

ORSSAB members see latest science behind OREM’s focus on mercury remediation in surface water, soils at Y-12



Robert Jett (left), a technician at the Aquatic Ecology Laboratory at Oak Ridge National Laboratory (ORNL), shows ORSSAB members lake sturgeon, one of the species under study. The 10,000-square-foot facility, which contains artificial and living streams as well as numerous holding tanks and a toxicology laboratory, allows researchers to experiment and collect data in a controlled environment before bringing the work into the field.

Part of OREM’s efforts to address mercury contamination is funding research to create new technologies and other science-based solutions to enable effective and efficient cleanup.

Scientists at the Oak Ridge National Laboratory’s (ORNL) Aquatic Ecology Laboratory are investigating East Fork Poplar Creek’s unique ecology and working to develop technologies to aid in OREM’s efforts there.

Historical releases of mercury from Y-12 at the headwaters of East Fork, primarily during the 1950s and 1960s, resulted in approximately 15 miles of East Fork Poplar Creek and five miles of Poplar Creek exceeding water quality criteria for mercury concentrations,

said Mark Peterson, leader for the Aquatic Ecology Group, during a recent ORSSAB monthly meeting.

“Mercury’s physical properties make remediation difficult,” said Peterson. “If you dig a hole with elemental mercury in the soil, the mercury beads end up at the bottom of the hole. As you dig more, the mercury becomes more embedded into the environment and closer to the subsurface flow paths in the groundwater.”

Peterson told members, however, that there are varying types of mercury, and these types also vary in their relative bioavailability and toxicity. Additionally, microorganisms in the stream environment can interact with

the mercury present and convert it into a form called methylmercury, the most toxic form, which tends to bioaccumulate, or become concentrated as it moves up the food chain, he said.

“The primary risk relative to bioaccumulation of methylmercury is typically through fish that are ingested by wildlife or humans,” said Peterson.

He said there are three key factors determining the level of mercury contamination in fish: The amount of inorganic mercury available in ecosystems (the source); the conversion of that inorganic mercury to methylmercury; and the bioaccumulation within the food chain.

“Many variable conditions, including pH, dissolved organic carbon, and the amount of wetlands in the system can impact mercury concentrations in fish,” said Peterson. “That’s a real challenge when thinking about remediation...It’s not enough to deal with just the source, we have to think about other kinds of solutions to address the existing mercury issues.”

Y-12 remedial and abatement actions from 1984 through the present have significantly reduced mercury releases.

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Reservation Update

Four tons of mercury retrieved from Y-12 cleanup project

OREM teams recently removed more than a ton of mercury from tanks in the Column Exchange (COLEX) equipment on the east side of Y-12's Alpha-4 building. The latest effort boosted EM's total mercury removal in the facility to more than 4.6 tons. EM and UCOR conducted the recent six-month project in three phases. During each test, mercury was recovered from the piping, consolidated, and stored in the facility. Last year, cleanup contractor UCOR collected nearly 3.5 tons of mercury from COLEX equipment on the building's west side.

Small businesses win contracts for environmental cleanup

OREM has awarded its Characterization, Deactivation/Demolition, and Remediation Services contract to five small businesses -- three from East Tennessee.

Through this arrangement, each company has a five-year Indefinite-Delivery/Indefinite-Quantity (IDIQ) contract where OREM can issue Firm-Fixed-Price task orders. The maximum value for services is \$24.9 million.

The five awardees include: Aerostar SES, based in Oak Ridge; ARS Aleut Remediation, based in Port Allen, Louisiana; CTI and Associates and GEM Technologies, both based in Knoxville, Tennessee; and TerranearPMC, based in Exton, Pennsylvania

Secretary Perry tours OREM mercury research facility

In May, U.S. Secretary of Energy Rick Perry visited Oak Ridge National Laboratory to break ground on a new research facility, which the lab is able to build thanks to previous work by OREM to demolish old, unused facilities and open space on campus.

The secretary also toured other



Workers are removing crust and scale from the inside of pipes in the Alpha-4 building.

lab facilities, including a stop at the Aquatics Lab, where OREM has partnered with scientists to research and develop new technologies to remove mercury from East Fork Poplar Creek. The research will also be applicable to cleanup projects across the nation.

