Attachment 1
Section D Facility
Description

RCRA PART B PERMIT REAPPLICATION

FOR THE

IDAHO NATIONAL LABORATORY

Volume 22
Idaho Nuclear Technology and Engineering Center

Calcined Solids Storage Facility

Attachment 1 - Section D
Process Description

May 2016

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LIST OF EXHIBITS

D. PROCESS INFORMATION

This permit reapplication focuses on the CSSF, also known as bin sets, located at the Idaho Nuclear Technology and Engineering Center (INTEC) on the Idaho National Laboratory (INL). The CSSF includes Bin Sets 1, 2, 3, 4, 5, 6, and 7 located in the northeast quadrant of the INTEC. CSSF Bin Set 1 contains four stainless-steel composite bins. CSSF Bin Sets 2–7 consist of either three or seven stainless-steel storage bins. All CSSF bin sets are located in underground or partially underground concrete vaults. The CSSF bins are permitted for tank storage (S02) under Idaho Administrative Procedures Act (IDAPA) 58.01.05.008 (40 CFR 264, Subpart J) requirements.

Although the Calcined Solids Storage Facility (CSSF) bins are not currently receiving any waste, This permit reapplication allows for the continued use of Bin Sets 1, 2, 3, 4, and 5 for storage and Bin Sets 6 and 7 for storage and to receive future waste transfers.

From December 1963 to June 2000, the calciners at the INTEC were used to convert approximately 7,920,000 gal of liquid mixed waste into approximately 155,600 ft^3 of granular calcine solids. In the calciner processes liquid wastes were injected into a high-temperature (400 to 600^{o} C) air-fluidized bed of granular solids. The liquid portion of the waste evaporated and the solids adhered to the granular material-producing calcine. Exhibit D-1 provides a diagram of the typical calciner process flow. Calcined solids were pneumatically transferred from the calciner facilities to the CSSF via air transport lines. In the CSSF, the solids are stored in stainless-steel bins located in underground or partially underground concrete vaults to isolate them from the environment. Exhibit D-2 provides the calcine solids flow path from the Waste Calcining Facility (WCF) to the CSSF. Exhibit D-3 provides the calcine solids flow paths from the New Waste Calcining Facility (NWCF) to the CSSF.

D-2. Tank Systems

The following identifies the CSSF tanks, ancillary equipment, and boundaries of the CSSF. Each individual bin set and ancillary equipment meets the Hazardous Waste Management Act (HWMA)/RCRA definition of a tank system, although no free liquids are stored in the CSSF. The bin sets are located inside underground or partially underground concrete vaults intended to satisfy radiation protection standards, not RCRA-defined secondary containment.

- CSSF 1 consists of four composite tank groups, VES-WCS-115-1 through VES-WCS-115-4, and Distributor Pipe VES-WCS-3083, located in Vault CPP-741 (see Drawings 106576 and 106577, Appendix 1).

- CSSF 2 consists of seven tanks, VES-WCS-136-1 through VES-WCS-136-7, and Distributor Pipe VES-WCS-137, located in Vault CPP-742 (see Drawings 118862 and 118871, Appendix 1).

- CSSF 3 consists of seven tanks, VES-WCS-140-1 through VES-WCS-140-7 (VES-WCS-140-7 was originally designated as VES-WCS-139 and later changed), and Distributor Pipe VES-WCS-141, located in Vault CPP-746 (see Drawings 153510 and 154129, Appendix 1).

- CSSF 4 consists of three tanks, VES-WS4-142 through VES-WS4-144, and Distributor Pipe VES-WS4-145, located in Vault CPP-760 (see Drawings 155750 and 157798, Appendix 1).

- CSSF 5 consists of seven tanks, VES-WS5-146 through VES-WS5-152, and Distributor Pipe VES-WS5-153, located in Vault CPP-765 (see Drawings 158491 and 158510, Appendix 1).

- CSSF 6 consists of seven tanks, VES-WS6-154 through VES-WS6-160, and Distributor Pipe VES-WS6-161, located in Vault CPP-791 (see Drawings 160283 and 161425, Appendix 1).

- CSSF 7 consists of seven tanks, VES-WS7-162 through VES-WS7-168, and Distributor Pipe VES-WS7-169, located in Vault CPP-795 (see Drawing 099162 and 165772, Appendix 1).

