ER Site No. 103: Scrap Yard (Bldg 9939)

ADS: 1335
Operable Unit: Southwest Test Area

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Site History

ER Site 103 is located on approximately 6 acres west of Lovelace Road about 2 miles south of Coyote Springs Road and 1.6 miles north of the Solar Power Tower. ER Site 103 is associated with the Large-Scale Melt Facility, an active site used to test nuclear reactor meltdown scenarios. The furnace and power source are scheduled for dismantlement and relocation. Discussions are underway to determine the future of the facility, including returning the facility to the U.S. Air Force. The scrap yard within ER Site 103 contains used and unused concrete crucibles from operations in Building 9939, sheet metal structures, large metal bins, and several large tanks. The scrap items do not contain hazardous or radioactive materials based upon surveys conducted by SNL/NM industrial hygiene and radiation protection. In addition, the scrap items are not considered waste and will remain on site as authentication of prior test results. The site is located on U.S. Air Force land permitted to the U.S. Department of Energy (DOE) and SNL/NM.

ER Site 103 lies on the eastern margin of the Sandia-Tijeras Fault complex at an elevation of 5,612 feet above mean sea level. The terrain is generally flat with a gentle slope to the west. The 1994 Site-Wide Hydrogeologic Characterization Project (SWHCP) Annual Report presents general soil characteristics for the area around ER Site 103. The dominant surface soil group in the area is Wink fine sandy loam. The soil infiltration rate is estimated to be on the order of 0.1 centimeter per year (cm/yr), which yields downward seepage velocities ranging between 0.03 and 11.8 cm/yr.

ER Site 103 is located in the HR-2 hydrological region described in the 1994 SWHCP Annual Report. This region is a transitional geohydrologic zone between the HR-1 zone to the west and the HR-3 zone to the east. It is comprised of a northeast/southwest-trending fault complex that includes segments of the Sandia, Tijeras, and Hubbell Springs Faults. It has been determined that the uppermost interval of groundwater saturation in HR-2 is unconfined to semiconfined aquifers in the alluvial facies of the Santa Fe Group and piedmont alluvium and semiconfined to confined aquifers in the local bedrock units. These faults not only complicate the local hydrostratigraphy

but also are likely to have a significant impact on groundwater flow. The estimated hydraulic conductivity of the local aquifers is highly variable-from approximately 0.004 to 0.10 feet per minute (ft/min) in the shallow alluvium; 0.00001 to 0.0005 ft/min in the Santa Fe Group alluvial fan facies; and 0.000002 to 0.007 ft/min in bedrock units.

The nearest groundwater monitoring well, LMF-1 (now plugged and abandoned), is located approximately 1,400 feet from SWMU 103 and the Large-Scale Melt Facility. The depth to groundwater at LMF-1 ranged between 335 feet (January 1996) and 292 feet. The uppermost interval of groundwater saturation underlying ER Site 103 is the Abo Sandstone aquifer unit. Local groundwater flow is predominantly to the west, although nearby fault boundaries may significantly alter the flow direction. The nearest production well, KAFB-4, is located approximately 5 miles northwest of the site. No perennial surface-water bodies are present in the vicinity of ER Site 103.

Originally designed as a facility where explosives would be formulated, Building 9939 at the Large-Scale Melt Facility was constructed in 1971. However, the building was never used for this purpose; rather it was used to house a high-temperature autoclave. In early 1977, the building was adapted to conduct molten/core concrete interaction studies sponsored by the U.S. Nuclear Regulatory Commission (NRC). As of 1992, SNL/NM continued to conduct experiments in the facility to support reactor safety programs for customers such as the NRC, the DOE, and Westinghouse Savannah River Laboratories. Currently, there is no activity at the site, and there are no plans to conduct molten core experiments at the facility. The furnace and power source are scheduled for dismantlement and relocation. Discussions are underway to determine the future of the facility, including returning the facility to the U.S. Air Force.

The Large-Scale Melt Facility consists of a furnace system, an experimental chamber, remote control data acquisition buildings, and several abandoned spray pits (ER Site 117) that were used to dispose of residual material (sodium) from the test crucibles. The heart of the Large-Scale Melt Facility is its induction furnace and the associated power supplies, cooling equipment, and gas purging hardware. The induction furnace is mounted on a platform for melt preparation, and the test chamber, mounted on a concrete pad outside Building 9939A, is situated below the furnace for the interaction test.

Typical melt materials (i.e., those found in a simulated reactor core) included glass, mild steel, stainless steel, aluminum, iron oxide, oxide mixtures, and a depleted uranium (DU) oxide mixture. Of all the simulants used, the DU oxide mixture was the most common. When these materials reached a molten state in the furnace, they were released into a concrete crucible housed in the test chamber. The reaction between the molten materials and the concrete crucible was then analyzed. Because many of the tests used molten DU, the crucibles were often coated with tungsten to maintain compatibility with the molten DU.

The Large-Scale Melt Facility system was cooled by a closed-loop ethylene glycol cooling system. The ethylene glycol coolant was pumped through the furnace, then recycled through two cooling towers located approximately 100 feet north of the furnace through a 3-inch-diameter underground line. Water was sometimes introduced into the chamber in a continuous flow to quench the test crucible and was captured in a 560-gallon reservoir.

The effluents were comprised of gases (hydrogen, carbon monoxide, and carbon dioxide) and slag generated from the liquid that remained upon completion of the crucible tests. All gaseous effluents passed through a gravel/sand filter backed with a high-efficiency particulate air (HEPA) filter prior to being released to the atmosphere. The system was designed to pull a slight negative pressure on the containment vessel, thus eliminating the escape of effluents except through the flow system. All particulates were captured within the experimental apparatus. Other sand and gravel filters had been used for removing debris from the slag. No hazardous material was associated with the debris. The slag was probably disposed of in the sodium crucible spray pits identified as ER Site 117.

