----- Forwarded by Edward Hanlon/DC/USEPA/US on 07/09/2009 09:57 AM -----
From: Joel Ducoste <jducoste@ncsu.edu>
To: Edward Hanlon/DC/USEPA/US@EPA
Date: 07/09/2009 09:20 AM
Subject: Re: Fw: EPA Science Advisory Board (SAB) Environmental Engineering Committee, augmented for the Aging Infrastructure Consultation

Hi Ed,

Please find my attached comments on the report. Thanks for allowing me to provide some feedback. Let me know how the meeting goes.

Regards

Joel

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).