

Long Term 2 Enhanced Surface Water Treatment Rule: Uncovered Finished Water Reservoirs Public Meeting

April 24, 2012
EPA East Building, Room 1153
1201 Constitution Avenue, NW
Washington, DC 20460

Overview

The Long Term 2 Enhanced Surface Water Treatment Rule: Uncovered Finished Water Reservoirs Public Meeting was held on April 24, 2012 as a part of the U.S. Environmental Protection Agency's (EPA's) Six Year Review process for the Long Term 2 rule. The meeting focused on the uncovered finished water reservoir requirement of the Long Term 2 rule. The major meeting objectives included the following:

- Discuss and solicit public input on data and information that may inform the regulatory review of the Long Term 2 uncovered finished water reservoir requirement;
- Provide background information on the Long Term 2 rule's uncovered finished water reservoir requirement;
- Provide an overview of the Six Year Review process and the requirement under Safe Drinking Water Act (SDWA) that any rule revision "shall maintain or, provide for greater, protection of the health of persons"; and
- Engage in a scientific and technical discussion on data and information related to microbial occurrence of *Cryptosporidium* and *Giardia* viruses, and other pathogens/indicators in uncovered finished water reservoirs; perspectives on public health risks; strategies to control or remove contaminants in uncovered finished water reservoirs; and potential assessment approaches to determine the effectiveness of these control and/or removal strategies.

The meeting was open to the public, and attendees participated in person and via an online webinar. This document summarizes the presentations and discussions that occurred during the meeting, and generally follows the sequence of the meeting agenda.

The U.S. EPA requests that anyone having data or information that would further inform the review of the Long Term 2 rule to please send it to César Cordero (cordero.cesar@epa.gov) or Kenneth Rotert (Rotert.kenneth@epa.gov) by December 31, 2012. Presentations from this meeting are available on the EPA Long Term 2 Rule web page for public meetings:

<http://water.epa.gov/lawsregs/rulesregs/sdwa/lt2/publicmeeting.cfm>.

Introduction and Welcome

Pam Barr, Acting Director of the Office of Ground Water and Drinking Water, provided opening remarks about the purpose of the meeting and the statutory requirements of the Six Year Review process. The meeting facilitator, Rob Greenwood, then provided an overview of the meeting procedures and the agenda.

Presentation 1: Overview of the Long Term 2 Enhanced Surface Water Treatment Rule (Michael Finn, U.S. EPA)

Mr. Finn gave an overview of the Long Term 2 rule. The Long Term 2 rule was published in 2006, with the intent of reducing pathogen contamination in drinking water. It was intended to address numerous public health issues by targeting high-risk water systems, especially those linked to *Cryptosporidium* and other microbial pathogens in drinking water. Long Term 2 reflects the Microbials and Disinfection Byproducts (MDBP) Federal Advisory Committee's Agreement in Principle (AIP) recommendations. Mr. Finn also provided information related to the history of uncovered finished water reservoirs (UCFWRs) in the United States and relevant regulatory and legal actions.

EPA established the uncovered finished water reservoir provision to address concerns related to contamination of treated water via bird waste, wild and domestic animal wastes, human activity, algal growth, insects, and airborne deposition. Following his presentation, Mr. Finn addressed clarifying questions from the audience, as referenced below.

- **Question:** *Portland, Oregon looked for a formal benefit analysis of the original Long Term 2 rule but has been unable to find one. Was there a benefit analysis conducted in addition to the cost analysis?*

Answer: There is not an actual cost-benefit analysis, but there are qualified benefits described in the economic analysis, as well as the preamble to the rule.

- **Question:** *Where are the 38 remaining uncovered reservoirs?*

Answer: The remaining UCFWRs are on the coasts – none exist in the Midwest. These range from small to very large, but for security reasons specific utilities cannot be named.

- **Question:** *Did the final MDBP AIP include mitigation options?*

Answer: Yes it did.

Presentation 2: Regulatory Review Process for Long Term 2 (Wynne Miller, U.S. EPA)

Ms. Miller provided an overview of the regulatory review process. This overview included the statutory requirements and considerations for the Long Term 2 review, a discussion of previous Six-Year reviews, a description of the expected timeframe for the Long Term 2 review, and a discussion of information and data that the U.S. EPA hopes to collect as a part of the review process. The Six-Year Review is a requirement of the 1996 Safe Drinking Water Act Amendments. Executive Order 13563 is an additional driver for EPA's review of the Long Term 2 rule as described in the document "Improving Our Regulations: Final Plan for Periodic Retrospective Reviews of Existing Regulations" (USEPA, August 2011). The Long Term 2 rule is one of 35 agency-wide regulations EPA is reviewing in response to Executive Order 13563.

