M/DBP Stage 2
Federal Advisory Committee (FACA2)
TWG Presentation and Discussion of Various Scenarios, Viability of UV, and Narrowing of Stage 2 Scenarios for Further Analysis

Meeting Summary - June 2000

Meeting #11

June 1-2, 2000
Washington, DC

Final

Table of Contents

ATTACHMENTS

I.a Meeting Participants - M/DBP FACA, June 1-2, 2000

I.b Meeting Agenda - MDBP FACA, June 1-2, 2000

I.c FACA Meeting Materials Notebook: Table Of Contents, June 1-2, 2000

II. TWG Presentation --Impacts of Stage 2 Regulatory Scenarios, Michael McGuire, MEC

III. Application of the Microbial Framework to LT2ESWTR FACA Options, Stig Regli, EPA

IV.a UV Disinfection: Technology Performance and Availability: An EPA Perspective, Dan Schmelling, EPA

IV.b Application of UV Technology for Drinking Water Treatment - A Utility Perspective, Roy Wolf, Metropolitan Water District of Southern California

IV.c Municipal Scale UV Disinfection of Drinking Water - UV Manufacturer's Perspective, Jon McClean, Hanovia Ltd.

V.a Detection, Treatment, and Management of *Crypto*sporidium At Philadelphia Water Department, Howard Neukrug, Philadelphia Water, and Caroline Johnson, PA Dept. of Public Health

V.b Countervailing Risk Considerations Important to Evaluation of Bromate Regulatory Options, Phillippe Daniel, Camp Dresser and McKee

V.c Summary and Conclusions: Oral (Drinking Water) Development Toxicity Study of Bromodichoromethane in Rabbits, Keith Christman, Chlorine Chemistry Council

Introduction

On June 1-2, 2000, EPA held the twelfth meeting of the Stage 2 Disinfection Byproducts and Long-Term 2 Enhanced Surface Water Treatment Rules (MDBP) Federal Advisory Committee (FACA). Facilitator Abby Arnold, RESOLVE, began the meeting by reviewing the proposed agenda and objectives of the meeting. The FACA approved the agenda with a change to the schedule - the public comment period was moved earlier in the day. The objectives of this meeting were to:

- present the results of TWG analysis of regulatory scenarios discussed by the FACA at the April meeting;
- present scenarios for addressing microbial occurrence and DBPs;
- discuss various Stage 2 scenarios and FACA discussion;
- provide direction to TWG on Stage 2 scenarios; and
- review and discuss one-text outline.

See Attachment I.a for a list of meeting participants and Attachment I.b for the draft meeting agenda.

In anticipation of this meeting the TWG, EPA staff, and consultants developed a package of background materials for the FACA. This information was compiled into notebooks which were distributed to FACA members before the meeting. The contents of the notebook are listed in Attachment 1.c. Copies of these materials are available by contacting RESOLVE.[(1)]

TWG Presentation to FACA Committee--Impacts of Stage 2 Regulatory Scenarios

Michael McGuire, MEC, presented the TWG's analysis of impacts of Stage 2 regulatory scenarios requested by the FACA [Attachment II.a]. McGuire's presentation covered primarily the disinfection byproduct data. (Stig Regli focused on the microbial data in the following presentation.) McGuire reminded FACA members that he was presenting on behalf of the TWG and data presented represents the consensus of the TWG. The TWG is working with a very large amount of data; what is presented is one cut at analyzing this data which the TWG hopes will be most useful to the FACA. This presentation covers a review of the analysis of scenarios requested by the FACA in April, a review of the DBP species requested by the FACA, action level and distribution system options reviewed by the TWG, and anticipated next steps for the TWG. Household cost data developed by the TWG and an EPA consultant were not ready for presentation during McGuire's presentation. A revised cost data summary with the household cost data was circulated to the FACA and meeting participants on June 2 [Attachment II].

