Pre-Stage 1 Characteristics of Non-ICR Systems, Methodology of Treatment Technology Cost Estimates, and Caucus Discussion of Stage 2 Proposals and Ideas

Meeting Summary - December 1999

M/DBP Stage 2 Federal Advisory Committee (FACA2)
Pre-Stage 1 Characteristics of Non-ICR Systems, Methodology of Treatment Technology Cost Estimates, and Caucus Discussion of Stage 2 Proposals and Ideas

Meeting #7

December 8-9, 1999

Washington, DC

February 4, 2000
Final

Table of Contents

Introduction

On December 8-9, 1999, EPA held the seventh meeting of the Stage 2 Disinfection Byproducts and Long-Term 2 Enhanced Surface Water Treatment Rules (MDBP) Federal Advisory Committee (FACA). This meeting included presentations by the Technical Work Group (TWG), the utility poll on the Stage 1 baseline, microbial occurrence and risk characterization, Pre-Stage 1 characteristics of non-ICR systems, and the methodology for developing treatment technology cost estimates. The FACA Committee also spent substantial time in caucus developing a list of problems and possible solutions related to the Stage 2 rule. [See Attachment I.a for a list of meeting participants.]

After introductions, mediator Abby Arnold, RESOLVE, reviewed the objectives of the meeting:

- Present:
    - Utility Poll reflecting Stage 1 baseline
    - Overview of microbial occurrence and risk characterization
    - Pre-Stage 1 characteristics of non-ICR systems
    - Overview of how costs of various technologies for various size systems is being developed
- Discuss and develop proposals and ideas for Stage 2

The Committee approved the agenda as revised based on changes in the Technical Work Group's (TWG) schedule [See Attachment I.b.] This meeting report summarizes the presentations and plenary discussions, and proposed next steps from this meeting.

II Report from TWG on Status of Analysis Being Conducted to Develop Stage 1 Compliance for ICR Systems

R. Scott Summers, University of Colorado presented the TWG's report to the FACA committee [Attachments II.a.] Summers began by reminding FACA members that this presentation was developed by the TWG and that in presenting this information he would act as a reporter from the TWG to the FACA. Information presented represents the consensus opinion of TWG members. The TWG presentation covered identification of plants that potentially will not meet criteria (with a safety margin) for the Stage 1 Rule, comparison of characteristics of plants that will and will not meet Stage 1 criteria, and introduce three methods of forecasting how plants will meet Stage 1 criteria. John Cromwell, Hagler-Bailley, also presented on the utility poll on Stage 1 baseline.

System compliance with Stage 1 Rules cannot be determined directly using ICR data. Summers was asked by FACA members to use the language "meeting Stage 1 criteria" instead of compliance. A FACA member added that ICR data reflects pre-Stage 1 situation in which some plants had taken steps to meet Stage 1 requirements and some had not. ICR data analyzed here is a snapshot of a 12 month period from July 1997 to July 1998. ICR data cannot be used to directly characterize plant response to Stage 1, however the TWG is developing three approaches to forecast the post-Stage 1 baseline based on ICR and other data.

The number of plants meeting the Stage 1 criteria targets as calculated using ICR data with a 20% safety margin for DBPs (MCLs for TTHM, HAA5, Bromate, Chlorite) and 15% safety margin for enhanced coagulation/softening requirements (TOC % Removal). The TWG presented the number of plants that would potentially not meet Stage 1 criteria. The TWG considers these estimates an upper bound, with the actual numbers possibly as low as half those calculated. The TWG included a comparison of estimates derived from ICR data and the prediction from the Stage 1 Rule Regulatory Impact Analysis for the distributions of plants meeting and not meeting criteria for Stage 1 Rule and population served by potential non-compilers. The TWG presented distributions of influent TOC and Bromide and the average, median, and highest TTHM and HAA5. The TWG also presented estimates on the minimum post-Stage 1 changes in annual average TTHM and HAA5 for all plants. Bromate data was not presented because none of the ICR plants exceeded the bromate MCL.