The Long Term 2 review is currently in its initial stages and is expected to be completed by the March 2016. Technical review elements generally included in Six-Year Reviews are health risks, occurrence, implementation-related issues, analytical methods, and treatment technologies and techniques. These elements are expected to be evaluated during the Long Term 2 review, which will ultimately result in either a decision to take no action, or a decision to revise the rule. If EPA makes a decision that a revision is necessary, then it would initiate the rule making process. Any final decision about revising the regulation would depend on further analyses conducted by EPA as part of the revision process. Ms. Miller addressed clarifying questions about the Long Term 2 review process as presented below.

- **Question:** *You used the phrase ‘pathogens of potential concern’ twice. Do you have a list of what those might be, or are you just casting a wide net for inventory?*
Answer: EPA is casting a fairly wide net. EPA is aware of some of the pathogens of potential concern and expects today’s discussion will provide additional information.
- **Question:** *In terms of the schedule, there was not a reference to the dialogue envisioned for changing analytical methods as envisioned in the agreement in principle that led to Long Term 2. Where in the process would that fall?*
Answer: The dialogue is scheduled to take place at the late 2012 stakeholder meeting.
- **Question:** *When do you think data will be available to stakeholders from Round 1?*
Answer: EPA is currently assembling the data, and it will be available later in 2012.
- **Question:** *You mentioned looking for data about *Cryptosporidium* infectivity at the species level. Does that mean you’re not interested in genotyping?*
Answer: EPA is interested in both species and genotype level.
- **Question:** *Can you comment on the sample volume that was analyzed by the utilities in Round 1?*
Answer: Most people did 10 liters of analysis.
- **Question:** *You have a deadline of March 2016 – will there be a preliminary notice in 2015 to allow for public comment?*
Answer: Yes, EPA will provide advance notice.

Presentation 3: Overview of New York City’s Protozoan Assessment Program – Hillview Reservoir (Kerri Alderisio, New York City Department of Environmental Protection)

Please note that because the information presented by Ms. Alderisio is pending publication in a copy written form, her slides will not be available to the public

Ms. Alderisio provided detailed information on the New York City Department of Environmental Health’s (NYC DEP) Protozoan Assessment Program as it relates to the New York City’s Hillview Reservoir. She gave an overview of *Cryptosporidium* and *Giardia* data collected from the inflow and outflow of the Hillview Reservoir using U.S. EPA Method 1623. Study objectives for Ms. Alderisio and her colleagues were to determine if there is a significant increase in protozoa between Hillview’s inflow and outflow sites, to select the most appropriate statistical tool for the dataset obtained, and to assess how matrix spike recoveries and duplicates may affect the data interpretation. Hillview is an uncovered finished water balancing reservoir, fed by the Catskill and Delaware Watersheds, which has an average residence time of two days. Ms. Alderisio stated that sampling over the last ten years showed that both watersheds have been below the Long Term 2 Treatment Threshold between the 3-log and 2-log removal, and that levels have steadily declined over time. The study results conclude that the outflow contaminant levels are not significantly greater than the inflow levels and that the Hillview Reservoir is not a significant source of *Cryptosporidium* for the New York City water supply. Following her presentation, Ms. Alderisio addressed clarifying questions from the audience, as described below.

- **Question:** *Did you conduct any tests on the mean concentration? The mean concentrations are more important in terms of public health.*
Answer: No, we did not.
- **Question:** *Is there any reason why the *Cryptosporidium* levels declined so much from 2003 to 2011?*

Answer: We believe that this is due to the success of our watershed management techniques. These include wastewater treatment plant upgrades and land acquisitions. Stormwater detention basins were also installed, which may have made a difference.

- **Question:** *Did you take any other routine water quality data to see if there was a shift in that as well?*

Answer: Yes, for conductivity, temperature, pH, chlorine residual, and turbidity. The only statistically significant result was a negative relationship between *Giardia* occurrence and temperature, *Giardia* increased as temperature decreased.

- **Question:** *Is it surprising that the *Giardia* went down between the outflow and the inflow?*

Answer: It was likely a result of method. The difference between 37 and 44 is within the range of methodological variability.

- **Question:** *Can you describe, based on the system schematic map, where UV treatment occurs?*

Answer: It is north of the Hillview Reservoir.

Presentation 4: Seattle's Open Reservoirs (Wylie Harper, Seattle Public Utilities)

Mr. Harper gave a presentation on the multiple reservoirs in Seattle, Washington, focusing on the in-town finished reservoirs that serve the city. There are two remaining uncovered finished water reservoirs in Seattle, which currently hold 18 percent of the city's water. Both UCFWRs are expected to be decommissioned by 2015. Seattle also has multiple covered finished water reservoirs. Mr. Harper provided an overview of the City of Seattle's open reservoir protection program elements, for example, security, patrol, bird control, reservoir cleaning, outlet disinfection, and most specifically, water quality monitoring (WQM). In terms of WQM, Seattle monitors microbial contaminants (fecal & total coliform, HPCs, and *Pseudomonas*), chemistry, bird population and estimated nutrient loading, algae, and taste and odor analyses. Fecal positive readings declined significantly from 1994-2011, due to more accurate open reservoir monitoring, and a decrease in bird population. Bird wires of high and low levels have been installed around the UCFWRs, which have been very effective in decreasing bird access to water, especially with geese. Clarifying questions addressed by Mr. Harper at the end of his presentation are as follows.

