



June 2018

Review of the Analysis of Supplemental Treatment Approaches of Low-Activity Waste at the Hanford Nuclear Reservation

The U.S. Department of Energy's Office of Environmental Management is responsible for cleaning up the 56 million gallons of radioactive waste from plutonium production stored in 177 large tanks at the Hanford Nuclear Reservation. A waste treatment plant under construction will have the capacity to convert all of the high-level radioactive waste and at least one-third of the low-activity radioactive waste into a glass form for long-term storage. Questions remain about the best method to concurrently treat the remaining two-thirds of the low-activity waste, known as "supplemental low-activity waste." Under direction from Congress, DOE set up a contract with a national laboratories' team of experts for an analysis of supplemental treatment options and a review of that analysis at critical points in its development by an expert committee of the National Academies of Science, Engineering, and Medicine.



In 1943 as part of the Manhattan Project, the Hanford Nuclear Reservation was established to produce plutonium for nuclear weapons. During 45 years of operations, the Hanford Site produced approximately two-thirds of the nation's stockpile of plutonium. Production processes generated radioactive and other hazardous wastes and resulted in airborne, surface, subsurface, and groundwater contamination. Presently, 177 underground tanks contain collectively about 210 million liters (about 56 million gallons) of waste that is both chemically complex and diverse.

The U.S. Department of Energy's Office of Environmental Management (DOE-EM) is responsible for managing and cleaning up the waste and contamination under a legally binding Tri-Party Agreement (TPA) with the Washington State Department of Ecology and the U.S. Environmental Protection Agency. Over the past three decades, more than \$19 billion has been spent on different treatment strategies for the tank waste. Treatment of all the waste at Hanford is expected to take 40-50 years at a cost of more than \$50 billion.

DOE-EM has been constructing the Waste Treatment and Immobilization Plant (treatment plant) at Hanford to process the waste for disposal. The plan is to produce two waste streams from the tanks, high-level waste (HLW) and low-activity waste (LAW), by removing several specific radionuclides that contribute most of the radioactivity. The HLW will contain more than 90 percent of the radioactivity but less than 10 percent of the volume of the total waste, while the LAW will consist of less than 10 percent of the radioactivity and more than 90 percent of the volume.

The treatment plant will use vitrification, or immobilization in glass waste forms, to treat the HLW for disposal in a deep geological repository at a site to be determined. The treatment plant has the capacity to vitrify at least one-third and perhaps up to one half of the LAW in tandem with all of the HLW. To treat the remaining portion of the LAW while keeping the HLW treatment on track, DOE-EM wants to increase LAW treatment capacity by building an additional facility for "supplemental treatment." DOE-EM is considering

supplemental treatment by one of three technologies: vitrification; grouting, to produce cementitious waste forms; or fluidized-bed steam reforming, which can produce a calcine powder or a crystalline ceramic waste form.

DOE-EM was to have negotiated with the Washington State Department of Ecology to select a mutually acceptable supplemental treatment approach by April 2015. To date, these negotiations have been unsuccessful. The use of a technology other than vitrification for LAW is controversial for use at Hanford (but not at other DOE-EM sites), and is at least initially opposed by the State of Washington, key Tribal Nations, and many Hanford stakeholders.

To speed negotiations, Congress directed DOE to contract with a Federally Funded Research and Development Center (FFRDC) to analyze at least three potential technologies for treating the SLAW and to report on its findings. DOE contracted with Savannah River National

Laboratory (SRNL), an FFRDC, which formed a team of experts from SRNL and other national laboratories. Congress further directed DOE to contract with the National Academies of Sciences, Engineering, and Medicine to undertake a concurrent, independent, peer review of the FFRDC's analysis, not only when the analysis is complete, but also at certain points during its development.

The National Academies of Sciences, Engineering, and Medicine will issue four reports reviewing the FFRDC's analysis. Issues examined will include the proposed risk assessment methodologies; expected costs, scheduling, and regulatory compliance; key information and data sources being used; the proposed waste conditioning and supplemental treatment approaches; and the nature of comments and concerns from stakeholders and the public.

COMMITTEE ON SUPPLEMENTAL TREATMENT OF LOW-ACTIVITY WASTE AT THE HANFORD NUCLEAR RESERVATION

John S. Applegate (*Chair*), Indiana University, Bloomington; **Allen G. Croff** (*Vice-Chair*), Vanderbilt University, Nashville, TN (*retired*), St. Augustine, FL; **Margaret S. Y. Chu**, M. S. Chu + Associates LLC, New York; **Kenneth R. Czerwinski**, University of Nevada, Las Vegas; **Rachel J. Detwiler**, Beton Consulting Engineers, LLC, Mendota Heights, MN; **Timothy A. Devol**, Clemson University, SC; **Rodney E. Ewing**, Stanford University, CA; **Craig S. Hansen**, Independent Consultant, Clinton, TN; **Milton Levenson**,¹ Independent Consultant, Menlo Park, CA; **Cathy Middlecamp**, University of Wisconsin, Madison; **Alfred P. Sattelberger**, Argonne National Laboratory (*retired*), IL; **Barry E. Scheetz**, The Pennsylvania State University; **Anne E. Smith**, National Economic Research Associates, Inc., Washington, DC; **Chris G. Whipple**, ENVIRON (*retired*), Lafayette, CA; **Charles D. Ferguson** (*Study Director*)

¹*Deceased on March 31, 2018*

For More Information . . . This Consensus Study Report Highlights was prepared by the Nuclear and Radiation Studies Board based on the Consensus Study Report *Review of the Analysis of Supplemental Treatment Approaches of Low-Activity Waste at the Hanford Nuclear Reservation* (2018). The study was sponsored by the Office of Environmental Management, Department of Energy. Any opinions, findings, conclusions, or recommendations expressed in this publication do not necessarily reflect the views of any organization or agency that provided support for the project. Copies of the Consensus Study Report are available from the National Academies Press, (800) 624-6242; <http://www.nap.edu> or via the Nuclear Studies and Radiation Board web page at <http://www.nationalacademies.org/nrsb>.

Division on Earth & Life Studies

The National Academies of
SCIENCES • ENGINEERING • MEDICINE

The nation turns to the National Academies of Sciences, Engineering, and Medicine for independent, objective advice on issues that affect people's lives worldwide.

www.national-academies.org