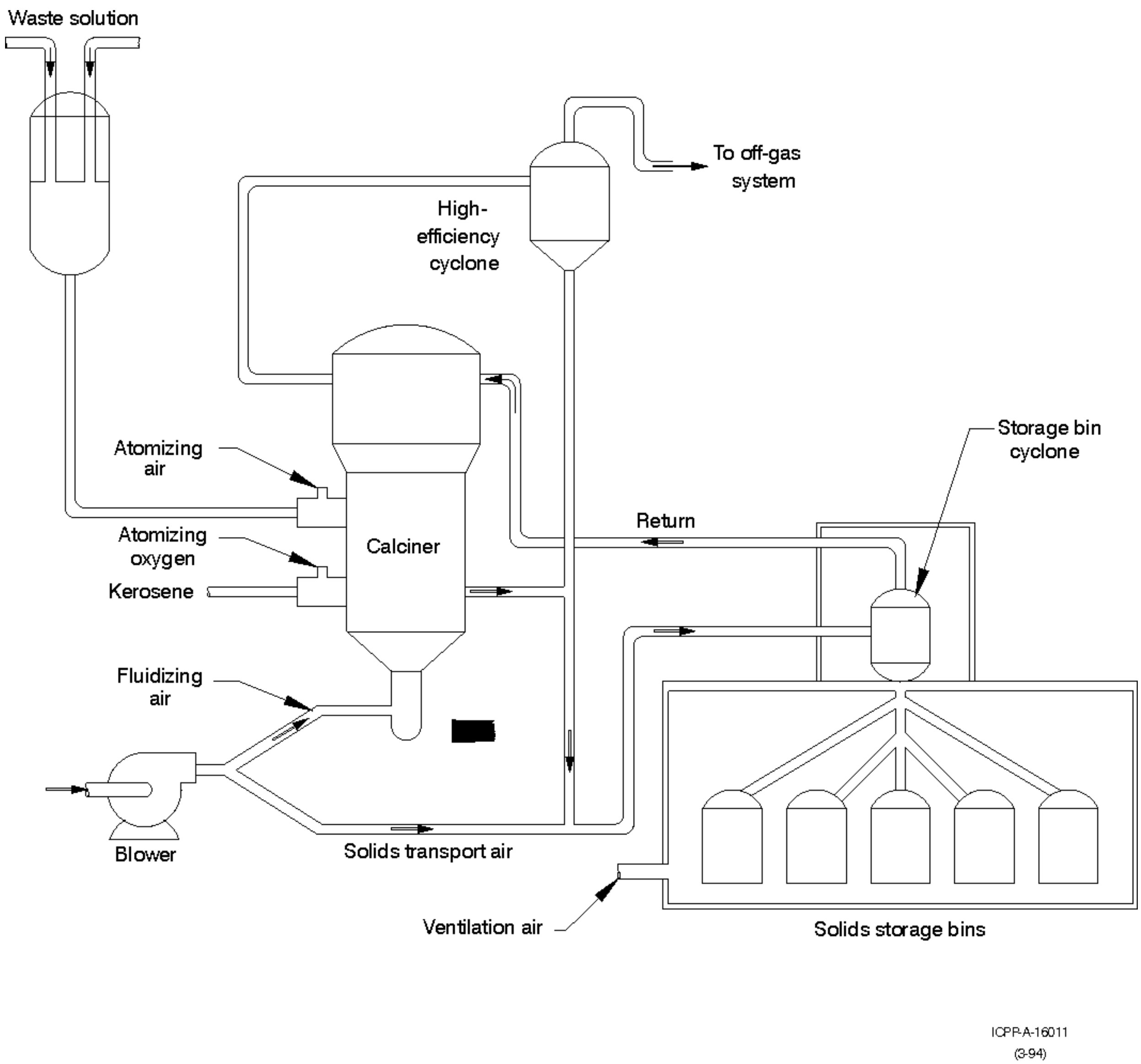

Exhibit D-1. Typical calciner process flow.