- **Question:** *Did you see any change in your DBPs (Disinfection Byproducts) downstream of your reservoirs that you covered?*

Answer: Seattle has low organics to begin with and has not tracked this. Our DBP compliance has not been a real challenge in Seattle. We have not seen a big difference there.

- **Question:** *Is there a quantitative measure for your fecal coliform data? What is the range?*

Answer: Seattle does have a quantitative measurement, but Mr. Harper was not sure about the range. He stated that more in-depth data are available for anyone who is interested.

- **Question:** *After ozonation, I see slants in your pH. Why do we see a higher upward swing?*

Answer: Variations can occur because the reservoir is exposed to the atmosphere. The target is 8.2 leaving the plant. Algae production can cause pH to increase and CO₂ can cause pH to decrease. It is hard to say definitely why those spikes or cycles are less predictable toward the end of the chart, but it could relate to the operation of that specific reservoir. This reservoir is not run continuously.

- **Question:** *Are bird counts given in monthly averages? Is there variability with bird counts? It would be interesting to see the maximum counts.*

Answer: Yes. Actual counts are conducted daily. The average daily bird count is a range.

- **Question:** *Is there something that prompted the addition of *Pseudomonas*?*

Answer: Some dialysis patients in the area had interest and concern. This was not mandatory but was added after discussion with dialysis patients and Washington Department of Health.

- **Question:** *You show a picture of before and after for a covered reservoir. What kind of cover do you have, and what kind of things do you have in place to secure it from the recreational activities going on above it?*

Answer: It's a concrete lid. There is an impermeable membrane between the concrete and ground that is installed before the area is landscaped, which is tested against fertilizers or anything else that might come through such as trace metals.

- **Question:** *Does Seattle have epidemiological surveillance data that demonstrates improvements in morbidity or public health since covering its reservoirs?*

Answer: No, but we may have more data available in the future. For the City of Seattle and King County, epidemiologic data are collected by King County Public Health, but they have not been matched up with open reservoirs.

- **Question:** *There was a media report of contamination of a covered reservoir?*

Answer: The type of membrane that the contractors put on didn't adhere in one case and had to be removed and re-applied. However, I do not believe that this was associated with a contamination event.

- **Question:** *What was the cost?*

Answer: I do not have cost information.

- **Question:** *In your opinion, out of all of the water quality parameters that you've measured for, what are the top two that you think best indicate issues related to public health?*

Answer: Total and fecal coliform.

- **Question:** *Is there any evidence that animals get inside of covered reservoirs?*

Answer: No, not that I'm aware of.

Presentation 5: Consideration of pathogen risks associated with uncovered finished water reservoirs (Nicolas Ashbolt, U.S. EPA)

Dr. Ashbolt presented on the pathogen risks associated with uncovered finished water reservoirs. According to Dr. Ashbolt, testing for pathogens in water is very problematic, and there is no "ideal" indicator. There is also uncertainty in the methods, and pathogens are not typically introduced regularly into reservoirs making it difficult to get an accurate mean estimate. Dr. Ashbolt has looked to model the change in relative risk due to an UCFWR, based on the likelihood of occurrence and the consequence of the disease and through the use of a quantitative microbial risk assessment (QMRA). The majority of pathogens of concern are zoonotic, meaning that they come from animals, and they may or may not cause disease. Dr. Ashbolt described multiple types of animal and human contamination sources, and provided an overview of fecal sources and microbial source tracking tools, as well as modeling techniques. He noted that various mitigation techniques can be used to target pathogens, and additional water treatment could negate pathogen risks in UCFWRs. Dr. Ashbolt concluded that UCFWRs are vulnerable to fecal inputs and other pathogen risks, including birds, rodents, feral cats, and dogs, but that additional treatment could negate these risks. Clarifying questions addressed by Dr. Ashbolt are described below.

- **Question:** *With regard to the QMRA model, outside of the Cryptosporidium strains that were tested, are you aware of any good dose-response data for wild-type strains that are found in source water monitoring?*

Answer: If you refer to the table on slide 9 of my presentation, you can see that the quick answer is no, which is why I included a question mark next to rodents. We can, however, make certain assumptions to account for this.

Question: *Describe the reservoir on slide 5, where in California?*

Answer: Not sure on the details but the slide is from 2005.

- **Question:** *On slide 14, could you estimate what the variability might be around the bottom line risk?*

Answer: It depends on which pathogen or scenario you are looking at. You can still estimate a mean or relative risk of the open water reservoir. It is of value to compare what the average risk comparison number is.

