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Innovations

from Savannah River National Laboratory

U.S. DEPARTMENT OF ENERGY • SAVANNAH RIVER SITE • AIKEN • SC

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Impact

This innovative process removes mercury from water using chemical reduction and air stripping and provides a new option to treat retention ponds.

- The process is simple, reliable and inexpensive
- Implementation at SRS was effective in protecting the stream ecosystem and saved over \$1.5 million in capital costs and cut operating costs in half compared to standard technologies.

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SRNL research leads to full-scale implementation of innovative low-cost mercury treatment

Standard treatment technologies struggle to meet current standards

Mercury is a persistent, bioaccumulative and toxic pollutant with widespread impacts throughout North America and the world. As a result, water quality standards for mercury are now set near background “part-per-trillion” levels to protect people and fisheries. The raw water currently discharged from outfalls into streams and rivers often contains small amounts of mercury and flow rates can be high and variable. For high flow rate outfalls, traditional water treatment processes, such as ion exchange or specially treated activated carbon, can be expensive and inefficient.



Mercury treatment,
lab-scale and full scale

Out-of-the-box thinking: SRNL research sets the stage for a solution

In 2001, anticipating a critical future need for innovative mercury treatment options, Savannah River National Laboratory (SRNL) invested Laboratory Directed Research and Development (LDRD) funding to explore the potential for using air stripping to treat mercury, a flexible and low cost alternative to standard practice. In this innovative treatment, soluble “ionic” mercury is reacted with tin(II) chloride, converting the mercury into a volatile form that can be easily and inexpensively removed by physical partitioning into air using available air stripping equipment. This early work was done in collaboration with researchers at Oak Ridge National Laboratory and forged a partnership that continues through today.

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SRS implements innovative mercury treatment in M Area

In 2007, in order to meet new regulatory standards, SRNL worked with Savannah River Nuclear Solutions Environmental Compliance, Area Completion Projects, and Engineering personnel to implement this unique treatment plan. This system has been in full-scale operation in M Area since November 2007 and has operated continuously, successfully and safely since startup, cost-effectively meeting regulatory commitments.

Mercury in the treated water has been reduced more than 95%, achieving the low “part-per-trillion” water quality limits that focus on lowering mercury levels in fish to protect people and fisheries.

Partners in success:

SRNL leads a multi-laboratory team to monitor performance

After three years of operation, a team of scientists studied the impact of the treatment on Tims Branch, a small Savannah River Site stream that receives treated groundwater and runoff from M Area. Led by SRNL, the team included Oak Ridge National Laboratory, University of Georgia’s Savannah River Ecology Laboratory and Florida International University. The researchers found that the system is a success.

- Concentrations in fish have decreased significantly at all downstream sampling locations.
- Mercury levels in a key fish species in Tims Branch, redbfin pickerel, decreased approximately 72% in the most contaminated pond just below the retention pond.
- Before treatment, mercury levels in edible fillets were about 5 times the Environmental Protection Agency recommended guidelines and are now approaching acceptable levels as mercury has cleared from the system during the first three years of operation.
- The data do not indicate any adverse collateral impacts from operating the treatment process.



“Cleanup activities need to be followed up with measurements to determine whether they have the desired outcome. This project is a unique example of the power of applied research and demonstrates the value of the collaboration of multiple organizations that offer diverse skills and perspectives.”

Kurt Gerdes
Director of the DOE EM
Office of Soil and
Groundwater Remediation



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