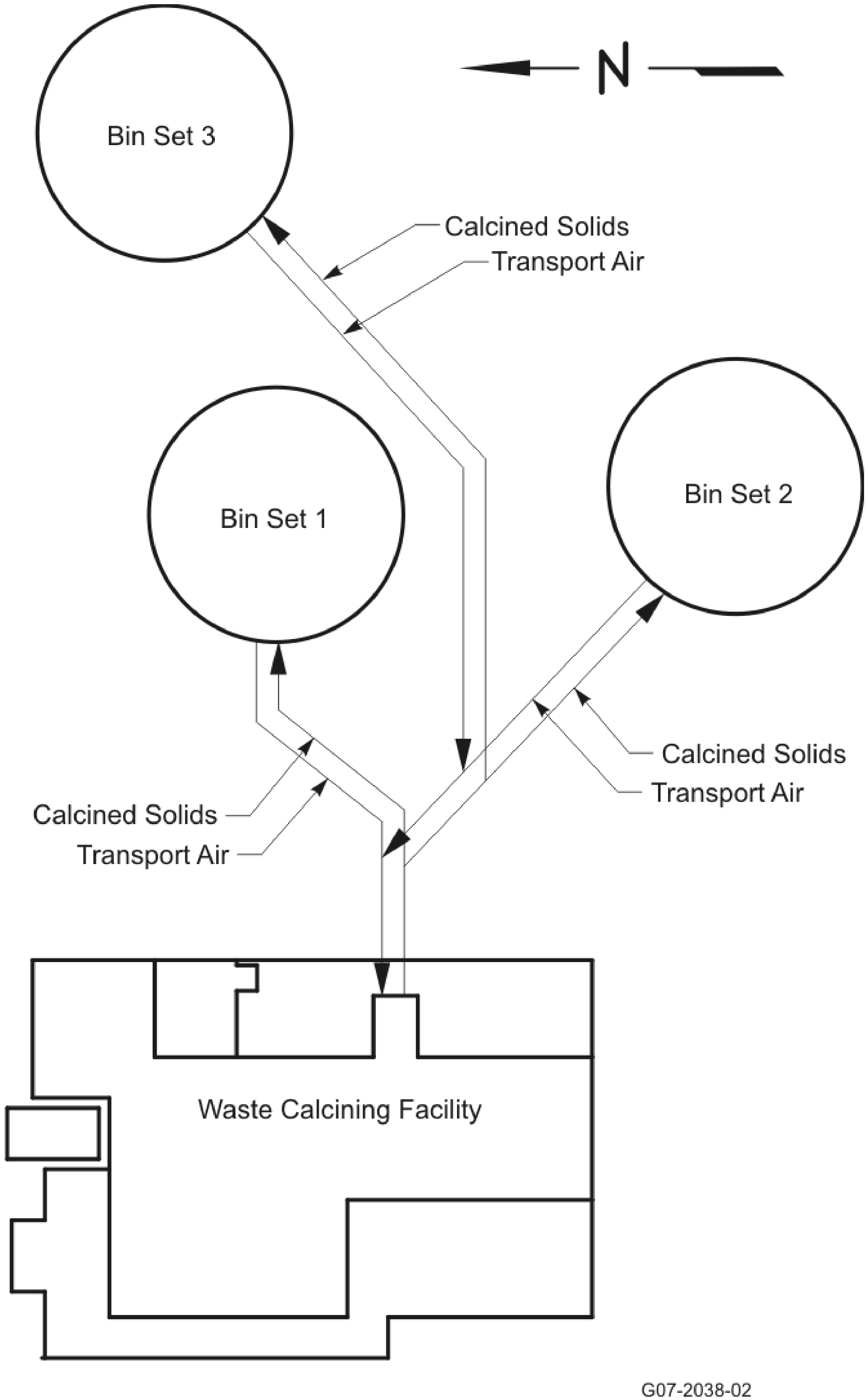

Exhibit D-2. Calcine solids flow.

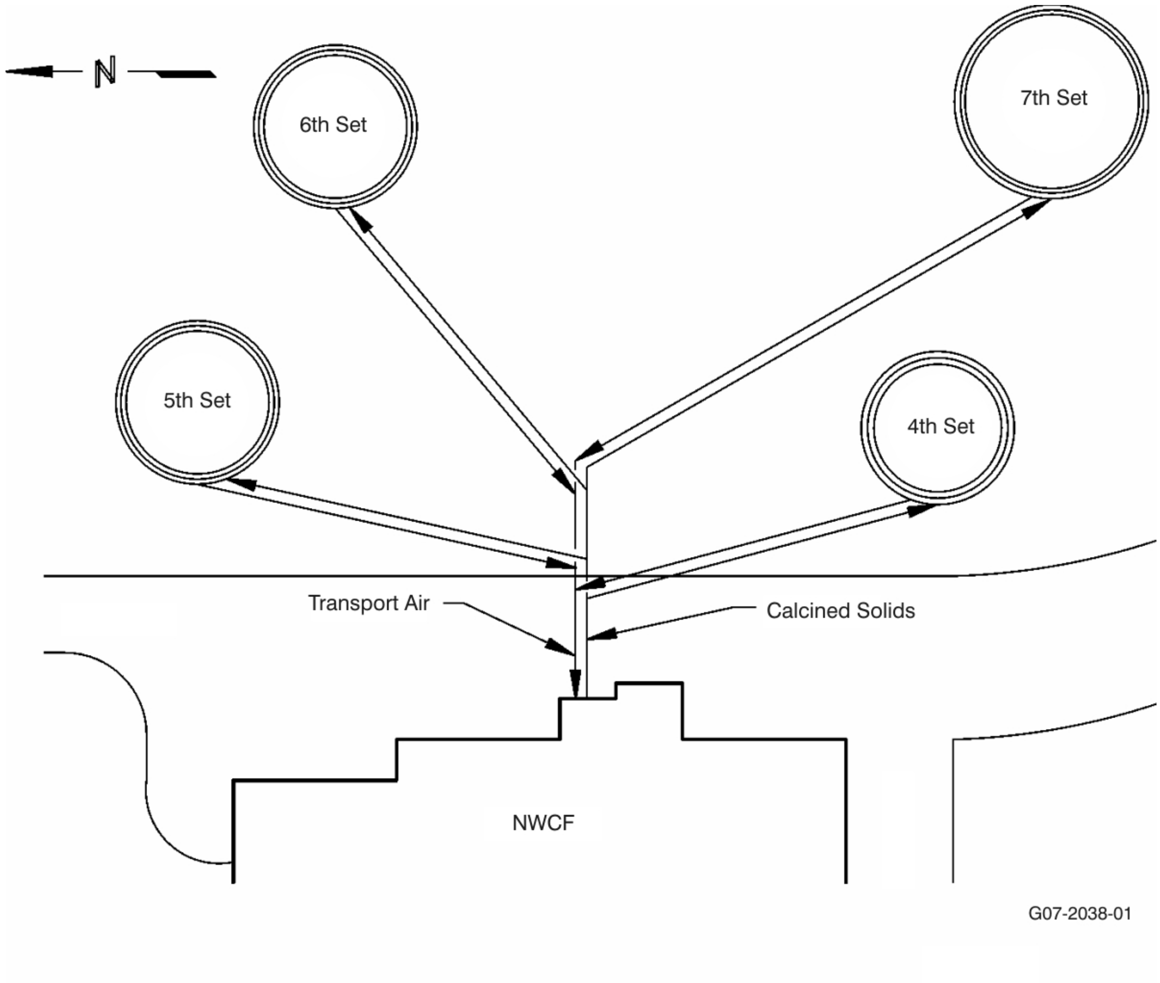

Exhibit D-3. Calcine solids flow.

- Waste piping systems and ancillary equipment associated with Bin Sets 1, 2, and 3 to the point where the transport lines were cut and capped during closure of the WCF. The boundaries for CSSF 1 begin after the cut and cap on Lines 3-TAA-3001 and 3-TAA-3009. The boundaries for CSSFs 2 and 3 begin after the cut and cap on Lines 3-TAA-3032 and 3-TAA-3034 (see Drawings 106576, 118862, and 154129 in Appendix 1).