- **Question:** *In comparing covered to uncovered, do you know of any data on the actual performance in terms of inadvertent intrusion of animals?*

Answer: Animals have been discovered in reservoirs, this would be a good analysis. We do have outbreak data, but this raises the issue that if you're going to cover a reservoir you need to have a maintenance plan in place.

- **Question:** *On slide 10, you mention the role of algae. Are you suggesting that we can see a re-growth of bacterial pathogens if algae counts are elevated?*

Answer: Yes. We've seen that this happens with opportunistic bacteria and other pathogens. In open reservoirs where a hint of chlorophyll is showing, we see *E. coli* and other opportunistic pathogens growing. They can also grow in suspension with the growing algal material. Indicators and a subset of pathogens can grow in an algal mass. Within an algal mass there is an increase of organic carbon and temperature is also a variable.

- **Question:** *Are these consequences based only on modeling, or are they based on epidemiologic surveillance data as well?*

Answer: What I've presented is a modeling approach that could be applied to UCFWRs. It can aid in our understanding of different scenarios. This is really a very problematic area to delve into, particularly at the low level of risk that we think we're aiming for. Epidemiologic studies, especially surveillance studies, will not have the sensitivity to pick up on important points. If you've done an epidemiologic study showing no effect, you ask the question, 'what is the amount of illness that needs to be present in the community to show that?' and the answer ends up being close to 8 to 15 percent of the population coming down with a particular disease to associate it with a reservoir. We have not been able to show clear epidemiologic evidence, even when there are contaminated source waters involved. To do this for a UCFWR scenario, it would be a very nice endeavor, but would not be likely to show any real results of value, hence the importance of models. Models more clearly show us where uncertainties lie, and where we may better manage reservoirs.

Presentation 6: Ending an Era: The Replacement of Open Finished Water Reservoirs (Chris McMeen, Tacoma Water)

Mr. McMeen provided an overview of the history of reservoirs in Tacoma, Washington. Tacoma Water serves approximately 500,000 customers directly and indirectly. In 1975, Washington State regulated that there would be no new uncovered finished water reservoirs (UCFWRs), and by 1999 a requirement was put into place stating that a plan would be developed for the covering of all existing reservoirs. Since 1999, Tacoma reservoirs have undergone restructuring, covering, and reductions in size. Through these processes, Tacoma spent \$53 million. The elimination of midge fly larvae was a major driver for the

covering of reservoirs in Tacoma. Tacoma had also previously experienced significant losses of chlorine and pH in its UCFWRs. These pH and chlorine effects have been mitigated through the covering of reservoirs. Mr. McMeen stated that based on his experiences in Tacoma, the risk of *Cryptosporidium* is low and does not necessitate the covering of reservoirs. Clarifying questions addressed by Mr. McMeen are as follows.

- **Question:** *Do you have data that show your reduction in DBP levels?*
Answer: No, we don't have clear data that would show reductions. It is difficult to parse out the impacts of reducing volume, larger retention times, and lower organics.
- **Question:** *Is it your position that midge fly increases are only seen in open reservoirs as opposed to covered reservoirs?*
Answer: I'm not an expert, but I wouldn't say that it's exclusive to open basins. Since the basins have been covered, we don't see them (not on filters and no complaints from consumers), so empirically this seems to be a good indication.

Presentation 7: New York City's Risk Mitigation Program for Protozoans – Hillview Reservoir (David Lipsky, New York City Department of Environmental Protection)

Dr. Lipsky provided an overview of the risk mitigation approaches taken by the New York City Department of Environmental Protection (NYC DEP) and management practices, specifically current risk mitigation at the Hillview Reservoir. Components implemented have included a waterfowl management program, an elevated *Cryptosporidium* response and communication action plan (has never been needed), a waterborne risk assessment program, and modeling, monitoring, and research to understand chemical and biological processes in the watersheds. NYC DEP has been successful in implementing a waterfowl management program to control fecal coliforms. It has additionally limited access to the Hillview Reservoir, which is patrolled by DEP Police. Through the implementation of its security and wildlife mitigation techniques, NYC DEP has seen a declining trend in both Cryptosporidiosis and Giardiasis since monitoring began in 1993. Dr. Lipsky noted that overall the risk mitigation program is considered a success by NYC DEP. Questions addressed by Dr. Lipsky following his presentation are described below.

- **Question:** *For risk mitigation, such as bird wires and surveillance, could you give an estimated cost? It would be helpful to know your estimates for labor and other monitoring costs.*
Answer: Off the top of my head, no. Weekly monitoring is done in-house for *Cryptosporidium* and *Giardia*, so I don't have an estimate.
- **Question:** *Bird counts are very high in July 1993 and July 1994. Do you see corresponding levels of high *Cryptosporidium* at those times?*
Answer: We were not testing for *Cryptosporidium* at that point. We have *Cryptosporidium* data from the watershed but don't show a relationship between birds and *Cryptosporidium*.
- **Question:** *What do you mean when you say 'characterizing fecal matter'?*
Answer: Scat can be analyzed and linked to different species.
- **Question:** *How do numbers of *Cryptosporidium* and *Giardia* outbreaks compare to other cities?*
Answer: We are on the low end on the national scales. There are limitations with degree of surveillance.
- **Question:** *On slide 5, you show a change in fecal coliform counts over time. Was there any other type of intervention going on during this time?*
Answer: We did have problems with fecal matter at Hillview, which was dealt with through enhanced management practices.

