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Revision 0

Saltstone Disposal Facility
Vault 4 Cells B and H
Drainwater Piping Anchor Bolt Inspection Summary

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ACRONYMS

DU2	Disposal Unit 2
NRC	U.S. Nuclear Regulatory Commission
PA	Performance Assessment
SDF	Saltstone Disposal Facility
SRR	Savannah River Remediation LLC

EXECUTIVE SUMMARY

During the July 2010 Salt Waste Monitoring Onsite Observation, the U.S. Nuclear Regulatory Commission (NRC) requested that Savannah River Remediation (SRR) assess the anchor bolt penetrations in Vault 4 that are used to keep the drainwater collection piping anchored to the cell floor. This request was based on observations of the Disposal Unit 2 (DU2) water tightness testing and potential leak paths from that unit at anchor bolt locations. On March 29, 2011, SRR entered Vault 4 Cells B and H to assess the condition of anchor bolt penetrations in the concrete floor. The purpose of the inspection was to assess whether bolts used to anchor the drainwater system to the floor displayed evidence of voids or cracking of concrete at the embed locations. Approximately 20% (48) of the total anchor bolts (approximate total of 240 per cell) were installed in a manner that visual inspection was possible. The remaining 80% were obstructed by the presence of the anchoring strap. Of the anchor bolts visible for inspection, there was no evidence of concrete cracking around the anchor bolt and no evidence of void spaces at the threads of the anchor bolts.

1.0 BACKGROUND

During the July 2010 Salt Waste Monitoring Onsite Observation (Accession number ML102180250), the NRC reviewed the status of the water tightness testing activities and interim results associated with DU2. As part of that discussion, SRR postulated mechanisms for leakage from DU2. These included the possibility that drainwater anchor bolts could have cracked the DU2 concrete or have voids around the threads such that water could bypass the concrete barriers relatively quickly (described as a fast flow path in Saltstone Disposal Facility (SDF) Performance Assessment (PA) modeling) instead of migrating through the concrete at a much slower rate (i.e., thousands of years). The NRC noted that a similar drainwater collection system had been installed in some cells in Vault 4 and requested that SRR assess the anchor bolt penetrations in Vault 4 that are used to keep the drainwater collection piping anchored to the cell floor.

1.1 Disposal Unit 2 Salient Drainwater Features

The DU2 drainwater system design includes a very robust anchoring system containing approximately 1,200 anchor bolts per cell. The concrete floor was drilled after curing and the bolts were installed in the holes instead of being embedded prior to the concrete pour. Thus, the concrete was drilled at 1,200 locations to accommodate insertion of the bolts. Drilling could have cracked the concrete surrounding the hole, or the hole could have been drilled deeper than required (down to the underlying rebar). In addition, standard epoxies were used to secure the bolts in place and a misapplication of epoxy could have resulted in fast flow paths around the bolt threads.

Imperfections in the installation of anchor bolts resulting in water tightness failure were not anticipated during design or construction. After installation, a coating was applied over the entire exposed surface of the floor and walls, including anchor bolt penetrations. Destructive examination of these locations was not feasible and detailed visual documentation of installation is not available.

Figure 1.1-1 below depicts the DU2 interior section along with a postulated fast flow path resulting from these imperfections. Figure 1.1-2 represents details of the postulated condition on the floor of DU2 occurring at the anchor bolt penetration.

Figure 1.1-1: DU2 Interior Section Postulated Fast Flow Path

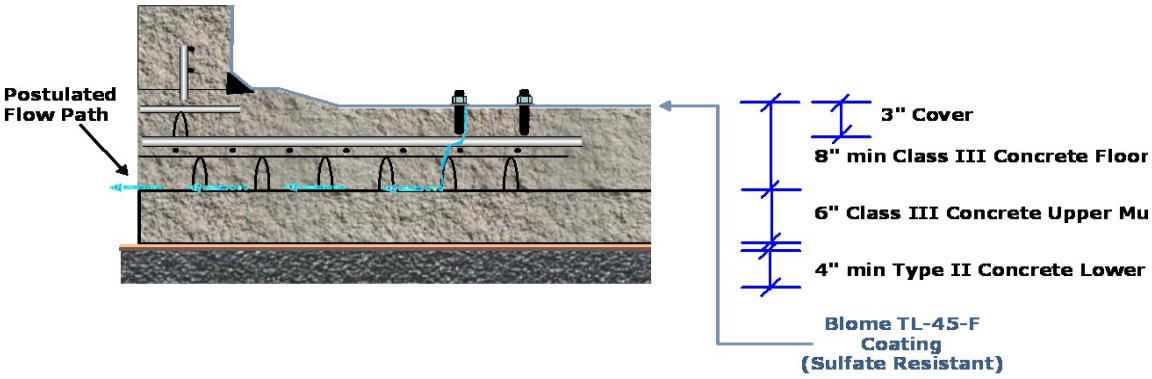
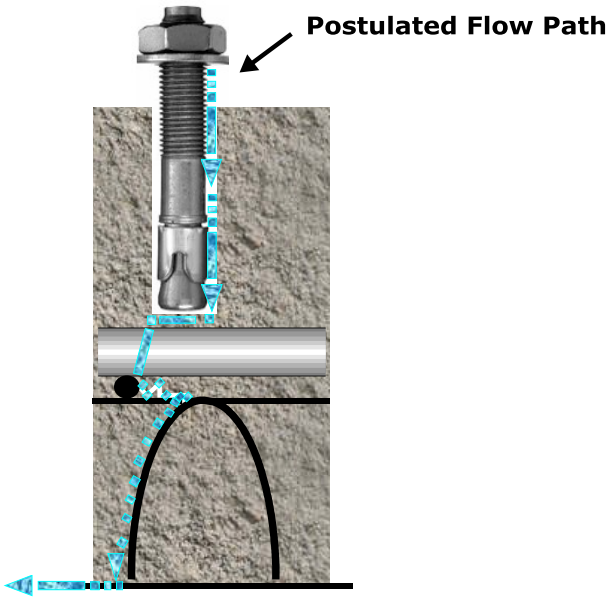