EMDF draft ROD scheduled for release in August

After discussions in April and May, representatives of the Oak Ridge Site's Federal Facility Agreement for cleanup — between DOE, EPA, and TDEC — agreed to delay the release of the draft Record of Decision for the proposed Environmental Management Disposal Facility to August. DOE is using this time to address questions it received from regulators and the public regarding certain aspects and details of the project.

The change also affects related documents: The Remedial Design Work Plan deadline will now be February 2020, and the Remedial Design Report/Remedial Action Work Plan will be due in January 2021.

Copies of the agencies'

correspondence can be viewed at doeic.science.energy.gov or at the DOE Information Center in Oak Ridge 8 a.m.-5 p.m. Monday through Friday.

UCOR, UTK partner on new nuclear cleanup minor

A partnership between Oak Ridge cleanup contractor UCOR and the University of Tennessee, Knoxville has resulted in the nation's first nuclear decommissioning and environmental management minor offered by a major educational institution.

DOE Oak Ridge Office of Environmental Management Manager Jay Mullis said the curriculum for the minor degree teaches students about a promising career field that will play an increasing role in the global economy and environmental stewardship.

In the years ahead, OREM will have a continuing need for trained workers as it shifts cleanup to ORNL and Y-12. DOE has similar needs at its 15 other sites across the country. Students can expect a variety of career opportunities throughout the DOE complex, with other government

agencies, scientific organizations and commercial nuclear operations.

Four people graduated with the nuclear decommissioning and environmental management minor degree in 2018 and 16 students are on track to complete the program this year. University officials confirmed that all of the seniors in this minor program will be employed after graduation this month, with some slated to join UCOR in Oak Ridge.

Preliminary cleanup starts at ETTP centrifuge complex

Workers are preparing to tear down one of the largest and most recognizable structures remaining at ETTP: The 180-foot-tall K-1200 Centrifuge as well as its associated buildings.

To prepare for the teardown, crews are clearing away hazards, which involves removing several hundred centrifuges, utilities, asbestos, and waste. Piping and equipment are being vented, purged, drained, and inspected to prepare the equipment for disposal. Many pieces of equipment will be removed throughout the complex prior to demolition, which is scheduled to begin in 2020.

The K-1200 Centrifuge Complex is comprised of several facilities constructed between 1975 and 1985 and spanning more than 235,000 square feet. The complex was built in stages to develop, test, and demonstrate the ability to enrich uranium using centrifuge technology. The last of these facilities ceased operations in the mid-1980s, and the site was closed in 1987.



Crews are preparing the Centrifuge Complex for demolition at the East Tennessee Technology Park. EM anticipates beginning the teardown in 2020.

Medical firm plans major facility at ETTP's Duct Island

Duct Island, a nearly 200-acre parcel of land remediated by OREM and transferred last year for reuse, has a new owner. The sale and estimated \$500 million investment by Coqui Radio Pharmaceuticals Corp. marks a significant boost to DOE's efforts to turn the former Manhattan Project site into a multi-use industrial park.

Coqui will build a medical isotope production facility at ETTP to focus primarily on the production of

molybdenum-99 (Mo-99) isotopes. It will be the first facility of its kind in the nation and is expected to provide more than 200 jobs starting in 2025. Mo-99 is used in more than 18 million medical procedures each year in the U.S.

Coqui cited Oak Ridge's strong nuclear and engineering workforce, as well as access to research opportunities at Y-12 and ORNL as key factors in its decision to locate here.



A rendering of the Coqui Radio Pharmaceuticals building to be built in Oak Ridge.

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DOE details end-state contracting during Spring Chairs' Meeting

DOE is moving toward a modern, completion-centric approach to cleanup and is working to increase transparency and efficiency, Mark Gilbertson, DOE principal deputy assistant secretary, told SSAB members at a recent meeting.

Gilbertson and other senior DOE officials shared this and other insights with officers from SSABs throughout the country at the Environmental Management Site-Specific Advisory Board (EM SSAB) Spring Chairs' Meeting, held May 8-9 in Augusta, Ga.

During the discussion, Gilbertson detailed DOE's shift toward end-state contracting and how that change is expected to help increase overall efficiency in the cleanup program.

