ATTACHMENT J

STABILIZATION UNIT MANAGEMENT

TA-55

CEMENTATION UNIT

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LIST OF ABBREVIATIONS/ACRONYMS

20.4.1 NMAC	New Mexico Administrative Code, Title 20, Chapter 4, Part 1
DOE	U.S. Department of Energy
ft	feet/foot
gal	gallon(s)
in.	inch(es)
L	liter(s)
LANL	Los Alamos National Laboratory
TA	technical area
TC	toxicity characteristic
TCLP	Toxicity Characteristic Leaching Procedure
WAC	Waste Acceptance Criteria
WIPP	Waste Isolation Pilot Plant

TA-55
CEMENTATION UNIT

The information in this Attachment addresses the applicable miscellaneous unit requirements of the New Mexico Administrative Code, Title 20, Chapter 4, Part 1 (20.4.1 NMAC), Subparts X and BB, revised June 14, 2000 [6-14-00], for the cementation unit. The Attachment provides a description of the cementation unit that is used to cement or stabilize mixed waste generated at Technical Area (TA) 55 and the Chemistry and Metallurgy Research Building at TA-3. It includes detailed descriptions of the cementation unit and associated ancillary equipment. Detailed drawings are provided as Figures I-1 through I-7 (LANL, 2003).

J.1 DESIGN, CONSTRUCTION, MATERIALS, AND OPERATION [20.4.1 NMAC §270.23(a) and 20.4.1 NMAC §264.601]

The cementation unit is located in Glovebox GB-454 along the west wall of TA-55-4, Room 401 (Figure I -1 of LANL, 2003). The unit has been in operation since 1991 and has a maximum capacity of 568 liters (L) (approximately 150 gallons [gal]). It consists of a pH adjustment column, a vacuum trap, two motor-driven mixers, four impellers, associated support structures, a glovebox, and piping (Figure I-2 of LANL, 2003).

The pH column has a straight side height of 5 feet (ft) and an outside diameter of 6.66 inches (in.). The maximum capacity of the column is approximately 27 L. The column is raised above the glovebox floor approximately 3 in. by three steel legs and is secured to one wall of the glovebox with a steel bracket that binds the column approximately 3 ft up from the base of the column. The vacuum trap associated with the column has a straight side height of 2 ft and an inside diameter of 6 in. The maximum capacity of the vacuum trap is approximately 11 L. Both the pH column and the vacuum trap are constructed of PYREX® glass with stainless steel end plates similar to the glass columns in the evaporator glovebox tank component described in Attachment H. The glass and stainless steel materials are corrosion-resistant and compatible with the waste received in the column. The pH column is used to adjust the pH of approximately 5 L of waste to ensure compatibility with the cement used for solidification. A compressed-air line enters the glovebox and is connected to two pressurized air tanks outside of the glovebox. The compressed-air line is used for remote valve operation.

The two mixers within the unit are high-flow, gear-driven, fixed-mount mixers. (Manufacturer's information on the fixed-mount mixers is included in Supplement I.1 (LANL, 2003)). All

couplings, shafts, and impellers are constructed of 316 stainless steel. The shafts are 5 ft long. Two impellers are mounted to each shaft. Each impeller has a diameter of approximately 11 in. The mixers are driven by 3.5-horsepower motors encased within the mixer housing. The mixer housing is approximately 2.5 ft long. The maximum weight of each mixer is 225 pounds. Each mixer is mounted on steel plates and supported by two steel guides on either side of each mixer. Each guide is bolted to a 6-in. steel flange at either end and is secured to the glovebox floor and ceiling. Each motor is mounted to a center screw drive that allows the mixers to be independently raised and lowered within the glovebox (Figures I-3 and I-4 of LANL, 2003).

The glovebox is constructed of a section of 0.75 in. lead between two sections of approximately 0.188-in.-thick low-carbon grade, 316 stainless steel. The floor of the glovebox contains two circular openings with removable covers that allow the shafts and impellers of each mixer to be lowered into drums attached beneath the glovebox.

During cementation operations, two 55-gal steel drums are positioned under the glovebox directly under the openings in the floor of the glovebox. A “bag-out” bag extends from the glovebox into each drum between the drum and the drum liner. This liner is fastened at the bottom of the glovebox with an elastic cord and clamped into place to prevent hazardous constituents from escaping the confinement of the glovebox and the drums during treatment operations. The cement and the waste to be solidified are transferred into the drums and homogeneously mixed inside the drums. Each drum is positioned on a steel platform/scale that is secured in a steel track. The platform allows the drums to be safely and easily removed from the unit after the cement has hardened.

The majority of the piping associated with the cementation unit is 316 stainless steel. Tygon® tubing is used to transfer sodium hydroxide and the contents of the pH column to the drums. The cement is transferred into the glovebox and drums from a hopper/screw feeder through rubber tubing. Figures I-5 and I-6 (LANL, 2003) present a legend and piping and instrumentation diagram for the cementation unit.

Waste analysis and inspection procedures for the cementation unit are provided in Attachments B and E (*Waste Analysis Plan* and *Inspection Plan* respectively).

