REQUEST FOR ADDITIONAL INFORMATION
Volume 2 – Preclosure
Chapter 2.1.1.4, Set 5 – Identification of Event Sequences
(RAI #1 - #11)

The following questions pertain to event sequences in the Wet Handling Facility (WHF) and Receipt Facility (RF). RAI #s 1-10 are associated with WHF and RAI #11 with RF. These event sequences are described in Section 1.7 of the SAR and associated references (BSC, 2008bo, 2008bq, and 2008be). These RAIs pertain to the original license submittal. This information is required to determine compliance with 10 CFR 63.21(c)(5), 10 CFR 63.112(b), and §63.111(a) and (b).

RAI #1

Explain how DOE quantified the potential tipover of a Shielded Transfer Cask containing a TAD canister (i.e., WHF-ESD-24-TAD) while lifting the STC/TAD from the pool ledge to the TAD Canister Closure area. Examples of areas needing clarification follow:

a) Explain if catching the edge of the pool was included in initiating event WHF-1505.

    i. DOE identifies “Cask tip over after being placed in TAD closure station” in Figure F-24 of BSC, 2008bo.

    ii. DOE identifies in Table E6.8-1 of BSC, 2008bq that the most likely cause for the tip over is the operator catches the edge of the pool (i.e., basic event, “050-OPTIPOVER002-HFI-NOD”).

b) Clarify the terminology, “pool ledge” versus “pool shelf” versus “staging-shelf.” Explain if DOE is referring to the same location in the pool.

    i. For human failure event 050-OPTIPOVER002-HFI-NOD, DOE indicates in Table E6.8-1 of BSC, 2008bq on page E-213, “In this step, the DPC/STC and SNF/TC are moved to the pool ledge from the DPC cutting station or SNF preparation platform, and the TAD canister/STC is moved from the pool ledge to the TAD canister closure station outside the pool. During this movement, the cask can be tipped over if it catches the ledge of the pool as the cask is moved onto the pool shelf.”

    ii. On page 1.2.5-54 of the SAR, DOE indicates, “The cask handling crane moves the shielded transfer cask with the TAD canister to the staging-shelf of the pool where the shielded transfer cask lid bolts are installed.”

RAI #2

For the WHF, explain how DOE accounts for the drop of a heavy load onto a cask in the pool or outside the pool, or onto the fuel staging rack in the pool. Examples of areas needing clarification follow:

a) For WHF-ESD22-FUEL, provide justification that the drop of a heavy load onto the fuel staging rack or a TAD canister (i.e., WHF-1809) is captured by the fuel drop event (i.e., WHF-1808).

   i. Explain how the heavy load drop onto the fuel staging rack or a TAD canister is captured by the fuel drop (i.e., SFT-DRP). DOE identifies in the SAPHIRE model for basic event, "050-SFTM-FUELDRP-RACK" included in Table A4.22-2 of BSC, 2008bq the description, "SFTM fuel drop on rack – failure captured in SFT-DRP."

   ii. Explain if the heavy load drop and the fuel drop are from the same crane.

b) For WHF-ESD24-TAD, explain why the drop of a heavy load onto an STC/TAD has a probability of zero for the pool (i.e., POOL-OBJDROPON).

c) Explain how many object lifts are associated with the movement of casks to and from the pool (i.e., WHF-ESD20-CSNF and WHF-ESD24-TAD). DOE identifies the drop from a jib crane (i.e., basic event 050-JIBCRANE-CRJ-DRP).

   i. Explain if one object lift applies to transportation casks containing CSNF as well as to DPCs and TADs contained in STCs. As indicated in Table 6.3-9 of BSC, 2008bq, DOE identifies one object lift for the movement of a DPC or TAD to or from the pool ledge (i.e., 050-OBJLIFT-POOL-TRANS). DOE does not indicate if this value of one object lift applies to a transportation cask as well; however, DOE does include this quantity, "050-OBJLIFT-POOL-TRANS" in fault tree ESD20-FLOOR-DROPON (for WHF-ESD20-CSNF) but does not include this quantity in fault tree ESD24-FLOOR-DROPON associated with a TAD canister (i.e., WHF-ESD24-TAD).

   ii. Justify that one object lift is applicable for both WHF-ESD20-CSNF and WHF-ESD24-TAD.

RAI #3

Explain how containment is maintained on various cask transfers to and from the pool ledge.

a) Explain how the transportation cask would provide containment for a drop or tipover while transferring the cask to the pool following preparation. DOE identifies on page 91

of BSC, 2008bo that, “Transportation cask sampling and cooling are completed through transportation cask access ports, which are uncovered during the preparation steps.”

b) Explain how DOE would determine that the STC would be capable of maintaining containment for a drop or tipover while lifting the STC from the pool. DOE describes on page 144 of BSC, 2008bo that, “A minimum number of fasteners are on the STC and are tightened to ensure proper containment.”