- Waste piping systems and ancillary equipment associated with Bin Sets 4, 5, 6, and 7. The boundaries for CSSFs 4, 5, 6, and 7 begin with CSSF Valves TAV-WS4-1 and TAV-WS4-2; TAV-WS5-5 and TAV-WS5-4; TAV-WS6-2 and TAV-WS6-5; and TAV-WS7-5 and TAV-WS7-4 shown in Drawings 157798, 158491, 161425 and 009162, respectively, in Appendix 1. Beyond these valves, the “RCRA-Controlled” piping systems and ancillary equipment (including cyclones) are shown in these same drawings, respectively. The bin sets are isolated from the NWCF calciner system by physical devices securing the valves in the closed position on the lines.

D-2a. Existing Tank Systems

The design concept is similar for all the bin sets: vertical, stainless steel bins inside a concrete vault. The vault for CSSF 1 is rectangular and wholly underground. The vaults for CSSFs 2 and 3 are cylindrical, located partially underground and have had gravel berms placed around them. The vaults of CSSFs 4, 5, 6, and 7 are cylindrical, and located partially underground. In addition to housing the bin sets and ancillary equipment, each vault also contains a cyclone cell (for calcine distribution) and instrument room with CSSF monitoring equipment. Exhibit D-4 provides a cutaway view of a typical CSSF vault.

Heat was generated in the CSSF by fission-product decay and was transferred from the bins to the surrounding air. Heat was then conducted from the vault air through the concrete walls surrounding the bins and dissipated to the surrounding soil and air. The temperature within the bins is monitored via thermocouples in various locations and has stabilized to show only ambient temperature fluctuations. Therefore, the ventilation system for cooling was determined to be unnecessary and was secured closed.

The CSSF is equipped with continuous air monitors (CAMs) to detect loss of bin containment. Any loss of containment would result in radioactive materials being suspended in the vault air that would be detected by the CAMs. The pump within the CAM unit allows monitoring of the vault through recirculation of vault air.

If a CAM alarms, a radiological control technician and an operator will have the CAM filter analyzed to determine whether or not a release has occurred. All vaults have been isolated from the atmosphere by mechanically securing the cooling air inlets and outlets closed. As a result there is no motive force to spread contamination outside the vault.

D-2a(1) Assessment of Existing Tank System's Integrity [IDAPA 58.01.05.008 and 58.01.05.012; 40 CFR 264.191 and 270.16(a)]

An assessment prepared by Jason Associates Corporation, *Tank System Integrity Assessment for the Calcined Solids Storage Facility Bin Sets at the Idaho Nuclear Technology and Engineering Center* (see Appendix 2 of this permit reapplication), has determined and provides an independent Professional Engineer certification that the calcine storage bins are adequately designed and have sufficient structural strength and compatibility with the wastes being stored to protect human health and the environment. The facility assessment subsequently determined that the bins in CSSF 1–7 can be permitted for tank storage (7 units) under IDAPA 58.01.05.008, and 40 CFR Part 264, Subpart J requirements.

D-2a(2) Existing Corrosion Protection [IDAPA 58.01.05.008; 40 CFR 264.191(b)(3)]

The tanks and ancillary equipment are contained within concrete vaults. The tank systems do not have RCRA compliant secondary containment, however, a variance from secondary containment is being requested (see Section D-2f). Since the tank systems are located in vaults and the permitted piping is not directly buried in the soil, cathodic protection is not required.

The assessment prepared by Jason Associates Corporation, Tank System Integrity Assessment for the Calcined Solids Storage Facility Bin Sets at the Idaho Nuclear Technology and Engineering Center (see Appendix 2 of this permit reapplication), provides an independent Professional Engineer certification that the CSSF by design, construction, and the nature of the wastes stored are adequate to protect human health and the environment.

D-2b. New Tank Systems [IDAPA 58.01.05.008 and 58.01.05.012, 40 CFR 264.192 and 270.16(f)]

There are no new tank systems associated with the CSSF as installation commenced prior to the July 14, 1986 regulatory date for new tank systems.

