Many Voices Working for the Community

Oak Ridge Site Specific Advisory Board

Approved June 8, 2016, Meeting Minutes

The Oak Ridge Site Specific Advisory Board (ORSSAB) held its monthly meeting on Wednesday, June 8, 2016, at the DOE Information Center, 1 Science.gov Way, Oak Ridge, Tennessee, beginning at 6 p.m. A video of the meeting was made and may be viewed by contacting ORSSAB support offices at (865) 241-4583 or (865) 241-4584. The presentation portion of the video is available on the board's YouTube site at www.youtube.com/user/ORSSAB/videos.

Members Present

Richard Burroughs
Alfreda Cook, Vice Chair
Martha Deaderick
Mike Ford
Bob Hatcher
David Hemelright, Secretary
Donald Mei
Greg Paulus
Belinda Price, Chair
Elizabeth Ross
Mary Smalling (via telephone)
Scott Stout
Ed Trujillo
Dennis Wilson

Members Absent

Leon Baker
Howard Holmes
Jennifer Kasten
Wanfang Zhou

Liaisons, Deputy Designated Federal Officer, and Alternates Present

Dave Adler, ORSSAB Alternate Deputy Designated Federal Officer (DDFO), Department of Energy, Oak Ridge Office of Environmental Management (DOE-OREM)
Sue Cange, Manager for the Department of Energy (DOE) Oak Ridge Office of Environmental Management (OREM) and ORSSAB DDFO
Kristof Czartoryski, Tennessee Department of Environment and Conservation (TDEC)
Connie Jones, Environmental Protection Agency (EPA) Region 4 (via telephone)
Melyssa Noe, ORSSAB Alternate Deputy Designated Federal Officer (DDFO), Department of Energy, Oak Ridge Office of Environmental Management (DOE-OREM)

Others Present

Scott Brooks, ORNL
Thomas Gebhart, TDEC
Ashley Huff, ORSSAB Support Office
John Huotari, Oak Ridge Today
Michael Logan, UCOR/RSI
Lara Manning, ORSSAB Student Rep
Charlie Mansfield, UCOR/RSI
Fay Martin, EM & Stewardship
Jimmy Massey, UCOR/RSI
Pete Osborne, ORSSAB Support Office
Mark Peterson, ORNL
Roger Petrie, UCOR/RSI
Elizabeth Phillips, DOE
Ellen Smith, EM & Stewardship

Eighteen members of the public were present.

Liaison Comments

Ms. Cange – DOE held its annual community workshop on May 26, 2016, to discuss FY 2018 budget formulation and priorities for Oak Ridge cleanup. The 2016 budget workshop included approximately 100 participants. On behalf of the advisory board, Dave Hemelright presented ORSSAB's recent recommendation to DOE on OREM's FY 2018 budget request. Three prime contractors for Oak Ridge cleanup were featured in panel discussions on the role EM plays in enabling the ongoing missions at Oak Ridge National Laboratory (ORNL) and the Y-12 National Security Complex (Y-12), as well the future mission at East Tennessee Technology Park (ETTP) as a private-sector industrial park.

The demolition of Building K-27, initiated in February 2016, continues on schedule. Building K-27 is the last of the five gaseous diffusion buildings at the ETTP site. Completion of the demolition project will realize OREM's "Vision 2016," the program's goal for the safe and successful demolition and removal of all five gaseous diffusion buildings at ETTP. The achievement will make the ETTP site the first in the world to have successfully completed the cleanup and removal of a uranium enrichment complex. A large celebration will commemorate the milestone and has been scheduled for August, during the week before Labor Day. All board members will be invited to attend. Announcements regarding the celebration will follow as more details develop.

The Energy Technology and Environmental Business Association will host a public information session this summer on the planning for a new onsite disposal facility. The public event will provide information and answer questions from the community on DOE's proposed new onsite disposal facility prior to an official proposed plan and public comment period. Board members will be notified of further details for the information session once the date has been set.