J.2 CEMENTATION UNIT DEMONSTRATION OF TREATMENT EFFECTIVENESS [20.4.1 NMAC §270.23(d)]

The cementation unit at TA-55, Building 4 (TA-55-4), Room 401 is considered a Subpart X miscellaneous unit and, as such, is subject to the miscellaneous unit requirements in 20.4.1 NMAC §270.23(d) [6-14-00] for "a report on the demonstration of treatment effectiveness of the treatment based on laboratory or field data." Supplement I.2 (LANL, 2003) provides a technical paper entitled “Waste Form Development for Conversion to Portland Cement at Los Alamos National Laboratory (LANL) Technical Area 55 (TA-55)” (Veazey et. al., 1996). This technical paper contains detailed information that demonstrates that the cementation unit at TA-55 effectively treats the mixed waste based on the treatment objectives described below:

- Stabilize mixed waste solutions that contain various radionuclides and toxicity characteristic (TC) metals in a cement matrix so that the metals are not leachable as determined by the Toxicity Characteristic Leaching Procedure (TCLP) and thus no longer exhibit the TC following treatment. The TC metals of primary concern are chromium, arsenic, cadmium, mercury, and lead.
- Stabilize mixed waste solids that contain various radionuclides and TC metals in a cement matrix so that metals are not leachable as determined by TCLP.
- Produce solidified cement monoliths that meet Waste Isolation Pilot Plant (WIPP) Waste Acceptance Criteria (WAC), which prohibit free liquids (U.S. Department of Energy [DOE], 1999).

The technical paper in Supplement I.2 (LANL, 2003) describes bench- and full-scale testing that was performed to evaluate the effectiveness of using Portland cement in the cementation unit to stabilize mixed waste. The goal of the project was to develop a Portland cement-based waste form that meets the WIPP WAC and reliably passes TCLP. The results discussed in this technical paper demonstrate that the use of Portland cement in the TA-55 cementation unit under the prescribed conditions produces a cement monolith that meets all of the performance standards devised for the project. These performance standards include no free liquids, passing TCLP, and meeting minimum compressive strength criteria. The use of these results in demonstrating the treatment effectiveness of the cementation unit is appropriate for the following reasons:

- The waste streams used in the testing are very similar or the same as those actually treated in the cementation unit;
- TA-55 uses Portland cement in their cementation process, as was done in the testing; and

- The testing conditions described in the technical paper were modeled to the actual cementation process at TA-55, to the extent practicable.
- Additional constituents, in addition to those described in Supplement I.2 (LANL, 2003), may be treated in the cementation unit to meet the physical criteria discussed above.

J.3 ENVIRONMENTAL PERFORMANCE STANDARDS [20.4.1 NMAC, Subpart V, Part 264, Subpart X]

The following information is provided to address the applicable hydrologic, geologic, and meteorological requirements of 20.4.1 NMAC §270.23(b) and (c) and 20.4.1 NMAC §264.601 [6-14-00] for the cementation unit at TA-55. The cementation unit is located within glovebox GB-454 in TA-55-4, Room 401. The location of the unit, the waste management practices outlined in Attachment J (LANL, 2003), and the containment features described in the following sections prevent the deposition or migration of hazardous constituents into the groundwater, surface water, soil surface, or the atmosphere and ensure that the cementation unit is in compliance with the environmental performance standards of 20.4.1 NMAC §264.601 [6-14-00]. Waste analysis requirements for the cementation unit are addressed in Attachment C (*Waste Analysis Plan*). Contingency measures applicable to the cementation unit are addressed in Attachment D (*Contingency Plan*).

J.3.1 Protection of the Groundwater/Vadose Zone [20.4.1 NMAC §264.601(a)]

In accordance with 20.4.1 NMAC §264.601(a) [6-14-00], the cementation unit is operated in a manner that prevents releases that may have adverse effects on human health or the environment due to migration of hazardous waste or hazardous constituents through the vadose zone to the groundwater. The cementation unit is located in a vacuum-pressurized glovebox at TA-55-4 inside Room 401. Room 401 provides secondary containment for the cementation unit. The floor of the room is recessed approximately 2.5 in. The room itself is approximately 60 ft long by 75 ft wide. The capacity of the secondary containment area is greater than 100 percent of the volume of waste that is treated in the cementation unit at any one time. The entire floor is constructed of a 10-in.-thick reinforced concrete slab. Certified operators inspect the cementation unit each working day to detect leaks. Eight continuous air monitors installed at various locations throughout TA-55-4, Room 401 detect any airborne alpha contamination that would be present if a leak were to occur resulting in a release outside of glovebox GB-454. In the event of a release, the materials in question are removed as quickly as possible and are packaged in an appropriate container.

