



The exterior of the EBR-II.

JUNE 2016

MATERIALS AND FUELS COMPLEX

EXPERIMENTAL BREEDER REACTOR-II

The Experimental Breeder Reactor-II (EBR-II) was an innovative sodium-cooled reactor with an output of 62 megawatts, which first achieved criticality in 1961. It was later connected to generators to produce up to 20 megawatts of electricity for other facilities at the Site. EBR-II was used for testing materials and design concepts to improve reactor safety, culminating in the successful, historic tests of the inherently safe Integral Fast Reactor (IFR) concept in 1986.

The IFR tests proved that reactors could be made virtually meltdown-proof – that is, even with a loss of all cooling systems and without operator intervention, the reactor would shut itself down through a design that takes advantage of the laws of physics. Funding for the IFR program was withdrawn by the U.S. Congress in 1994, three years before the intended completion of the

program. EBR-II was subsequently shut down and defueled and most of the sodium removed for treatment. The remaining sodium and NaK required management as a RCRA hazardous waste.

DEMOLITION/FINAL END STATE

Several of the ancillary buildings at MFC that supported EBR-II have already been demolished. Hazardous wastes including mercury, PCBs, and over 800,000 lbs of lead were removed from the systems. In EBR-II, systems and structures above the reactor building floor have been removed, and the systems and structures below the floor level, including the EBR-II reactor vessel and primary tank, have been grouted in place. This was completed in late 2014, effectively entombing the EBR-II reactor.

The reactor containment dome is scheduled to be removed in 2016. Following the removal of the iconic

reactor dome, the final end state of EBR-II will be a concrete/grout monolith that covers the EBR-II primary coolant tank with internal components, including leaving the reactor vessel in place. The concrete/grout monolith will extend approximately eight feet above ground level and will be finished with a concrete cover to facilitate drainage away from the EBR-II site. After D&D activities are complete at EBR-II, residual radioactive materials will remain in place and be managed under DOE's Long-term Management and Control Program.

SODIUM TREATMENT

The D&D of EBR-II and its ancillary buildings began in 2009 with the treatment of reactive sodium and NaK. The sodium had been used as coolant for the EBR-II reactor to transfer heat from the reactor through heat exchangers to steam which drove a turbine to generate electricity. Sodium is a challenge to work with because it reacts vigorously with water and sometimes air.

Unique treatment techniques and systems were developed to treat the residual sodium and NaK in its various forms. Some of the sodium had been passivated by passing wet carbon dioxide over the remaining sodium to convert it to sodium bicarbonate. In some cases, this only

treated the surface layer, leaving reactive sodium beneath. Various treatment combinations using superheated steam, citric acid solutions, molten sodium/sodium hydroxide tanks, and condensed steam were used to complete the treatment sodium and NaK. In all cases it was important to add water to the treatment system in a controlled manner to prevent uncontrolled exothermic reactions. These methods were used to treat the sodium from the EBR-II reactor, Secondary Boiler Building, Sodium Process Facility, as well as the sodium piping connecting the buildings.

In 2014 and 2015 crews completed the treatment of the sodium in the Sodium Boiler Building significantly ahead of schedule and more than \$1 million under budget. That allowed the demolition of the Sodium Boiler Building in October 2015. One of the unique aspects of that demo was the sizing of a 48-foot-long, 103,000-pound steam drum on the third floor level into three parts. Reducing the size of each part was critical in safely demolishing the building.

D&D WRAP-UP AT MFC

Completing the demolition of the EBR-II reactor dome is the last scheduled D&D project at MFC.

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D&D workers pour grout inside the EBR-II reactor area, completing a significant milestone for the Idaho Cleanup Project.

