research Program:** August 2007- Program Initiated.
- **Science Advisory Board Consultation:** July 2009 - Meeting
- **Science Advisory Board Consultation:** September 2009 - Anticipated SAB consultation report.



EPA/600/X-09/003

AWI Research Program

Goal: To evaluate and demonstrate innovative technologies and improve the cost effectiveness of operation, maintenance, and replacement of aging and failing water infrastructure

Strategies

- Provide critical research results and outputs:
 - that support the Office of Water's Sustainable Water Infrastructure Initiative.
 - that can be provided to drinking water and wastewater utilities.
- Determine the innovative technologies that can cost-effectively improve performance and extend the life of existing infrastructure.
- Conduct national assessments to identify the effects of major influencing factors on future system threats and demands.
- Develop new designs and approaches that will maintain the long-term performance of water infrastructure.
- Determine the factors that affect infrastructure deterioration to predict and prevent system failure.

CONDITION ASSESSMENT



SYSTEM REHABILITATION



Research Areas



ADVANCED CONCEPTS



INNOVATIVE TREATMENT TECHNOLOGIES FOR WASTEWATER & WATER REUSE

AWI Research Program

Goal: To evaluate and demonstrate innovative technologies and improve the cost effectiveness of operation, maintenance, and replacement of aging and failing water infrastructure

Impact on Costs

Based on national estimates of infrastructure funding needs, a 1% cost savings equates to \$9 billion.

Cost Comparison of Traditional and Green Infrastructure			
Project	Traditional Cost	Green Cost	Savings
Laurel Springs, WI	\$1,654,021	\$1,149,552	30%
Gap Creek, AR	\$4,620,600	\$3,942,100	15%
Prairie Glen, IL	\$1,004,848	\$599,536	40%

2007 OWOW report

CONDITION ASSESSMENT



SYSTEM REHABILITATION



Research Areas



ADVANCED CONCEPTS



INNOVATIVE TREATMENT TECHNOLOGIES FOR WASTEWATER & WATER REUSE

Expected Impacts

CONDITION ASSESSMENT

Improved methods of determining the structural, operational and performance status of capital infrastructure assets by...

- Reducing infrastructure failures and their adverse public health, safety, environmental, and economic effects by improved condition assessment technologies.
- Reducing water loss in distribution systems by providing more reliable leak detection.
- Enabling the prioritization of critical infrastructure to inspect, monitor, and assess the performance of rehabilitation activities.
- Increasing the Agency effectiveness by establishing an adaptation research framework.
- Incorporating corrosion research into regulatory guidance and technical assistance for various clients and stakeholders.



Expected Impacts

SYSTEM REHABILITATION

Increased effectiveness of infrastructure repair, renewal, and replacement of drinking water or wastewater systems by...

- Lowering the cost and increasing effectiveness of design, operation, maintenance, rehabilitation, and replacement of aging water infrastructure.
- Extending the service life and functionality of existing conveyance systems and reducing their life cycle cost.



Expected Impacts

ADVANCED CONCEPTS

Increased adoption of new and innovative infrastructure designs, management procedures and operational approaches by...

- Lowering the national cost for CSO control by using green infrastructure, and improving the aesthetic value of drainage infrastructure.
- Increasing the acceptance of permeable surfaces, such as permeable asphalt, porous concrete, and paver stone systems.
- Enhancing acceptance of new and innovative technologies for retrofitting green roofs on existing building.
- Improving the understanding of the performance, limitations, and costs of dual distributions systems.
- Assessing the effectiveness of advanced drinking water quality monitoring-modeling-control approaches.



Expected Impacts

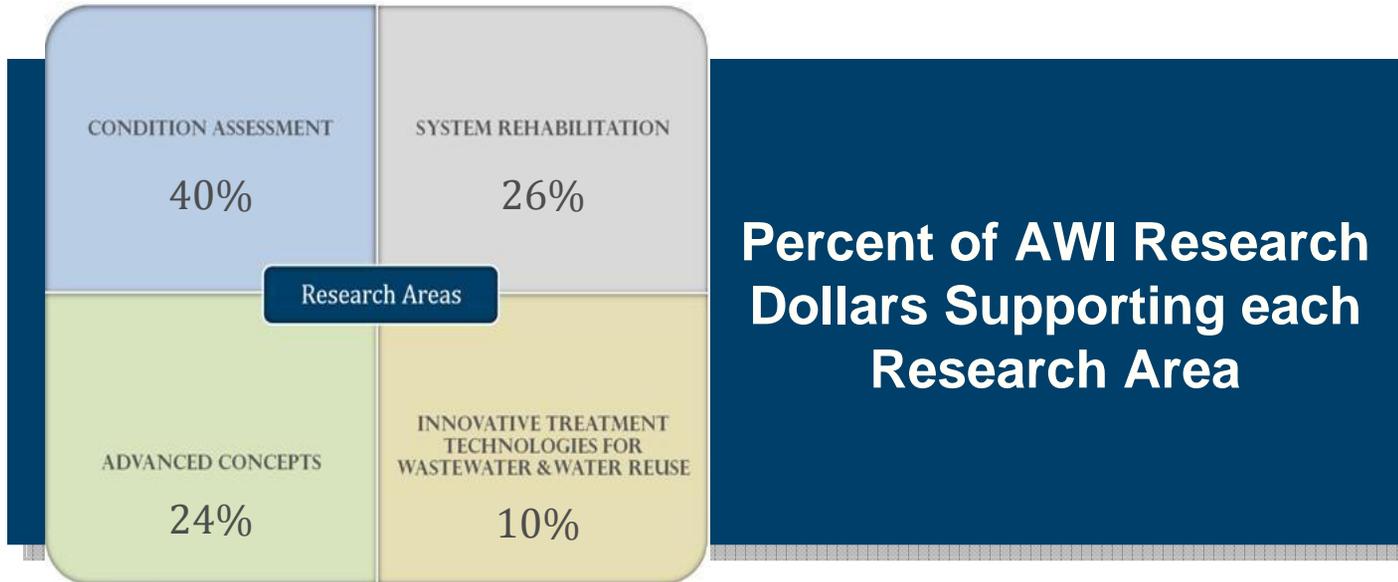
INNOVATIVE TECHNOLOGIES FOR WASTEWATER & WATER REUSE

Improved water quality and increased reliance on safe and dependable reclaimed wastewater and storm water by...

- Increasing acceptance of new and innovative technologies by decision makers who adopt, regulate, and design infrastructure technologies.
- Updating engineering design guidance for nutrient and emerging contaminant removal at municipal wastewater treatment plants.
- Improving guidance to state, regional, and local governments on water reuse technologies.



Resources



EPA/ORD FTE Supporting the AWI Research Program

Area	FY				
	2008	2009	2010	2011	2012
Drinking Water	3.1	3.1	3.1	3.1	3.2
Water Quality	5.7	5.7	6.5	7.2	7.5
Total	8.8	8.8	9.6	10.3	10.7

Accomplishments to Date

Agreements & Grants

- \$10M Cooperative Agreement - *Innovation and Research for Water Infrastructure for the 21st Century (2009)*
- STAR Grants - *\$1.5M awarded in 2009*

Ongoing Projects

- 26 research projects in support of the Program

State of Technology and Assessment Reports:

1. **Nutrient Control Design Manual** (EPA/600/R-09/012)
2. **Rehabilitation of Wastewater Collection and Water Distribution Systems** (EPA/600/R-09/049)
3. **Condition Assessment of Wastewater Collection Systems** (EPA/600/R-09/048)
4. **Condition Assessment of Water Transmission and Distribution Systems** (EPA/600/R-09/055)
5. **Advanced Drainage Concepts** (7/30/2009)
6. **National Assessment on Water Infrastructure Adaptation to Climate Change** (7/31/2009)

Presentations & Publications

- 15 publications & over 60 presentations

Forums/Workshops

- First National Expert and Stakeholder Workshop on Water Infrastructure Sustainability and Adaptation to Climate Change (2009)
- EPA Asset Management Workshop (2008)
- Three National EPA forums on condition assessment and rehabilitation of conveyance systems (2008)
- Two International EPA forums on advanced/green drainage concepts (2008)
- Green infrastructure research forum, cosponsored by OW and ORD (2007)
- Workshop on Innovation and Research for Water Infrastructure in the 21st Century (2006)

Leveraging

Enhanced Program's research capabilities by leveraging with outside entities...

... by more than doubling research investment to date.

- **\$5 Million** - Kansas City National Green Infrastructure Demonstration Project
- **\$4.5 Million** - NCER STAR Grants Solicitation
- **\$3.3 Million** - Cooperative Agreement Awarded to WERF
- **\$1.8 Million** - B & F funds for Porous Pavement Parking Lot Demonstration Site

...by leveraging personnel and resources from Agency Offices.

- **OW, OAR, 4 Regions** - First National Expert and Stakeholder Workshop on Water Infrastructure Sustainability and Adaptation to Climate Change
- **Region 2** - Porous Pavement Testing Facility at the Edison Environmental Center
- **OW, OST, Regions 1, 5, & 10** - Nutrient Control at POTWs – State of the Technology Review Report and Technology Transfer Seminars
- **Region 2, OW** - Green Roof Project at the Edison Environmental Center

...by leveraging technical expertise and facilities from national municipalities, universities, and associations.

- **City of Cincinnati/University of Cincinnati/Metropolitan Sewer District** - EPA AWBERC green infrastructure demonstration project
- **City of Kansas City** - National green infrastructure demonstration project
- **City of Louisville Water Company** - Innovative condition assessment and leak detection technology demonstration
- **University of Houston** - Multi-vendor grouting verifications
- **National Asphalt Pavement Association, Northeast Cement Shippers Association, and Interlocking Concrete Pavement Institute** - Porous Pavement Testing Facility at the Edison Environmental Center

...by collaborating with governments, organizations, and universities from other nations.

- **New Zealand** - Green Roof Project at the Edison Environmental Center with the University of Auckland
- **United Kingdom** - Application of SUSTAIN to new urban community in England by Penine Water Group and Sheffield University

Future Possibilities...

- Full-scale condition assessment and rehabilitation demonstration projects with multiple municipalities across the nation.
- Full-scale demonstrations of green technologies to control CSO for broader application.
- Forensic studies for investigation of infrastructure failures for a wider range of pipe materials under different environmental settings.
- Expanded test facilities to enhance in-house capabilities
- Infrastructure decision support/asset management, including life-cycle cost analysis and engineering risk assessment.



In Conclusion

The AWI Research Program...

- will put EPA on the forefront of addressing the nationwide high priority need for drinking water and wastewater infrastructure research.
- will allow EPA to play a national and international leadership role by cooperating and collaborating with its federal, national and international research partners.
- outputs will assist utilities to more effectively implement comprehensive asset management, provide reliable service to their customers, and meet the Clean Water Act and Safe Drinking Water Act requirements.
- supports and will enhance OW's Sustainable Water Infrastructure Initiative.
- has helped foster communication between ORD and OW.



Questions?

Attachment 5: Presentation by Dan Murray on Condition Assessment Research

Aging Water Infrastructure Research Program SAB Consultation Infrastructure Condition Assessment

*Daniel J. Murray, Jr., P.E., BCEE, M.ASCE
Water Supply and Water Resources Division*



Condition Assessment

Goals:

- To generate the science and engineering to improve and evaluate promising innovative technologies and techniques.
- To enable utilities to make technically sound asset management judgments based on the condition of their assets.