McGuire presented the revised Stage 2 Scenario Matrix, as requested by the FACA at the April meeting:

Stage 2 Regulatory Scenario Matrix - April 29

DBPs:	80/60 RAA Bromate = 10	80/60 RAA Bromate = 5	80/60 AAM Bromate = 10	80/60 AAM Bromate = 5	80/60 LRAA & 80/60 SH Action Level (5% SF) Bromate = 5	80/60 LRAA & 100/75 SH Bromate = 5	80/60 SH Bromate = 10	80/60 SH Bromate = 5
Microbial:								
0 log *Crypto* removal	**xx**	**xx**	**xx**	**xx**	**xx**	**xx**	**xx**	**xx**
0.5 log *Crypto* removal	**xx**	**xx**	**xx**	**xx**	**xx**	**xx**	**xx**	**xx**
Sort only 20% 2.0 log *Crypto*removal	**xx**	**xx**	**xx**	**xx**	**xx**	**xx**	**xx**	**xx**
2.0 log *Crypto* removal	**xx**	**xx**	**xx**	**xx**	**xx**	**xx**	**xx**	**xxxx**
each x represents one run of the SWAT								

McGuire presented an overview of the SWAT runs performed by the TWG for the new Matrix:

- Each option was run with UV On and UV Off;
- Total national costs for some options and Large/Medium SW costs for all options (not all were analyzed because of time constraints);

- Determine impact of 1 Fg/L bromate in sodium hypochlorite on regulatory options;
- Determine DBP species production;
- Safety factor sensitivity analysis; and
- System vs. plant compliance.

In addition to the SWAT runs on the scenarios in the Matrix, the FACA asked the TWG to develop information on:

- Tools to respond to DBP action level exceedances;
- Qualitative description of RAA, LRAA, AAM and SH;
- Characterization microbial risks (covered by Stig Regli);
- Microbial Framework (toolbox) for source waters (covered by Stig Regli);
- UV characterization (UV was also covered as a separate agenda item - Section IV);
- Viability/applicability of GAC and chloramine for small systems; and
- Distribution System Water Quality Framework.

McGuire then reviewed the organization of TWG cost data into summary tables provided as part of the FACA's notebook materials (Tab 1).

McGuire presented an overview of the analysis of scenarios requested by the FACA in April for:

- Capital costs (in $billions) versus decrease in TTHMs - with UV on and off. Log inactivation for *Crypto* = zero.
- Capital Costs versus decrease in TTHMs - UV on, log inactivation 0.5.
- Capital Costs versus decrease in TTHMs - UV on, 20 percent log inactivation 2.0.
- Capital Costs versus decrease in TTHMs - UV on, log inactivation 2.0.
- Capital Costs versus decrease in TTHMs - UV on and off, log inactivation 0.5.
- Capital Costs versus decrease in TTHMs - UV on and off, log inactivation 2.0.
- Capital Costs versus decrease in TTHMs - UV on, log inactivation 0.

In addition McGuire made the following points:

- UV does show up in the technology mix when UV is on and inactivation is zero because the Long-Term 1 Enhanced Surface Water Treatment Rule requires inactivation of *Giardia* and viruses, some plants will use UV to meet this requirement.
- The figures shown in the cost summary are for the average and 90^{th} percentile. These points were chosen as one way to present data, they are important because small changes in the average have a dramatic impact on the tails. The 90^{th} percentile is one measurement of the tail.
- UV on means that UV is an available technology, not that all plants will use it.
- The TWG has assumed a 5 percent safety factor on the 80/60 action level for all MCLs and a 20 percent safety factor.

McGuire reviewed the distribution of TTHM species for the ICR baseline and regulatory options requested by the FACA. The TWG did not have sufficient time to develop and present data for HAA species. McGuire reviewed the TWG method and assumptions behind the analysis of TTHM species. This analysis was performed only for surface water ICR plants. McGuire presented the following analyses:

- Average level of TTHM and species concentrations;
- Average percent reduction in TTHM and species from ICR baseline;
- 90^{th} percentile levels of TTHMs and species (focused on tails);
- Reduction in 90^{th} percentile TTHM and species from ICR baseline;
- Reduction in Average TTHM Levels (ug/L) for Stage 1 Baseline and Stage 2 Options

The TWG analyzed the impact of action levels on surface water plants, and developed a toolbox for dealing with action level exceedances in the distribution system. The TWG analyzed impact on surface water ICR plants for the 80/60 LRAA scenario, with an 80/60 single highest action level (with a 5 percent safety factor):

- 3 to 6 % of plant months exceeded the action level while remaining in compliance with the 80/60 LRAA.
- 20 to 35% of SW plants in the ICR exceeded an action level in at least one month while in compliance with the 80/60 LRAA.

Distribution system toolbox for action level exceedences developed by the TWG:

• Modified sampling strategies • Hydraulic monitoring / Modeling • Tank turnover • Modify tank design • Eliminate dead ends	• Improve reservoir mixing • Flushing • Change disinfection practice • pH control • Water Treatment Plant changes

The TWG analyzed small systems costs to identify the estimated impacts of proposed rule options on those surface and ground water systems serving fewer than 10,000 people. The TWG analyses described:

- Impacts as a percentage of systems needing to change to an advanced technology; and
- Cumulative distribution of household costs to affected households served by small systems.