For both WHF-ESD20-CSNF (Figure F-20 of BSC, 2008bo) and WHF-ESD24-TAD (Figure F-24 of BSC, 2008bo), DOE credits the cask for maintaining containment if an event such as a drop or tipover occurs. For the transportation cask, DOE identifies basic event, “CASK-DROP-OPERATIONAL” in Table A4.20-3 and Table A4.20-7 of BSC, 2008bq. For the shielded transfer cask, DOE identifies basic event, “CASK-DROP-OPERATIONAL” in Table A4.24-3 and Table A4.24-7 of BSC, 2008bq. Table 6.3-8 of BSC, 2008bq shows a value of 1×10^{-5} for this basic event and describes it as, “Failure of cask due to drop from operational height.”

RAI #4

a) Explain if DOE considered the possibility that a worker could receive a direct exposure as a result of improperly placing the lid on the TAD canister or STC in the pool or as a result of the lids being inadvertently displaced when the STC/TAD is lifted to the staging shelf of the pool.

b) Explain if DOE considered the possibility that a worker in a subsequent operation (i.e., TAD canister closure) could receive a direct exposure when the STC lid is removed if the TAD canister inner lid had been displaced or improperly installed.

DOE identifies on page 1.2.5-54 of the SAR that after the TAD is loaded, the TAD canister inner lid, which also functions as a shield plug, is returned to the TAD canister and the lid of the shielded transfer cask is returned to the shielded transfer cask. Then, the cask handling crane moves the STC/TAD to the staging shelf of the pool where the STC lid bolts are installed.

RAI #5

For direct exposure due to the splash of pool water (i.e., WHF-1803) for WHF-ESD30 shown in Figure F-30 of BSC, 2008bo, explain how DOE quantified event sequence frequency. Examples of areas needing clarification follow:

a) Explain how DOE considered the splash of pool water from the drop of both loaded and unloaded casks (i.e., shielded transfer cask containing a DPC and a transportation cask for CSNF); the drop of equipment such as a lifting yoke; and the drop of a shielded transfer cask containing a loaded TAD canister.

DOE identifies in Table 10 of BSC, 2008bo on page 98 that it accounts for the, “Drop of a loaded STC/DPC or TC/CSNF resulting in splash of contaminated pool water.” Table 6.1-2 of BSC, 2008bq on page 116 identifies initiating event trees WHF-ESD30-DPC and WHF-ESD30-FUEL. However, Table A4.30-2 of BSC, 2008bq on page A-109 associates the splash of pool water only with the transfer of an STC containing a loaded DPC to the pool (i.e., WHF-ESD30-DPC). DOE combines the probability for a drop with a throughput value of 346 DPCs identified in Table A4.30-1 of BSC, 2008bq on page A-108.

b) Explain how the Pool Handling Crane is involved in the splash of pool water and explain how DOE quantifies the drop probability involving the Pool Handling Crane shown in Figure B10.4-3 of BSC, 2008bq on page B10-26.

    i. Explain how the Pool Handling Crane differs from the Auxiliary Pool Crane described on page 1.2.5-21 of the SAR that is rated at 10 tons.

    ii. Explain if the drop probabilities and two-block drop probabilities included in Figure B10.4-3 of BSC, 2008bq are for very heavy load lifts only. As shown in Figure B10.4-3 of BSC, 2008bq, the Pool Handling Crane has the same drop probability and two block drop probability as the Cask Handling Crane.

RAI #6

Explain the following statement in Table 6.3-9 of BSC, 2008bq on page 183 for basic event 050-OBJLIFT-TAD-CLOSE: “There are three crane lifts associated with the closure of the TAD canister at the TAD canister closure station. Therefore, a value of 2 is assigned to this basic event.”

RAI #7

Explain how DOE developed the nuclear safety design basis for the cask cooling subsystem identified in Table 6.9-1 of BSC, 2008bq on page 234. Examples of areas needing clarification follow:

a) Explain if the operator error, “Operator causes overpressurization” identified as basic event 050-OPDPC-OVP01-HFI-NOW shown in Figure B5.4-8 of BSC, 2008bq is included as part of the nuclear safety design basis. The operator error is connected by an “OR” gate to the components that are part of this system.

b) Explain if all components that could result in an over pressurization have been accounted for in Figures B5.4-8 and B5.4-9. For example, DOE identifies failures such as pump failure and relief valve failure. DOE shows in Figure 1.2.5-69 of the SAR, the piping and instrument diagram for the Cask Cooling Subsystem. This figure also shows check valves and pressure transmitters. Explain if these other components can contribute to an over pressurization.

c) DOE identifies, “Pipe BW-0003 plugs” in Figure B5.4-9 of BSC, 2008bq. Clarify where this pipe is and explain if this failure accounts for all of the areas where a pipe could plug and result in an over pressurization.

DOE identifies in Table 6.9-1 of BSC, 2008bq on page 234, “The mean probability of an overpressure of a cask or cooling system line during the cask cooling operation shall be less than or equal to 8×10^{-6} per cask.” In this table, DOE identifies the source as, “OVERPRESSURIZATION.” DOE describes cask over pressurization in Section B5.4.2 of BSC, 2008bq starting on page B5-11 and includes the fault tree in Figures B5.4-8 and B5.4-9.