Components:

- Collection of data and information through direct inspection, observation, investigation, in-direct monitoring and reporting.
- Analysis of data and information to make a determination of the structural, operational and performance status of capital infrastructure assets.
- Failure analysis, which seeks to determine the causes of infrastructure failures in order to estimate remaining useful life and to prevent future failures.

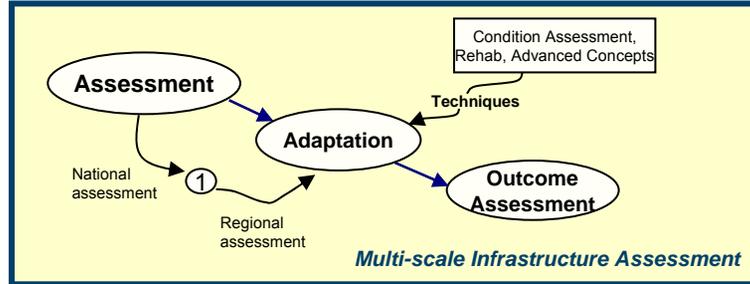
Key Projects

- National/regional infrastructure assessments
 - Example: Climate change adaptation
- Condition assessment of wastewater collection systems
 - Example: SSOAP
- Condition assessment of drinking water distribution systems
 - Example: Leak detection technology development
- Controlled condition testing facility



National and Regional Infrastructure Assessment

Multi-Scale Infrastructure Assessment



- Assessing infrastructure sustainability and adaptability on national and then regional levels
- Develop/suggest adaptations to meet the needs of the region
- Assess the outcomes of the adaptations

Major Components of Assessment

Prediction Uncertainty Management

Developing ways to manage the impact of model uncertainties in infrastructure decisions.

Water Availability

Assessing the impacts of climate changes and land use developments in terms of water availability.

Water Conservation

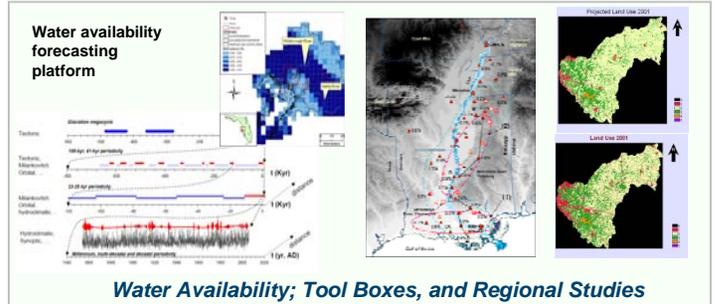
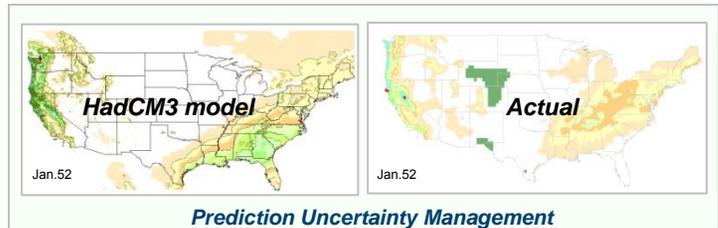
Developing and applying advanced techniques and technologies to reduce water loss and water quality deterioration during distribution.

Water Reuse

Identifying regions and technologies to amend water resource availability under future climatic and global conditions.

Water Resources in Energy Production

Assessing and developing water conservation policies and infrastructure for sustainable energy productions.





Proceedings of the First National Expert
and Stakeholder Workshop on Water
Infrastructure Sustainability and
Adaptation to Climate Change



U.S. Environmental Protection Agency
Office of Research and Development
Office of Water

April 2009
EPA-600-R-09-010

Infrastructure Adaptation to Climate Change



EPA Stakeholder Workshop

Condition Assessment of Wastewater Collection Systems

Objectives:

- Evaluate current and innovative condition assessment technologies and assess the state of the technology
- Prepare for and conduct field demonstrations of selected innovative technologies to provide third-party cost and performance data

Major Tasks:

- Establish stakeholder group
- Assess and report on State of the Technology
 - International technology forum
- Develop protocols and metrics for technology demonstrations
- Develop site selection criteria for technology demonstrations
- Conduct field demonstrations



Schedule

- Initiated in December 2007
- Estimated Completion in December 2010

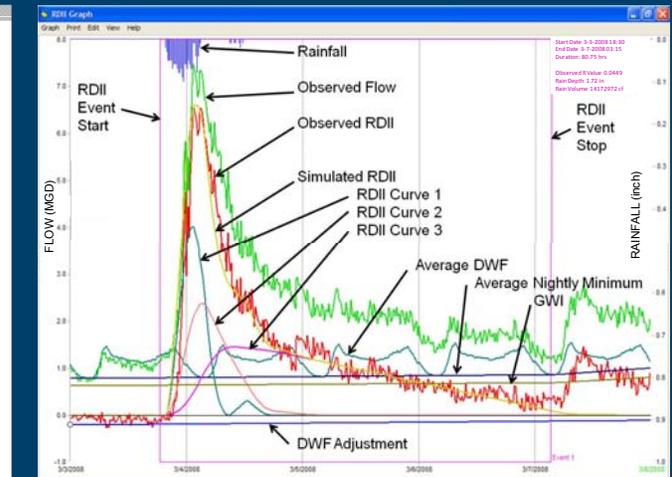
Research Partners

- Cadmus Group
- Louis Berger Group
- ADS Environmental Services
- Redzone Robotics

Sanitary Sewer Overflow Analysis and Planning Toolbox (SSOAP)

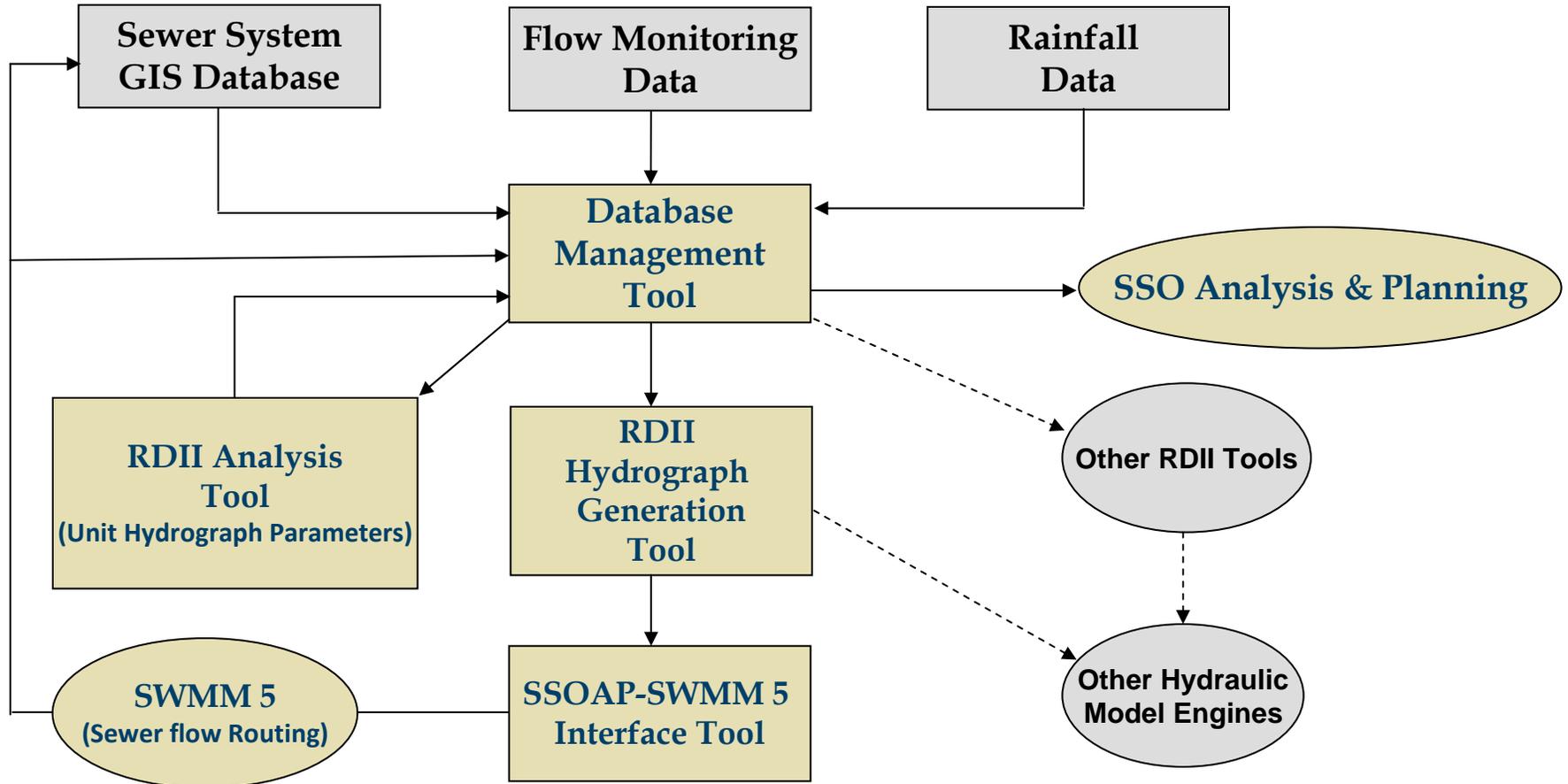
- Condition assessment toolbox using flow monitoring data.
- Analyze sewer flow data to determine characteristics and infiltration and inflow rates.
 - Prioritize collection system subareas for inspection and condition assessment
 - Conduct performance assessment of rehabilitation activities

- SSOAP was developed under a cooperative research and development agreement (CRADA) with CDM
- Two reports published
- Three one-day workshops conducted
- Two-day hands-on training conducted in March 2009 for 10 beta testers in VA
- Public release of SSOAP expected August 2009



RDII Graph

SSOAP Toolbox



Condition Assessment of Drinking Water Distribution Systems

Objectives:

- Evaluate current and innovative condition assessment technologies and assess the state of the technology.
- Prepare for and conduct field demonstrations of selected innovative technologies to provide third-party cost and performance data.

Major Tasks:

- Stakeholder group
- State of the Technology (SOT) assessment
 - International technology forum – SOT Report on condition assessment of ferrous mains
 - Predictability/preventability indices feasibility
 - Pipe condition curves SOT
 - Inspection technology usage
 - Federal research technology transfer opportunities
 - Critical research review
- **Technology Field Demonstrations** – Louisville, KY



Research Partners

- **Battelle Institute**
- **Jason Consultants**
- **Virginia Tech**
- **National Research Council of Canada**
- **PARS (Picatinny Arsenal Research Services) Environmental Services**

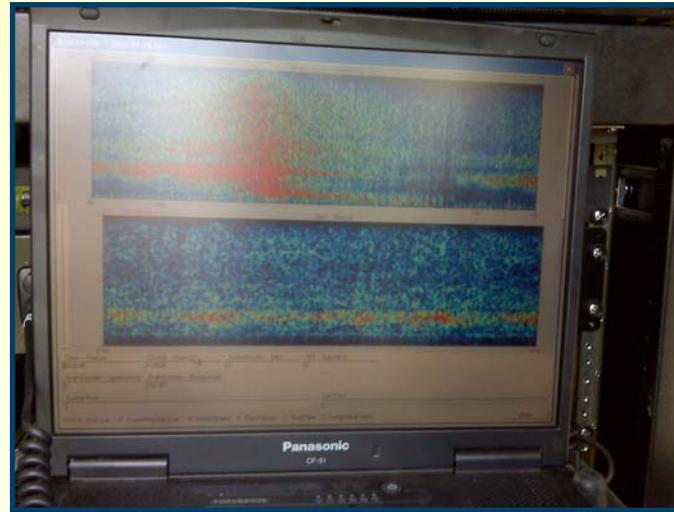


Condition Assessment Technology Demonstration Louisville, KY

Demonstration Hosted by Louisville Water Company

- 2500-ft, 24-inch, cement-lined, ductile iron pipe, 76-yr old
- Recent breaks, reduced flow; seven previous leaks found
- Demonstration period: July 6th – August 21st
- Pipe will be replaced and upsized to 30-inch in September
- Demonstration in progress
 - 13 technologies; 6 vendors
 - 7 developmental and 6 commercial
 - Leak detection and external & internal inspection
- Post-demonstration pipe extraction and condition confirmation – August 21st - September 15th

Condition Assessment Technology Demonstration Louisville, KY



Water Pipe Leak Detection Experimental Station

Goal: Locate leaks to within a few centimeters with significantly reduced false identifications.