Participant Perspectives Session 1

Public Comment 1: *I'd like to thank Lisa Jackson, who said in 2011 that "science will drive our ultimate decision" on Long Term 2, yet the scientific and public health benefits of open reservoirs have been left out of the EPA's Long Term 2 discussion. Open reservoirs provide important barriers in the drinking water system that promote public health.*

Open reservoirs in Portland, OR have never had a chemical or microbiological public health incident, and no occurrences of Cryptosporidium or viruses. Open reservoirs that are highly oxygenated provide a barrier against bacterial and other microbial growth. Sunlight reacting with oxygenated water creates peroxides, acting as a microbial disinfectant, and also provides a natural broad spectrum of microbial photo-disinfection involving ultraviolet light. Open reservoir sunlight provides a barrier against toxic and carcinogenic chemicals before they can move into the distribution system, ending up in schools, work places, and homes. Sunlight inhibits the bacterial nitrification processes that generate nitrites, nitrates, and carcinogenic nitrosamines. Sunlight breaks down nitrosodimethylamine (NDMA), a carcinogenic byproduct. Aerobic bacteria break down disinfection byproducts, such as Trihalomethanes and Haloacetic acids. Open reservoirs naturally vent unwanted gases such as chloroform and radon.

In the end, with prudent risk mitigation, Portland and other utilities should be provided a waiver from the EPA Long Term 2 regulation.

Public Comment 2: *Thank you to Lisa Jackson for including the rule of Long Term 2 as part of Obama's order to revise and repeal burdensome regulations. We submitted to the EPA the new public health disease surveillance data and epidemiological data that were collected in support of our source water variance. We also submitted the American Water Works Association Research Foundation 3021study, which Portland participated in, which detected zero Cryptosporidium at the outlets of Portland's open water reservoirs.*

We have great concerns about this 'treat or cover' requirement, and in reviewing over 700 documents that were included in the official rule, we found less than a handful that even mentioned the words 'open reservoirs.' Only one study has concluded that covering reservoirs is problematic, and speaks to nitrification problems. We're in agreement with that.

In the rule itself, EPA does not identify a single public health problem associated with open reservoirs. They cite a contamination event of a salmonella outbreak in Missouri, but fail to disclose that it was a covered storage contamination event.

In Portland, Oregon, we have 115 years of history supporting that our open reservoirs are protective of public health. All Oregon public health officials agree that our reservoirs are protective of public health. We have submitted, in writing, information to EPA for review that supports the interest of over 20 organizations that would like to see an alternative to the 'treat or cover' requirement.

Public Comment 3: *Portland, Oregon Mt. Tabor Park Reservoirs 1 and 2 and Washington Park Reservoirs 3 and 4 were constructed in 1893-1894. Mt. Tabor Park Reservoirs 5 and 6 were constructed in 1910-1911. Mt. Tabor Park Reservoir 2 was disconnected and decommissioned. Washington Park Reservoir 3 and Mt. Tabor Park Reservoir 5 have hypalon liners in them. All the reservoirs leak. Washington Park Reservoirs 3 and 4 are at the toe of a 30 acre landslide, which the Portland Water Bureau has known about since 1887. The reservoirs are close to two earthquake faults.*

The Oregon Health Authority/Drinking Water Program has told the Portland Water Bureau to cover its open distribution reservoirs since 1969. In spite of interim security measures, dead animals and

dog feces are found in the bottom of the reservoirs when they are drained and cleaned. Mt. Tabor Park Reservoirs are surrounded by residential neighborhoods, not a commercial area. Washington Park Reservoirs are encircled by local streets.

There is no room for a treatment plant at the finished open distribution reservoir outlets at either Mt. Tabor Park or Washington Park. Portland Parks and Recreation Bureau has a central maintenance yard facility at Mt. Tabor Park.

A risk mitigation plan, which was part of the proposed Long Term 2 ESWTR, could not be done to adequately protect Portland's finished open distribution reservoirs. There is no room for set-back fences to prevent people from approaching them.

The Portland Water Bureau took a cue from New York City and plans to "backfill" its capital improvement project budget with projects, which are not necessary to be completed before the finished open distribution reservoirs are disconnected and decommissioned. A reservoir compliance schedule extension to 2024 and 2026 has been requested. This is just a ruse to delay compliance with Long Term 2 ESWTR further due to pressure from a few Portland residents since May 29, 2002. The Portland Water Bureau was supposed to begin constructing the 25 million gallon Kelly Butte replacement reservoir by December 2011 or July 2012, but will not do so now until 2017. This project is required to be completed before the finished open distribution reservoirs are disconnected and decommissioned. Please consider these comments as testimony opposing Portland Water Bureau's Long Term 2 ESWTR reservoir disconnection and decommissioning compliance schedule extension.

