RAI Volume 2, Chapter 2.1.1.4, Third Set, Number 1, Supplemental Question 4:

Clarify the DOE's plan for ensuring the invert structure and rails in emplacement drifts will retain alignment, grade, and structural integrity necessary for subsurface facility operations for approximately 100 years.

1. RESPONSE

Emplacement drift inspections by remotely operated gantries equipped with high-resolution cameras and other sensors provide visual examinations of the emplacement drift invert, ground support, and waste packages. These inspections also support performance confirmation activities and acquire environmental readings. The invert and rail structure is not important to safety or waste isolation. Longitudinal beams and transverse support beams of the steel invert structure are designed with design basis ground motion (DBGM)-2 or 2,000-year-return-period seismic loads. The TEV rail and rail runway beams are designed with DBGM-1 or 1,000-year-return-period seismic loads. The invert consists of the steel invert structure and the crushed-tuff ballast fill. Because the rails are attached to runway steel beams bolted to the steel invert structure, inspections of the rail are expected to provide a reliable indicator of the overall structural condition of the invert and rail. Inspection of the invert structure below the top-of-ballast elevation with these methods is not possible; however, the ballast surface condition is a good indicator of potential degradation of the structure below the top of ballast (i.e., fill subsidence or movement).

1.1 INVERT STRUCTURE AND RAIL DESIGN

The invert design described in SAR Section 1.3.4.5 is supported by the *Steel Invert Structure—Emplacement Drifts* calculation (BSC 2007). Neither the invert structure nor the rail is relied upon for prevention or mitigation of event sequences, and they are, therefore, classified as not important to safety (SAR Section 1.9, Table 1.9-1). These structures do not contribute significantly to barrier capability and they are, therefore, classified as not important to waste isolation. Regardless of these components' safety classifications, the emplacement drift invert structure/rail assembly is conservatively designed for the DBGM-1 and DBGM-2 seismic criteria as identified in SAR Section 1.3.4.5. Table 1 summarizes the primary structural members for the invert structure used in the design. The robust steel beams are the result of the design load combinations described in SAR Section 1.3.4.5.9, which considers the loaded TEV loads on the invert structure (BSC 2007, Section 4.3.2).

Table 1. Emplacement Drift Invert Structure Principal Steel Component Design Details

Primary Member[1]	Member Size
Runway Beams	W12 × 65
TEV Crane Rail	171 lbs/yd
Transverse Beams	W12 × 65
Longitudinal Beams	W12 × 40

NOTE: [1]See SAR Figures 1.3.4-5, and 1.3.4-8 through 1.3.4-10.

Source: BSC 2007, Sections 3.2.4 and 7.

The transverse beams and stub columns are anchored to the host rock and transmit the loads directly to the drift walls. The invert structure design also prevents buckling that could result from thermal growth caused by temperature variations ranging from ambient to 392°F (BSC 2007, Section 4.3), and accommodates rock wall displacements by the use of expansion joints with slotted holes at bolt connections (BSC 2007, Section 6.1). Because the invert steel structure beams are specified as corrosion-resistant material (ASTM A 588/A 588M-05), corrosion is not a concern for the low humidity conditions that will exist in the ventilated drifts during the preclosure period (BSC 2007, Section 4.3.6; SAR Table 1.3.5-1).

Given the conservative design of the invert structure/rail combination for the applicable thermal and seismic loads (BSC 2007, Section 4.3), it is anticipated that no planned/routine maintenance will be required during the 100-year preclosure period.

1.2 INSPECTIONS

Inspections performed with remotely operated equipment are planned to monitor the conditions of the invert structure and rail, as reflected by the physical condition of the rails (i.e., alignment, grade, and general appearance) and the above-ballast portions of the invert steel.

Postemplacement inspections will be performed by remotely operated equipment such as the vehicle concepts presented in Figures 2 and 3 of RAI 2.2.1.2-001. The principal purpose of the emplacement drift inspection gantry will be to visually inspect the emplacement drifts, waste packages, drip shields, and support performance confirmation activities to ensure that the subsurface facility is maintained in an operational condition.

The inspection gantry contains cameras mounted on the inspection gantry framework (RAI 2.2.1.2-001, Figure 3), which will be used to view the top and sides of the emplacement drift ground support, the invert, the pallet, and the waste package or drip shield. Visual examinations of the emplacement drift rail, which is physically attached to the invert, will provide a reliable indicator of the overall structural condition of the invert and rail. An inspection plan for the rail will include checking of rail alignment, gauge, and grade to verify the operational conditions of the emplacement drift. An inspection plan for the invert structure/rail assembly will be developed in the future, and the plan will include a method to measure the rail alignment and grade by methods such as photogrammetry, laser scanning, or laser targeting of fixed targets. Detection of invert structure or rail damage would warrant actions if the operational conditions of the emplacement drift are adversely affected. Any such invert structure or rail damage that would impact the operational conditions and that requires repair would be handled with remediation methods developed for each case.

The operational tolerances for the emplacement drift rail and in-drift remote equipment will be developed in the future.

2. COMMITMENTS TO NRC

None.

3. DESCRIPTION OF PROPOSED LA CHANGE

None.

4. REFERENCES

ASTM A 588/A 588M-05. 2005. *Standard Specification for High-Strength Low-Alloy Structural Steel, up to 50 ksi [345 MPa] Minimum Yield Point, with Atmospheric Corrosion Resistance*. West Conshohocken, Pennsylvania: American Society for Testing and Materials. TIC: 258058.

BSC (Bechtel SAIC Company) 2007. *Steel Invert Structure—Emplacement Drifts*. 800-SSC-SSE0-00200-000-00C. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20070924.0044.