REQUEST FOR ADDITIONAL INFORMATION
Volume 2 – Preclosure
Chapter 2.1.1.2, Set 1 – Description of Structures, Systems, Components, Equipment, and Operational Process Activities
(RAI #1 - #15)

The following questions pertain to DOE's description and discussion of design of surface and subsurface facilities of GROA. The questions pertain to Drip Shield, Transport and Emplacement Vehicle, Piping and Instrumentation Diagrams (P&IDs) of surface facilities, Radiation Monitoring and Criticality, and Controls and Communication systems. These systems are described in SAR Sections 1.2.4, 1.2.5, 1.2.8, 1.3.4, 1.4.2, 1.14.2, and 1.14.3. This information is needed to verify compliance with 10 CFR 63.21(c)(3), 63.21(c)(6), 63,21(c)(16), 63.112 (a), 63.112(e)(6), 63,112(e)(7), 63.112(e)(10), 63.113(b), and 63.113(c).

RAI #1

Provide dimensions of the drip shield components listed in SAR Table 1.3.4-4, and dimensions of additional components, if any, associated with the drip shield, but not listed in Table 1.3.4-4.

In SAR Figure 1.3.4-15, DOE has provided dimensions for an assembled (welded) drip shield. However, dimensions for various drip shield components listed in SAR Table 1.3.4-4 are not provided. This information is needed for evaluation of drip shield structural performance as an ITWI SSC.

RAI #2

Provide details of the drip shield interlocking feature shown in SAR Figure 1.3.4-15, including dimensions of various components.

DOE has indicated that SAR Figure 1.3.4-15 provides details of the drip shield interlocking feature. However, the Figure 1.3.4-15 does not explicitly show details necessary for evaluation of the drip shield installation and drip shield structural performance as ITWI SSC.

RAI #3

Provide information pertaining to the codes and standards used for the drip shield design and fabrication, including, but not limited to, code and standards used for drip shield welding and heat treatment.

DOE has indicated that codes and standards applicable to the design and fabrication of the drip shield are provided in SAR Table 1.3.2-5. However, in the Table 1.3.2-5, DOE has listed only codes and standards that govern material properties (e.g., density, elongation, yield and

ultimate tensile stresses). In "Yucca Mountain Project Engineering Specification Prototype Drip Shield" (BSC, 2007m), cited in SAR Section 1.3.4.7.7, DOE provides information on other codes and standards used for drip shield welding, heat treatment, etc.; however, this reference is not on the docket.

RAI #4

Provide technical basis for using Titanium Grade 28 as a filler material for joining Titanium grade 7 to Titanium Grade 29, including fabrication methods used to perform welding operations. Specifically, address the technical basis for the selection of the weldment, given the metallurgical, mechanical, and thermal differences between these three metals.

Titanium Grade 7 is a palladium-containing single α-phase material and titanium Grades 28 and 29 are aluminum-, vanadium-, ruthenium-containing $\alpha+\beta$ phase material. Their mechanical strengths increase in the following order: titanium Grade 7< titanium Grade 28< titanium Grade 29. These three materials also have slightly different thermal properties. The mechanical properties of the titanium Grade 7 to titanium Grade 28 to titanium Grade 29 welding joint were not provided by the applicant and they were also not available in the literature. This information is needed for evaluation of drip shield fabrication and drip shield structural performance as ITWI SSC.

RAI #5

Provide technical basis for the selection of the stress relief conditions of 1100 °F ± 25 °F for 120 minutes and its applicability to the Titanium Grade 7 to Titanium Grade 28 to Titanium Grade 29 welding joints.

DOE has indicated in the Yucca Mountain Project Engineering Specification Prototype Drip Shield (BSC 2007) and SAR Table 1.3.4-5, Parameter 07-13 that, after fabrication, the drip shield will be stress relieved at 1100 °F ± 25 °F for 120 minutes. According to the literature (ASM International, 2000) this is the recommended stress-relief treatment condition for Titanium Grade 7 to Titanium Grade 7 and Titanium Grade 29 to Titanium Grade 29 welds. However, welding Titanium Grade 7 to Titanium Grade 29 using Titanium Grade 28 as filler metal has never been used in the industry and has not been tested by DOE. The applicability of the stress relief condition to this dissimilar welding joint is needed for evaluation of drip shield fabrication and drip shield structural performance as ITWI SSC.

RAI #6

Provide the following document:

TEV Collision with an Emplaced 5-DHLW/DOE SNF Short Co-Disposal Waste Package, 000-00C-MGR0-04100-000-00A. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20070904.0033.

SAR Section 1.3.5.1.1 provides basic description of the Transport and Emplacement Vehicle (TEV), and refers to this document for the analysis of a low-speed impact of the TEV to a waste package. The staff needs this information to verify that the description of the analytical and design methods used to evaluate TEV for this and other scenarios comply with 10 CFR 63.21(c)(3)(i).