Mr. Adler – The board's recommendation on the FY 2018 budget request has been received and is being transmitted to headquarters along with input from regulators. Official correspondence is also being prepared. A "thank you" letter will be sent to the board soon.

Ms. Jones – No comment.

Mr. Czartoryski – No comment.

Public Comment

None.

Presentation

Mark Peterson, ORNL, discussed technology development to support the Mercury Cleanup Strategy. His presentation (Attachment 1) focused on "Aquatic Ecology Research and Technology Development in East Fork Poplar Creek (EFPC)." Mr. Peterson discussed the problem of mercury contamination in EFPC and highlighted the aquatic ecology research being performed at ORNL in an effort to develop technologies for future applications to treat and reduce mercury in soil, water, and fish.

Background on Aquatic Ecology Research and Mercury Contamination in Oak Ridge

As one of the few aquatic ecology research facilities in the southeast, ORNL's Aquatic Ecology Lab (AEL) addresses some of the most challenging energy and environmental issues across the U.S. A major area of its current research focuses on the problem of mercury contamination in EFPC, stemming from enrichment activities begun in the 1950s during which large quantities of the element were lost to the environment from operations at Y-12. Over a thirty-year period, from 1953-1983, an estimated 700,000 pounds of mercury was released from Y-12, and of that total, an estimated 239,000 to 470,000 pounds of mercury went into EFPC (slide 6).

Though the AEL was established in the 1970s, aquatic ecology research in Oak Ridge goes back to shortly after the Manhattan Project in the late 1940s. Supporting what was then known as the "Clinton Laboratories" (today's ORNL), researchers were already beginning to survey nearby streams for radioactivity and collect environmental data. However, it was not until the 1980s, through the Biological Monitoring and Assessment Program, that a serious effort began to assess and evaluate mercury contamination and its impact on the EFPC ecosystem. New environmental legislation led to major actions in the 1990s to remediate contaminated soils on the flood plain. Those actions resulted in the removal of large amounts of mercury and successfully reduced the risk of contamination from the flood plain itself. Since that time, subsequent remedial actions have been focused on the Upper EFPC Watershed area within Y-12, where the headwaters for EFPC are located, as well as several excess facilities which also contribute to the mercury that continues to enter the creek from Y-12.

Strategic planning with regulators in the 2013-2014 time period helped establish future milestones for DOE's Mercury Cleanup Strategy. The first future priority is the construction of the Mercury Treatment Facility, already in design, to address the source water and reduce mercury inputs before EFPC exits Y-12 and proceeds downstream. A second, related effort was set to address mercury contamination in Lower EFPC, the portion of the creek which proceeds westward from Y-12 and flows through the city of Oak Ridge to join the Clinch River near the ETTP. Even with the remedial and abatement actions planned for Y-12, further strategies will be needed for the downstream environment of EFPC. Source removal, though a high priority, is only one facet of the overall Mercury Cleanup Strategy.

In addition to the Mercury Treatment Facility planned for Y-12, the overall cleanup strategy emphasizes the importance of research and technology development. ORNL researchers are developing and evaluating environmentally-friendly approaches for future downstream applications in Lower EFPC. The goal is to develop approaches that will preserve or enhance the natural resources of EFPC. Conventional remediation activities, such as soil and bank removal, are intrusive and destructive. A stated intent of research and technology development to support the Mercury Cleanup Strategy is to avoid major disruptions to the ecosystem while also reducing risk and lowering mercury concentrations in water, soil, and fish.

Mercury TD in Lower EFPC

Mr. Peterson highlighted the "technology readiness" level or pyramid approach to developing technologies that will support mercury cleanup (slide 9). Early groundwork includes research and literature review as well as site characterization work. Over time, the project will increasingly conduct lab and field testing that will lead to larger pilot studies. Those pilot studies will help inform an evaluation of recommended alternatives and potential final actions.