Number of plants estimated from ICR data that do <u>not</u> meet Stage 1 criteria for DBPs (with safety factor):

- HAA5 - 61 plants
- TTHM - 70 plants
- Both - 32 plants

The TWG is developing three approaches for forecasting the distribution of technologies plants will use to meet criteria for Stage 1. The estimates assume full compliance with Stage 1 rule.

1. SWAT model - uses ICR and non-ICR data as input to water treatment plant (WTP) model with structured cost-sensitive decision tree for treatment technology selection. Beta testing is now underway and results for large ICR systems will be ready in February.

In response to a question Summers explained that the SWAT will consider a full range of possible technology options. It will not give cost information, but ranks options by relative cost based on specifics of the plant. The model will be size sensitive with separate large and small system decision trees.

2. Delphi poll - Using the ICR data and other inputs, 12 technical experts predict compliance choices on a case-by-case basis (for 274 plants). Results of each expert are compiled. Overall forecast will be ready in January.

3. Utility poll - Faxed survey to all ICR utilities in Fall 1999. Preliminary results are available (78% ICR plants have responded). Final forecast will be ready in January.

John Cromwell presented an overview of the background and rational for the utility poll and some preliminary data from the poll [Attachments II.b.] The utility poll is a survey faxed to ICR utilities in the fall of 1999. The purpose is to close the gap between where the ICR leaves off and where utilities will be when Stage 1 compliance is achieved, and to get first-hand insights from utilities to ground forecasts of treatment choices and resulting distribution system exposure. The utility poll data can be compared against individual plants ICR data. Cromwell presented data on TTHMs, HAA5s, and DBPs for all surface water plants that have responded to the survey. Cromwell also presented ICR DBP data for non-respondents and found that the data that has been collected is representative of the entire population of ICR plants.

Next steps for the TWG include preparing forecast of the post-Stage 1 baseline using the three approaches listed above and using SWAT for non-ICR systems forecast.

III Pre-Stage 1 Characteristics of non-ICR Systems

Stig Regli, EPA, presented the pre-Stage 1 characteristics of non-ICR systems [Attachment III.] Non-ICR systems are categorized by source and system size. Regli presented the sources of data for each system category:

Analytical Approach for Non-ICR Systems:

System size	Ground Water		Surface Water
Large (>100K)	use ICR data		use ICR data
Medium (10K-100K)	Non-Florida Based on Extrapolation from ICR & GWSS	Florida Based Primarily on State Data	Based on Extrapolation from ICR
Small (<10K)			Based on Small System

			Model

Ground Water System Analysis

Regli reviewed the population served by ground water system type. There are the approximately 42,000 small ground water systems (28,000 disinfecting ground water systems) serving less than 100,000 people.

- Florida differs from other states - frequency of ground water non-compliers with Stage 1 is significantly higher than other states. Therefore, the analysis of ground water systems was split into Florida and non-Florida states.
- Medium ground water systems are similar to ICR (large) ground water systems in source water, treatment types, and DBPs.
- Small ground water systems differ from medium and large systems because they are not required to meet the TTHM standard (promulgated in 1979).

Regli also presented ground water baseline for Florida and non-Florida, non-ICR systems.

Surface Water System Analysis

There are 5,439 small surface water systems, making up 75.6% of all surface water systems and representing 9.9% of the population served by surface water systems.

- ICR systems and medium non-ICR systems (10K-100K) are comparable in source water, treatment types, and DBPs.
- Characterization of ICR systems (WQPs, treatment, DBPs) can serve as inputs to baseline analysis for medium systems.
- Small surface water systems need to be modeled.

The TWG will establish a separate small system surface water baseline using state data, the disinfection survey, supplemental survey, and rural water survey. SWAT modeling, considering this data and development of representative systems, will be used to estimate the baselines as well as Stage 2 regulatory aspects. The rural water survey consists of 112 community, non-purchased, surface water systems. The survey includes data elements required to run SWAT and will be completed during two sampling periods - Winter 1999 and Summer 2000. Based on data from the rural water survey, if necessary, the WTP model used for ICR analysis may be calibrated for small systems.