- Research the application of acoustic/noise logger technology using state of the technology “leak noise correlation” techniques.
- Leak noise correlation techniques in development have the potential to improve detection accuracy in noisy field operations.

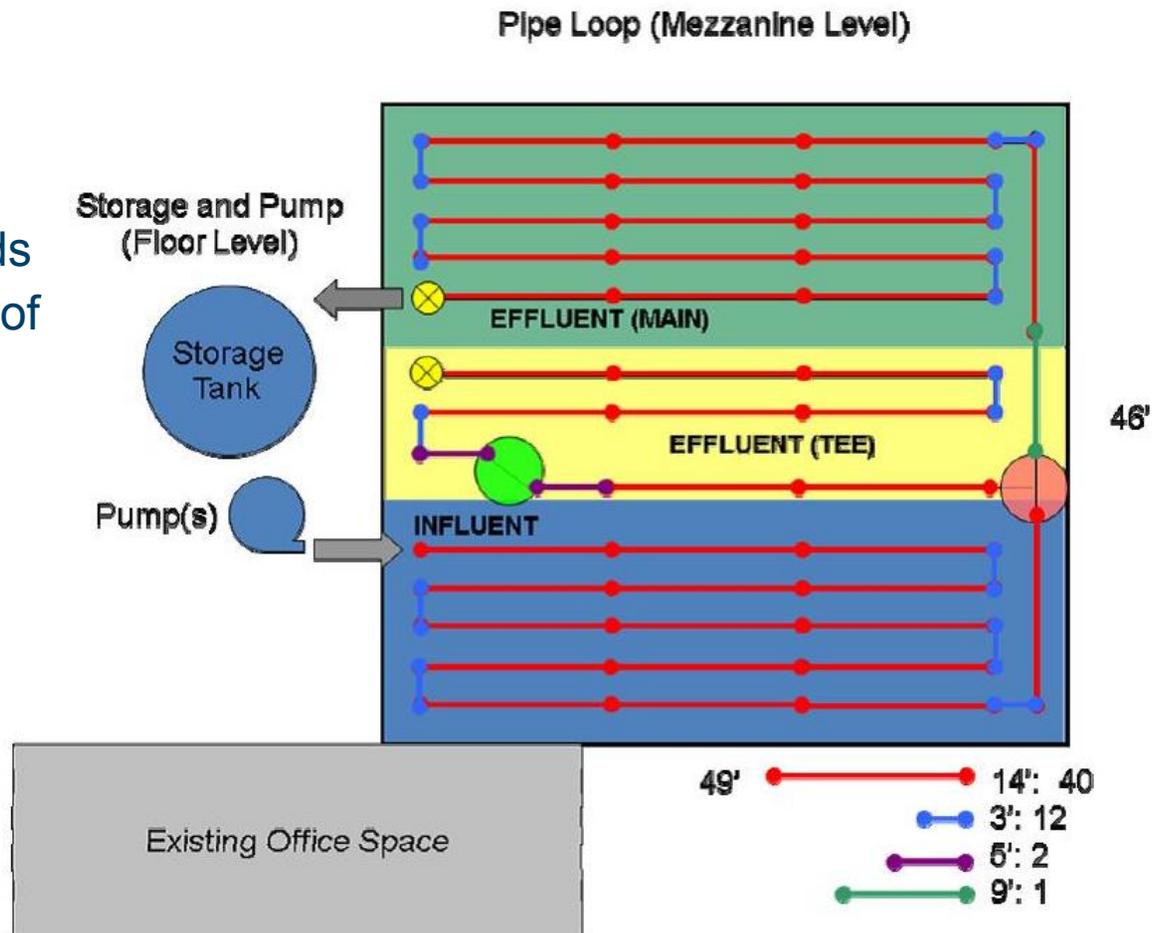
Leak Detection Test Pipe Loop

Test Loop Design

- Provide long runs without bends
- Provide option for adding tees of various angles
- Provide option to test leaks of various geometries

Pipe Materials

- PVC
- Unlined ductile iron
- Cement lined ductile iron



Controlled Condition Research

Goal: Evaluate controlled condition testing needs for innovative technologies for aging water infrastructure, and develop preliminary designs for upgrading Edison Pipeline Test Facility.

Highest Rank Data Needs

- Assessment of Ferrous Potable Water Pipe (>18")
- Assessment of Ferrous Sewer Force Main (>18")
- Examination of Bedding Conditions of Buried Piping
- Assessment of Ferrous Sewer Force Main (<18")
- Assessment of Non-Ferrous Sewer Force Main (>18")
- Leak Detection in Sewer Force Mains

Next Steps (through FY10)

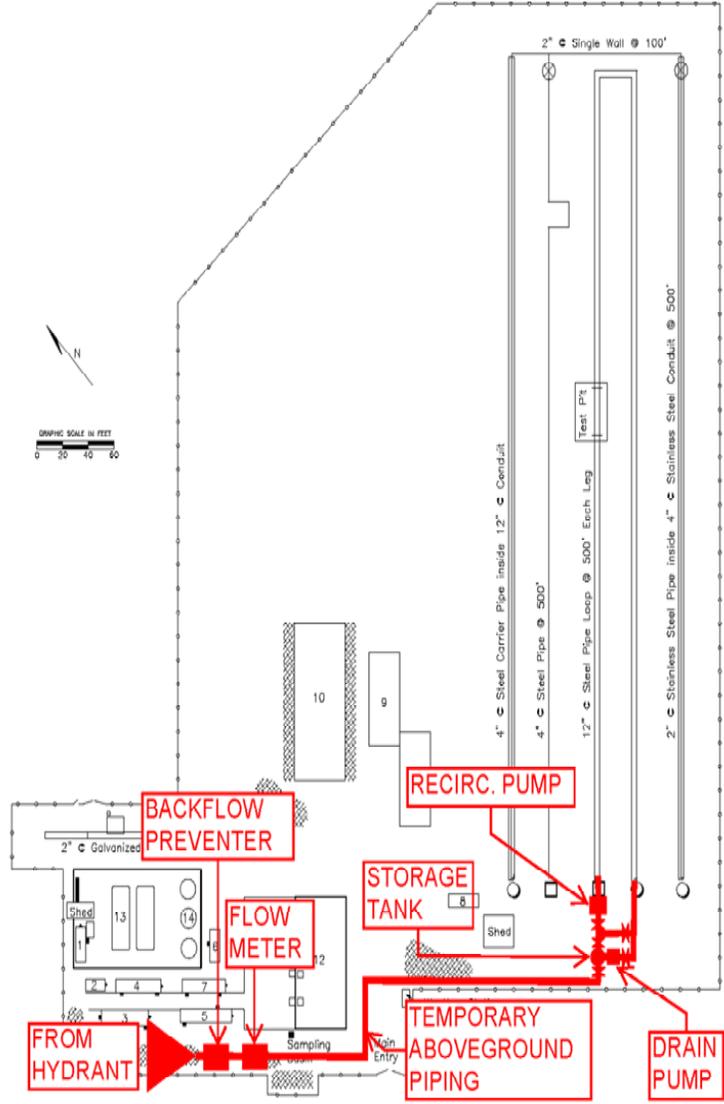
- Revised Report & Preliminary Designs
- Select Priority Needs
- Generate final design
- Implement improvements
- Initiate testing



Research Partners

- Research Triangle Institute
- CDM

Proposed Initial Upgrades Edison Pipeline Test Facility



Future Program Areas of Interest and Activity

- Infrastructure failure analysis and modeling
 - Forensics/failure cause evaluation
 - Factors/warning signs of failure
 - Standardized data collection
 - Failure prediction/useful life assessment
- Cooperative Agreement
 - 4-year agreement
 - Team of nationally recognized research foundations and university research centers
- Asset Management Decision-Support Tools



Questions?

Attachment 6: Presentation by Dr. Ari Selvakumar on System Rehabilitation Research

Aging Water Infrastructure Research Program SAB Consultation Rehabilitation of Wastewater Collection and Water Distribution Systems

*Dr. Ari Selvakumar
Water Supply and Water Resources Division*



Rehabilitation

Definition:

Rehabilitation includes repair, renewal, and replacement of pipes and components (pump stations, manholes, etc.) to return the system to near-original condition and performance.

Research Area Goals:

- To accelerate the application of innovative technologies for cost-effective rehabilitation/replacement of aging/failing drinking water distribution and wastewater collection systems.
- To conduct full-scale demonstrations of promising technologies that will gather reliable cost and performance data.



Project Strategies

- Identify, characterize, and document the SOT at the global level, including critical data and capability gaps, for the rehabilitation of DW and WW conveyance systems.
- Demonstrate and evaluate promising innovative technologies and decision-support systems under controlled-conditions and at sites of opportunity.



Tasks

- Establish Stakeholder Group
- Conduct Technology Forum
- Develop State-of-the-Technology Reports
- Develop Protocols/Metrics for Demonstrations
- Develop Site Selection Criteria for Demonstrations
- Field Demonstration of at Least Two Technologies
- Develop Rehabilitation vs. Replacement Decision Support Strategies

Stakeholder Members

- **Steve Allbee** - EPA Office of Water
- **Dr. Daniel Woltering** - WERF
- **Dr. Jian Zhang** - WRF
- **John Hemphill** - NASTT
- **Duncan Rose** - GHD Consulting, Inc.
- **Dr. David Hughes** - American Water
- **John Griffin, Jr.** - City of Atlanta

Research Partners

- **Battelle Memorial Institute**,
Columbus, OH
- **Trenchless Technology Center**,
Louisiana Tech. (Dr. Ray Sterling)
- **Jason Consultants**
- **Virginia Tech University** (Dr. Sunil Sinha)

International Forum

Purpose: Develop inventory of rehabilitation technologies and identify candidate technologies for demonstration.

Forum Highlights

- Need decision-support systems:
 - Rehabilitation methods/materials
 - Rehabilitation vs. replacement
- Lack of understanding of rehabilitation capabilities; need rational/uniform design approach
- Proprietary systems, procedures, materials
- Need long-term performance/cost data
- Better technologies for water distribution pipes
- EPA clearing house for performance/cost data
- **Retrospective evaluation of rehabilitation technologies**



- 31 Invited Experts
- 21 Presentations
- Group Discussions
- Vendor & Utility Roundtable Discussion

Retrospective Evaluation of Lining Technologies

- Develop protocols for the forensic evaluation of existing rehabilitation systems.
- Demonstrate protocols on selected case studies.
- Encourage municipalities to examine their rehabilitated systems using the protocols.
- Develop/provide database on performance.