The cementation unit is located, designed, constructed, operated, and maintained, and will be closed in a manner that ensures protection of human health and the environment. The conditions outlined in 20.4.1 NMAC §264.601(a) [6-14-00] were considered and there is little or no potential for deposition or migration of waste constituents into the groundwater or subsurface environment. The cementation unit is located inside a building, provided with secondary containment, designed and constructed as described in Section J.1 (LANL, 2003), operated and maintained in accordance with waste management procedures described in Attachment J (LANL, 2003), and will be closed in accordance with the procedures described in Attachment F.3 (LANL, 2003); therefore, adverse effects on human health or the environment due to the treatment operations conducted in the cementation unit are unlikely.

J.3.2 Protection of Surface Water/Wetlands/Soil Surface [20.4.1 NMAC §264.601(b)]

In accordance with 20.4.1 NMAC §264.601(b) [6-14-00], the cementation unit is operated in a manner that prevents releases that may have adverse effects on human health or the environment due to the deposition or migration of waste constituents into surface water, wetlands, or onto the soil surface. Section J.3.1 (LANL, 2003) provides a detailed description of the effectiveness and reliability of the containment features to be utilized by the cementation unit to prevent releases.

The cementation unit is located, designed, constructed, operated, and maintained, and will be closed in a manner that will ensure protection of human health and the environment. The conditions outlined in 20.4.1 NMAC §264.601(b) [6-14-00] were considered and there is little or no potential for deposition or migration of waste constituents into surface water, wetlands, or soil surface. The cementation unit is located inside a building, provided with secondary containment, designed and constructed as described in Section J.1 (LANL, 2003), operated and maintained in accordance with waste management procedures described in Attachment J (LANL, 2003).

J.3.3 Protection of the Atmosphere [20.4.1 NMAC §264.601(c)]

In accordance with 20.4.1 NMAC §264.601(c) [6-14-00], the cementation unit is operated in a manner that prevents releases that may have adverse effects on human health or the environment due to the deposition or migration of waste constituents into the atmosphere. The cementation unit is located within a negative pressure glovebox that is connected to the TA-55-4 facility ventilation system. The high-efficiency particulate air filters on the glovebox are on the air intake side of the ventilation and are designed to prevent escape of contamination from the glovebox in the event of a power failure. TA-55-4 is equipped with a backup generator that re-establishes power to all vital systems, providing exhaust to the glovebox. The unit is a batch waste treatment system. If a power failure occurs, all operations cease inside the glovebox until power is restored. In addition, the glovebox is located within three succeedingly greater pressure zones. These zones are (in order of increasing pressure) the glovebox, Room 401, and the main corridor outside of Room 401. These pressure zones are designed to create an airflow into Room 401 and the glovebox and limit the potential for hazardous constituents to migrate to the atmosphere.

Operation of the cementation unit does not impact air quality at LANL. The cementation unit is operated within a negative pressure environment and, therefore, adverse affects on human health or the environment due to migration of hazardous constituents to the atmosphere as a result of treatment operations conducted in the cementation unit are unlikely. The conditions outlined in 20.4.1 NMAC §264.601(c) [6-14-00] were considered and there is little or no potential for health risks caused by human exposure to waste constituents or for damage to domestic animals, wildlife, crops, vegetation, and physical structures caused by exposure to waste constituents.

J.4 SPECIAL REQUIREMENTS FOR IGNITABLE, REACTIVE, OR INCOMPATIBLE WASTE [20.4.1 NMAC §270.14(b)(9) and §264.19]

No ignitable, reactive, or incompatible mixed wastes are treated in the cementation unit.

J.5 AIR EMISSIONS STANDARDS FOR EQUIPMENT LEAKS [20.4.1 NMAC, Subpart V, Part 264, Subpart BB]

The cementation unit addressed in this permit application is not subject to 20.4.1 NMAC, Subpart V, Part 264, Subpart BB [6-14-00], “Air Emission Standards for Equipment Leaks,” with the exception of the reporting requirements specified in 20.4.1 NMAC §264.1064(k) [6-14-00].

None of the equipment associated with the cementation unit at TA-55 contains or contacts mixed waste with organic concentrations of at least 10 percent by weight.

In accordance with 20.4.1 NMAC §264.1064(k) [6-14-00], TA-55 uses knowledge of the nature of the mixed waste stream(s) or knowledge of the process by which the mixed waste was produced to document their exemptions to these standards. Production process information documenting that no organic compounds are contained in or contacted by equipment associated with the cementation unit is recorded in TA-55's facility operating record.

J.6 REFERENCES

DOE, 1999, “Waste Acceptance Criteria for the Waste Isolation Pilot Plant,” DOE/WIPP-069, REV 7, U.S. Department of Energy, Carlsbad Area Office, Carlsbad, New Mexico.

LANL, 2003, “Los Alamos National Laboratory Technical Area 55 Part B Permit Renewal Application,” Revision 2.0, September 2003, LA-UR-03-6303, Los Alamos National Laboratory, Los Alamos, New Mexico

Veazey, G.W., Schake, A.R., Shalek, P.D., Romero, D.A., Smith, C.A., 1996, “Waste Form Development for Conversion to Portland Cement at Los Alamos National Laboratory (LANL) Technical Area 55 (TA-55),” Los Alamos National Laboratory, Los Alamos, New Mexico.