Mercury technology development and mercury-related cleanup activities will continue for many years. The project currently focuses on three major tasks (slide 10):

- Soil and Groundwater Source Control—to decrease mercury source inputs, or **flux**.
- Water Chemistry and Sediment Manipulation—to decrease mercury concentration and limit **methylation**.
- Ecological Manipulation—to decrease mercury **bioaccumulation**.

With many contaminants source control, such as removal or treatment, is the typical approach to remediation. One area of investigation is to focus on potential actions that limit the amount of inorganic mercury flux entering the aquatic system from downstream soil, sediments, and groundwater. Controlling mercury flux is one aspect of technology development. Currently, characterization work is being done to evaluate the use of various sorbents to bind or, in some cases, remove mercury deposits in soils and sediments. Bank and soil stabilization technologies are also potential source control applications that might be utilized downstream. (See slides 12-13 for further information on soils and banks).

Mercury is a complex contaminant that often behaves differently depending on the chemical and biological characteristics of the aquatic system. For example in EFPC, source control actions at Y-12 have substantially decreased mercury concentrations in water, while fish concentrations have not responded and remain above regulatory requirements for safe consumption. An important process in the downstream environment is mercury methylation, the microbial-driven conversion of inorganic mercury to its toxic form as methylmercury. Although methylmercury in water is relatively low, methylmercury easily biomagnifies within the aquatic food chain, with high mercury levels in fish providing a potential source of mercury to humans and wildlife through consumption. Controlling methylmercury and subsequent bioaccumulation is a difficult technological challenge, but also a potential opportunity to limit mercury risks without largescale and expensive source soil removal. Current research and technology development is focused on obtaining a greater understanding of EFPC water chemistry, flow conditions, sediment chemistry, and the methylation process (see slides 14-16 for further information on water chemistry and sediments). With a greater understanding of the EFPC system, new technologies can be explored that could change water or sediment chemistry and limit methylation or enhance demethylation (the return of methylmercury to its non-toxic inorganic state).

A third area of investigation and technology development is focused on the potential to limit the bioaccumulation of methylmercury through the food chain. Biological factors that influence the level of mercury in fish at the top of the food chain include fish size and age, the length of the food chain (longer food chains have greater opportunities for biomagnification), and the species' bioaccumulation potential. Since organisms differ in their potential for bioaccumulating methylmercury, one way to address the problem of bioaccumulation would be through ecological manipulations that enhance the populations of low bioaccumulators, change fish age or growth, or shorten the food chain. Current research is evaluating the role of algae on the methylation and bioaccumulation process, as algae populations supply the greatest biomagnification step. Other potential strategies involve stocking native low-bioaccumulating species, such as some fish and mussels (see slides 17-19 for further information on bioaccumulation).

Summary & Future Developments

Future activities for mercury cleanup in Lower EFPC include the development of several control technologies, potentially utilizing sorbents to reduce mercury inputs from soil, water, and sediment; applying chlorine removal techniques to decrease dissolved mercury concentrations emanating from Y-12; and possibly reintroducing native mussels that may change the mercury inventory and form of mercury in the system through removal of suspended algae and particles (slide 20).

A major step forward will occur with the construction of the EFPC Field Research Station, a planned near-creek research facility that will provide a creek "flow-through" system to aid researchers in evaluating approaches and technologies to decrease in-stream mercury (slide 21).

After the presentation, board members raised the following questions:

Mr. Hatcher—Given that stream waters rise and fall, how are you accounting for fluctuating surface levels in your measurements, such as those on slide 13 (see Attachment 1)? Mr. Peterson clarified that the recorded measurements on slide 13 are under base flow conditions. He went on to associate Mr. Hatcher's point about water level fluctuations with an overall point about mercury flux in EFPC, which is largely storm driven. That means, mercury deposits high in the banks may be unavailable to the system except during relatively rare high flow events or during winter frost spalling.