Next Steps

1. Selection of Technologies for Demonstration

- *Wastewater*: CIPP with UV-cured (Glass fiber & polyester tube impregnated with polyester or vinylester resin & UV cured)
- *Water*: CIPP with hot water or steam cured (Aqualiner, Aquapipe, InSitu Main)

2. Selection of Potential Demonstration Sites

- Columbus, OH
- Indianapolis, IN
- Omaha, NE

3. Preparation for Demonstration

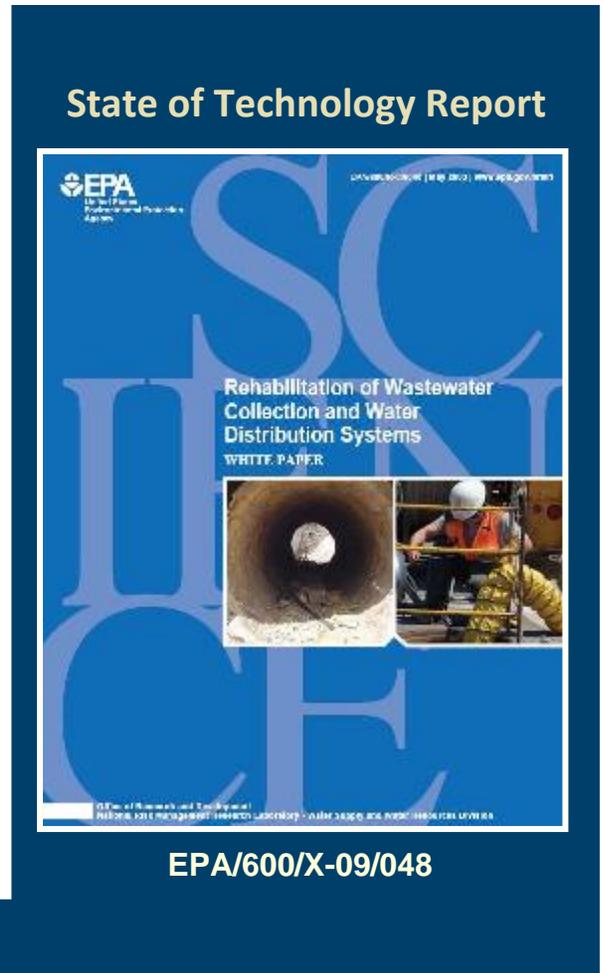
- QAPP
- Protocols/Metrics
- Site Selection Criteria



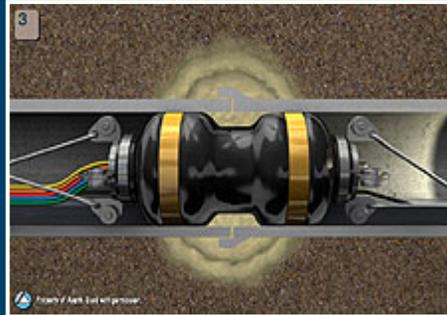
4. Demonstration Trials

Planned Outputs

- State of the technology reports on rehabilitation of:
 - Wastewater collection pipes & service laterals
 - Force Mains
 - Water distribution pipes & service lines
- Report on initial field demonstrations
- Rehabilitation vs. replacement decision approach
- Report on retrospective evaluation of lining
- Journal articles



ETV Program



- Established Infrastructure Stakeholders Group.
- Evaluating coatings & grouting materials for rehabilitating stormwater & wastewater infrastructure.
- Six vendors participating at University of Houston's Center for Innovative Grouting Materials and Technology.
- Verification Reports in 2010 & 2011.

Stakeholder Members

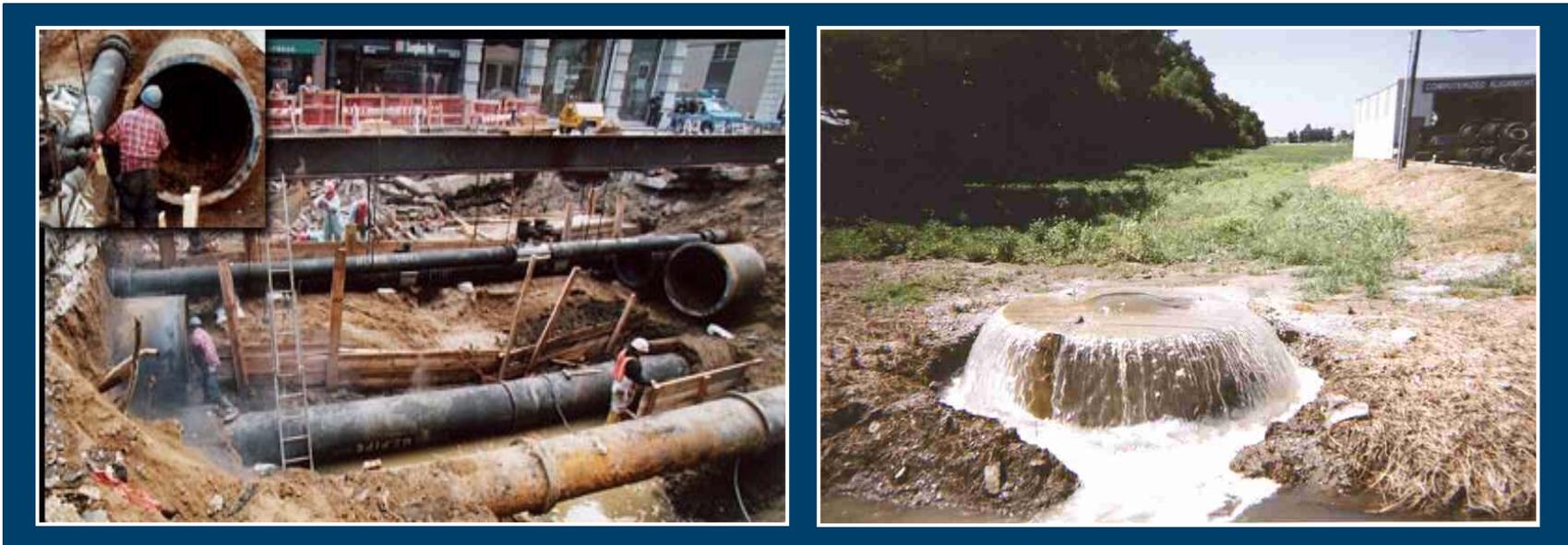
- NSF International
- NASSCO
- WRF
- University of Houston
- Springfield Water/Sewer Comm
- Inland Water Pollution Control
- Black & Veatch, Hydroqual
- Ultraliner
- Virginia Public Works Equip.
- Prime Resins
- Cues, Inc.

Summary

- Water & sewer systems are critical to the effective functioning & environmental health of our cities.
- Delay in addressing the problems only increases total costs.
- Rehabilitation technologies are available & continue to be developed.
- International technology transfer, design, & performance data can improve the cost-effectiveness of rehabilitation efforts.
- This can translate into billions of dollars saved.

Thank You!

Questions/Comments?



Attachment 7: Presentation by Rich Field on Advanced Concepts Research

Aging Water Infrastructure Research Program SAB Consultation Advanced Design Concepts

*Richard Field, PE, D.WRE, BCEE
Water Supply and Water Resources Division*



Advanced Drainage Concepts

Goal:

To foster implementation of innovative approaches and green technology for urban drainage.

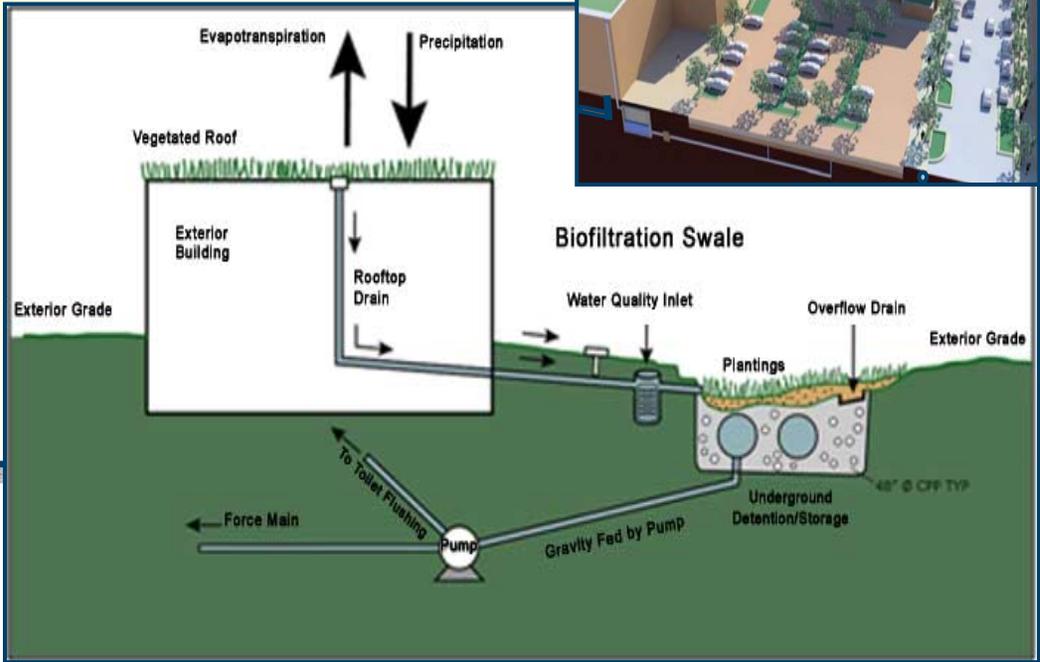
Approach:

- Identify state of the technology (SOT) via literature search and international forums.
- Demonstrate optimal system designs for new and retrofitting existing urban areas.