RAI #7

Provide the following documents cited in the SAR and references:

- BSC 2007l "Emplacement and Retrieval Drip Shield Emplacement Gantry Mechanical Equipment Envelope." 800-MJ0-HE00-00201-000-00B. Las Vegas, Nevada: Bechtel SAIC Company ACC:ENG.20071026.0031

- BSC2007j "Concepts of Operations for the Drip Shield Gantry".800-30R-HEE0-00200-000 REV 00B, Las Vegas, Nevada: Bechtel SAIC Company. ACC:ENG.20070810.0010.

- BSC 2008. "Drip Shield Gantry Mechanical Equipment Envelope Calculation" 800-MQC-HEE0-00100-000-00B. Las Vegas, Nevada. Bechtel SAIC Company. ACC: ENG. 20080125.0005.

- BSC 2007 "Interlocking Drip Shield Configuration" . (Sheet 1) 000-M00-SSE0-00101-000 REV 00C. Las Vegas, Nevada. Bechtel SAIC Company. ACC: ENG.20070409.0001.

- BSC 2007 "Interlocking Drip Shield Configuration". (Sheet 2) 000-M00-SSE0-00102-000 REV 00C. Las Vegas, Nevada. Bechtel SAIC Company. ACC: ENG.20070409.0002.

- BSC 2007 "Interlocking Drip Shield Configuration". (Sheet 3) 000-M00-SSE0-00103-000 REV 00B. Las Vegas, Nevada. Bechtel SAIC Company. ACC: ENG.20070409.0003.

- BSC 2007. "Waste Package Emplacement Mechanical Handling System Block Flow Diagram Level 3" 800-MH0-HEE0- 00201-000 REV 00C. Las Vegas, Nevada: Bechtel SAIC Company. ACC" ENG.20070830.0034.

In SAR Section 1.3.4, DOE refers to these key documents describing the drip shield and the gantry. These documents are needed to verify the adequacy of the drip shield and gantry for operational and natural events, and compliance with 10 CFR 21(c)(3)(i).

RAI #8

Provide technical basis for categorizing important to safety (ITS) piping and instrumentation components (e.g., valves, sensors, interlocks, pumps, blowers) (SAR Section 1.2.5.3).

In SAR Section 1.2.5.3, DOE provides a system description of process systems and identifies only pressure relief valve as ITS. However, SAR Figures 1.2.5-69 through 1.2.5-72 show piping and instrumentation component configurations (pressure relief valves, cask connections, quick disconnects and connection piping) as ITS. The Bechtel SAIC Company (BSC) Q-List Report, Section 7, states, in part, "if one or more components of a system are determined to be ITS, the system is identified as ITS even though only a portion of the system may actually be relied upon to perform a safety function. It is not clear why only piping, pressure relief valve, cask connection, and quick disconnects of the cask cooling system shown in Figures 1.2.5-69 through 1.2.5-72, are categorized as ITS.

Also, in Table A-1, BSC 2008a Q-List for WHF Cask Cooling System, DOE identifies Cask/DPC Overpressure Protection Feature of the system as ITS. However, the list does not include the components of that feature, as is done for other ITS features listed in the Table. It is not clear why the Table does not include the ITS components of the Cask/DPC Overpressure Protection Feature of the system.

RAI #9

Provide information on the boundaries and interfaces of ITS components in P&ID drawings in SAR Section 1.2.8.

The design descriptions and system function requirements in SAR and in P&IDs do not identify any requirements and their bases that might exist among ITS systems, non-ITS systems, and the components at their boundaries. The system design description and P&IDs should define the boundaries of the system so that components at or near the boundaries are classified properly. Examples of lack of boundary identification include the following:

a. Lack of the system boundary divisions between ITS and non-ITS sections of interfacing systems described in Emergency Diesel Generator Facility (EDGF) P&IDs, in the following SAR figures: Figures 1.2.8-17, ITS Diesel Generator Train A; Figure 1.2.8-18, ITS Diesel Generator Fuel Oil System; Figure 1.2.8-22, ITS Diesel Generator Jacket Water Cooling System; Figure 1.2.8-23, ITS Diesel Generator Lube Oil System Train A; and Figure 1.2.8-24, ITS Diesel Generator Air Intake and Exhaust.

b. The boundaries of the Cask Cooling system described in SAR Section 1.2.5.3.4.1.1, and Figures 1.2.5-69 through 1.2.5-72 do not describe or identify any requirements and their bases that might exist at the ITS boundaries (for example ITS piping and cask connection). The ITS boundaries of the system should encompass all components necessary for the system to meet all of its safety requirements. This includes mechanical, electrical, other support systems boundaries, and instrumentation and control boundaries.