IV Methodology Being Used To Develop Costs of Various Treatment Plant Technologies

In the limited time available during the December 6-7 meeting, the TWG was not able to reach consensus on treatment technology and system size costs per household. In discussing the agenda for the afternoon caucuses, some FACA members expressed concern that members would be discussing Stage 2 options during the caucus session without adequate cost information. Cost data could be presented without TWG consensus; however, without TWG consent and analysis, the FACA will have missed utilizing the expertise of TWG. In response to a question, Stig Regli, EPA, explained that the TWG presentation did include sorting of ICR data to see where systems fall in Stage 1 compliance and what technologies have been used to meet Stage 1 rules. Some FACA members noted that cost information is not necessary for identification of options, it is however necessary for discussing the merits of options.

Stig Regli reviewed the process the TWG is using to develop cost information. EPA has hired a contractor who is initially compiling the information. The TWG reviews this data before it is presented to the FACA. Ephraim King, EPA, added that the FACA could see preliminary data, if they choose, as long as FACA members understand the lower level of confidence in the data.

V Microbial Occurrence and Risk Characterization

Michael Messner, EPA, and Stig Regli, EPA, presented an overview of ICR *Cryptosporidium (Crypto)* occurrence in drinking water sources and a preliminary *Crypto* risk assessment.

Messner began with an overview of *Crypto* occurrence data from the ICR [Attachment V.a.] Observed means for total *Crypto* occurrence was presented for all surface water and aggregated by water category (flowing streams and reservoirs and lakes). Means are calculated for all samples from 12 months of ICR data and nondetects are treated as zeros. Oocysts are identified as empty, amorphous, or having internal structure. There is potential for mis-categorization and variability between analysts. The priority question for the risk assessment is:

- What is the distribution of *Cryptosporidium* occurrence in source water?

In the national risk characterization, microbial occurrence will be estimated using two approaches. The balance of over- and under-estimates of risk for each approach is not known:

1. Simple - observed means for total oocysts enter risk calculation with no adjustment (total counts as observed):

- No adjustment for fraction measured/recovery (tends to underestimate)
- No adjustment for fraction with amorphous and/or internal structure (tends to overestimate)
- No adjustment for false positive measurement error

2. Statistical Treatment/Bayesian - results (and uncertainty) reflect the method's low and variable recovery and small volumes analyzed:

- Use percent internal structure or percent non-empty (amorphous + internal structure) as multiplier
- Include false positive measurement error
- Include likelihood that influent concentration equals zero (exactly zero rather than very-nearly zero)

The first outputs of the Bayesian analysis were first viewed by the TWG on December 6. This analysis needs further quality assurance/quality control and sensitivity. When completed, the results will include:

- A central (or "best-fit") distribution of source water means and
- A credible interval (like confidence bands) to indicate uncertainty of the central distribution.
- Comparable figures (distributions and credible intervals) for total oocysts, those with internal structure, and nonempty (amorphous or internal structure) oocysts.

Regli followed with a review of the latest information regarding *Crypto* risk [Attachment V.b.] Regli presented the level of uncertainty of different factors in the analysis, the analytical approach for the risk assessment, and assumptions used in the analysis. Transmission by secondary spread from source can be calculated for different *Crypto* removal assumptions as a 5.7% multiplicative factor. Regli presented graphics on the estimated risk for *Crypto*, including comparisons of different strains. In response to a question Regli explained that the distribution of different *Crypto* strains is not known. Future work on the risk assessment includes:

- distribution of removal efficiencies among plants
- source water occurrence distributions (Bayesian analysis)
- consideration for viability/infectivity using internal and non-empty oocyst data (internal + amorphous structures)

- characterize risk by population
- consider supplemental survey data
- non-ICR system analysis

In response to a question Regli explained that removal alone, depending on its source water concentration, may not be adequate for a given system to achieve a 10^{-4} risk level. Additional disinfection/inactivation for *Crypto* might be needed depending on physical removal efficiencies and source water concentration. If ozone were used as a disinfectant to inactivate *Crypto*, DBP requirements (particularly the bromate standard) could be related to the amount of disinfection needed on an source by source basis. A FACA member added that there is no human data on *Crypto* infectivity among sensitive sub-populations, therefore we may need to consider more stringent treatment requirements to protect for sensitive sub-populations.