Figure 1.1-2: DU2 Interior Details Postulated Fast Flow Path



1.2 Vault 4 Salient Drainwater Features

The Vault 4 drainwater system was constructed in a fashion similar to DU2 with the following salient differences:

- Only approximately 240 locations per cell were drilled to accommodate insertion of the bolts.
- The floor slab of Vault 4 is approximately 2 feet thick with a 4-inch working slab below. [W828992]
- A coating over the concrete surfaces was not applied in Vault 4.

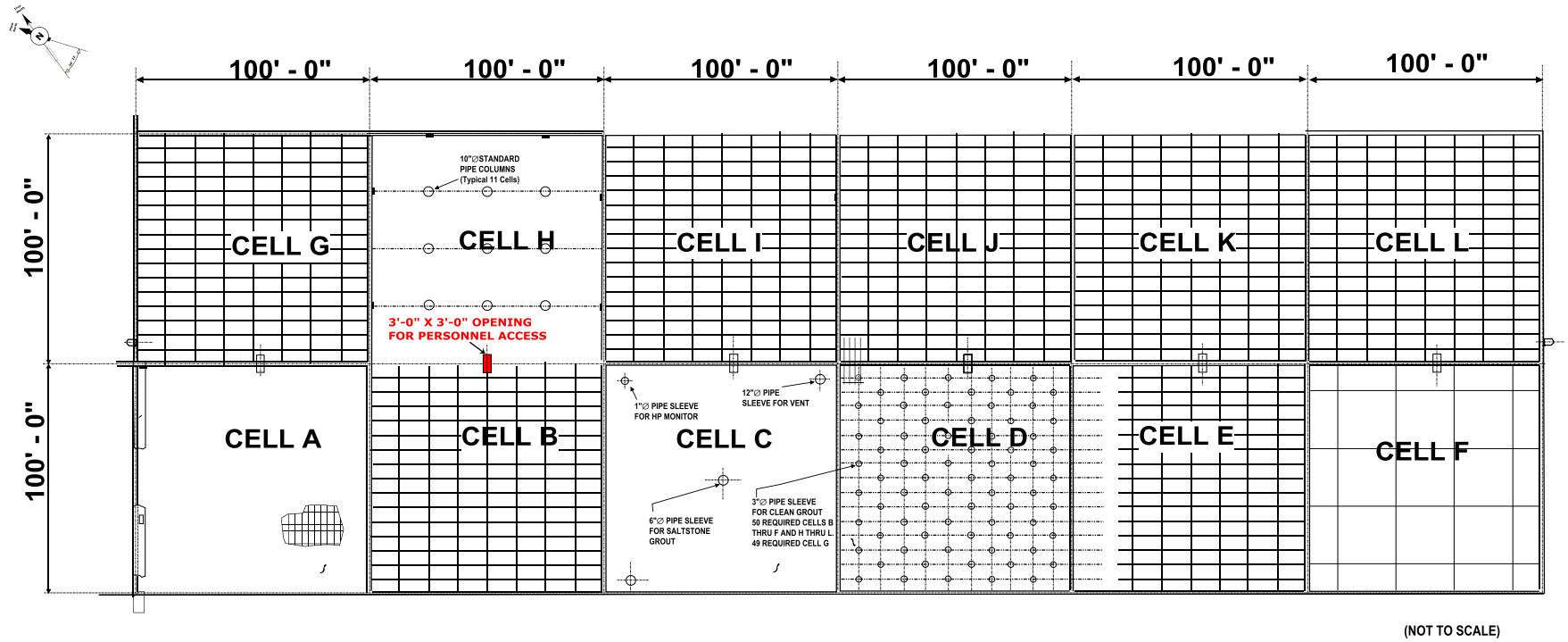
1.3 Objectives

The objective of the Vault 4 Cells B and H entries were to address questions related to anchor bolt penetrations in the floor concrete of DU2 (their potential to facilitate fast flow paths in the unit) raised by the NRC during their July 2010 Onsite Observation. Specifically, do the anchor bolt penetrations in Vault 4 display evidence of cracking or voids around the bolt threads.