Gilbertson explained that under the standard contracting model, bidding contractors prepared extensive projections and estimates covering the total scope of a years-long project. He said the review and negotiations process often took so long that conditions at the site had changed to the point where the estimates were no longer accurate, and the process would be drawn out even



ORSSAB Chair Dennis Wilson, left, discusses technology development during the annual EM SSAB Spring Chairs' Meeting in Augusta, Ga., in May.

further while adjustments were made.

End-state contracting, however, splits the process into two stages. In the first stage, contractors bid instead on a base and model tasking of work that will be performed onsite and DOE selects the preferred contractor. During the second stage, after the contract is awarded, DOE enters open-book negotiations on a task-by-task basis.

"It is a change in contracting that we believe will be beneficial to get better results for cleanup at your individual communities," said Gilbertson.

The meeting also provided SSAB members the chance to share recent accomplishments.

ORSSAB Chair Dennis Wilson

(See *Chairs* on page 7)

Recent Recommendations

Following are recommendations from the EM SSAB Chairs Meeting in May. ORSSAB began discussion of the items in June. More information is available at www.energy.gov/emssab

On EM's Review of Cleanup Milestones

In response to a recent Government Accountability Office report, the Chairs recommend EM create a complex-wide, consistently applied data dictionary for milestones terminology to reduce confusion in discussion of cleanup issues. Further, local boards and the public should be able to access milestone information in a timely manner. It should contain the

rationale for identifying the type based on the data dictionary of milestones and detailed information about why a milestone will be changed.

On EM's Science and Technology (S&T) Program

In response to a National Academies of Sciences' report, three recommendations were produced:

The EM SSAB Chairs support the development of a programmatically integrated robust S&T effort that is fully funded to: a) identify and pursue development of the technologies necessary to achieve risk-based reduction of hazardous waste material; b) to integrate decisions that are common between sites with similar remediation needs;

c) to identify scientific challenges common to sites. Additionally, a portion of the technology effort for the cleanup program should focus on breakthrough solutions that can substantially reduce cleanup costs, schedules and uncertainties. Third, the Chairs recommend exploring already developed computer platforms to see if they are flexible enough to systematize verification of Best Practices decisions. Lastly, they recommend EM explore working with the Advanced Research Projects Agency-Energy (ARPA-E) office, coupled with public outreach and transparency to implement a directional shift towards better control.

ORSSAB gets rare look at MSRE, tours ORNL waste treatment sites

ORSSAB members were able to look inside Oak Ridge's Molten Salt Reactor Experiment (MSRE) recently.

Members joined DOE's Bill McMillan, ORNL portfolio federal project director, in April for a tour of some of the lab facilities within OREM's mission to extend operational life and reduce surveillance and maintenance requirements (S&M).

Staff at MSRE, which shut down in 1969, explained that MSRE contains residual fuel salt contaminated with fission products, which produce hydrogen fluoride gases that must be periodically treated. OREM is upgrading electrical, technological, and other areas of the facility to enable remote maintenance of the tanks as well as a continuous treatment of the gases. This will allow OREM to remove personnel from the aging building, reducing risk to them and the environment as well as saving on costs for building operations.

In addition to MSRE, members visited Building 3608 of the Process Waste Treatment Facility, where non-radiological liquid wastes are treated. The facility is part of OREM's



ORSSAB members Leon Shields, Bill Clark, Shell Lohmann, and Harriett McCurdy tour LGWO with OREM's Chuck Curtis and Bill McMillan.

Liquid and Gaseous Waste Operations (LGWO) providing treatment of radioactive and non-radioactive wastewater and gaseous wastes from multiple users at ORNL.

According to McMillan, although operated safely, many LGWO systems are operating past their design life and are experiencing frequent and significant routine maintenance, while replacement parts are becoming increasingly obsolete. OREM is

investing in upgrades to these facilities, including improved wiring, modern equipment, and cutting-edge filtration materials to enable LGWO to continue its mission far into the future. Eventually, as OREM operations at the lab are complete, much of the current facility will be removed and ongoing waste created through lab operations will be treated with modern modular and mobile technology.

Budget

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Security Complex (Y-12) mercury contamination.

The planning required for achieving these goals is intricately tied in with the budget process, according to Stokes, who joined Mullis to give an overview of the federal budget process and go over details of Oak Ridge's budget history and ongoing planning for future appropriations from Congress.

"We've enjoyed a steady increase in our funding, and it's been fairly constant the last two years," said Stokes.