VI FACA Member and Alternate Caucuses and Reports to Plenary

Before breaking into caucus groups FACA members discussed the purpose and groundrules for the caucus sessions. Some FACA members expressed preference for getting unit cost information prior to discussing regulatory proposals. A FACA member asked other FACA members to trust the ability of all members to hear information, understand the information is preliminary, and not make final conclusions about what they have heard. A number of FACA members pointed out that the TWG is doing an outstanding job, in terms of level of complexity and quality, others pointed to the need for the FACA to provide more guidance to the TWG on what ought to be the TWG analysis priorities and what format is most useful to present the information.

After agreeing that the FACA needed to be clearer about their needs from the TWG, facilitator Abby Arnold identified the following question to guide the caucus sessions:

- What are the range of possible ideas (problems and solutions) that the FACA should consider for Stage 2?

Arnold reiterated that each caucus ought to develop a list of the problems that need to be addressed and potential solutions to solve the problems. These lists should be inclusive; therefore participants should not critique ideas. The report out of the caucus discussions will be a reflection of the discussion; consensus is not being sought.

In order to stimulate thinking of the caucus discussions, FACA member Chris Wiant, provided his current thinking about possible regulatory options - an integrated water quality strategy - as a starting point for FACA caucus discussion [Attachment VI.a.]

FACA members and alternates split into two caucuses, which met on the afternoon of December 8 and for one hour on the morning of December 9.

Caucus Reports to Plenary

On the morning of December 9 caucuses presented the results of their sessions to the FACA plenary. (See Attachment VI.b for the notes from these sessions.)

- Group 1 organized it's discussion into problems and solutions related to: DBP cancer, DBP reproductive effects, and microbial occurrence issues.
- Group 2 organized it's discussion into problem and solutions related to: non-regulatory actions, principles, Microbial problems and options, and DBP problems and options.

Following the presentations by the caucus groups, FACA members added the following points:

- MCLs for brominated DBPs is one option for capping risks in distribution system.
- Reliability has two different meaning - residual disinfectants at certain point in distribution system and system-wide problems. Operation and management of system, including backup systems may be functioning; however, variation in the system may be large. Current monitoring may not be adequate.
- The overall focus of the FACA seems to be regulatory changes to address microbial and reproductive DBP risk. It is uncertain whether 80/60 needs to change or if the focus should be on outliers.
- A FACA member cautioned against the possible tendency to identify brominated species as the main problem because of the great uncertainty surrounding them.

Report from Rochelle Tyl Informal Session - December 7, 1999

FACA member Rodney Tart summarized the December 7 informal session with reproductive/developmental toxicology expert Rochelle Tyl, RTI. Tart began by thanking EPA for providing a forum for FACA members without expertise in the field to ask questions on health effects. Tart reported that Tyl had made the following points during the session based on available DBP studies:

- There is currently not enough toxicological data for a risk assessment: multi-generational studies with low doses and long-term exposure are needed to understand true risk - primarily for brominated DBP species.
- Current hazard identification of DBPs may or may not tell us that there is true "risk."
- There remains a large level of uncertainty due to the lack of long-term, low-dose exposure data.
- More information is needed on the human/rodent metabolism relationship.
- That studies cannot definitively say that there is not a problem, nor do current studies tell us there is a problem. The current studies can be used to separate endpoints of concern and raise red flags for further study and analysis. These studies are the first step in determining the level of risk.
- Epidemiology studies are not compelling at this time.