Project Areas

- Advanced Drainage Concepts: SOT
- Green Infrastructure Development
 - Integrated Green/Gray Infrastructure for CSO Control
 - Green Roofs
 - Porous Pavement
 - SUSTAIN Framework
- Total Water Management



State of Technology Findings

- Innovative combined sewerage system designs (larger diameter/steeper slopes, larger WWTPs, combine green/gray)
- Sociology...success depends on social reaction...
- Aesthetics...part of criteria
- Tailored solutions...no “one-size-fits-all”
- Dual water distribution systems (fire fighting, graywater, irrigation vs. potable water)
- Emerging contaminants ...R&D in stormwater needed
- Multi-functional strategies/TWM...beneficial stormwater use/conservation/black-graywater separation

Research Partners

**Tetra Tech
ACR, LLD. (Dr. Charles Rowney)**

Planned Outputs

Interim Report:

- “*WWF Control: SOT*” - 7/2009
- Final Report - 2/2010
- Presentation/Proceedings
“*Innovative Approaches for Urban Watershed WWF Mgmt & Control*”
33rd IAHR Congress, Vancouver, BC - 8/2009

State of Technology Report

Challenging the State-of-Practice in Water Quality Mgmt: Where Should We Drive the Technology Next
9/2008

Next Steps

Full-scale demonstrations of advanced designs

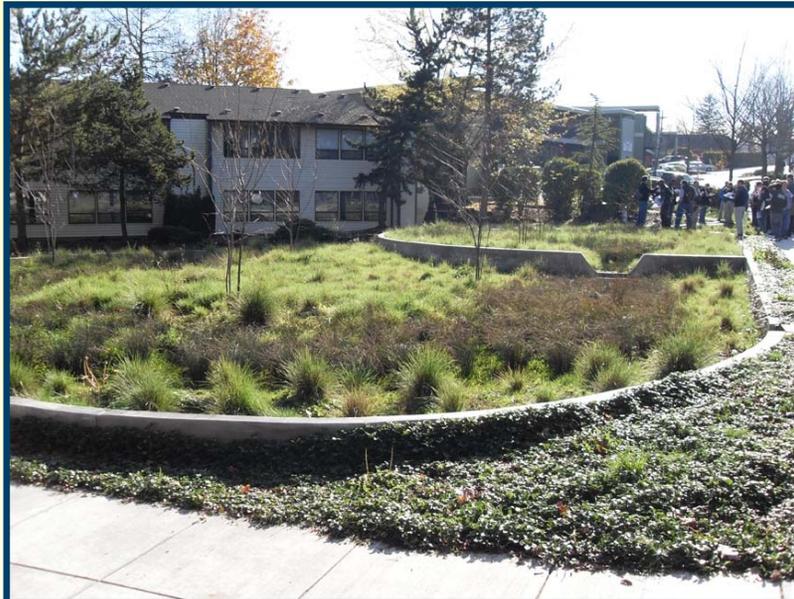
- Integrated green/gray infrastructure for CSO control & stormwater management (KC/others)
- Beneficial use of stormwater (KC/others)
- Combined sewerage systems
- Steeper slopes, bottom cross-sections, cunettes, grit traps, larger diameters, intermittent storage
- Larger WWTPs
- RTC
- Total water management



Demonstration of Green/Gray Infrastructure for Combined Sewer Overflow Control

Kansas City, Missouri

Will provide guidance on integrating
green with gray solutions for CSO
& stormwater control



Research Partners

- Tetra Tech
- University of AL
- University of MO-KC
- MARC
- Bergmann Assoc

Collaboration

- EPA: NRMRL & Region 7
- KCMO WSD (leveraged > \$6M)
- KCMO Parks Dept
- Neighborhood & watershed levels

Demonstration of Green/Gray Infrastructure for Combined Sewer Overflow Control

Objectives:

Demonstrate value of integrated green infrastructure to alleviate WWF problems in a combined sewer system.

- Design & placement for “best” performance
- Monitor/model multiple practices (Win SLAMM, SWMM, SUSTAIN)
- Economic analyses
- Community education & outreach

Status:

- Pilot & control subwatersheds selected
- Monitoring devices installed
- SWMM model for sewers calibrated
- WinSLAMM calibration/studies ongoing
- Detailed land use characterized



Planned Outputs

- “Cost Comparison of Conventional Gray CSO Control Infrastructure vs. Green/Gray Combination”
ASCE Journal (pending publication)
- Final Report on KC Demonstration
- 4/2011
- Presentations/Proceedings
National and International

Guidance Manual

Green/Gray Integration

For Region, Nation, OECA, OW
4/2011

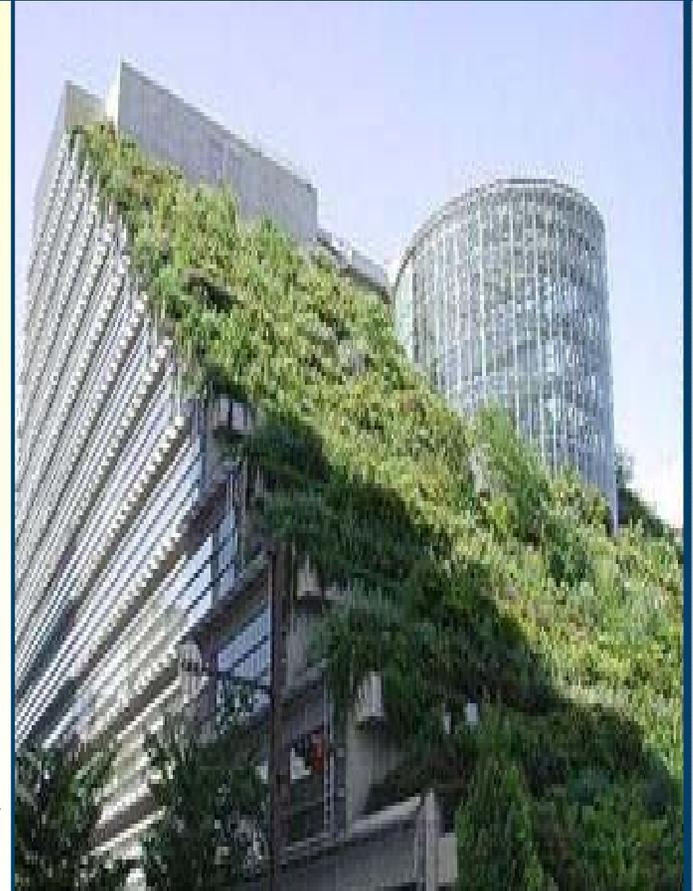
Research: Green Roofs

Penn State field studies:

- Evaluated runoff volume, pollutant control, energy usage
- Final EPA report on specifications for vegetation & media (2/2010)
- Recommended evaluating larger roofs, more water quality & site specific plantings

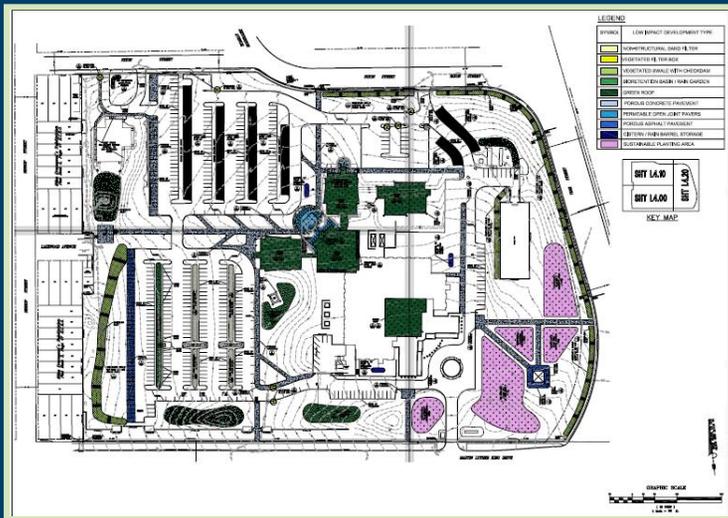
Next Steps:

- Full-Scale Demonstrations
 - Collaborating with Regions 2, 3, 8
 - Leveraging w/Sichuan University on green vs blue roof



Green Infrastructure

Demonstration: EPA AWBERC Green Infrastructure Site



SYMBOL	LOW IMPACT DEVELOPMENT TYPE
	NON-STRUCTURAL SAND FILTER
	VEGETATED FILTER BOX
	VEGETATED SWALE WITH CHECKDAM
	BIORETENTION BASIN / RAIN GARDEN
	GREEN ROOF
	POROUS CONCRETE PAVEMENT
	PERMEABLE OPEN JOINT PAVERS
	POROUS ASPHALT PAVEMENT
	CISTERN / RAIN BARREL STORAGE
	SUSTAINABLE PLANTING AREA



Collaboration:

- Cincinnati Metropolitan Sewer District
- City of Cincinnati Parks
- University of Cincinnati

Green Infrastructure

Research Facility: Edison Environmental Center



Green Infrastructure

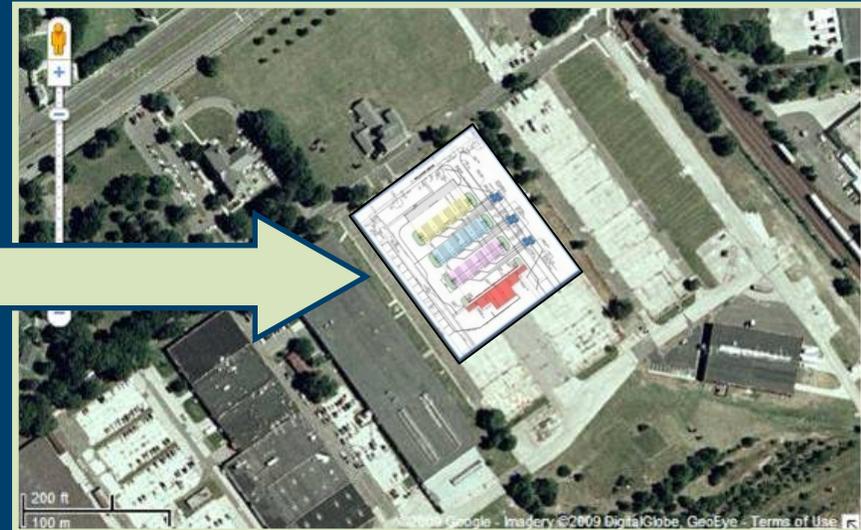
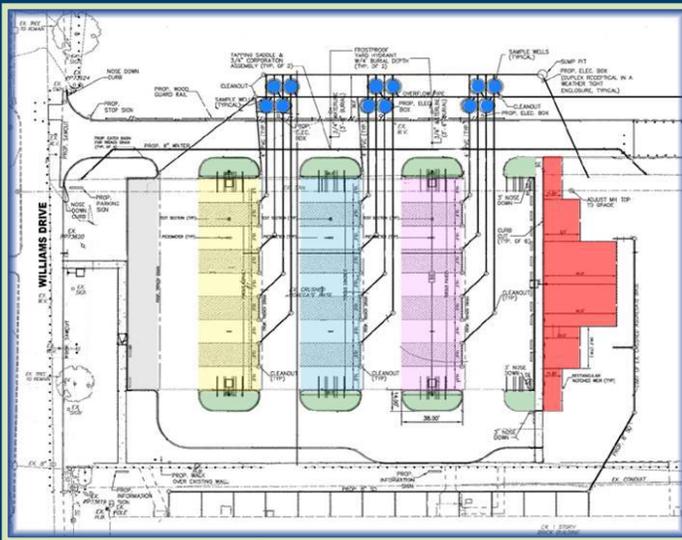
Permeable Pavement Demonstration: Edison Environmental Center



Side-by-side demonstration of 3 permeable pavement systems

- Paving Stones
- Porous Concrete
- Porous Asphalt

- Installing in a heavily used parking lot.
- Measuring (among other things) relative infiltration changes with time (use).
- Measuring the performance of each surface under similar climatic conditions and operation.



SUSTAIN: System for Urban Stormwater Treatment & Analysis INtegration

- GIS-based framework to support performance evaluation & decision-making
 - Four 1-day workshops conducted (300 attended)
 - Public release this fall
 - Edison 12/08, Chicago 1/09, Atlanta 3/09, Seattle 5/09
- Two-day training 3/09 to 10 beta testers (2 from UK)

Immediate Applications

- **Kansas City, MO** - Determine best cost-effective mix of GI for tunnel storage reduction goals
- **Univ. of Sheffield, UK** - Investigate Brownfield recovery

Total Water Management (TWM)

Goals: Improve water resource management and reduce waste streams.