1.4 Approach

Due to the potential for transferable and airborne contamination, a remote camera inspection was initially performed to assess the condition of anchor bolts in Vault 4 Cells B and H. A camera with video was lowered through the main access hatch located near the "spine" of Vault 4 at the midpoint of each cell (see Figure 1.4-1).

Figure 1.4-1: Vault 4 Main Access Hatch Location



Note: Main access hatch in red.

The camera was lowered to approximately the 25-, 15-, and 5-foot elevations of each cell to perform inspections. Even though areas near the camera were more clearly visible than areas farther away, sufficient detail could not be obtained using this method. Though the camera inspection did not reveal sufficient detail about the anchor bolt locations, it should be noted that the southwest corner of Cell B displayed freestanding water both beside and underneath the drainwater piping system. This condition is not unexpected since, during operations, the Vault 4 vapor space of each cell is interconnected with other cells and the external environment, resulting in condensation. It should also be noted that Cells C and I are adjacent to the south wall and southwest corner (respectively) of Cell B and contain approximately 15.5 and 13.2 feet of grout respectively. Figure 1.4-2 summarizes the grout levels for the cells in Vault 4 as of April 2011.

Figure 1.4-2: Cell Designation and Approximate Fill Height (ft.)

G 21.5	H 0	I 13.2	J 19.5	K 23.5	L 23.25
A Full	B 0	C 15.5	D 23.75	E 21	F 22.75

Due to the limited ability to obtain adequate resolution and field of vision using the remote camera, personnel entry was made March 29, 2011 for visual inspection of the anchor bolt locations. A description of the observations and photographs of typical anchor bolt penetrations in Vault 4 is provided in Section 1.5.

1.5 March 29, 2011 Inspection Observations

Approximately 20% (48) of the total anchor bolts (approximately 240 per cell) could be inspected and/or clearly photographed. Inspections of the visible anchor bolts in Vault 4 Cells B and H revealed no visible means for immediate leakage of liquids, via either cracks or voids. Several typical locations are shown in Figures 1.5-1 through 1.5-4 (e.g., Figure 1.5-1 shows both used and not used bolt installations). Figure 1.5-2 shows a concrete fragment under a strap that is excess from construction activities and was not dislodged from the anchor bolt location. One location at the southwest corner of Cell B contained freestanding water approximately 10 feet x 10 feet x 1 inch deep (Figure 1.5-4). Several straps and anchor bolts were located in this section. The presence of freestanding water over these anchor bolts supports the conclusion that anchor bolts installed in Vault 4 do not result in fast flow paths.

Figure 1.5-1: Typical Vault 4 Anchor Bolt Installations – Used and Unused

Figure 1.5-2: Typical Vault 4 Anchor Bolt Installation – Excess Construction Concrete Fragment

Figure 1.5-3: Typical Vault 4 Anchor Bolt Installation – No Cracking or Voids

Figure 1.5-4: Typical Vault 4 Anchor Bolt Installation – In Freestanding Water

2.0 SUMMARY

The objective of the Vault 4, Cells B and H entry was to address questions related to anchor bolt penetrations in the floor concrete of Saltstone DU2 (their potential to facilitate fast flow paths in the unit) raised by the NRC during their July 2010 Onsite Observation. Specifically, do the anchor bolt penetrations in Vault 4 display evidence of cracking or voids around the bolt threads that would allow liquid to bypass the cementitious materials to move into the environment. Visual indications from entry into Cells B and H indicate that the concrete remains continuous and free of cracking around the visible bolt locations. In addition, there is no visual evidence of voids around the bolt threads. Finally, standing water in the area of anchor bolts suggests that water does not flow through cracks or voids around the threads, nor through any other pathway.

Together, these observations support the position that anchor bolt penetrations present in Vault 4 do not introduce fast flow paths.

3.0 REFERENCES

W828992, *200 Z Area Saltstone Vault 4 Plan, Section and Details – Concrete*, Savannah River Site, Aiken, SC, Rev. 2, March 10, 1989.

ML102180250, *U.S. Nuclear Regulatory Commission July 28, 2010 Onsite Observation Report for the Savannah River Site Saltstone Facility,* U.S. Nuclear Regulatory Commission, Washington D.C., November 19, 2010.