RAI #8

Explain how DOE quantified human error event 050-OPDPC-OVP01-HFI-NOW shown in Figure B5.4-8 of BSC, 2008bq on page B5-16 to account for a potential over pressurization involving a transportation cask containing CSNF (i.e., WHF-ESD16-CSNF). DOE indicates on page B5-11 of BSC, 2008bq that the cask over pressurization fault tree described in Section B5.4.2 of BSC, 2008bq is associated both with DPC preparation activities (i.e., WHF-ESD17-DPC) and transportation cask preparation activities (i.e., WHF-ESD16-CSNF); however, it is not clear that DOE accounted for the differences. Examples of areas needing clarification follow:

a) DOE describes in Table E6.7-1 of BSC, 2008bq on page E-185 that, “The system is designed to accommodate the hot DPCs (temperature greater than 350 °C); therefore there is not a human-induced overpressurization event if the DPC is not at a low temperature before cooling begins (i.e., due to steam pressure).” However for transportation casks containing CSNF, DOE associates the temperature with cask over pressurization in the MLD diagram shown in Figure D-16 of BSC, 2008bo. In the detailed quantification for this human error event in Section E6.7.3.4.3 of BSC, 2008bq, DOE does not appear to account for an erroneous temperature reading leading to over pressurization (i.e., WHF-1604) as described in Figure D-16 of BSC, 2008bo on page D-17.

b) DOE describes in Table E6.7-1 of BSC, 2008bq on page E-185 that, “This value was adjusted (x5) to account for the fact that this operation is performed by one crew member and is only performed weekly.” Explain how the analysis would change given the throughput for transportation casks containing CSNF versus the throughput for DPCs.

c) DOE indicates in Table E6.7-1 of BSC, 2008bq on page E-185 that this operation is performed by one crew member; however, page E-199 of BSC, 2008bq indicates that a second crew member is present.

d) Explain how the dependencies were considered among the operator events, “A,” “B,” and “C” shown in Table E6.7-6 and Equation E-41 of BSC, 2008bq.

RAI #9

Explain what initiating events DOE identified for preparation activities involving a transportation cask containing CSNF (i.e., WHF-ESD16-CSNF). Examples of areas needing clarification follow:

a) Explain how the initiating events in Figure F-16 of BSC, 2008bo correspond to the results from the HAZOP analysis in Table E-22 of BSC, 2008bo on page E-32 and the MLD in Figure D-16 of BSC, 2008bo on page D-17. For example, Figure F-16 of BSC, 2008bo identifies over pressurization of the transportation cask as WHF-1602; however, the MLD in Figure D-16 associates over pressurization as WHF-1604 (i.e., error taking temperature sample resulting in cask over pressurization) and WHF-1606 (i.e., water added while cask inside temperature is too high). In addition, the MLD in Figure D-16 associates sample line failure with WHF-1603 and WHF-1605; whereas, the event sequence diagram in Figure F-16 associates WHF-1603, WHF-1604, WHF-1605, and WHF-1606 with sample line break.

b) Table 10 of BSC, 2008bo on page 98 does not identify the initiating event WHF-1607; however, the MLD in Figure D-16 of BSC, 2008bo does identify this initiating event as a direct exposure associated with the water line breaking.

RAI #10

For the response tree, "RESPONSE-TCASK-CSNF" shown in Figure A5-3 of BSC, 2008bq on page A-125, DOE considers a filtered radionuclide release for both with and without importance to criticality and an unfiltered radionuclide release for both with and without importance to criticality. Explain why DOE separated the end states and resulting frequencies for filtered and unfiltered radionuclide releases based on importance to criticality. Address similar importance to criticality event sequences to other areas of the Preclosure Safety Analysis.

RAI #11

This RAI is associated with Receipt Facility Fault Tree on Collision of Shield Door into ST (200-ST-COLLIDE-SDR)

Justify the use of a mean probability value (2.843×10^{-2}) for failure of two motor No. 1 over torque sensors in fault tree 200-ST-COLLIDE-SDR in the SAPHIRE model that is different from that (1.44×10^{-2}) listed in Table 6.3-1 for active component reliability data summary (BSC, 2008be).

References:

BSC. 2008bo. "Wet Handling Facility Event Sequence Development Analysis." 050–PSA–WH00–00100–000. Rev. 00A. CACN 001, CACN 002. Las Vegas, Nevada: Bechtel SAIC Company, LLC.

BSC. 2008bq. "Wet Handling Facility Reliability and Event Sequence Categorization Analysis." 050–PSA–WH00–00200–000. Rev. 00A CACN 001. Las Vegas, Nevada: Bechtel SAIC Company, LLC.

BSC. 2008be. "Receipt Facility Reliability and Event Sequence Categorization Analysis." 200–PSA–RF00–00200–000. Rev. 00A. CACN 001. Las Vegas, Nevada: Bechtel SAIC Company, LLC.