Mr. Paulus—Are the figures for 239,000 to 470,000 pounds of mercury (on slide 6) estimates of the total amount released from Y-12 during the 1953-1983 timeline? Do those figures suggest that all of the material lost from Y-12 ended up in EFPC? Mr. Peterson explained that the figures specifically correspond to the creek and are estimates for the amount of mercury believed to have entered EFPC during that timeframe. Mr. Brooks added that during the time when mercury was actively being

discharged from Y-12, sampling operations took place, so data do exist for these estimates. An estimated 128,000 kilograms was discharged directly into creek, which is a fraction of the total loss for mercury. Ms. Cange added that the general estimate given for the total loss of mercury to the environment during that timeframe is approximately 700,000 pounds. Of that 700,000 pounds, an estimated 239,000 to 470,000 pounds (slide 6) went into the creek.

Mr. Paulus asked a follow-up question on the extent of mercury contamination in EFPC. How far down river is this a concern? Mr. Peterson said that in testing mercury concentrations in fish, the farthest downstream exceedances occur slightly downstream of the confluence of Poplar Creek and the Clinch River.

Mr. Wilson asked about eco-manipulation and the possibility of using mussels to decrease the level of methylmercury in the creek. Even though the mussels would bioaccumulate mercury, it would not really be removed from the system, would it? When the mussels complete their lifecycle, the mercury would be returned to the sediments. Mr. Peterson said that mercury would not be removed in that scenario. Some applications elsewhere have introduced mussels in cages that can then be harvested, a scenario which would remove inorganic mercury. However, the goal for ecological manipulation would not necessarily need to be removal, he explained. Research for mercury technology development seeks to control or manipulate water chemistry to minimize the level of methylmercury in order to limit risk and routes of exposure to humans and wildlife. Mussels could be used to change water chemistry and suspended particle processes that limit the availability of mercury to methylating bacteria. Since mussels accumulate inorganic mercury, rather than methylmercury, they pose little risk to any wildlife that might eat them, such as raccoons. Also, unlike fish, mussels are not considered a food source for humans and are not eaten by the local population.

Mr. Wilson asked a follow-up question on soil and groundwater source control strategies and the possible use of sorbents. Could you elaborate on the applications being considered? Is the idea to put a membrane on the bank? Mr. Peterson explained that currently characterization work is being done to determine the best approach. Mats and barriers are possible options, as are other solutions to limit erosion, such as plant cover. Sorbents differ widely in type and application, all with potential advantages and disadvantages for use in EFPC, so characterization work needs to be done before any are introduced into the ecosystem. A number of sorbents are being evaluated; carbon fiber has shown promising results in lab testing so far.

Mr. Trujillo asked about previous flood plain remediation work. A portion of the flood plain has already been remediated, so does the remaining mercury from the flood plain still get into the banks? Mr. Peterson stated that in recent evaluations contributions from the flood plain, such as through leaching or surface erosion, appear to be minor and have a much smaller impact on mercury flux in EFPC than current releases from Y-12 or the bank soils. Prior action on the flood plain has effectively reduced its risk. The primary drivers for mercury flux in EFPC, and thus the focus for developing technologies, are the creek bank and the erosion of the bank soils.

Mr. Trujillo also asked about the methylation process. How much is understood about the process of methylation? For instance, can we accurately estimate the amount of methylmercury that will be produced given the figures for releases of inorganic mercury? Mr. Peterson reiterated the complexities of the methylation process. High levels of inorganic mercury do not necessarily result in a high level of methylmercury. In some cases, low levels of inorganic mercury have resulted in high degrees of methylation. The correlation between the two states is influenced by biological and non-biological factors that are themselves dynamic or given to change, which is why research prior to any remedial action is vital for a mercury cleanup strategy. Natural shifts in the ecosystem and especially the food chain can have a dramatic impact on mercury bioaccumulation. Researchers are looking very closely at the methylation process, but a great degree of uncertainty remains.