Strategies:

- Evaluate approaches for water reuse/recycle
- Evaluate TWM of potable, wastewater, WWF

Products:

- Systems model
- Case study

Expected Impacts:

- Improved understanding of performance, limitations, & costs of TWM systems
- Improved guidance on water reuse technologies

Advanced Water/Energy Design for Sustainable Infrastructure

New project to address:

- TWM strategies research
 - Reduce drinking water demand
 - Increase water reuse
 - Reduce burden on water/wastewater treatment
- Comprehensive energy strategy
 - Energy recovery/savings
- Integrate “green” water & energy saving/recovery at household & community level

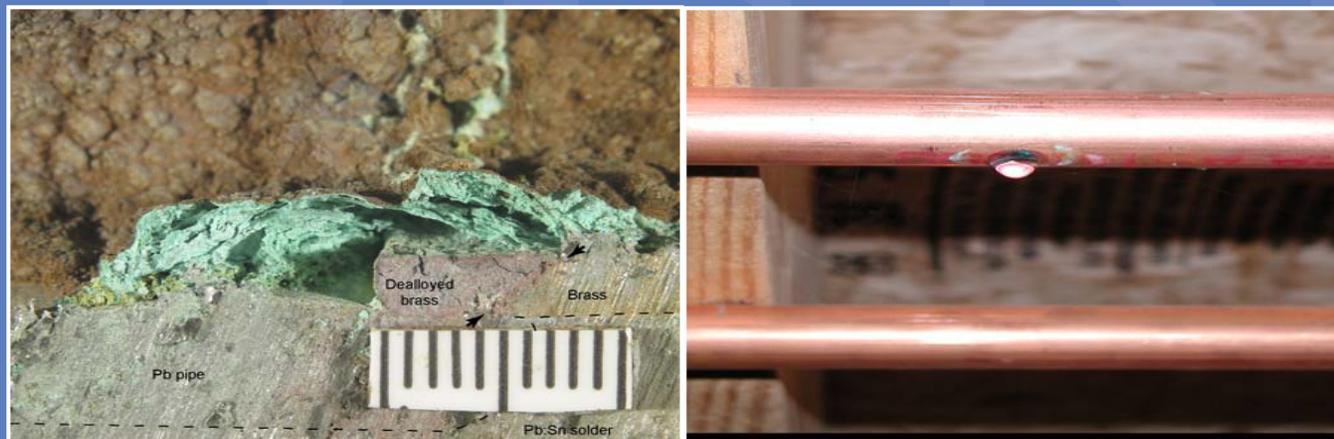


Questions?

Attachment 8: Presentation by Dr. Darren Lytle on Cross-cutting, Integrative Research

Aging Water Infrastructure Research Program SAB Consultation Cross-Cutting, Integrative Research

*Dr. Darren Lytle, P.E.
Water Supply and Water Resources Division*



Corrosion, Dissolution, and Leaching of Distribution System Materials

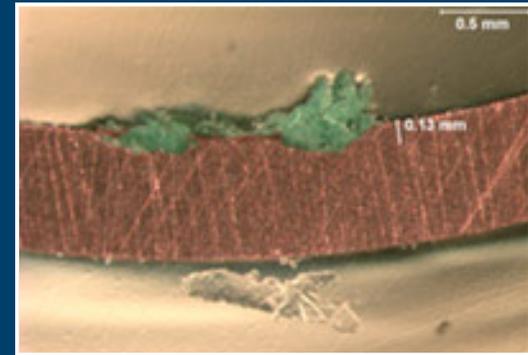
- Degradation of material
- Material failure
- Leaching of hazardous components
- Flow restrictions
- Energy (e.g., pumping) costs
- Aesthetic issues
- Biofilm



Impact of Water Chemistry on the Localized Corrosion of Copper Pitting

Strategies:

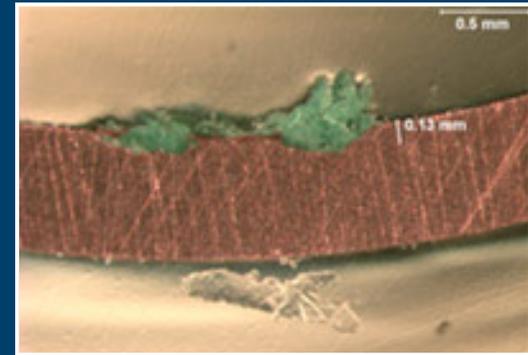
- Develop qualitative models for predicting pitting corrosion that lead to leaks of copper plumbing.
- Improve understanding of mechanism(s) responsible for pit initiation and propagation.
- Develop methods to prevent pitting corrosion and repair existing pits.



Impact of Water Chemistry on the Localized Corrosion of Copper Pitting

Expected Outcomes:

- Provide water utilities, engineers and others a guide to types of waters that support copper pitting corrosion.
- Establish approaches and protocols to investigate full-scale copper pitting case studies.
- Provide new details regarding the nature of copper pitting corrosion in water with emphasis the structural and morphological characteristics of active pits.
- Improve our understanding of pitting corrosion.
- Develop strategies to reduce copper pitting corrosion in water.

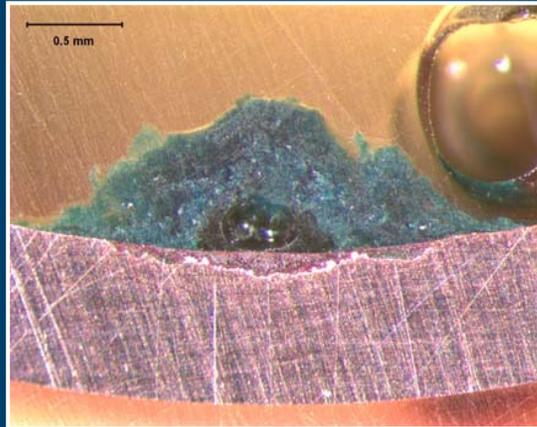


Experimental Approaches

Impact of Water Chemistry on the Localized Corrosion of Copper Pitting

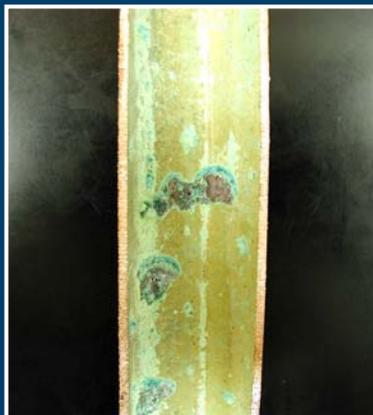
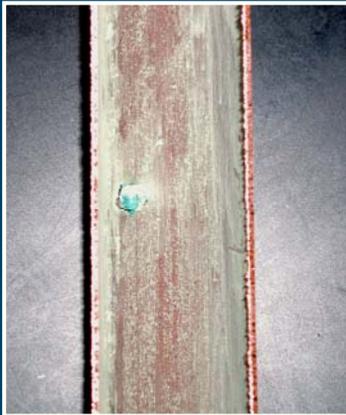
Pilot-Scale:

- Pipe rigs
- Recirculation pipe systems



Impact of Water Chemistry on the Localized Corrosion of Copper Pitting

- **Full-Scale:**
 - Distribution system evaluation
- **Solids analysis of failed pipe**



In-house Iron, Copper and Lead Solubility/Corrosion Studies

Strategies:

- Develop quantitative predictive models for metal release from corrosion of infrastructure materials, particularly lead, copper and iron.
- Test, adjust and refine the selection of chemical species and thermodynamic data for well-documented existing chemical equilibrium models.

In-house Iron, Copper and Lead Solubility/Corrosion Studies

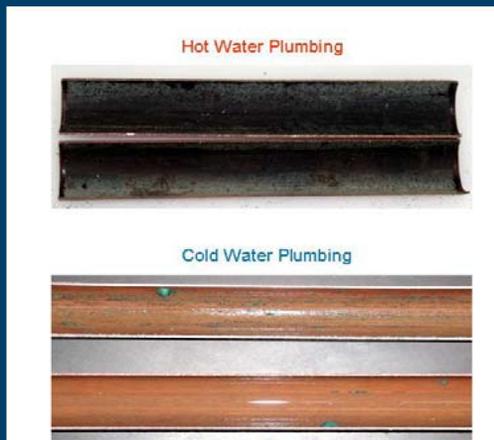
Expected Outcomes:

- Better future compliance with the Lead and Copper Rule.
- Fewer detrimental secondary impacts of corrosion control treatment.
- Fewer treatment mistakes that cause high metal release episodes.
- Extended service life and functionality of existing conveyance systems.
- Improved guidance on the selection of appropriate plumbing materials for a given water quality or treatment capability.
- Improved prioritization of critical infrastructure to inspect, monitor and assess the performance of rehabilitation.
- Reduced infrastructure failures caused by corrosion.

Experimental Approaches

In-house Iron, Copper and Lead Solubility/Corrosion Studies

- **Pilot-Scale:**
 - Pipe rigs
 - Recirculation pipe systems
- **Benchtop Precipitation Experiments**



Cross-Cutting, Integrative Research

Analysis of Distribution System and Domestic Drinking Water Distribution System Materials to Understand Water Treatment/Metal Release/Corrosion Relationships

Strategies:

- Samples tested for this research include pipe samples, scales from storage tanks, failed plumbing devices and distribution system sediments.
- These samples are obtained through technical support efforts by water systems, consultants, state regulators, and EPA regional offices.
- Tests performed primarily by the on-site contractors using a variety of on-site techniques.
- Tests performed through an interagency agreement with the U.S. Geological Survey Advanced Photon Source (DOE) for XANES, XAFS.

Cross-Cutting, Integrative Research

Analysis of Distribution System and Domestic Drinking Water Distribution System Materials to Understand Water Treatment/Metal Release/Corrosion Relationships

Expected Impacts:

- Understanding of operable corrosion, corrosion inhibition, metal accumulation and metal release mechanisms.
- Ability to predict the impact of various proposed changes in water sources, disinfection, or other treatments, on the stability of existing pipe scales and deposits.
- Guide regulatory revisions.
- Provide information for guidance manuals for simultaneous compliance with the Lead and Copper Rule, the Arsenic Rule, the Ground Water Rule, D/DBP regulations, and other water systems regulations.
- Puts EPA into a unique position to apply advanced analytical tools to solve or anticipate future drinking water infrastructure water quality and material performance problems, where little application expertise exists in either universities or the private sector.