RAI #10

Explain how the capability of the waste package closure subsystem will be confirmed by demonstration testing of a full-scale prototype system (SAR Section 1.2.4.2.3.1). Specifically, address the following:

a. Clarify how performance requirements will be defined, considering functional requirements, safety classification, and performance capabilities of the Waste Package Closure system.

b. Describe in detail the iterative process of revising and modifying the Waste Package Closure Subsystem prototype, and how the performance capability of the as-built system will be evaluated against the acceptance criteria specified in Yucca Mountain Review Plan Section 2.1.1.2.

In SAR Section 1.2.4.2.3.1, DOE states that the design of the Waste Package Closure Inerting System, which includes piping and instrumentation, will be confirmed by demonstration testing of a full-scale prototype system. DOE has provided a conceptual description that is at a system functional level, based on preliminary design basis information. However, DOE has not described how the full-scale prototype system testing will be used to design the waste package closure system. This information is needed to verify compliance with 10 CFR 63.21(c)(3) and 10 CFR 63.21(c)(16).

RAI #11

Provide technical basis for DOE's assertion in Section 2.3.11.4 of BSC 2008b, that installing a Criticality Accident Alarm System (CAAS) could have adverse effects on safety and operations.

RAI #12

Provide information on the relevant codes and standards for the design of the Digital Control and Management Information Systems (DCMIS), and clarify whether or not the DCMIS network is protected from undesired interactions and intrusions resulting from the operations of networks to which the DCMIS is connected (SAR Section 1.4.2.1.3).

In SAR Section 1.4.2.1.3, DOE has listed the codes and standards for the DCMIS system. It is not clear why other codes and standards (e.g., NIST 800-53, ANSI/ISA TR 99.00.01-2007) that may apply to this system are not listed. Also, a DCMIS system architecture diagram is provided in Figure 1.4.2-1 and system block diagrams are depicted in Fig. 1.4.2-2 (Sheets 1 and 2). However, the system architecture diagram does not provide any indication that protection devices are available to protect the DCMIS from undesired interactions or intrusions resulting from the operation of the other network.

RAI #13

Provide information on the design characteristics for the local controllers (SAR Section 1.4.2). Also, confirm whether the controllers and input/output modules are classified as Class 1E equipment, and provide DOE's plans for periodically calibrating these analog signals.

In SAR Section 1.4.2, DOE has described the DCMIS. Its major components are controllers, human-machine interface consoles, input and output modules, engineering workstations, data historians, networks and network interface devices, and foreign-device interfaces. However, information regarding the required design characteristics for the local controllers is not provided. It can be inferred from other sections of the SAR that the intention is to utilize the local controllers to regulate operation of the GROA in that the combination of hardware and software is configured to await for permissive signals from either a local or remote operator before allowing the automation functions to proceed. From a safety perspective, it is important to evaluate the criteria used to implement the logic incorporated into the controllers. Analog signals are not linear over a wide range and hence changes from input to output will not be constant over time and hence will tend to drift. Therefore, periodic calibration of the equipment may be necessary.

RAI #14

Confirm whether and how DOE plans to apply the IEC, NIST and ANSI standards (e.g., IEC 61784-3 draft, NIST 800-53, 53a) to the protection of the communication systems from possible compromise due to deliberate attacks or natural occurring phenomena (SAR Section 1.4.2).

In SAR Section 1.4.2, DOE mentions the security of the communications system, including a reference to network protocol security text and one NIST standard (NIST 800-21). However, there is no description regarding how these standards will be applied to protect the communication systems from possible compromise due to deliberate attacks or natural occurring phenomena.

RAI #15

Confirm that the sensors/monitors used for temperature and humidity are Class 1E equipment as they could be used in a harsh and hostile environment.

In SAR Section 1.4.2.3, DOE describes Environmental/Meteorological monitoring system. Meteorological instruments monitor wind speed, wind direction, temperature, humidity, barometric pressure, solar radiation, and precipitation. Figure 1.3.2-1 provides a functional block diagram of the system. However, it is not clear whether or not the environmental monitors/sensors used for temperature and humidity will be qualified to serve in the harsh and hostile environment conditions.

References:

ASM International. 2000. Titanium—A Technical Guide. 2nd Edition by Matthew J. Donachie, Jr.

ANSI/ANS-HPSSC-6.8.1-1981, *Location and Design Criteria for Area Radiation Monitoring Systems for Light Water Nuclear Reactors*

ANSI/ANS-8.3-1997, *American National Standard Criticality Accident Alarm System*

BSC 2007m. *Yucca Mountain Project Engineering Specification Prototype Drip Shield*. 000-3SS-SSE0-00100-000 REV 000. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20071206.0013.

BSC 2008a. Q-List, Bechtel SAIC Company, 000-30R-MGR0-00500-000-004, March 2008; ENG.20080312.0037.

BSC 2008b. *Preclosure Criticality Safety Analysis*. TDR-MGR-NU-000002. Rev. 01.Las Vegas, Nevada, Bechtel SAIC Company. ACC:ENG.20080307.0007.