Public Comment 4: *Thank you for the opportunity to share with you the perspective of a public water system impacted by the reservoir provisions of the Long Term 2 rule.*

The Portland Water Bureau has supplied domestic water to residents of the Portland area for more than 100 years and is the largest supplier of domestic water in Oregon. Our primary source of water comes from the Bull Run Watershed in the Mt. Hood National Forest. It is unique in the nation, having just received a variance under the treatment portion of the Long Term 2 rule.

Covering, treating in place, or replacing uncovered finished drinking water reservoirs is a major cost-burden to utilities and their customers. In Portland's case, we are projecting an overall cost of over \$400 million following hard on the heels of over \$1 billion in CSO investments, resulting in Portland's having among the highest in the country combined sewer & water rates.

There is no evidence showing that outbreaks from open reservoirs occur more often than in closed reservoirs. Similar to how Portland showed it should have a variance for Long Term 2 treatment, EPA should provide utilities using uncovered finished drinking water reservoirs the opportunity to demonstrate that public health is safeguarded. Using risk mitigating concepts such as bird wires, fencing, quick shutdown of the reservoir, and robust water quality monitoring at the outlets (such as for E. coli, total coliform, general bacteria, turbidity, and chlorine), utilities can provide added protection and a sensitive indicator as to when conditions might be changing in the reservoir.

As a water utility, it is of great importance that we react appropriately when water quality indicates a threat to public health. It would be imprudent for a utility to maintain an open reservoir if a public health threat continuously was identified and the utility were unable to remedy the situation. However, similar to Portland's treatment variance, if a utility were able to demonstrate adequate protection of its open reservoirs and implement an aggressive water quality monitoring program, it would reduce a significant burden on ratepayers and allow a utility to invest in infrastructure issues that have greater impacts on public health threats.

Thank you for your consideration.

Public Comment 5: *Good afternoon. I thank you for the opportunity to discuss California's experience with open water reservoirs. I have worked for the Drinking Water Program for a little over 30 years, and in my time I have seen a number of open reservoirs be replaced based on the statistics previously defined this morning. In California, we had a number of really large reservoirs, but had some that were very small, and all of them were constructed about 100 years ago. We now are down to having six large open reservoirs left that are all operated by the Los Angeles Department of Water and Power. LADWP has a compliance agreement with us to either cover or replace all of the reservoirs. Out of the six, only one will be equipped with UV disinfection. The total cost will be roughly \$1.4 billion.*

It has been my experience that since the State of California has aggressively pursued the open reservoirs and eliminated them, that we do not have as many total coliform problems within those systems, nor do we have water quality problems such as midge fly larvae, as the individual from [Tacoma] talked about today. What I would say is that most of the systems that have eliminated their open reservoirs are very happy to have them gone when it is over and done. Thank you.

Public Comment 6: *Last spring, New York City asked for this review in conjunction with the administration's regulatory reform initiative. As discussed today, New York has one very large uncovered reservoir, Hillview. Notwithstanding the provisions of Section 1412 V6C of the city's drinking water act, covering the Hillview reservoir would cost well over \$1 billion. In a time of such limited resources stiff competition for available funding for water and wastewater programs, it is imperative that the decision to require such expensive actions is based on sound science. The presentations and discussions here today should be considered the start of a conversation on possible modifications to the Long Term 2 rule, with respect to uncovered finished water reservoirs. Thank you.*

Panel Session: Options and Opportunities for Long Term 2 Rule Revisions

Chuck Haas, Ph.D., Drexel University

Ed Hallock, Delaware Department of Public Health

Mark LeChevallier, Ph.D., American Water

Leonard Schantz, City of Rochester Water Bureau

Lynn Thorp, Clean Water Action

A panel consisting of five experts was convened in order to obtain perspectives on the information provided and the observations made throughout the meeting. Panelists introduced themselves and were asked to take no more than seven minutes each to respond to the questions listed below (participant responses shown in *italics*), based on the day's presentations, participant contributions, and their own knowledge of the issues.