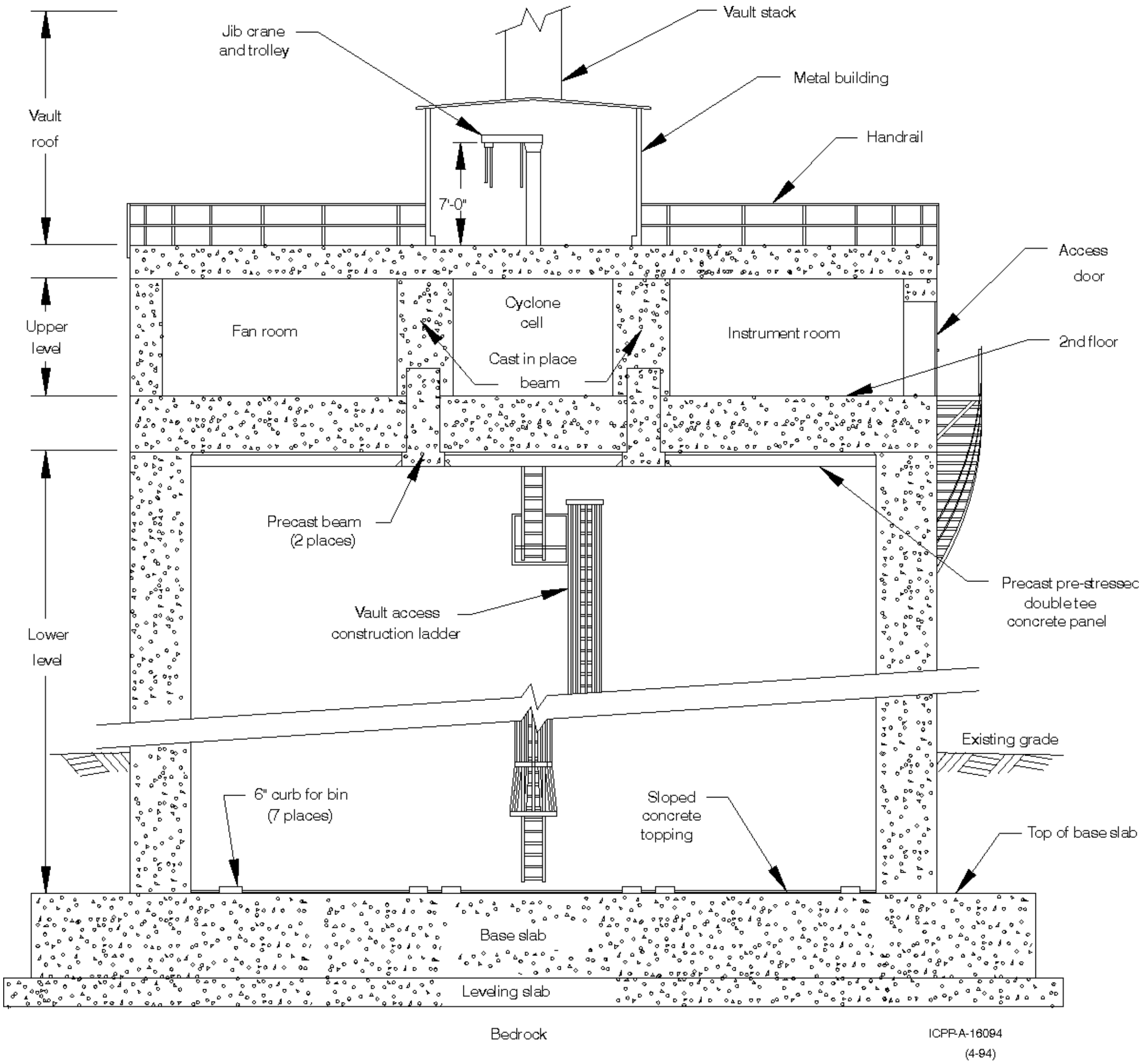

Exhibit D-4. Cutaway view of a typical CSSF vault.

D-2c. Dimensions and Capacity of Each Tank [IDAPA 58.01.05.012; 40 CFR 270.16(b)]

CSSF 1 contains four composite bin sets. Each bin set consists of two concentric ring (annular) tanks with a third, right-circular cylindrical tank located in the middle. There are gaps, of 2 to 3 in. in width, between the two annular tanks and between the inner annular tank and the cylindrical tank to support movement of cooling air between the tanks. The annular tanks are 20 ft tall and the outer one has an inside diameter of approximately 94 in. and an outside diameter of 142 in. The inner annular tanks have an inside diameter of approximately 41 in. and an outside diameter of approximately 90 in. VES-WCC-115-1 through VES-WCC-115-3 cylindrical tanks in the center are 25 ft tall and have a 36-in. diameter. The VES-WC-115-4 cylindrical tank in the center is approximately 27 ft tall and has a 36-in. diameter. Exhibit D-5 provides a cutaway view of the CSSF 1. The date construction and installation commenced, materials of construction, and the date CSSF 1 was filled are provided in Table l. The total, useable and filled volumes are provided in Table 2. CSSF 1 no longer receives calcine and is physically isolated from the closed WCF.

CSSF 2 contains seven bins, or tanks, each a right circular cylinder approximately 42 ft tall and 12 ft in diameter. The vertical tanks are arranged with six of them in a circular pattern that is centered on the seventh. Exhibit D-5 provides a cutaway view of the CSSF 2. The date construction and installation commenced, materials of construction, and the date CSSF 2 was filled are provided in Table l. The total useable and filled volumes are provided in Table 2. CSSF 2 no longer receives calcine and is physically isolated from the closed WCF.

CSSF 3 contains seven bins, or tanks, with a design and layout very similar to that of CSSF 2, except that the six bins arranged in the circular pattern are approximately 53 ft tall and the inner, central bin is 61 ft tall. The diameter of each bin is approximately 12 ft. Exhibit D-5 provides a cutaway view of the CSSF 3. The date construction and installation commenced, materials of construction, and the date CSSF 3 was filled are provided in Table l. The total useable and filled volumes are provided in Table 2. CSSF 3 no longer receives calcine and is physically isolated from the closed WCF.

CSSF 4 contains three bins, or tanks, each a right circular cylinder approximately 55 ft tall with a 12-ft diameter. Exhibit D-6 provides a cutaway view of the CSSF 4. The date construction and installation commenced, materials of construction, and the date CSSF 4 was filled are provided in Table l. The total, useable and filled volumes are provided in Table 2. CSSF 4 no longer receives calcine from the NWCF calciner.

CSSF 5 contains seven bins, or tanks, each a right circular cylinder approximately 50 ft tall, with an outer diameter of 12 ft. These tanks are annular in design with the open annulus measuring 4 ft in diameter (specifically, this is the inner diameter of the annular tank). The seven tanks are arranged in the same pattern as the tanks in CSSFs 2, and 3 (six of them in a circular pattern centered on the seventh). Exhibit D-6 provides a cutaway view of the CSSF 5. The date construction and installation commenced, materials of construction, and the date CSSF 5 was filled are provided in Table l. The total useable and filled volumes are provided in Table 2. CSSF 5 no longer receives calcine from the NWCF calciner.