McGuire reviewed the TWG small system cost analysis, included in the materials notebook (Tab 5: Small System Compliance Forecasts and Household Costs). He then summarized the data:

- Generally, more stringent DBP regulatory options result in higher costs and lower DBP levels;
- While Average DBP levels may only be reduced by a few ug/L, some regulatory options significantly reduce the "tails";
- The reduction in TTHM levels results in a high percentage reduction in chloroform and some BDCM (cromo dichloromethane) reduction;
- More stringent regulatory scenarios results in the production of some CHBr3;
- The greatest reduction in TTHM species is for chloroform as TTHMs are reduced under more stringent regulatory scenarios; and

Highlights of the discussion that followed:

- The percent reduction in TTHM may not be the best measure of reduction of risk due to species shifts. EPA responded that TTHMs have been identified as an good indicator of chlorinated byproducts and brominated THMs. A FACA member noted that as you bring down TTHMs or HAAs other DBPs and species of TTHMs or HAAs are reduced.
- In response to a question regarding the prediction of speciation from the ICR baseline McGuire noted that estimates of ICR baseline are compared with model predictions and the fit of the data is very good, though not perfect. Overall, the model is a good estimate of DBP speciation.
- Dose response relationship may be linear at low doses for cancer, however, there is more likely to be a threshold for reproductive and developmental effects.
- The FACA should avoid taking action that lead to a shift in technologies without understanding the consequences of those changes. Changes should not lead to substituting hazards or risks.
- The predicted Stage 1 baseline includes a significant drop in TTHM and HAAs from the ICR baseline.

- In response to a question, Michelle Frey, MEC, noted that small system water quality is likely to be as good or better than the medium and large systems once they come into Stage 1 compliance.
- The toolbox for distribution system remedies may contradict other existing regulations, especially those regarding water storage.
- A FACA member asked for more data on small system costs and technology shifts as a result of Stage 1 compliance. EPA responded that some of this data is available in the cost summary charge (Tab 5 of the materials notebook).

Application of the Microbial Framework to LT2ESWTR FACA Options

Stig Regli, EPA, presented on behalf of the TWG the microbial framework developed by the TWG [Attachment III.]. Regli's presentation on the microbial framework included:

- Monitoring methodology for sorting plants into different mean *Crypto* source water concentration ranges (bins) (*E. coli* indicator and/or *Crypto* monitoring)
- Toolbox of available control measures for shifting plants into lower bin classifications (e.g., watershed control options, treatment options)

Regli reviewed the monitoring approach developed by the TWG microbial subgroup. Sstems would be sorted into bins based on the monitoring results,. The TWG is evaluating the potential for misclassification into bins. Additional issues that the TWG is addressing and Regli reviewed are:

- National estimates of *Crypto* concentrations in source waters (how to reconcile differences between Supplemental Survey and ICR data);
- Reliability of using *E. coli* for predicting mean *Crypto* concentrations in source water (cost of monitoring for *Crypto)*;
- Reliability of estimating mean *Crypto* concentrations using Method 1623;
- Evaluation of tool box options and how to assign credit per option; and
- Estimates of number of systems in different source water bins.

A FACA member expressed concern that the log credit (1 or 1/2) is difficult to distinguish because the real change in finished water occurrence cannot be measured.

Regli presented an overview of the LT2ESWTR FACA options for microbial disinfection (for filtered systems), developed by the TWG:

- **Option A (monitoring to assess if more treatment needed)**
  +1/2 log *Crypto* treatment if *Crypto* source conc. >0.1/L & <1/L
  +1 log *Crypto* treatment if *Crypto* source conc. >1/L
- **Option B1 (monitoring to assess if more treatment needed)**
  +1/2 log *Crypto* treatment if *Crypto* source conc. >0.03/L & <0.1/L
  +1.5 log *Crypto* treatment if *Crypto* source conc. >0.1/L &<1/L
  +2.5 log *Crypto* treatment if *Crypto* source conc. >1/L
- **Option B2 (inactivation required but outs with monitoring)**
  same as B1 except must monitor and make demonstration to avoid default 1/2 log inactivation treatment requirement
- **Option C (inactivation or membranes)**
  1/2 log inactivation or membranes and for high *Crypto* conc. >1/2 log treatment (required *Crypto* monitoring)