Mr. Trujillo asked if the Mercury Treatment Facility would play a role in reducing methylmercury in EFPC. What is the status of the Mercury Treatment Facility planned for Y-12, and would its design address mercury methylation? Ms. Cange stated that design work for the facility is being performed by UCOR. Standard technology will be utilized to remove inorganic mercury from the water released at Y-12 in order to reduce mercury flux in the water. No innovations specific to removing methylmercury figure into the design. Mr. Peterson provided a follow-up response to help differentiate between the strategies for reducing mercury flux and those to address mercury methylation. He explained that in one aspect, the total concentration of mercury in EFPC presents a challenge with a straightforward solution. Higher concentrations of mercury exist near the source waters in Y-12 and are more dilute downstream. The Mercury Treatment Facility will address the source waters to remove mercury and reduce the concentration of mercury flux overall. The related problem of methylmercury, however, presents a very complex challenge with a more complicated approach. Relatively low levels of methylmercury exist near Y-12, but unlike inorganic mercury, concentrations of methylmercury increase with distance downstream. Efforts to remove inorganic or elemental mercury from the environment may not result in decreased methylation. While the Mercury Treatment Facility will address one aspect of mercury remediation, ORNL's researchers are developing strategies for addressing methylmercury and for implementing remediation activities downstream to complement the overall cleanup strategy for mercury.

Mr. Hemelright asked if the methylation in fish is generational or passed on through reproduction? Mr. Peterson said that methylmercury in fish is largely food chain driven. Evidence does not suggest methylmercury to be toxic to fish, nor does it appear to have an effect on reproduction.

Mr. Hemelright also asked for clarification of the basic differences in elemental (liquid) mercury, inorganic mercury, and methylmercury. Mr. Peterson explained that very little elemental mercury exists in the EFPC environment, though some is present near buildings where past spills occurred, such as those at Y-12. Inorganic mercury, or mercury salts, binds in the environment as red-tinted rock. Methylmercury is largely generated by microbial organisms. The levels of methylmercury in water are orders of magnitude lower than the levels of inorganic mercury. However, even though very little methylmercury exists in the water of EFPC, it has an enormous impact on the food chain, and high levels can be observed in predatory fish.

Mr. Adler summarized the overall approach to mercury cleanup, explaining that a metallic and inorganic mercury problem exists at the Y-12 area, which will be addressed by decontamination and decommissioning activities as well as the water treatment program. The methylmercury problem presents downstream and poses a risk of absorption to fish. The methylmercury problem will be addressed by the ORNL efforts toward technology development to support mercury cleanup. So, a two-phase approach is being applied to mercury cleanup.

Mr. Hatcher said that releases of mercury from water and also buildings at Y-12 involve a straightforward approach. We can tear down the buildings and clean the water before it enters the creek, he stated. He further suggested that action might be taken to remediate the mercury downstream by removing banks and sediments, especially if the deposits are not too deep in the flood plain.

Ms. Cook asked about the dangers of mercury for humans. Is the mercury in EFPC only a hazard to humans if they eat the fish? Or does contact with the water also pose a risk? Ms. Cange clarified that the only risk to humans would be from consuming large amounts of contaminated fish or invertebrates. Mr. Peterson stated that contact with water does not pose a risk to humans. Mr. Czartoryski cautioned that methylmercury can be absorbed through the skin, and postings on EFPC caution people against contact with the water due to the presence of methylmercury and bacteria. Mr. Adler explained that while methylmercury is more easily absorbed through skin than inorganic mercury, all risk assessment work has determined dermal absorption not to be a significant exposure pathway. He reiterated that the only risk of exposure to humans would come from eating large amounts of contaminated fish, not from recreational swimming or other forms of contact with the water itself.

Ms. Smith asked about the terminology distinction between upstream and downstream or "upper" EFPC vs. "lower" EFPC. Mr. Peterson explained that ORNL researchers are focused on Lower EFPC, or the area outside of Y-12, where the creek originates. Lower EFPC flows westward through Oak Ridge from the Upper EFPC Watershed area in Y-12 and ends near ETTP. Upper EFPC is synonymous with the watershed area within the Y-12 facility, while Lower EFPC pertains to the downstream region of flow outside of Y-12.