Following Tart's presentation FACA members added the following points:

- Reproductive/developmental health effects remain among the most difficult and puzzling issues for the FACA.
- Concern was expressed that during the informal session the prior day, Tyl had been asked questions about risk of DBPs in drinking water that may inappropriately affect the opinions of members who attended the session.
- There is wide variation of how individual FACA members interpret and understand the same reports and data that has been presented to the FACA depending on understanding of the data as well as personal and professional perspectives.
- During the tenure of this FACA, members may never agree on the exact level of health risk posed by DBP's in drinking water.
- Future conversations with technical experts on this subject need to take place in front of the entire FACA.
- The FACA will continue to look to the TWG and health effects experts to present data that brings clarity and closure to issues, while accurately portraying levels of uncertainty.

VII Report from TWG on Tasks and Time Needed To Conduct Tasks

Jennifer McLain, EPA, presented TWG work program activities and anticipated schedule, including target dates for presentation to the FACA [Attachment VII.] In response to a question from a FACA member McLain explained that there are approximately 60 TWG participants at each TWG meeting. Abby Arnold facilitates TWG meetings. The TWG agenda is split among the 17 TWG subgroups with subgroup chairs

leading the meeting. However, all 17 subgroups do not meet at every meeting. Each TWG meeting consists of a few major topics with some time spent meeting among smaller subgroups and some time spent as the full TWG. The full TWG has input into data that is presented to FACA.

Additional points:

- The January 15 deadline for the SWAT depends on if problems arise in the QA/QC of the program. The TWG has critical path schedules that determine if deadlines can be met - this is a resource intensive effort.
- The TWG has built a "Cadillac" model for data analysis. The TWG has been trying to anticipate all possible data analysis needs of the FACA. The TWG has worked on the assumption of providing the highest possible quality for the broadest possible range of options.
- Rough estimates of assumptions behind various options could be calculated to let FACA know some of the implications of possible options. Ballpark estimates on a relative scale of costs for options is doable.
- In response to a request from a FACA member to provide unit cost information as soon as possible. The TWG will present unit cost estimates that will include membrane costs at the February meeting.
- A FACA member asked to see prediction of different technologies and the levels of *Crypto* inactivation achieved.
- The ICR is not the only tool that the TWG is using - especially for small systems. The TWG is developing a toolbox of methods and confidence in these tools.
- Another FACA member asked that all TWG presentations be simple, clear, and directed at decisions the FACA will need to make in development of recommendations on the Stage 2 rule.

VIII Next Steps

FACA members discussed the following next steps:

- **Additional FACA meeting dates:**

    May 31- June 1
    June 27-28

- **Assignment for December -** Review the Brainstorm Problems/Solutions notes [Attachment VI.b].
- **The January 2000 meeting** - will be dedicated to reviewing, adding to, refining, and editing the results of the caucus Brainstorm Problems/Solutions Stage 2 ought to address.

IX Public Comment

No speakers asked to address the FACA.

X ATTACHMENTS: [NOT INCLUDED IN WEB VERSION]

I.a Participants List

I.b Meeting Agenda

II.a Analysis of ICR Data for Potential Noncompliance to Stage 1: TWG Presentation to FACA Committee - R. Scott Summers et al., December 8, 1999

II.b Status of AWWA Utility Poll - December 8, 1999: John Cromwell, Dave Cornwell, Alexa Obolensky, Steve Via

III. Pre Stage 1 Baseline Characterization of Non-ICR Systems: Non-ICR Subgroup of the M/DBP Technical Workgroup Presentation to the FACA, December 8, 1999 - Stig Regli, EPA

V.a ICR Cryptosporidium Occurrence in Drinking Water Sources Distribution Systems and Water Quality - Michael Messner, EPA

V.b Preliminary Cryptosporidium Risk Assessment - Stig Regli and Michael Messner, USEPA-OGWDW

VI.a Integrated Water Quality Strategy, Outline for M/DBP Regulatory Options - Chris Wiant

VI.b Brainstorm Problems/Solutions 12/99 - Draft notes from FACA caucuses

VII. TWG Work Program Activities And Anticipated Schedule - Jennifer McLain, EPA