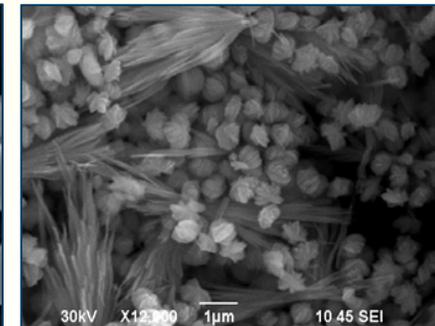
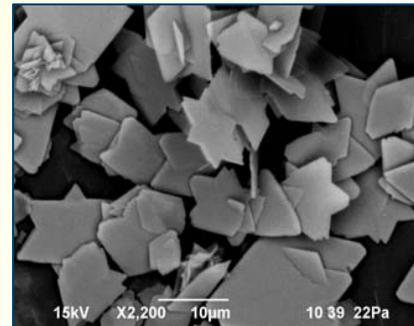
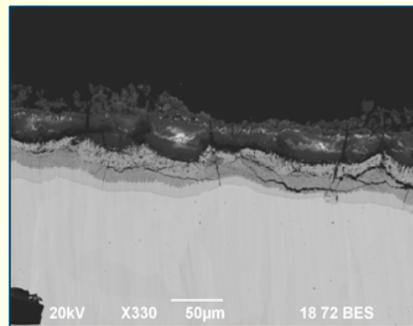
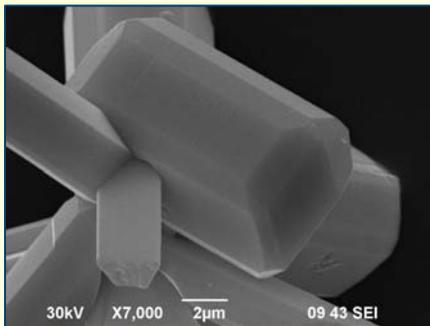
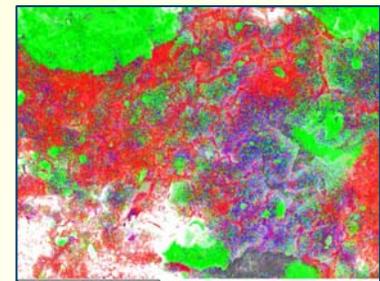
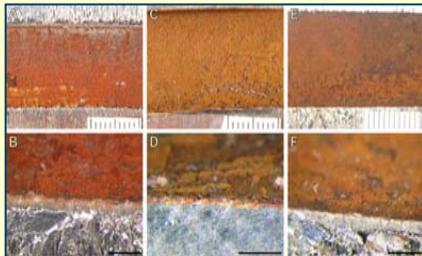
Solids and Materials Analysis

Equipment



Solids and Materials Analysis

Results and Microscopy Images



Molecular Characterization of Microbial Induced Concrete Corrosion (MICC)

Why Study MICC?

- Concrete corrosion has enormous economic impact worldwide.
- MICC suggested to play important part in biodeterioration of concrete sewers.
- Important to identify mechanism in order to develop protocols/metrics for innovative condition assessment tools.

Molecular Characterization of Microbial Induced Concrete Corrosion (MICC)

What Do We Know About MICC?

- Relatively high bacterial numbers.
- Some bacteria populations have been identified.
- Most identified organisms based on culture-based techniques.
- Overall, little is known about bacteria implicated in MICC.

Short and Long Term Goals

Molecular Characterization of Microbial Induced Concrete Corrosion (MICC)

- Establish partnership (MOU) with MSD and identify key issues.
- Develop protocol for sampling.
- Study bacterial community structure associated with different stages of MICC using 16S rDNA-based techniques.
- Study MICC of sewers receiving different waste sources.
- Study key microbial functions associated with MICC using PCR targeting functional genes.
- Establish rapid detection of key players.
- Develop predictive models associated with different levels of MICC.

Deliverables

Molecular Characterization of Microbial Induced Concrete Corrosion (MICC)

- MICC literature review (report).
- Develop sampling protocol.
- Phylogenetic (molecular) survey of concrete biofilm communities (peer-review manuscript).
- Detection of corrosion bacteria in biofilms using off-the-shelf and novel genetic assays (peer-review manuscript).
- Succession/dynamics of corrosion associated bacteria (peer-review manuscript).

Questions?

Attachment 9: Public Attendance

**List of Attendees
SAB Environmental Engineering Committee Public Meeting on the
Consultation on the Aging Water Infrastructure Research Program**

July 21, 2009

<u>Name</u>	<u>Affiliation</u>
Ari Selvakumar	EPA/ORD/NRMRL/WSWRD, Urban Watershed Management Branch
Anthony Tafuri	EPA/ORD/NRMRL
Dan Murray	EPA/ORD/NRMRL/WSWRD
Darren Lytle	EPA/ORD/NRMRL/WSWRD, Treatment Technology Evaluation Branch
Dr. Thomas Speth	EPA's Office of Research and Development, (ORD), National Risk Management Research Laboratory (NRMRL), Water Supply and Water Resources Division (WSWRD)
Rich Field	EPA/ORD/NRMRL/WSWRD, Urban Watershed Management Branch
Michelle Latham	EPA/ORD/NRMRL/WSWRD
Jennifer Brenner	EPA/ORD/NRMRL
Jules Byrne	EPA/ORD/NRMRL
Dr. Dennis Lai	EPA/ORD
Jorge Sant Domines	EPA/ORD
Andy Gilley	EPA/ORD
Nick Ashbon	EPA/ORD/NERL
Joe Williams	EPA/ORD/NRMRL
Bill Shuster	EPA/ORD/NRMRL/STD
Tai Wu	EPA/ORD/NRMRL/TTEB
Lili Wang	Battelle Inc.
Joyce Walling	EPA/ORD/NRMRL
Srini Vallabhaneni	CDM, Inc.
Angela Ristiro	EPA Region 6
Abe Chen	Battelle Inc.
Jill Neal	EPA/ORD/NRMRL/WSWRD
Ray Haught	EPA/ORD/NRMRL/WSWRD
Dr. Sally Guterrez	Director, EPA/ORD/NRMRL
Jeff Young	EPA/ORD/NRMRL/WSWRD

July 22, 2009

<u>Name</u>	<u>Affiliation</u>
Joe Williams	EPA/ORD/NRMRL
Hale Thurston	EPA/ORD/NRMRL
Debbie Westerman	EPA/ORD/NRMRL
Ari Selvakumar	EPA/ORD/NRMRL/WSWRD, Urban Watershed Management Branch
Anthony Tafuri	EPA/ORD/NRMRL
Dan Murray	EPA/ORD/NRMRL/WSWRD
Darren Lytle	EPA/ORD/NRMRL/WSWRD, Treatment Technology Evaluation Branch
Dr. Thomas Speth	EPA's Office of Research and Development, (ORD), National Risk Management Research Laboratory (NRMRL), Water Supply and Water Resources Division (WSWRD)
Rich Field	EPA/ORD/NRMRL/WSWRD, Urban Watershed Management Branch
Michelle Latham	EPA/ORD/NRMRL/WSWRD

Attachment 10: Federal Register Notice Announcing EEC July 2009 Committee Meeting

[Federal Register: July 7, 2009 (Volume 74, Number 128)]

[Notices]

[Page 32155]

From the Federal Register Online via GPO Access [wais.access.gpo.gov]

[DOCID:fr07jy09-53]

ENVIRONMENTAL PROTECTION AGENCY

[FRL-8927-4]

Science Advisory Board Staff Office Notification of an Upcoming Meeting
of the Science Advisory Board Environmental Engineering Committee

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notice.

SUMMARY: The Environmental Protection Agency (EPA or Agency) Science Advisory Board (SAB) Staff Office announces a public face-to-face meeting of the SAB Environmental Engineering Committee (EEC). The EEC augmented with additional members will conduct a consultation on EPA's Aging Drinking Water and Wastewater Infrastructure Research Initiative.

DATES: The meeting dates are Tuesday, July 21, 2009 from 8:30 a.m. to 5 p.m. (Eastern Daylight Time) and Wednesday, July 22, 2009 from 8 a.m. to 12 noon (Eastern Daylight Time).

ADDRESSES: The Committee meeting will be held at the Kingsgate Marriott Conference Hotel at the University of Cincinnati, 151 Goodman Drive, Cincinnati, Ohio, 45219.

FOR FURTHER INFORMATION CONTACT: Members of the public who wish to obtain additional information regarding this meeting may contact Mr. Edward Hanlon, Designated Federal Officer (DFO), EPA Science Advisory Board (1400F), U.S. Environmental Protection Agency, 1200 Pennsylvania Avenue, NW., Washington, DC, 20460; telephone/voice mail: (202) 343-9946; fax (202) 233-0643; or via e-mail at hanlon.edward@epa.gov. General information about the EPA SAB as well as any updates concerning the meeting announced in this notice, may be found on the SAB Web site at <http://www.epa.gov/sab>. Any inquiry regarding EPA's Aging Drinking Water and Wastewater Infrastructure Research Initiative should be

directed to Dr. Thomas Speth, EPA Office of Research and Development (ORD), at speth.thomas@epa.gov or (513) 569-7208.

SUPPLEMENTARY INFORMATION: Pursuant to the Federal Advisory Committee Act, 5 U.S.C., App. 2 (FACA), notice is hereby given that the SAB Environmental Engineering Committee augmented with additional experts will hold a public meeting to discuss comments on EPA's Aging Drinking Water and Wastewater Infrastructure Research Initiative. The SAB was established pursuant to 42 U.S.C. 4365 to provide independent scientific and technical advice to the Administrator on the technical basis for Agency positions and regulations. The SAB is a Federal Advisory Committee chartered under FACA. The SAB will comply with the provisions of FACA and all appropriate SAB Staff Office procedural policies.

Background: As discussed in the Federal Register Notice dated March 31, 2009 (74 FR 14553-14555) announcing this advisory activity, EPA's ORD initiated a research program in 2007 to improve and evaluate innovative technologies and techniques for reducing the cost and improving the effectiveness of operations, maintenance, and replacement of aging and failing systems for drinking water and wastewater treatment and conveyance. The outputs from this research program are intended to assist EPA's program and regional offices to implement Clean Water Act and Safe Drinking Water Act requirements; to help states and tribes meet their programmatic requirements; and to assist utilities to more effectively implement comprehensive management of drinking water and wastewater treatment and conveyance systems, provide reliable service to their customers, and meet their statutory requirements. In response to a request from EPA's ORD, the augmented EEC will hold a public meeting to provide comments on the suitability and appropriateness of completed, existing and upcoming research projects; whether additional projects are needed; and the overall scope of the initiative. Additional information about this consultative activity including a meeting agenda will be posted on the SAB Web site prior to the meeting at <http://www.epa.gov/sab>.

Availability of Meeting Materials: The agenda and other meeting materials will be available on the SAB Web site at <http://www.epa.gov/sab> in advance of the meeting.

Procedures for Providing Public Input: Interested members of the public may submit relevant written or oral information for the SAB EEC to consider during the advisory process. Oral Statements: In general, individuals or groups requesting an oral presentation at a public face-to-face meeting will be limited to five minutes per speaker, with no more than a total of one hour for all speakers. Each person making an oral statement should consider providing written comments as well as their oral statement so that the points presented orally can be expanded upon in writing. Interested parties should contact Edward

Hanlon, DFO, in writing (preferably via e-mail) at the contact information noted above, by July 14, 2009 to be placed on the list of public speakers for the meeting. Written Statements: Written statements should be received in the SAB Staff Office by July 14, 2009 so that the information may be made available to the Committee members for their consideration. Written statements should be supplied to the DFO in the following formats: one hard copy with original signature, and one electronic copy via e-mail (acceptable file format: Adobe Acrobat PDF, WordPerfect, MS Word, MS PowerPoint, or Rich Text files in IBM-PC/Windows 98/2000/XP format). Submitters are requested to provide versions of each document submitted with and without signatures, because the SAB Staff Office does not publish documents with signatures on its Web sites.

Accessibility: For information on access or services for individuals with disabilities, please contact Edward Hanlon at the phone number or e-mail address noted above, preferably at least ten days prior to the public face-to-face meeting to give EPA as much time as possible to process your request.

Dated: June 29, 2009.
Anthony F. Maciorowski,
Deputy Director, EPA Science Advisory Board Staff Office.

Attachment 11: Public Comments

7/9/09

Dear Ed Hanlon,

Thanks for the opportunity to submit my opinion on the document entitled "Aging Water Infrastructure Research Program". I had a chance to read up to page 73 of the document. I wish I had more time to read it before your deadline of July 14. However, I am preparing for an overseas trip and had limited amount of time to do other activities. I will be out of the country from July 10 through July 23. I would be very interested in the results of your meeting and would be willing to help out the EEC in any capacity. Let me know.