- 1. What additional information are you aware of regarding the potential public health risks from uncovered finished water reservoirs from implementation of the Long Term 2 rule? From other data sources?**
 - The trend in the industry has been to cover reservoirs, but newly available options may provide methods for reducing financial burdens for doing so. The case for this rule still seems clear, but what we've learned today is that it is time for review, as there are interesting new practices that could be implemented through a rule change or otherwise. The design of the reservoir is important with respect to public health.*

- *There are many challenges facing water systems that are not economically feasible to address currently such as covering reservoirs and replacing water mains.*
 - *EPA needs to check on the basis for the rule. Has the “to maintain a greater protection of public health” basis of the rule still apply. There is a reason most systems have covered there uncovered reservoirs. I don’t see justification for the rule change but it is a good time to review.*
 - *Uncovered reservoirs can be at risk of contamination from: airborne contaminants, contaminants transported by surface water runoff, groundwater transported contaminants, contaminants resulting from the products of chemical reactions occurring in the reservoir, microbial contamination from animal and bird droppings (such as rabbits that have been known to cause Crypto outbreaks), contamination due to growth and decomposition of algae and other aquatic organisms as the result of sunlight, nutrients, and other related environmental conditions, contamination due to violation of reservoir security, and contamination as a result of exposure to ambient weather conditions.*
- 2. What have we learned about pathogen risk management related to uncovered finished water reservoirs from implementation of the Long Term 2 rule? From other data sources?**
- *Even if contamination occurs, the appropriate response level may not say you must prevent by covering or treating different degrees of contamination. Not all reservoirs are alike. There is variability within resonance time, how much contamination is able to enter the storage tank, low vs. high variability, source water. There is also a lack of data on animal derived strains. Given this, it may be appropriate to ‘bin’ the response based on the level of vulnerability to contamination for each individual reservoir. At the very least, it would be valuable to have a benchmark demonstrating what the goals are for risk and protection, answering ‘what is an appropriate level of risk?’ (such as having an MCL for Giardia, Crypto, and viruses).*
 - *Each water system is different and has its own nuances. Specific problems for each system stem from source waters, and for this reason it is impossible to generally define the risk of an uncovered system.*
- 3. How would you assess the protectiveness of the different risk management options relative to the existing rule?**
- *The rule essentially states that open reservoirs should be at least equivalent in their level of protection to covered reservoirs. This means that we need to consider other sources of contamination, such as airborne pollutants, surface water runoff, groundwater-transported contaminants, and others that apply to open reservoirs. While there are challenges in trying to evaluate the protection as being equivalent, it must be acknowledged that the risks are not equivalent. One panelist mentioned that all of their uncovered reservoirs had been covered due to Long Term 2 rule and security issues, not due to previous microbial issues. Comparing covered reservoirs to uncovered reservoirs would provide additional knowledge such as comparing incidence before and after covering.*

After allowing panelists to respond to initial questions, the moderator led a discussion amongst them to further explore their perspectives on the Long Term 2 rule. The moderator’s questions are described below, with panelist responses shown in *italics*.

- **What do you see as the most promising strategies for managing risks related to uncovered finished water reservoirs?**
 - *There are innovations in measuring contaminants. We know a lot more about species differentiation than we did at the time of Long Term 2's inception, even though we don't yet know what it means. We also have molecular techniques that could be used for measurements.*
 - *New York City has demonstrated many promising strategies for enhanced surveillance in its presentations today. There is uncertainty associated with these methods, but if their uncovered reservoirs were related to Cryptosporidium growth, then it would be measurable.*
 - *There has been a great deal of discussion related to monitoring today, but not much about addressing problems associated with small animals and water runoff. These can be addressed through the construction of protective walls surrounding reservoirs. Some contamination could occur in the reservoirs before it would show up in the monitoring. Risk based approaches based on hydraulic flow would help with detection, such as more flow would lead to more monitoring. Although nowhere else do we monitor to see if the water is safe instead of monitoring to see if control measures are working.*
 - *Innovations in the field of disease surveillance are an interesting area to explore, though they can be expensive.*
 - *Better analytical methods for Crypto are needed. PCR would be helpful though rapid test typical methods do not analyze enough volume.*
 - *Microbial risk assessment allows you to see what the drivers of risk are. Models are useful to see what approaches can be used to mitigate risks. Effort should be put forth to build a risk model for open reservoirs. It would be a useful tool to see what is most cost effective in order to mitigate risk.*
- **Perspectives have been shared regarding management strategies. What do you think the key bases are for the differences in these perspectives?**
 - *There isn't really that much difference in perspective. Everyone is interested in reducing Cryptosporidium occurrences as much as possible. It is really about the final question about doing it in a cost effective manner.*
 - *If funds were not an issue, I would never let water see the light of day from the time it left the treatment facility until it came through the customer's tap. The reality, though, is that we have to make decisions on monitoring and protection based on finances. If we don't have any evidence of contamination, how do we justify to the public that we are going to spend funds to cover a reservoir or add UV?*
 - *At what point do ongoing costs to maintain open reservoirs reach the cost of covering the reservoirs?*
 - *The biggest difference is what the priorities are of each utility. Past experiences at particular facilities influence their perspectives. Until and unless an issue occurs, they will likely continue down the roads that they are already on.*
 - *There are intensely local controversies. We debate over covering or uncovering as a proxy for land use and development decisions in a watershed. Some operating agencies respond to that in one way or another, leading to differences in perspectives.*
 - *What are going to be the issues in the future?*