Regli presented estimated number of plants in each bin for each of the regulatory options listed above, approximate impact and cost for each of the options and analysis of misclassification rates. FACA members made the following points:

- These calculations do not include risk calculations for susceptible populations.
- 24 samples may be enough to determine/assign bins, but gives only a limited ability to monitor at low occurrence ranges. EPA believes 0.03 oocysts per liter is the lowest mean concentration that can be determined with reasonable confidence by 24 monthly 10 L samples. The 0.01 level corresponds to the 10^{-4} risk level for the mix of *Crypto* strains.
- Surrogate monitoring is cheaper. However, some FACA members have concerns that *E. coli* is not an adequate indicator of *Crypto*. One option, would be to allow 1 year of *E. coli* monitoring as a surrogate. Based on results some systems would go to monitoring for *Crypto,* while others would be passed out of *Crypto* monitoring.
- In response to a question Regli explained that presence/absence testing, based on split samples, has been debated by the TWG. However, there is not enough data to support this approach. Advice from statistics experts is to assign zero as zero in the data, even though there is some level of misclassification.
- ICR data indicates there is a relationship between *E. coli* and turbidity, although it has not been quantified.
- During the Las Vegas *Crypto* outbreak there was no rise in *E. coli*, though there was a change in total coliform in the month before the outbreak.
- A FACA member noted that spike events may not be captured by monthly monitoring so risk is never overestimated.
- Regli noted that in determining the acceptable level of risk there is also a question whether risk must be at a consistent level throughout the year, or if the majority of the risk can be concentrated into a few days a year.
- The use of the 10^{-4} risk level is not an EPA policy for pathogens, it is a reference point.
- Plant efficiency and removal may rise as particulate concentration increases. Reliability and redundancy is designed into treatment plants specifically to achieve this goal.
- A FACA member noted that there may be low risk systems which will fall into the low risk bin that experiences occasional peaks with high probability of outbreaks or systems with high probability of system failures that could lead to outbreaks.

EPA explained that to make the Framework approach to microbial protection work the FACA will need to decide:

1. On a monitoring strategy to place systems into low, medium and high risk bins;

2. On appropriate bins and markers; and

3. On required actions for systems in each bin.

UV: Viability of UV for Treating Drinking Water

EPA, a large utility, and a UV manufacturer each provided a presentation on UV.

UV Disinfection: Technology Performance and Availability: An EPA Perspective

Dan Schmelling, EPA, presented EPA's perspective on UV technology [Attachment IV.a]. Schmelling reviewed the following concerns regarding use of UV that remain to be addressed:

1. Efficacy of UV to inactivate pathogens and dose response relationship. UV (expressed as mJ/cm^2) equals irradiance (mW/cm^2) times contact time. Typical UV doses for water disinfection range from 30 - 140 mJ/cm2. Log inactivation of bacterial pathogens is reported at doses of 3 - 34 mJ/cm2.

- *Viruses* are the most UV resistant pathogens: 4-log inactivation of many viral pathogens reported at doses of 7 - 50 mJ/cm2 and 4-log inactivation of Adenovirus is reported at doses of 120 to 140 mJ/cm2
- *Cryptosporidium* data includes 4 large independent data sets which suggests at least 3-log inactivation at 20 mJ/cm2. Studies by Sobsey and Linden indicate *Crypto* does not reactivate following UV inactivation.
- *Giardia* data includes 6 independent data sets which suggest at least 3-log inactivation of *G. lamblia* at 20 mJ/cm2. *G. muris* may be slightly more resistant

Schmelling concluded that UV can inactivate high levels of waterborne pathogens at feasible doses and is effective against bacteria, viruses, Giardia, and Cryptosporidium. UV is highly effective in multi-barrier approach.

4. Current use of UV in water treatment. Information was gathered from six UV manufactures and 431 UV drinking water plants (> 0.1 MGD). Most of these plants are in Europe (7 of 431 are in the United States) and approximately half use surface water. Existing UV plant median design flow is 0.53 MGD and the maximum design flow is 53.2 MGD. Over 90% of the UV plants were installed after 1990. The largest individual UV reactors (Wedeco) is 15 MGD and UV use in drinking water plants is increasing around the world.

