



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

Hon. Lee M. Thomas
Administrator
U.S. Environmental Protection
Agency
401 M Street, SW
Washington, D.C. 20460

SAB-EHC-88-020

OFFICE OF
THE ADMINISTRATOR

Dear Mr. Thomas:

The Drinking Water Subcommittee of the Science Advisory Board's Environmental Health Committee has completed its independent scientific review of the Office of Research and Development's (ORD) Drinking Water Distribution System Research Program, and is pleased to transmit its final report to you. The Subcommittee's efforts resulted from a public review meeting held in Cincinnati, Ohio on December 3-4, 1987, at which time it commented upon background documents describing the program and held discussions with EPA staff.

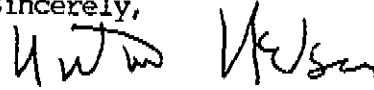
The Subcommittee's major conclusions and recommendations are as follows:

- o The research program needs greater cohesiveness both in terms of scientific integration and research planning. The Subcommittee had difficulty identifying the relationship of the ongoing work of this program to ORD's efforts in general.
- o In the area of microbiology research, the Assimilable Organic Carbon (AOC) studies merit additional support: to establish whether or not microbiological contaminants are growing within the distribution system, and if so to identify contributing factors, and to provide sufficient information for regulatory decision making.
- o The declining support for research on corrosion is short-sighted, due in part to the existence of a number of unresolved scientific and policy issues related to the public health threat posed by the leaching of lead and the corrosion of asbestos pipe.
- o The cost modeling studies should be terminated because of their apparent lack of integration within the existing research program, and the availability of similar modeling systems.
- o Water quality modeling studies should continue but with refinement in the research objectives and appropriate verification measures.

A discussion of these and other comments is presented in the attached report.

The Subcommittee appreciates the opportunity to conduct this particular scientific review. We request that EPA formally respond to the scientific advice provided in our evaluation.

Sincerely,



Norton Nelson, Chairman
Executive Committee



Richard A. Griesemer, Chairman
Environmental Health Committee



Gary P. Carlson, Chairman
Drinking Water Subcommittee

Review of the Office of Research and Development's
Drinking Water Distribution System Research Program
by the
Drinking Water Subcommittee
Environmental Health Committee
Science Advisory Board

Summary

The Drinking Water Subcommittee has completed its evaluation of the Office of Research and Development's (ORD) Drinking Water Distribution System Research Program following its public meeting on December 3-4, 1987 in Cincinnati, Ohio. This is part of a series of research program review conducted by the Science Advisory Board (SAB) and is designed to advise the senior officials of the U. S. Environmental Protection Agency (EPA) on the quality, research relevance and future needs of Agency research programs. The SAB Executive Committee assigned this particular review to the Drinking Water Subcommittee of the Environmental Health Committee.

As with previous research program reviews, ORD prepared a background document presenting the basic components of ongoing research. This document, entitled "The ORD Control Technology Research Program on Control of Water Quality in Drinking Water Distribution Systems," was prepared by the Drinking Water Research Division of the Water Engineering Research Laboratory. Along with staff briefings at the meeting, it served as the basis of the Subcommittee's review. The Subcommittee focused upon the program as a whole, while also commenting upon its three main components: microbiology, corrosion and cost modeling.

The Subcommittee's major conclusions and recommendations are as follows:

- o The research program needs greater cohesiveness both in terms of scientific integration and research planning. The Subcommittee had difficulty identifying the relationship of the ongoing work of this program to ORD's efforts in general. In addition, there is need for improved coordination among the program's existing three components. For example, work on the modeling of drinking water quality requires closer integration with work on the effects of corrosion upon microbial growth.
- o In the area of microbiology research, the Assimilable Organic Carbon (AOC) studies merit additional support, to establish whether or not microbiological contaminants are growing within the distribution system, to identify contributing factors, and to provide sufficient information for regulatory decision making.
- o The declining support for research on corrosion appears short-sighted. There are, for example, a number of unresolved scientific and policy issues related to the public health threat posed by the leaching of lead. Second, the issue of the corrosion of asbestos pipe is of public health

concern. While not currently a high priority issue within EPA, the Subcommittee believes these issues will grow in importance. In order to be prepared for this development, EPA should continue research on studies relating to mitigation measures. EPA must also expect to confront issues relating to the mechanisms of corrosion by which other metals, such as copper and cadmium, enter drinking water.

- o The Subcommittee recommends the termination of the cost modeling studies because of their apparent lack of integration within the existing research program and the availability of similar modeling systems.
- o Water quality modeling studies should continue but with refinement in the research objectives and appropriate verification measures. The emphasis of such studies should include: additional information on the dispersion of chemicals in the distribution system (kinetics), and biofilm interactions and changes in the chemicals themselves while in the distribution system.

Specific Technical Comments on Components of the Research Program

A. Microbiology

Microbiology research has been of consistently high quality, and this is reflected by the numerous publications of the staff in peer reviewed journals. Previous research efforts have contributed significantly to an improved understanding of the behavior of micro-organisms in water distributions systems.

Decreased funding has caused the program, in the recent past, to become too narrowly focused. The research program document identified several issues that the Subcommittee believes are of high priority and necessary to regulatory decision making. These include:

- o Continuing the investigation of alternative disinfectants and surveying the number of reported incidents of the occurrence of coliform bacteria in the presence of free chlorine residuals. In addition, these research efforts could contribute significantly to reducing costs associated with the corrosion of distribution systems.
- o Determining the effect of organic matter on microbial contaminant control. The major future effort should be directed toward defining the effect of assimilable organic carbon (AOC) in distribution systems on bacterial growth including both heterotrophic plate count (HPC) and coliform organisms. Another important factor that should be pursued is the role of AOC upon opportunistic pathogens, focused especially on the increased potential for amplification in the distribution system.