Committee Reports

EM & Stewardship

Dr. Hatcher reported –

- Issue managers convened via conference call on May 25, 2016, to discuss a possible recommendation on the DOE's proposed Environmental Management Disposal Facility. A draft recommendation is in progress.

- A follow-on tour for Mercury Technology Development is planned. Board members are invited to participate in a tour of the Aquatic Ecology Laboratory and chemistry laboratories at ORNL on Thursday, June 16, 2016, at 9 a.m. To participate in the tour, notify Ashley.Huff@orem.doe.gov.

- The next EM & Stewardship Committee meeting is scheduled for June 22, 2016, at 6 p.m. Discussion will follow on the June 8, 2016, ORSSAB presentation on technology development to support the Mercury Cleanup Strategy and the June 16, 2016, site tour at ORNL.

Executive

Ms. Cook reported –

- The Executive Committee did not meet in June and has no outstanding comments to report.

- The next meeting of the Executive Committee is scheduled for August 3, 2016, at 6 p.m.

Announcements and Other Board Business

- In lieu of ORSSAB's next monthly meeting, new member training will occur on July 13, 2016, at the DOE Information Center. Existing members are welcome to attend.

- The Annual Planning Meeting is set for Saturday, August 6, 2016, 9 a.m. to 2:30 p.m., at the Tremont Lodge in Townsend, Tennessee.

- Six board members will retire from ORSSAB at the end of June. Alfreda Cook, Bob Hatcher, Jennifer Kasten, Donald Mei, Scott Stout, and Wanfang Zhou were recognized by DOE and the board at the June 8, 2016, meeting and presented with service awards.

Alternate DDFO Report

Ms. Noe reported –

- New member packages have been sent to headquarters for review and are awaiting the final signature by EM Assistant Secretary Monica Regalbuto.

- The Annual Planning Meeting has been scheduled for Saturday, August 6, 2016. It will be held in the same location as last year's meeting at the Tremont Lodge in Townsend, Tennessee. The time has been revised for 9 a.m. to 2:30 p.m. on Saturday. An agenda is being finalized and will be provided to the board prior to the meeting.

Motions

6/8/16.1
Mr. Hemelright moved to approve the minutes of the May 11, 2016, board meeting. Mr. Paulus seconded and the motion passed **unanimously**.

6/8/16.2
Mr. Hemelright moved to elect the Nominating Committee for FY 2017 board officers to be comprised of Mary Smalling, Dennis Wilson, and Richard Burroughs, all of whom accepted nominations. Mr. Hatcher seconded and the motion passed **unanimously**.

Action Items

Open Action Items

1. Mr. Adler will update Mr. Czartoryski and the board on the status of a response to TDEC's letter concerning a request for additional EM milestones. *(Carryover from 3/9/16)*.

Closed Action Items

1. DOE will provide an update on the final analysis of groundwater samples collected during the third sampling event in February 2016. *(Carryover from 3/9/16).* **Closed.** Dennis Mayton, DOE, provided a follow-up from the February 2016 ORSSAB meeting to the board with the results of the Confirmation Sampling event completed during the second quarter of FY 2016. "The lab results from the event indicated there were no exceedances of U.S. EPA National Primary Drinking Water Standards. DOE continues to prepare the Remedial Site Evaluation Report which has a milestone of November 15, 2016."

2. Ms. Noe will report on the status of soliciting new student representatives from area high schools, potentially on a rotating schedule. **Closed**. The issue of recruiting student representatives to the board, raised during a meeting of the Executive Committee, will hold until next year's selection process begins. DOE and ORSSAB staff are evaluating recruitment practices to determine the best approach for next year's requests for new student representatives. The status will be addressed prior to additions made to the board in May 2017.

The meeting adjourned at 7:27 p.m.

Attachments (1) to these minutes are available on request from the ORSSAB support office.

I certify that these minutes are an accurate account of the June 8, 2016, meeting of the Oak Ridge Site Specific Advisory Board.

Dave Hemelright, Secretary

Belinda Price

Belinda Price, Chair
Oak Ridge Site Specific Advisory Board
BP/ach

September 16, 2016