5. Applicability of UV to different types of systems.

- *Conventional plants*: UV is currently used most often in smaller plants. For use in larger plants, the size and number of UV reactor vessels is increased. For very large plants customized designs may be required.
- *Softening plants*: Fouling studies indicate that hardness levels in filter effluent from softening plants will not preclude use of UV. Mackey et al. reported equivalent performance in softening and conventional plants in pilot study

3. Performance and reliability of critical UV system components (e.g., sensors) is addressed through validation protocols. Germany has developed standards for UV use and operation which include support documentation, standards for sensors, full scale bioassay, and continuous monitoring. Eight manufacturers are currently certified under the German certification program.

4. Feasibility: UV industry has the capacity to meet new demand. A conservative estimate is that the UV industry currently has capacity to develop 300 - 500 systems per year and the supply of components to UV reactors (e.g. lamps, sensors, reactor vessels) is not constrained. Limiting factors for widespread implementation are the limited design experience in US consulting firms, lack of state approval process, lack of regulatory standards (IT tables) or validation protocols, and little operational experience in US water treatment.

5. Risk associated with breakage of mercury vapor UV lamps is low. EPA has identified no catastrophic on-line failure of low pressure lamps and three cases of medium pressure lamps shattering on-line (EPA estimates that there are at least 50,000 medium pressure lamps in service). Risk is mitigated through standard operating procedures and training, equipment design, thermal sensors and alarms, and placement of unit within treatment train. Risk of mercury contamination is low and manageable with standard operating procedures.

Application of UV Technology for Drinking Water Treatment - A Utility Perspective

Roy Wolf, Metropolitan Water District of Southern California (MWDSC), presented MWDSC's perspective on UV technology [Attachment VI.b]. In summary Wolf made the following points: UV may offer benefit as multiple barrier for *Crypto* that must be used with other disinfectants; UV implementation is site specific and large utilities face unique challenges to implementing new technologies; and UV should be included in the toolbox of options for utilities.

Wolf concluded that UV is not ready for use as Best Available Technology (BAT) for Stage 2 schedule (see discussion below) and outlined criteria that he would proposed to be used to determine UV's commercial readiness:

- Identification of required dose for UV disinfection of Crypto, Giardia, and viruses;
- Resolution of problems with measurement methods to determine UV dose applied to water;
- UV monitoring issues (sensors);
- Use of other disinfectants/oxidants; and
- Resolve implementation concerns for medium and large-scale plants.

Following Wolf's presentation the FACA discussed what is meant by "Best Available Technology" (BAT) in the context of the Stage 2 Rule:

- EPA uses BAT to determine if a requirement (e.g., log inactivation) is achievable and what the costs would be to the industry.
- EPA noted that BAT is a technology that is feasible and will allow systems to meet a specific Maximum Contaminant Level (MCL). There can be more than one BAT.
- Jim Malley, University of New Hampshire, explained that UV is ready for widespread application. However, in Malley's opinion it should not be considered the BAT. Before UV can be considered BAT the following issues must be resolved:

  Operational protocols must be developed;

  Mercury issues must be resolved;

  There is a lack of experience with large systems (100s million gallons per day such as NYC or Chicago); and

  Taste and odor control issues must be resolved.

Municipal Scale UV Disinfection of Drinking Water - UV Manufacturer's Perspective

Jon McClean, Hanovia Ltd., presented an overall review of the use of UV technology to disinfect water including wavelength, operational parameters, measurement and monitoring technologies, and examples of applications and designs of UV apparatus [Attachment IV.c]. McClean summarized that, regarding UV's drinking water track record:

- There are currently over 20,000 potable installations world-wide;
- The largest potable flow, located in Finland, is 74 million gallons/day (mgd);
- Largest effluent flow, located in New Zealand, is 294 mgd;
- The largest UV drinking water installation in the US is in Fort Benton, Montana, installed in 1987; and
- Municipal UV has been used in Europe since 1950.

Regarding UV's effectiveness McClean concluded:

- No species has demonstrated an ability to resist UV;
- Dose data is well documented by several research groups working independently; and
- *Crypto* has been demonstrated to not reactivate.

McClean closed with the following points regarding engineering of UV systems:

- Sensors within UV mechanisms are calibrated and sealed;
- Wipers automatically remove any deposition;
- UV dose = intensity x residence time x transmittance of water;
- Design protocols are robust and fail safe; and
- The technology is mature, the consulting community well informed and the equipment vendors have the capacity to meet additional needs.