Oak Ridge's enacted budget for FY 2018 was \$640 million, and it increased to nearly \$650 million in FY 2019.

Stokes told members OREM funding

is split among three Congressional appropriation accounts: the Uranium Enrichment Decontamination & Decommissioning Fund (UED&D); Defense; and Non-Defense.

The largest percentage of funding – more than 65 percent in FY 2019 and more than 70 percent in the FY2019 President's Request – goes to Defense, which includes items such as the new Mercury Treatment Facility (MTF), Y-12 & ORNL surveillance, maintenance and waste operations and the U-233 disposition program.

Non-Defense funds go toward historic preservation at ETTP.

The UED&D Fund, said Stokes, is a trust fund established to clean up the three gaseous diffusion plants: ETTP, Paducah and Portsmouth.

After OREM completes major

By the Numbers

- \$650 million - Funding from Congress to OREM in FY 2019
- 147 - Cleanup sub-projects to accomplish EM's vision for Oak Ridge
- 65-70 - Percent of the budget coming from defense appropriation
- 4 - High-priority goals to be completed in the near term.

cleanup at ETTP in 2020, Defense will comprise even more of Oak Ridge's budget since UED&D funds may only be used on gaseous diffusion cleanup.

That means Y-12 and ORNL cleanup will rely on only Defense funds, which have seen steady increases over the last two years.



Researchers test the efficacy of various sorbent technologies at capturing mercury in soils along the banks of East Fork Poplar Creek.

Science

(Continued from page 1)

However, addressing the source is the first priority in OREM’s remediation strategy. OREM is constructing the Mercury Treatment Facility (MTF) to treat water passing through Y-12. The facility is slated to begin operations in 2024.

“The facility will reduce the mercury flux from the most contaminated outfall in Y-12 into the creek and provide a control mechanism as buildings start coming down to control mercury releases during the demolition,” said Peterson.

After MTF becomes operational, scientists will monitor the creek environment to determine the facility’s effectiveness and help OREM make changes to improve its impact.

In the meantime, scientists at the Aquatic Ecology Group have been working to develop technology solutions for the downstream environment, where they expect multiple approaches will need to be combined with MTF to reduce target mercury concentration levels below water quality requirements. Because OREM already has a robust water treatment program in ORNL’s Liquid and Gaseous Waste Operation (see page 5), scientists here can safely experiment with mercury contamination directly in the lab.

Peterson said the researchers’ strategy

includes three main tasks: Addressing the soil and groundwater sources in the downstream environment; trying to develop water chemistry or sediment manipulation options and technologies; and evaluating potential ecological manipulations. The following are some of the specific strategies researchers are investigating:

Source Identification

Peterson told board members that researchers have used erosion information to focus in on small creek zones where there is high mercury and bank erosion so they can target those areas for potential technology deployment to reduce mercury flux into the system.

Sorbent Technologies

Researchers have been looking at various sorbent technologies in varying

applications, such as using sorbent materials in bank stabilization efforts to keep contaminated soil from entering the creek or absorb mercury from soil that is being eroded.

Peterson said researchers have been looking at these technologies’ effectiveness with dissolved organic matter and how it affects methylmercury. Materials being tested include biochar, activated carbon fiber mats, and others. Researchers in December 2018 shared findings in a paper, “Effectiveness of Sorbents to Reduce Mercury Methylation.”

Ascorbic Acid (Vitamin C)

Another research target is reduction of methylmercury concentrations in the water. One method that researchers are investigating involves ascorbic acid (Vitamin C). He said researchers have seen promise with using ascorbic acid to lower chlorine—a critical component in the conversion from elemental mercury to the highly-toxic methylmercury. Although long-term study is needed, findings of a 20 percent to 25 percent reduction of mercury in testing in Y-12 storm drains indicate that process adjustments inside the site could make a difference.

Ecological Manipulation

Peterson said researchers are studying the organism populations in East Fork Poplar Creek to learn more about those that are present and whether they can be adjusted in any way. Some examples:

(See Science on page 7)



Bivalves have the potential to clean their environment by filtering the water. These two tanks began in the same condition; the tank with clams was cleared over a period of hours.

Board, DOE thank two student representatives for their service

OREM and ORSSAB in April recognized local graduating seniors Olivia Fleenor and Jasleen Narula for completing terms of service as the board's student representatives.