CSSF 6 contains seven bins, or tanks, with a design and layout very similar to that of CSSF 5, except that each of the seven annular tanks is approximately 68 ft tall, with 13.5-ft outer and 5-ft inner diameters. Exhibit D-6 provides a cutaway view of the CSSF 6. The date construction and installation commenced and the materials of construction are provided in Table 1. CSSF 6 is not filled to capacity. The total useable and current filled volumes are provided in Table 2. CSSF 6 was active when the NWCF calciner was shut down and has remaining capacity.

CSSF 7 contains seven bins, or tanks, which are laid out in the same pattern as the bins in CSSF 6. Each of the seven annular tanks is approximately 68 ft tall, with 13.5-ft outer and 1-ft inner diameters. Exhibit D-6 provides a cutaway view of the CSSF 7. The date construction and installation commenced and the materials of construction are provided in Table l. CSSF 7 is empty and has never stored calcine or other hazardous waste.

Table 1. CSSF–Date construction and installation commenced, materials of construction, and year filled.

CSSF	Date Construction and Installation Commenced	Materials of Construction	Year Filled
1	1959	405 stainless-steel plate	1964
2	1965	304 stainless-steel plate	1972
3	1969	304 stainless-steel plate	1981
4	1976	304L stainless-steel plate	1983
5	1978	304L stainless-steel plate	1992
6	1980	304L stainless-steel plate	Not Full
7	1985	304L stainless-steel plate	Not Used

Table 2. CSSF–Total, useable and filled CSSF volumes.

CSSF	Total (ft^3)	Usable (ft^3)	Filled (ft^3)	% Full
1	8,300	8,000	7,800	96
2	31,600	30,000	30,000	100
3	40,000	39,900	39,500	99
4	17,700	17,200	17,100	100
5	36,200	35,600	35,600	100
6	55,200	53,200	25,600	48
7	63,000	63,000	0	0

Exhibit D-5 and D-6 provide cutaway views of the CSSF 1 - 7.

D-2d. Description of Feed Systems, Safety Cutoffs, Bypass Systems, and Pressure Controls [IDAPA 58.01.05.012; 40 CFR 270.16(c)]

The calcine stored in the CSSF is a solid granular waste form that does not contain free liquids. The bins temperatures are monitored during filling to determine the approximate level of the calcine in each bin.

Safety Cutoffs. There are no safety cutoffs associated with the CSSF.

Bypass Systems. There are no bypass systems associated with the CSSF.

Pressure Controls. Bin vent lines are provided with three pressure relief valves used during bin filling; a high-pressure relief valve, a low-pressure relief valve, and a vacuum relief valve. The high and low pressure relief valves discharge into the vent system exhaust duct, while the vacuum valves allow air to be drawn into the bins.

D-2e. Diagrams of Piping, Instrumentation, and Process Flow [IDAPA 58.01.05.012; 40 CFR 270.16(d)]

A list of drawing numbers and the drawings are located in Appendix 1 of this permit reapplication.

D-2f. Containment and Detection of Releases [IDAPA 58.01.05.012 and 58.01.05.008; 40 CFR 270.16(h) and 264.193(g)]

Regulations allow application for a variance from the secondary containment requirements provided the containment is designed and operated to be at least as effective at protecting human health and the environment as secondary containment. Other considerations include the nature and quantity of the waste and the hydro-geologic setting of the unit.