In response to questions from FACA members McClean made the following points;

- UV systems are built with automatic, failsafe, shut downs so untreated water is not sent into distribution system if the UV system fails.
- 0.4% of lamps fail, only 1 lamp has broken in Hanovia's experience.
- Retrofitting will be a major challenge to UV implementation in the US, however, 80% of Hanovia's experience is with designing UV systems for existing plants.
- EPA added that it does not endorse or otherwise have a relationship with Hanovia or any other UV manufacturer.
- Water temperature (i.e., cold water) has no effect on effectiveness of UV technology.

FACA Discussion of UV

FACA members made the following comments regarding UV:

- In drinking water applications UV will face different challenges than in wastewater applications, such as calcium deposition. The majority of the issues that face widespread UV implementation concern operations and maintenance, and reliability.
- EPA's current thinking on UV is that it is an available technology, and it is readily available to a sub-set of systems.
- There is no measurable residual from UV, therefore you cannot measure from the water if UV has been applied. Sensors are used inside the UV housing to monitor level of performance.
- Some organisms have been shown to be capable of repair of DNA after low dose UV application. However, Crypto is a relatively complex organism and only very simple organisms are capable of photo reactivation.
- In response to a question from a FACA member Wolf explained that the wavelength of UV used is the same for all types of pathogens because it is based on absorption by DNA.

Public Comment

Detection, Treatment, and Management of *Cryptosporidium* At Philadelphia Water Department

Howard Neukrug, Director Watersheds - Philadelphia Water Department, and Dr. Caroline Johnson, PA Dept. of Public Health, presented Philadelphia's experience with watershed management, *Crypto* monitoring, filtration and ozone research, disease surveillance, and citizen involvement and partnerships [Attachment V.a].

During his introduction Neukrug stated that:

- Source water *Crypto* levels are influenced by wet weather and vary seasonally;
- Existing treatment is highly successful - up to 5.5 log removal has been demonstrated;
- Pilot studies show no added reduction using ozone; and
- Evidence does not suggest endemic Cryptosporidiosis in Philadelphia is related to drinking water quality.

Johnson presented surveillance data on the incidence of Cryptosporidiosis from Philadelphia:

- Documented incidence of Cryptosporidiosis is very low (1 case/100,000) in Philadelphia, especially in comparison with other notifiable conditions;
- Majority of Cryptosporidiosis cases (>85%) have a known source of exposure or risk for acquisition of infection; and
- Their interpretation of available evidence does not suggest that endemic Cryptosporidiosis is related to drinking water quality.

Neukrug concluded that *Crypto* in drinking water is unlikely to be a major contributor to any background or endemic level. EPA and FACA should work with utilities by (1) giving us the opportunity to continue our treatment optimization programs, (2) helping us strengthen our efforts towards source water protection; and (3) supporting our efforts to address real environmental and health improvements.

Following the presentation by Philadelphia FACA members made the following points:

- Regarding the observed similarity between Cryptosporidiosis and giardiasis occurrence by age distribution, a FACA member noted that the similarity could be a result of the surveillance system. Another FACA member noted that though the curves are the same, this does not necessarily mean the same routes of exposure.
- A FACA member noted that the general level of risk for non-morbid of Cryptosporidiosis, those infected but not identified as having the disease, is not known.
- A FACA member pointed out that public health surveillance systems are not geared to pick up diseases such as Cryptosporidiosis and giardiasis. There are two or three asymptomatic cases for each symptomatic case that is picked up by the system.

Engineering Feasibility of UV Disinfection for NYC, Catskill and Delaware Systems

Orren Schneider, Hazen and Sawyer, presented New York City's study of engineering feasibility of UV Disinfection. This study was conducted at the request of the New York City Department of Environmental Protection. The purpose of this study was not as a conceptual design. Rather, the goal of this study was to determine if it is feasible to engineer a UV disinfection system for the Catskill and Delaware portions of the NYC water system. The study examined the available UV systems (lamps and reactor types) and ancillary support systems (sensors and cleaning systems); the engineering feasibility and hydraulic issues surrounding a specific NYCDEP site; and conceptual economics for a recommended system. The study did not look at the scientific basis of UV disinfection (required doses) or other water quality issues (disinfection by-products and regrowth). The results of this study appear to indicate that a UV disinfection system could be engineered to fit at a specific NYCDEP site. Also, preliminary projected costs were presented.

- In response to a question from a FACA member Orrin explained that NYC has a gravity system, therefore water will continue to pass through UV apparatus even if there is a system failure. The amount of time to install the UV system in NY is unknown.