As for my comments for the document, overall, I think the document does capture the major issues that need to be addressed with the water and wastewater infrastructure. I particularly like how it was divided into the areas of condition assessment, system rehabilitation, advance concepts, and innovative treatment technologies for wastewater and water reuse. The research proposed are ambitious yet necessary to solve many of the problems described in the report. While the list of participating groups listed on pages 6 and 7 would be necessary to help tackle these problems and conduct the research, I think there are others outside this group that would be necessary to help really understand and provide solutions to these problems.

For example, to tackle problems related to failure analysis, you will likely need researchers that are experts in mechanics of structures or structural forensics. These types of researchers may be able to provide more fundamental understanding of failure mechanisms, what kind of sensors to use or develop, and appropriate placement/frequency of sensor usage. I would also think that for the development of sensors, the research consortium will also need a group (probably IEEE organization) who has experts in the creation of sensors for a targeted purpose. While it's possible we may have this type of expertise within the organizations listed on pages 6 and 7, I do not want to limit ourselves and think we would benefit from a diverse set of researchers.

Although I have not read the detailed description of the research projects at the end of the document, I want to stress that the descriptions should be general enough not to be too prescriptive. In other words, I don't want these descriptions to either stifle innovation or alienate potential non-traditional researchers for submitting a proposal. We are dealing with very complex issues whose solutions may come from researchers outside our traditional networks.

Specific comments to each section are below:

Condition assessment

The challenge here will be the development of appropriate sensors that can help monitor the collection system and water distribution integrity. The collection system integrity will be plagued by different failure modes (i.e., deterioration by sulfuric acid build up, root intrusion through cracks, fat oil and grease deposit build up). It's likely that one sensor type may not capture all methods that pipes may deteriorate. So as a suggestion, the EPA should consider development of an expert system that allows for processing different types of sensor information so that a complete picture of the collection system and water distribution integrity or a risk factor for failure is computed. Clearly, the research outlined in the collection system section are required to help determine the appropriate technology for each failure mechanism. Once these technologies have been developed, then additional research may be necessary to gather the data from these different sensors to compute an overall risk assessment.

In terms of the drinking water distribution system, I agree that lessons learned from the petroleum and nuclear industry on pipe integrity would be very useful. I understand that they don't have all the answers and that we have more complex challenges for our pipe networks. However, I think it will be important to have them in the research loop (i.e., professional and academic associations in the petroleum and nuclear industry as part of our consortium on pages 6 and 7). For example, I can envision that our traditional network of researchers can tackle research question 1 (bottom of pg 24 and continued on top of pg 25. For question 2, researchers from both traditional and non-traditional networks will have to participate while question 3 will likely come from non-traditional research networks.

Rehabilitation of Wastewater Collection systems and Drinking Water Distribution

For the following research question in collection system:

“Can approaches and methods be developed for determining the long-term performance and life-cycle cost effectiveness of various system rehabilitation technologies, including new and existing materials?”

We don't have a lot of experience with plastics. This leads me to wondering whether there are methods to rapidly age pipes to test what may happen over the operation life of the pipe. While I understand that there are many complexities that influence the age of pipes in our systems. However, it's worth asking whether this type of rapid testing of new materials could be useful if developed.

As for the following question in collection system:

“Can guidance be provided for establishing comprehensive system rehabilitation program, including rehabilitation of non-sewer assets, selection of pipe and rehabilitation materials, and testing and quality assurance of field installation and application of rehabilitation technologies?”

We need to be careful that when a rehabilitation program is enacted for specific portion of the sewer collection system, it accounts for the site specific problems in that section of pipe network. While that sounds obvious, there are problems that occurred in the sewer collection system that were made worse when an alternate pipe material was used for that section of sewer line. For example, my research team is investigating why some municipalities have experienced an increase in FOG deposit formation in a section of sewer pipe that was relined. My point is that there maybe other site specific problems that maybe exacerbated by the rehabilitation method used. Therefore the rehabilitation method should account for the special challenges faced by these pipes at the specific site (i.e., if the site is prone to root intrusion, FOG deposition, H2S formation, etc.).

As for the 8th research item on page 34, I think it would be a good idea that material scientists/engineers be involved if new materials with alternative strength properties are explored.

Advanced Concepts- Wastewater Collection Treatment Systems

In this section, a significant list of alternative technologies was presented on pages 44 through 55. In my work with FOG deposit formation, grease buildup could be a significant problem in some of these alternative technologies. As my research team tries to better understand what influences FOG deposit formation, I want to stress that FOG deposition typically increases with increasing number of food service establishments and high density apartment/condo dwellings.

On pg 54, the document states the following in Sanitary Sewer Technology-Small Diameter Gravity Sewers:

“These systems consist of a system of interceptor tanks, usually located on the property served, a network of small-diameter collector gravity sewers (USEPA 1991b). The interceptor tanks remove settleable solids and grease from the wastewater.”

However, our research has determined that grease interceptor performance significantly depends on the reactor design and it is still unknown whether the level of removal achieved by simple gravity separation is sufficient to be protective of the sewer collection system against FOG deposit formation.

On pg 55, a brief discussion on Blackwater/graywater separation system was provided. Graywater systems has the potential to be a major new system at the developer/community level for water reuse. I also want to mention that we should also consider the potential for rainwater collection system as another water source that may impact new collection system designs. I’m not sure how much of an impact it will be, however, I just want to mention it here just to keep that in mind for future consideration.

On pg 57 under research questions: For new systems that may include graywater or rainwater, we may need to explore the potential impact from cross contamination with drinking water lines (i.e., what is the risk to pathogen exposure).

Sincerely,

/Signed/

Joel J Ducoste, Ph.D.
Associate Professor
North Carolina State University
Dept. of Civil Construction and Environmental Engineering
208 Mann Hall, Campus Box 7908
Raleigh, NC 27695
919-515-8150
919-515-7908 (Fax)
jducoste@eos.ncsu.edu

----- Forwarded by Edward Hanlon/DC/USEPA/US on 07/20/2009 06:47 AM -----

From: Duncan.Rose@ghd.com

To: Edward Hanlon/DC/USEPA/US@EPA

Date: 07/16/2009 08:20 PM

Subject: Re: Fw: Public comments to the July 21-22 EPA SAB consultation on Aging Water Infrastructure

Thanks, Ed. Yes, let's please remove the original public comments and the accompanying documents.

I would submit the following comment instead:

Improving the cost effective management of aging and deteriorating buried infrastructure is a major agenda item for many other water industry organizations around the world (eg, WERF, Water Research Foundation, UKWIR, GWRC, IPWEA, ARC, CSIRO, IWA to name a few). Excellent work has recently been done or is currently underway in the systematic advancement of our understanding of the causes of failure in buried pipe, how to more cost effectively assess the condition of pipe, and how to more accurately predict remaining physical life. I would urge EPA to continue its strategy of building on this body of work in an internationally collaborative manner so as not to "reinvent" work already accomplished elsewhere. Rather, I would hope we would invest our limited research budgets in collaboratively advancing the level of practice (from the perspective of the practitioner) in renewal investment decision making in our water utilities. Much of the international work is lies in the materials sciences realm; arguably, even more needs to be done in the practical integration of what we are learning in the physical sciences about pipe failure modes and mechanics and the prediction of failure with the decision sciences/micro economics so that a much higher level of uptake occurs in day to day investment decision making.

Regards,

T. Duncan Rose III
Technical Director, Asset Management
Principal Consultant

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Dr. David A. Dzombak
Chair Environmental Engineering Committee
Carnegie Mellon University
Department of Civil and Environmental Engineering
Pittsburgh, PA 15213-3890.

August 6, 2009

Dear Dr Dzombak,

I wanted to make a few comments and observations on the overall charge to the ECC regarding the Consultation on the Aging Water Infrastructure Research Program. I applaud EPA for tackling this important issue. I believe that much of what is proposed will bring value to the industry; however I can not help that think that we may be trying to answer some of the wrong questions. Instead of asking what technologies are required to help utilities make decisions about aging infrastructure in the future, we should be asking how utilities can use existing technologies (as indentified in previous EPA studies) to make decisions about aging infrastructure today! By focusing on technology development we are giving utilities justification on delaying implementation of any sort of meaningful condition assessment program.

The reality is that decisions are being made on assets that are worth hundreds of millions of dollars based on poor information and indirect indications such as age, location and environment. There are many examples where large scale replacement projects have been justified under the guise that technologies do not exist or are too expensive to deploy. In most cases this just isn't true. When the cost of an assessment is judged against the time it might take to collect data, there is a perception that condition assessment is expensive. When judged against magnitude of the decisions that are faced by the CFO of a utility when prioritizing capital budgets the value of the information far outweighs the cost.

There is no doubt that improvement in assessment technologies is required however it is unlikely that we will ever be able to find every piece of information on the current wish list. The EPA and others have already identified a range of technologies (many of which are the results of decades of fundamental research and years of commercial development) that can provide critical information about aging infrastructure right now. Multi-million dollar decisions can be vastly improved by spending hundreds of thousands of dollars on direct assessment using technologies that exist today.

Many asset management programs make very limited use of condition assessment technologies arguing that technologies are so expensive that it should only be used where the consequence of a failure is unacceptably high. Since most assessment projects require considerable setup efforts,

the best way to drive unit inspection costs down is to increase the rate at which utilities adopt technologies. EPA should consider how to promote the systematic use of assessment techniques throughout entire systems and on regular intervals.

The Government Accounting Standards Board in their Statement 34 has offered opportunities for proactive utilities to strengthen their balance sheets by implementing a qualified asset management program (including condition assessment). EPA should consider offering incentive for utilities that engage in using “science and engineering” to assess the condition of their infrastructure. This encouragement could come in the form of grants for utilities that engage in a “qualified condition assessment program”. Such a program might run over a 3-5 year period and use technologies that EPA is aware of. There should be clear guidelines on what sort of activities qualify under “condition assessment” and the grant should be repayable if the assessment program is not completed. This would allow the initial costs of the “evaluation” of technologies to be covered by EPA but would allow a much wider range of conditions (pipe materials, bedding, regional differences...) to be considered. The increase in technology utilization will allow technology providers to reduce costs (based on business volumes) and will encourage technology innovation. The impact of EPA encouraging 100 water utilities to use available technologies in proactive long term condition assessment programs, will be far greater than if EPA spends an equal amount developing next generation technologies.

The question regarding what role EPA should play is an interesting one. It is difficult to be a “validator” of technology. The development of a testing facility that can provide meaningful results to the industry seems a daunting task. The variance in pipe materials, historic pipe manufacturing practices, bedding conditions, construction practices, environmental and operating conditions, failure modes and technology applications suggest that at best the facility will allow a small subset of actual conditions to be simulated and tested. The value of such specific tests to the more general case will always be suspect. The EPA should aim to drive utilization of technology to the benefit of the industry.

Much has been made of the infrastructure funding gap. The funding gap is severely overstated because much of the infrastructure that is in the ground that is close to or even beyond its design life is actually in good condition and could be safely operated for many years to come. The challenge is to systematically identify which areas have deteriorated and have not and to take appropriate actions. Technologies are commercially available today that allow this to be done and the adoption of these technologies by the mainstream utilities is our best opportunity to bridge the infrastructure funding gap.

I would be pleased to meet with you or the committee to provide further details on my thoughts on how the EPA can help address aging pipeline infrastructure.

Yours sincerely

Dr. Brian J Mergelas, PhD
President and CEO