Fleenor will be graduating from Hardin Valley Academy with distinction and an endorsement in science. She will attend the University of Tennessee in the fall on full scholarship. She plans to major in neuroscience and has been selected for the Chancellor's Honors Program.

Narula will graduate from Oak Ridge High School with honors. She will be attending Emory University this fall to major in environmental science.

"On behalf of the Department of Energy and the advisory board, we really appreciate the time you have given to us," said Adler. "I hope your college experiences are great for you and if there's anything we can do as you move toward your careers, we want to help you with that."

In addition to participating in monthly board meetings, students serve on the board's Environmental



OREM's David Adler presented service plaques to outgoing student representatives Olivia Fleenor (left) and Jasleen Narula (right) at the April meeting

Management and Stewardship Committee, attend informational tours of facilities on the Oak Ridge Reservation, and take part in drafting recommendations to DOE.

New students will join the board this summer for training and begin serving in September.

Science

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Periphyton – algae on rocks – are a vector for methylation, so changes to nitrates, nutrient concentrations, and variations of light and shade to affect algae growth could change methylation activity. Fish species vary in the amount of methylmercury they bioaccumulate, so if the number of organisms with low methylmercury accumulation was increased, the risk could potentially change for the downstream environment. Researchers are also investigating the use of bivalve organisms such as mussels and clams to filter mercury particles from the water, which could reduce mercury available to other organisms.

Chairs

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detailed the board's recent public outreach efforts, including additional website updates and increased Facebook advertising, highlighting a pageview increase of more than 500 percent over last year.

EM SSAB members also considered three recommendations. Two were passed and sent to local sites for ratification (see page 4). A third regarding infrastructure improvement was deferred until after DOE can present information on waste transport safety measures.

The next Chairs' Meeting will be held in Idaho this October.



Join Us for ORSSAB's Annual Planning Meeting

9:00 a.m. – 2:30 p.m.
Saturday, August 24, 2019
Tremont Lodge & Resort
7726 E. Lamar Alexander Pkwy.,
Townsend, TN 37882

ORSSAB will soon consider issues to address in fiscal year 2020, which begins in October. At its annual meeting, liaisons from DOE, EPA and TDEC will present their agencies' suggested topics.

There will also be an OREM program update, general overview, and review of recent ORSSAB actions. The meeting is open to the public and time will be scheduled for public questions and comments.

Questions? Contact us at 865-241-4584 or orssab@orem.doe.gov

Mullis presents FY2021 budget priorities for ORSSAB recommendation

What does the path look like for Oak Ridge's future cleanup? DOE Oak Ridge Office of Environmental Management (OREM) Manager Jay Mullis recently shared OREM's current plan to advance cleanup in the next few years during the Oak Ridge Site Specific Advisory Board (ORSSAB) June monthly meeting.

Mullis was there, along with OREM Planning and Execution Division Director Alan Stokes, to get board members' feedback on the upcoming FY 2021 budget request as part of OREM's community outreach efforts.

Mullis told ORSSAB and community members attending the public meeting that OREM has set four main cleanup goals – complete



OREM Manager Jay Mullis discusses OREM's cleanup plans and near-term budget priorities during ORSSAB's June monthly meeting. The board will prepare a recommendation in response.

cleanup at East Tennessee Technology Park (ETTP); disposition of Oak Ridge National Laboratory (ORNL) uranium-233 inventory; disposition of

ORNL transuranic waste inventory; and addressing Y-12 National

(See Budget on page 5)



ABBREVIATIONS	
DOE	Department of Energy
EM	Environmental Management
EMDF	Environmental Management Disposal Facility
EMWMF	Environmental Management Waste Management Facility
ETTP	East Tennessee Technology Park
OREM	Oak Ridge Environmental Management
ORNL	Oak Ridge National Laboratory
ORR	Oak Ridge Reservation
ORSSAB	Oak Ridge Site Specific Advisory Board
TDEC	Tennessee Department of Environment & Conservation
UCOR	URS CH2M Oak Ridge
WIPP	Waste Isolation Pilot Plant
Y-12	Y-12 National Security Complex

UPCOMING MEETINGS	
Meetings are held at 6 p.m. in the DOE Information Center, 1 Science.gov Way, Oak Ridge, TN, unless noted otherwise.	
Board: Wednesday, September 11	
EM & Stewardship Committee: Wednesday September 25	

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