Countervailing Risk Considerations Important to Evaluation of Bromate Regulatory Options

Phillippe Daniel, Camp Dresser and McKee, discussed the risk tradeoffs associated with lowering the bromate MCL [Attachment V.b]. The FACA should take a comprehensive, systems based approach to considering the bromate MCL. Daniel discussed the following "challenges" in balancing microbial and DBP risks:

- DBP regulations must consider the mixture composition resulting from source and treatment factors;
- Assessing DBP health effects is difficult due to incomplete information on DBP mixtures of interest;
- Technology choices influence far more than DBP mixtures and microbes; and
- The FACA must determine how to regulate individual contaminents while preserving flexibilty to lower the overall drinking water risk.

Publication of the Oral (Drinking Water) Development Toxicity Study of Bromodichoromethane in Rabbits.

Keith Christman, Chlorine Chemistry Council, announced the release of the Oral (Drinking Water) Development Toxicity Study of Bromodichoromethane in Rabbits by Argus Research Laboratories, Inc [Summary and Conclusions provided as Attachment V.c].

Discussion of Regulatory Options

Day 2 of the FACA meeting consisted of a discussion among FACA members of regulatory options. The day included plenary and caucus discussions among FACA members. The plenary discussion was split into DBP and microbial issues and led to a narrowing of the regulatory scenarios for discussion at the June 27-28 FACA meeting and next steps (see below).

At the FACA's request, FACA member Chris Wiant introduced a "conceptual starting place" for the FACA's discussion of regulatory options. Based on Wiant's discussion with individual FACA members, he presented a package that he viewed as representing "common ground." This does not represent an agreement among the FACA members and was presented only as a starting place for discussion.

Conceptual Starting Place for FACA Stage 2 Discussion Presented to FACA by Chris Wiant - June 2, 2000
Microbial Pathogens Monitoring for *Crypto:* o Use of a surrogate for *Crypto?* o Difference between large, medium and small system monitoring requirements o Analytical difficulties of monitoring *Crypto* If system is in "High" *Crypto* bin: o Source water protection credit (if possible) o If not, chance to effect source water or watershed then toolbox (membranes, ozone, UV, in bank filtration, others.) o Reliability of systems - plant reliability credit? o How to define/use BAT (UV) o How to stratify utilities into bins and bin parameters (e.g., 0.03, 0.1, 1.0) o Are there ways to do multiple barriers that are equivalent to inactivation

Disinfection ByProducts (DBPs)

80 TTHMs/60 HAAs

- How can we be sure that we achieve temporal and spatial equity?
- Methods of averaging (RAA, LRAA, etc.)?

Action Level

- Based on single high (SH) trigger level
- Toolbox - required if action level is exceeded with some frequency
- Intended as an incentive for prevention

Monitoring

- Quarterly
- Monthly (if action level triggered)
- Phased (action level exceedences trigger more frequent monitoring)

Reliability

- Operations and Maintenance
- Distribution System

Bromate

- 5 MCL
- 10 MCL (current Stage 1 level)

The FACA members discussed Chris Wiant's approach. Below is a summary of the overall discussion, the summary also identifies the issues to be discussed by the FACA:

FACA discussion of microbial issues

The FACA did not reach consensus on the following, however, all that participated in the discussion appeared comfortable at the time with concepts in the following bullets:

- The FACA is concerned if there are "high" levels of *Crypto* in the raw water.
- Many systems are currently addressing meeting protective goals; there is not a need to require these systems to do more treatment (it is unclear whether parties' desire continued monitoring for these systems).
- There are a subset of utilities at high risk for *Crypto* in raw water: these systems need to address this through use of toolbox options - [inactivation, treatment or membranes].
- Objective criteria are needed to minimize transactional costs in accepting tool box options.

Microbial Scenario Under Discussion

- Monitor in order to characterize whether a system is at "high risk" for presence of *Crypto* in the source water.
- If in a high *Crypto* bin, address through:
    - Source water protection, if possible

  - Application of multiple barriers (membranes, ozone, UV, inbank filtration, or other items from the tool box)
  - Differentiate monitoring requirements for large, medium, small systems.[(2)]