The test chamber was designed to withstand an internal pressure of 2 atmospheres. A spring-loaded relief port prevents overpressurization. When the chamber was overpressured, the material was released to the atmosphere. However, of the overpressure events that were known to have occurred, all the material released was nonhazardous (molten steel and molten aluminum).

When DU was used, it was delivered to the facility in billets. In order for the DU to be loaded into the crucibles, it had to be crushed. The crushing and loading operation was conducted in Building 9939C. For this activity, a contamination step-off pad was put into place at the entrance, and a plastic film adhesive pad was placed inside the door. Workers wore anticontamination clothing and full-face respirators. Before the compressed billets could be ground into DU gravel, they were broken into workable chunks to be loaded into the crusher. The billet was placed on a thick plate of steel and hammered with a long steel bar. The chunks were then loaded into the crusher, and the gravel would fall into a large, seamless plastic box. After the DU was crushed, the dust that had settled on all surfaces (including the floor) was hand-swept into the box of gravel, and a lid was placed on the box.

When introduced to Building 9939C, the crucible was wrapped in plastic sheeting with the top open for loading. The DU was scooped into the crucible slowly to reduce stirring up its dust. Any leftover DU was bagged and returned to the Materials Balance Accountability storage bunker, Building 9936. Upon completion of the loading operation, the upper edge of the crucible was tape-sealed for transport, and the outside plastic was wiped down and inspected for transferable contamination before the crucible was released to the test pad. After all of the operations at Building 9939C had been completed, tools and equipment were rinsed in a bucket of water and wiped with both wet and dry rags. The floor and walls were also wiped down. The water in the bucket was left to evaporate in the shed, and the rags were dried and then packaged with the other contaminated waste.

Sodium, used in the interaction tests, came in 55-gallon barrels that were heated up to 120 degrees fahrenheit and then transferred to the dump tank for additional heating. The sodium was transferred into the crucible at the start of the test. No spills occurred from this operation.

After the tests had been completed, the crucible was removed to the crucible spray pit (ER Site 117). The residual sodium in the crucibles was exposed to a spray mist of water. A steel piece

tilted the crucible so that the spray mist runoff was transferred into the pit. It typically took two to three weeks of spraying continually during the day to wash down all of the residue.

The ethylene glycol closed-loop coolant system was designed to prevent a release into the environment in the event of a system failure. Even during catastrophic experiments, the coolant lines remained intact, although there have been instances of small leaks of ethylene glycol when the hoses to the furnace were disconnected. Typically, 1 to 2 gallons drained from the hoses onto the pad.

In 1988, an underground leak occurred at the ethylene glycol feeder line that ran from the cooling towers approximately 100 feet north of the furnace to the coolant pump adjacent to the furnace on the east side of the pad. About 3,000 gallons were lost. Tank closure and site characterization were performed in 1997.

In the event that the closed-loop ethylene glycol system failed during a test, a secondary piping system was installed that utilized city water and discharged the water out the emergency drain onto the ground surface. It is believed that the water would not have come into contact with any DU metal. However, the water did flow through the furnace chamber, where it would have come into contact with residual ethylene glycol in the chamber. The backup system was used in only one incident, and approximately 50 gallons were flushed down the drain.

The polychlorinated biphenyls (PCB) transformer oil was removed from the transformers on the north side of Building 9939C. The oil was contained when the transformers were removed.

The scrap yard consists of used and unused concrete crucibles from operations conducted in Building 9939. No hazardous or radioactive materials are associated with the unused concrete crucibles stockpiled along the shoulders of the entrance road to the Large-Scale Melt Facility. Most of the used crucibles stockpiled along the southern edge of the Large-Scale Melt Facility property were associated with the sodium-interaction tests; the JAERI-1 and 2 tests; the SRL-1, 2, and 3 tests; the SRLST-1 test; the HACR-2 test; the WETMET-1; and the WETCOR-1 test. Of these, the SRL-1 and 2 tests used simulated fission products. All other crucibles in the scrap yard, except for those crucibles used in the sodium-interaction tests, contained nonhazardous and nonradioactive materials. Other materials associated with the scrap yards include sheet metal structures that appear to be hoods or vents, some large metal bins, and two large tanks about 15 feet long.

Constituents of Concern

Ethylene glycol
Depleted Uranium (DU)
Beryllium
Lead

Current Hazards

There are no current hazards at this site related to contamination of the surface or subsurface soils. There are stored scrap materials that remain at the site that are a potential hazard.

Current Status of Work

In 1994 RUST-Geotech conducted a surface radiation survey. Eight point-source anomalies and thirteen area-source anomalies were located. A combined Sites 103/117 surface radiation Voluntary Corrective Measure (VCM) was conducted on the radiation anomalies in 1995. Also in 1995, surface soils were sampled and analyzed for metals, gamma radiation, and PCB. The RFI Work Plan was submitted in 1996 to investigate the ethylene glycol spill. In 1997, the ethylene glycol spill from the underground piping was investigated by the line organization and a closure report was submitted by the line organization to the New Mexico Environmental Department (NMED) UST Bureau. A site risk assessment was conducted based on analytical results from surface soil samples, and a risk-based No Further Action (NFA) proposal was submitted to NMED in June 1998. In December 1999, following review of SNLs response to a Request for Supplemental Information (RSI), NMED indicated that the site was acceptable for NFA. The NFA was approved by NMED in July 2000 after completing the public review and permit modification process.

Future Work Planned

No further work is planned.

Waste Volume Estimated/Generated

The Sites 103/117 VCM generated 47 drums of radioactive waste.

Information for ER Site 103 was last updated Jan 22, 2003.