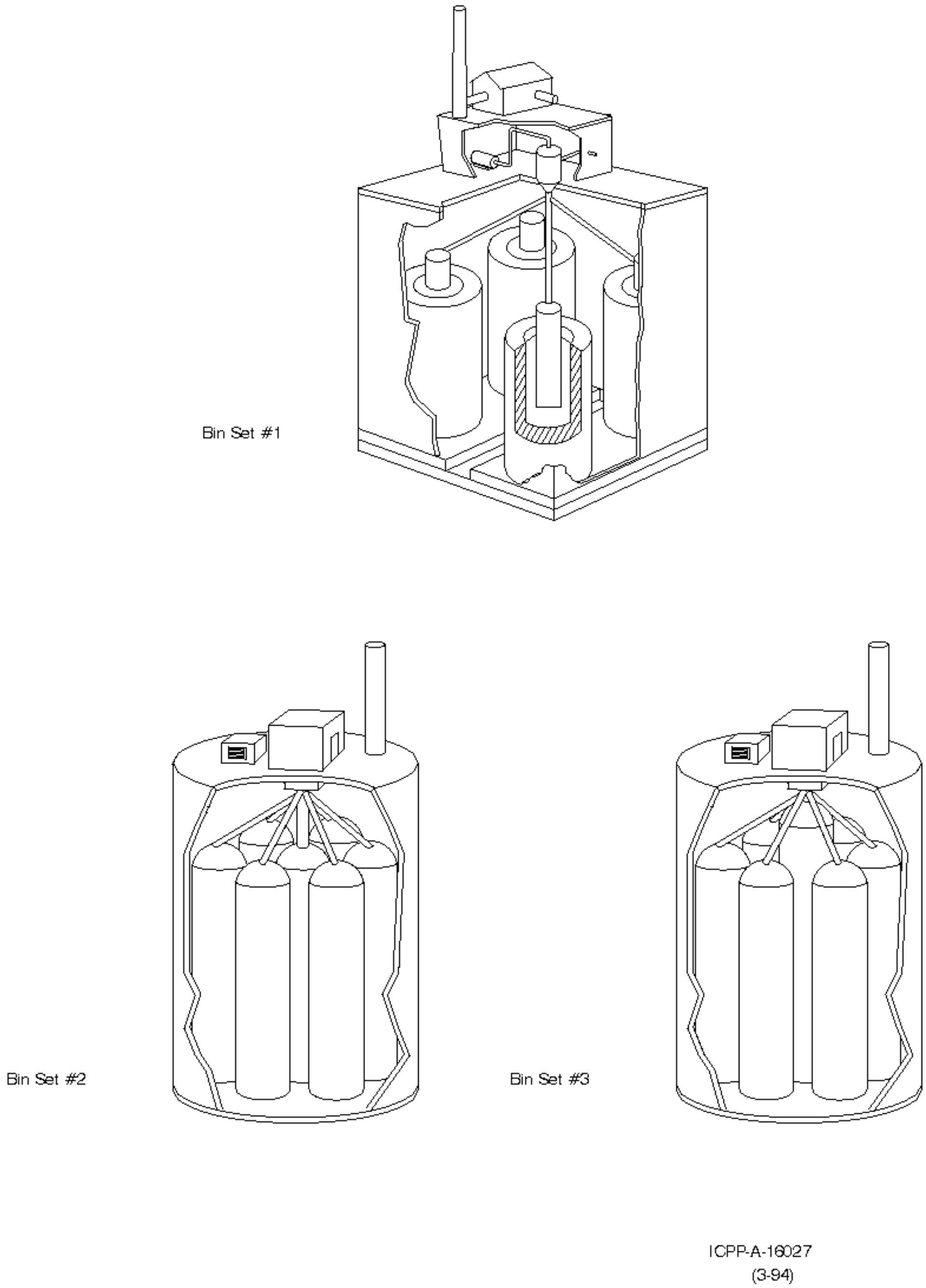

Exhibit D-5. CSSFs 1, 2, and 3 cutaway view.

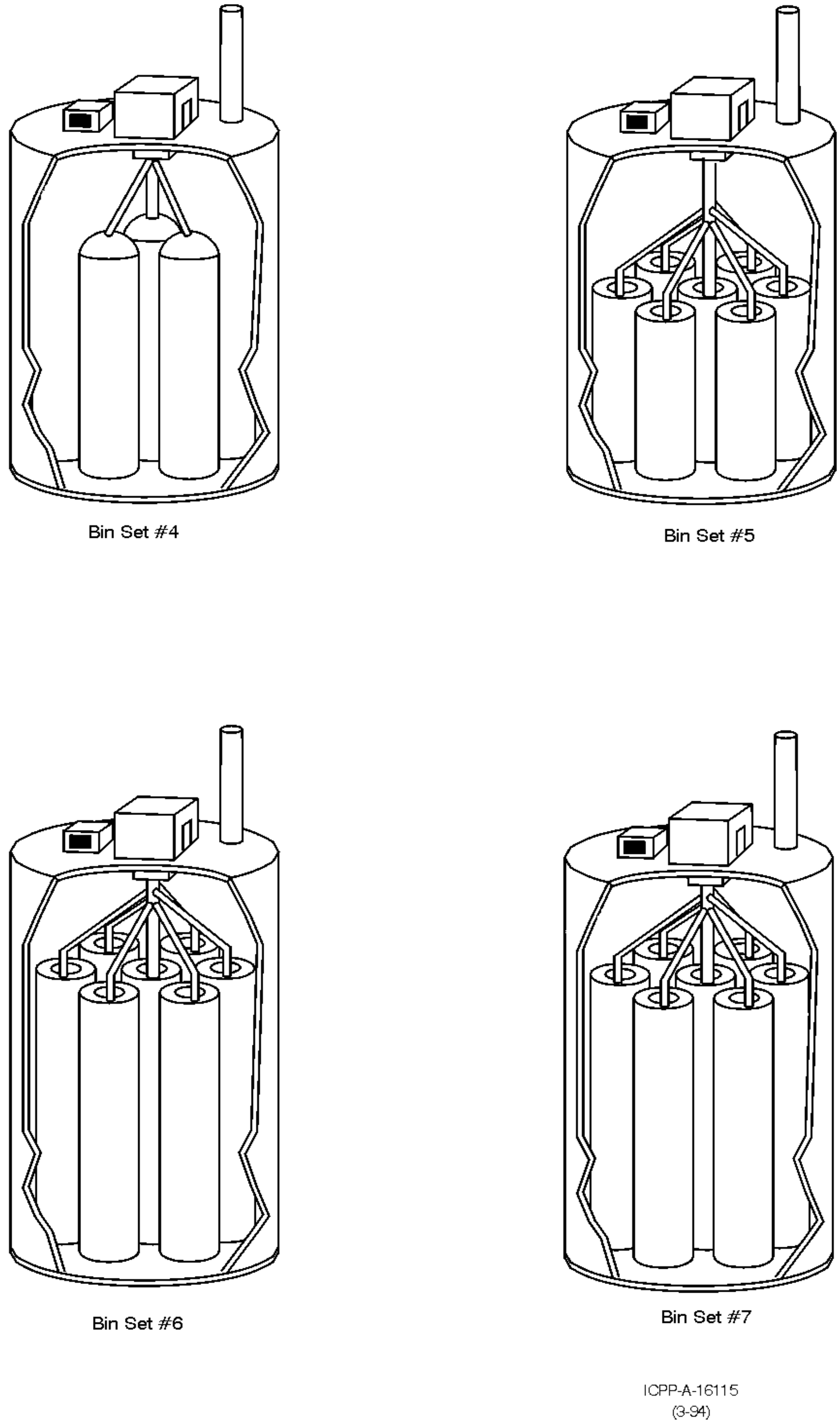

Exhibit D-6. CSSFs 4, 5, 6, and 7 cutaway view.