Microbial Issues That Need Further Discussion

- What to do about unfiltered systems?
- Bin boundaries (..03, 1,.)
  - How many bins? (3,4?)
  - What tool box options should pertain to each bin?
- Number of systems affected
- Costs
- Monitoring:
  - Differentiate frequency and type of monitoring required and techniques used between large, medium, small systems
    - One suggestion: require large systems (>100K) to monitor for Crypto; Allow small systems to use indicator; if indicator level is exceeded, Crypto monitoring would be triggered.
  - Question about monitoring for E.Coli, turbidity as surrogates to *Crypto*
  - Possibly conduct research on using E.Coli or other index as a surrogate within a certain time frame
  - Allow small systems to use other indicator (turbidity, E.Coli, monitor finished water - there is a question about technical feasibility of this)
- Can EPA develop criteria to characterize source waters? And if designated as meeting water quality criteria, would the utility be dismissed from monitoring under LT2ESWTR? (develop water quality criteria for microbial pathogens for a specific stream reach, if the stream reach meets criteria)
  - Questions about, who would develop assessment, what amount of monitoring is needed to define drinking water use, how to define drinkable.
  - What process would be developed to address the questions above?
- If characterized as in a "high bin"; or [if applicablea "moderate bin"], what would utility be required to do?
  - Ideas discussed:
    - Use of multiple barriers defined as broadly as possible (Recognize membranes/removal/inactivation)
    - Source water protection
    - Involvement in Partnership., get credit
    - Removal
    - Inactivation
  - Tool box
    - Few transaction costs as possible
    - Use of toolbox as automatic/objective as possible
- For small systems
  - Those in high risk waters monitor finished water, if test becomes available.
- Need to provide help to states
  - Resources
  - Training
  - Recognize changes in state role
  - Require more highly trained professionals
- Distribution Systems

FACA discussion of disinfection byproduct issues

DBP Scenario under discussion

- 80/60 Standard. Recognize spatial and temporal equity issues. Address these issues with a combination of an MCL standard and an enforceable action level.
- Locational Running Annual Average MCL or Annual Average of the Max MCL
- Action Level
  When action will be triggered (e.g., frequency and level at which Action Level is exceeded). To be determined. Response to action level is exceedences to be determined.

  Response to action level exceedence will be taken from a DBP toolbox of activities, which will include incentives.

DBP Issues That Need Further Discussion

  - Use of LRAA or AAM. The FACA did not reach a conclusion about whether to use the LRAA or the AAM.
  - Monitoring scheme
- What level of monitoring is needed to identify peaks?
  - Quarterly samples?
  - Quarterly samples during particular seasons?
  - Monthly samples?
  - Other scheme?
  - If after monitoring, over a period of time (to be determined), there are no exceedences, monitoring frequency could be reduced.
  - Action Level exceedence
- When would an action level be triggered (80/60; 100/75..)
- What would happened if the action level was triggered multiple times (two, three.)
- Would there be a phased approach where certain, as yet undefined exceedences would trigger activities (actions undefined)
- Public notification stage
  - When would this be required, what type of public notification would be required, and how would this be required?
  - Reliability of the distribution system
  - What are the unintended consequences of this approach?, Will there be a loss in microbial protection?
  - To what extent could a benchmark approach as in Stage 1 or LTESWTR prevent loss of microbial protection?
  - Toolbox
  - What is in the toolbox to address exceedences?
  - Use of tools needs to result in verifiable measurable results
  - Bromate 5, 10/ppb on the table
- We now have the ability to detect bromate at 5/ppb
- Issue is whether to lower standard, impact on utilities currently using ozone, and the impact on utility technology choices.
- What are the other environmental costs for those systems that have to use control measures to achieve a 5ppb bromate level?

Next Steps

- **June 14 FACA Subgroup Meeting Scheduled**
  A FACA subgroup meeting was scheduled for Wednesday, June 14th in Denver Colorado. The meeting will be held at the Denver offices of MEC, Inc. The meeting will be attended by a subgroup of FACA members.
- **June Follow up Activities**

  The schedule for developing the "one-text" for the possible FACA agreement will be:

June 8: Abby will circulate a brief summary of the discussion from the meeting on June 2nd.

June 14: a sub-group of FACA members will meet in Denver to continue to discuss issues raised on June 2nd.

June 20: Abby will circulate to FACA members a revised "one-text" with comments suggested by FACA members and the results of the Denver meeting.

June 27-28: FACA meeting in Washington

- **July 28 FACA meeting date added**

  The FACA decided to expand the July 27 meeting to two days. The meeting is now scheduled for July 27 and 28th.

- **June 7-8 TWG meeting cancelled**

  The FACA decided to cancel the TWG meeting in June 7-8. The TWG may be asked to provide further analysis after the June 14th meeting in Denver.

Adjourn

1.

[*] For copies of the notebook materials contact Eddie Scher at [escher@resolv.org] or 202-965-6203.

2. [1] Large = >100,000 population; Medium = 10,000-100,000; and Small = <10,000.