Participant Perspectives Session 2

Public Comment 7: *I understand that the goal of the rule is to reduce community disease levels due to Cryptosporidium and Giardia. Many presenters today have touched on physical invasions of reservoirs, such as by pop bottles, phones, and other items, as well as urine. But, I ask, what are the real public health risks posed by these things? They seem nonexistent. Additionally, covering or burying reservoirs does not completely eliminate the risk of animals making their way into reservoirs. There have been multiple cases of animals entering covered reservoirs.*

Public Comment 8: *I agree that we're not aware of this compelling history of evidence that uncovered reservoirs provide a cause of illness or outbreaks. A few times today, there has been mention of how we went from 700 to 38 uncovered reservoirs in the United States. Has anyone looked at the differences between before and after covering of those other 662 reservoirs that were uncovered and are now covered? We should have this information. For the modeling, are we detecting enough to run a model? It seems like most of the data give non-detect readings.*

Public Comment 9: *This is a Long Term 2 meeting focusing on Cryptosporidium and its implications. I hope that people understand that there are many more issues relevant to covered reservoirs than Cryptosporidium, which may be even more important to customers. Water providers are competing against bottled water. In some settings, open reservoirs adversely affect the confidence of our customers on drinking water. Our customers were not confident with open reservoirs. I also want to note the importance of the comments related to the generational effects of building infrastructure for covered reservoirs. We need to look at the totality of risks associated with these decisions, not just Cryptosporidium.*

Public Comment 10: *How long would it take to develop a robust risk model? Do we need to use a model to predict how much Cryptosporidium and Giardia might be coming from fecal matter because our sampling is not frequent or accurate enough? I question whether with the period of record that NYC has, whether 10-15 years of data from one reservoir, whether that is really a correct statement. The whole Long Term 2 rule was built on trying to make sure that filtered systems can achieve certain levels of removals, and this is based on only 24 monthly samples collected from uncontrolled streams or lakes. How do we know that when environmental disturbances occur in between samples that there are also not higher occurrences of Cryptosporidium or Giardia? We need to manage risks through complementary systems, such as risk mitigation and epidemiology.*

Public Comment 11: *Large uncovered finished water reservoirs may be a public health risk in times of drought. These 'lakes' have been accumulating sediments for the life of their existence. During drought the water levels may be at historic lows, and concurrently, the water flows may be at historic high flows. This combination has capability of dredging up sediments from the bottom and sides of the reservoirs. The sediments may harbor pathogens and the dredging up of these sediments is episodic risk to public health. In both Gideon, Missouri and Alamosa, Colorado the cause of these outbreaks was in part caused by pathogen-laden sediments being carried into the distribution system. These episodic events need to be considered for uncovered finished water reservoirs.*

Public Comment 12: *New York City has not had a TCR violation in all of the years that I have been there, and we rarely detect E. coli in the distribution system. We did have problems at the Hillview Reservoir in the early 1990s that precipitated changes. With respect to our balancing reservoir, we don't drop the reservoirs to the bottom – the reservoir is 35 feet, and the water level cannot fluctuate more than 7 feet. We have control over water fluctuation within the reservoir. Last time we had a TCR issue was in 1994, before we understood the source of total coliforms in our system. We have not had a violation since then.*

Public Comment 13: *Portland has five uncovered reservoirs. We're looking at a lot of unique systems. Some look like lakes, but none of the ones that we're looking at today look like lakes – they are all highly engineered structures in industrial settings. Assumptions are made that reservoirs all work the same, but nothing could be remotely further from the truth, especially in Portland. I would be willing to bet that my five open reservoirs are cleaner than any closed reservoirs in the country, given that I drain, clean, sanitize, and refill them every six months. I suspect that a lot of the closed reservoirs in this country aren't regularly cleaned at all.*

Public Comment 14: *There is risk of uncovered reservoirs that lead to this rule we are discussing today. The risk of illness was the motivation for the rule.*

Public Comment 15: *Why wasn't it stated, when writing source water monitoring, that uncovered reservoirs would be an issue. Covering is an industry where there is money to be made.*

Public Comment 16: *Potential study designs: 1) Look at a community in the process of covering and get zero prevalence before and after covering; 2) Look at currently uncovered systems that is deemed comparable to a covered systems and measure zero prevalence, won't get health effects but will be able to get an idea of exposure.*

At the end of the second public comment session, EPA responded to participant questions related to data gaps.

Wrap-Up and Adjourn

Pam Barr, Acting Director of the Office of Ground Water and Drinking Water, provided closing remarks related to the meeting's content and next steps for the Long Term 2 review process. She noted that there will be an additional public meeting in the fall of 2012, and again requested that anyone with available information or data relevant to the review process should please send it to César Cordero (cordero.cesar@epa.gov) or Kenneth Rotert (Rotert.kenneth@epa.gov) by December 2012.

The meeting adjourned at 3:29pm Eastern Time.