D-2f(3) Variance from Secondary Containment Requirements [IDAPA 58.01.05.012 and 58.01.05.008; 40 CFR 270.16(h) and 264.193(g)(1)]

D-2f(3)(a) Variance Based on a Demonstration of Equivalent Protection of Groundwater and Surface Water [IDAPA 58.01.05.012 and 58.01.05.008; 40 CFR 270.16(h) and 264.193(g)(1)(i)]

D-2f(3)(a)(i) Nature and Quantity of the Waste [IDAPA 58.01.05.012 and 58.01.05.008; 40 CFR 270.16(h) and 264.193(g)(1)(i)]

The waste stored in the CSSF is a dry, rounded, granular solid. The bin sets containing the calcine are mechanically isolated to prevent addition of materials to the tanks. The chemical nature of the calcine is described in detail in Section C of this permit reapplication. The quantity of wastes stored in the CSSF is listed in Table 2 of Section D.

D-2f(3)(a)(ii) Proposed Alternate Design and Operation of the Containment System [IDAPA 58.01.05.012 and 58.01.05.008; 40 CFR 270.16(h) and 264.193(g)(1)(ii)]

In accordance with 40 CFR 264.193(g), a variance may be obtained from the secondary containment requirements if it can be demonstrated that the alternative design and operating practices, together with location characteristics, will prevent the migration of any hazardous waste or hazardous constituents into the ground water or surface water at least as effectively as secondary containment during the active life of the tank system. An assessment was prepared in accordance with 40 CFR 264.191 by Jason Associates Corporation, *Tank System Integrity Assessment for the Calcined Solids Storage Facility Bin Sets at the Idaho Nuclear Technology and Engineering Center*, (see Appendix 2 of this permit reapplication), that demonstrates the calcine storage bins and vaults are adequately designed and have sufficient structural strength and compatibility with the wastes being stored to protect human health and the environment at least as effectively as secondary containment.

D-2f(3)(a)(iii) Hydrogeologic Setting of the Facility [IDAPA 58.01.05.012 and 58.01.05.008; 40 CFR 270.16(h) and 264.193(g)(1)(iii)]

The hydrology conditions at the INL are addressed in the *DOE Programmatic Spent Nuclear Fuel Management and INEEL Environmental Restoration and Waste Management Programs Final*

Environmental Impact Statement (DOE/EIS - 0203F, Volume 1, Appendix B). A copy of this document has already been provided to DEQ.

D-2f(3)(a)(iv) Other Factors Influencing Quantity and Mobility of the Waste [IDAPA 58.01.05.012 and 58.01.05.008; 40 CFR 270.16(h) and 264.193(g)(1)(iv)]

The following is a list of factors that would influence the quality and mobility of the hazardous constituents and the potential for them to migrate to ground water or surface water.

- In the calciner processes liquid wastes were injected into a high-temperature (400 to 600^{o} C) air-fluidized bed of granular solids. The liquid portion of the waste evaporated and the solids adhered to the granular material-producing calcine. This calcine is dry stable rounded waste form.

- No free liquids have ever been introduced into the bins. The calcine contains no free liquids as a result of the calcining process. No visible evidence of liquids has been observed within the vaults via camera inspections that have been completed to date. Therefore, an external mechanism would be necessary for transport of the calcine outside of the vaults.

- The vaults are monitored for leaks from the bins using CAMs and for liquid infiltration using sumps that are equipped with level indicators and jets for liquid removal. The engineered barrier is the vault boundary. In order for calcine to migrate outside of this boundary a bin would have to leak into the vault. A liquid (which would collect in the vault sump, be detected, and removed) capable of dissolving the calcine would have to be introduced, dissolve the calcine, and then find a path out of the vault to the environment.

- The vault cooling air inlets and outlets are blind-flanged, supporting the condition that air within the vaults does not provide a transport mechanism for calcine out of the vault.

- The INTEC is located in the south-central portion of the INL in Butte County. The physical conditions around these buildings are typical for the INL Site, approximately 5,000 ft above mean sea level. The area is relatively flat and receives little rainfall. The mean annual precipitation at the INL is approximately 8.5 in./yr.

- There is little or no potential for damage to wildlife, crops, vegetation, and physical structures caused by a leak from the CSSF due to the robust construction of the bins and vaults.

D-2g. Controls and Practices to Prevent Spills and Overflows [IDAPA 58.01.05.012 and 58.01.05.008; 40 CFR 270.16(i) and 264.194(b)]

The level of calcine in the bins is monitored through temperature variances using thermocouples on the bins. Drawings 106574, 118888, 154127, 157814, 158523, 161448, and 168211 in Appendix 1 of this permit reapplication show the location of the thermocouples in CSSFs 1 through 7, respectively. As calcine is transported to the CSSF, the temperature increases in the bins to correlate with the level of calcine being added. CSSFs 1, 2, 3, 4, 5, and 6 have reached equilibrium temperatures. Thermocouples for these bins are monitored on an annual basis. CSSF 7 is not storing calcine and is not being monitored.

Due to the highly radioactive nature of the calcine, replacement of thermocouples in CSSFs 1 through 6 is not protective of human health. Therefore, as the thermocouples fail, RCRA remedials will not be opened. The annual monitoring of thermocouples will be performed using only those thermocouples that remain functional.