There is a serious problem with the level of funding projected for microbiology research. If current levels prevail, the Agency will not have generated the data needed to support the alternatives in treatment called for in the upcoming regulatory action for trihalomethanes (THM). Water utilities will have to comply with the new THM regulation. It is likely that many new treatment technologies will be available to enable them to do so. The majority of the

population will look for EPA to provide public health protection and obtain it for a research investment of approximately a \$300,000 per year effort. What is perplexing to the Subcommittee is that EPA has already devoted more resources to research that is not as directly linked to its regulatory needs (e.g. chlorine induced arteriosclerosis). The Subcommittee recommends that EPA reconsider how to achieve a better balance between its research planning and its regulatory needs.

Limited resources have had other consequences such as removing research opportunities for in-house scientists. Other regulatory agencies, such as the Food and Drug Administration, have taken advantage of recent advances in molecular biology and biotechnology by reorienting their research programs. At present, there is little or no opportunity for EPA scientists in this program to achieve similar advances.

B. Corrosion

The written and verbal presentations of the corrosion research program indicate that the available time and money have allowed these achievements productive results. Specific achievements include findings that:

- o Excessive leaching of lead from certain brass faucets.
- o Water quality indices are not reliable predictors of corrosion.
- o Protective films can be formed on asbestos/cement (AC) pipe.
- o Elucidation of the role of pH on lead leaching.
- o Demonstration of the role of treatment in reducing corrosion by-products in the Seattle distribution system.
- o Assessment of the suitability of tin/antimony solders in distribution system.
- o Decreased leaching from tin/lead solders with age.

The Subcommittee is concerned, however, that the efforts in corrosion research appear to be diminishing at a time when public concern over health risks is rising and when significant unanswered questions related to corrosion by-products remain. If funding for in-house and extramural research is not available, the Subcommittee recommends that, at the very least, a minimal expertise in corrosion research be maintained to enable EPA scientists to obtain and make wise use of information generated by the private sector and other organizations.

The Subcommittee recommends that several specific corrosion research issues need to be addressed by EPA:

- o Water quality and corrosion. Uncertainty remains about the relationship between water quality and corrosion. A national field survey of water quality and its effect on corrosion could elucidate this relationship. Although lead has received considerable attention, other metals, including iron, copper and cadmium, should be addressed.
- o Field studies on corrosion treatment. Field studies should be conducted on treatment methodologies to reduce corrosion, selecting several communities in the National Corrosion Survey that have above-average concentrations of corrosion by-products.
- o Impact of banning lead in plumbing. Although in the long run, the banning of lead will reduce lead exposures from potable water, the possible negative impacts of alternative materials should also be investigated to avoid unpleasant surprises. Candidate materials for additional research include plastic and stainless steel pipe.
- o Relationship between corrosion and coliforms. Corrosion and microbiological contamination and growth in distribution systems are often related. EPA studies in these areas should be integrated into a cohesive effort.
- o Asbestos. The Subcommittee is not convinced that the issue of adverse health risks from asbestos exposure in drinking water has been resolved including potential inhalation exposure from the re-entrainment of asbestos from previous water used. EPA should continue to maintain an active research effort for this issue.
- o Paintings and linings. EPA should consider establishing a program to evaluate methods for assessing the leaching of chemicals from coatings and linings used in water distribution systems.

C. Cost Modeling

The Subcommittee concludes that water quality simulation research should receive the highest priority within the modeling and cost estimation area. This applies to both the presently scheduled evaluation in New Haven, to be conducted by the University of Michigan, and to future research efforts. The Subcommittee recognizes the potential for utilizing water quality simulation as a means to identify representative monitoring locations within the distribution system. Another logical application is to define the variation of water quality on a temporal basis in order to address the changes that may occur between sampling at specified frequency.

The soon to be initiated North Penn Water Authority study to evaluate expert system technology provides an opportunity to assess the applicability of this approach to water distribution systems. The Subcommittee supports the objective of this study and the insights it can provide for applying expert systems within the water industry. Upon successful completion of this study, the Subcommittee urges the Office of Research and Development to evaluate the need for a follow-up study at a larger, more complex water system.

Future efforts in water quality simulation should center in at least three areas. These include:

- o Incorporating dispersion of substances.
- o Evaluating the chemical kinetics of non-conservation [Rick: is this the right word?] substances.
- o Simulating the transfer from biofilms on the pipe surface.

At present, there are no planned projects in these areas. As the New Haven study is conducted, the Subcommittee recommends that the Office of Research and Development evaluate the potential for expanding the number of parameters beyond those investigated in the North Penn Water Authority study, to investigate the desirability of including dispersion and kinetics and to formulate proposals for future research.

The Drinking Water Research Division's studies on pipe replacement/rehabilitation/repair will be completed in the near future. These studies provide much insight into the factors that need to be considered in assessing the history of pipe breaks, costs and causes leading to pipe replacement decisions and repairing distribution mains. They have also established an excellent data collection system and data base that is available for many future studies. The Division conducted a thorough peer review in March 1987, and the Subcommittee concurs with observations made at that time, particularly the requirement for independent verification. The Subcommittee commends the Division on the work conducted to date. However, it agrees with its decision not to use limited research funds in this area in the near future because this work is also being conducted by other research organizations.