Graphite Pebble Bed Risk Areas Details

Waste Disposition

Description:

Includes CASTOR Casks, Salt, and DWPF canisters. Unknown amount of salt at this time, unknown if the fission products can be separated from the salt which changes the type of disposal unit allowed (LLW versus HLW), total number of glass canisters produced is only a rough estimate more details on the actual process and scale will be needed to refine this estimate. Unknown if a Waste Incidental to Reprocessing (WIR) will be required; this requires concurrence by the NRC.

Potential Impacts:

- Salt disposal could be costly especially since offsite disposal at a commercial facility is currently the only alternative. If the fission products cannot be separated from the salt, potential to end the project since the salt would then be considered HLW with no disposition path and a new form that would have to be analyzed by a federal repository.
- Glass canisters were estimated based on the known information in the waste as well as typical generation rates from past campaigns through H-Canyon.
- WIR issue causes potential delays to the schedule with obtaining approval. If not approved then it could also end the project as the material would then be required to be dispositioned as HLW.

Mitigation Plans/Actions:

- Salt regeneration is being evaluated to reduce the salt produced. Experience from the SRS HLW system with actinide removal techniques are being evaluated for the removal of fission products from the salt.
- Pursue a General Counsel position on WIR applicability to better characterize this risk
- Investigate disposal site viability during the WFO step 1 actions

Other Alternatives:

- (b)(5)
- Pursue use of electrolytic technology to remove salt and separate

Probability of Risk Realization:

Medium

Graphite Pebble Bed Risk Areas Details

Risk carried into draft contract: Yes
If yes, how will it be addressed in contract:

Contract waste handling costs should include mitigated risk consequence costs based on maturity at the end of Step 2 of the WFO. Overall impact is increased costs to Germans based on the unknowns at the time (b)(5)

Graphite Pebble Bed Risk Areas Details

Uranium Disposition

Description:

Unknown if the down-blended Uranium can be disposed of at a commercial entity.

Potential Impacts:

Waste Incidental to Reprocessing (WIR) issue causes potential delays to the schedule with obtaining approval. If not approved then it could also end the project as the material would then be required to be dispositioned as HLW. If the down-blended Uranium cannot be dispositioned, this potentially could end the project.

Mitigation Plans/Actions:

- Pursue a General Counsel position on WIR applicability to better characterize this risk
- Investigate disposal site viability during the WFO step 1 actions

Other Alternatives:

- (b)(5)

Probability of Risk Realization:

Low

Risk carried into draft contract: Probably not
If yes, how will it be addressed in contract:

Resolution should be pursued during the WFO stage to eliminate the need for carrying this into the contract.

Graphite Pebble Bed Risk Areas Details

Carbon Digestion

Description:

Scale up issues unknown at the time. This is a first of its kind process. Unclear where or how much of the fission products will be in the salt, which would require salt cleaning for removal of the fission products. . Not known if salt accumulates in the offgas systems, if it does may require flushing of the offgas systems. This additional cleaning and potential flushing was not included in the estimate.

Potential Impacts:

- Scale up limitations may require smaller than ideal batch sizes (may not be able to make 1000 pebbles/day) which increases the scheduled time for digestion process
- Fission products in the salt would preclude disposition as Low Level Waste (LLW)
- Offgas system requirements may drive cost for offgas system size and design
- Salt accumulation (pluggage, flow restriction, etc.) in offgas system may require flushing capability

Mitigation Plans/Actions:

- Use WFO funds to complete scale up of batch sizes
- Evaluate salt dissolution, solid/liquid separation, and ion exchange to remove fission products to allow salt treatment as LLW
- System scale up will be studied under WFO
- Evaluate need for flushing solids and a separation stage for flushwater and undissolved solids

Other Alternatives:

- (b)(5)

Probability of Risk Realization:

Medium

Graphite Pebble Bed Risk Areas Details

Risk carried into draft contract: Yes
If yes, how will it be addressed in contract:

Carbon Digestion costs in the Contract should include mitigated risk consequence cost based on likelihood and maturity at the end of Step 2 of the WFO. Overall impact is increased costs to Germans based on the unknowns at the time (potentially could cost share in any savings realized).

Graphite Pebble Bed Risk Areas Details

Carbon Digestion Frame

Description:

Pebble removal from the canisters has not been done before. Current plans envision mechanical cutting of the canisters and removal of the pebbles to a hopper type collection system via a pouring mechanism.

Potential Impacts:

- Pebble spill events
- Remote can cutter failure frequency may be high
- Graphite dust may cause a fire hazard
- Canister retrieval and disposition to waste is required
- A method to comply with MC&A orders must be developed

Mitigation Plans/Actions:

- Designs will need to prevent spills or provide for pebble retrieval
- Spare cutters will be required
- Fire hazard analysis will be required early in design
- Tooling for can and can lid removal will be unique and will be piloted early in design
- (b)(5)

Other Alternatives:

- Evaluate different cradle methods for vertical and horizontal can cutting

Probability of Risk Realization:

Medium

Risk carried into draft contract: Yes
If yes, how will it be addressed in contract:

Contract Carbon Digestion Frame costs should include mitigated risk consequence cost based on likelihood and maturity at the end of Step 2 of the WFO. Overall impact is increased costs to Germans based on the unknowns at the time (b)(5)

Graphite Pebble Bed Risk Areas Details

HEU Recovery and Down-Blending

Description:

- (b)(5)
- Kernel dissolution is envisioned to be a standard process used in the past (THOREX campaign). Thorium disposition in prior campaign went to HLW tanks. This poses a problèm due to thixotropic tendency (peanut butter consistency) of thorium. Not known what dilution or amounts will be acceptable to HLW tanks. Evaluating if thorium could be solidified and then disposed as a low level waste.
- Security requirements for kernel accumulation are being questioned by HSS and EM-40. Estimate only includes costs for storage within H-canyon under a cell cover.

Potential Impacts:

- (b)(5)
- (b)(5)
- HLW tanks do not want this large amount of thorium
- WIR issue would also apply to the thorium.
- If the storage of kernels in H-Canyon under cell covers is not acceptable, costs will increase dramatically estimates show up to $100M increase for additional guards, handling and security equipment.

Mitigation Plans/Actions:

- Work with General Counsel to get the Defense classification similar to what was done for the FRR fuels received at SRS.
- Timing of the project is crucial to ensure H-Canyon availability.
- Solidify the thorium so it can be disposed of as low level waste. Disposal facility would have to be located (potentially same one as the down-blended Uranium). Costs for solidification need to be developed (not included in the current estimate)
- Investigate disposal site viability during the WFO step 1 actions
- Pursue a General Counsel position on WIR applicability to better characterize this risk
- Work with HSS and EM-40 during the WFO process to gain their acceptance on security requirements for the entire project. Document the assumption/approach with signatures.

Other Alternatives:

Graphite Pebble Bed Risk Areas Details

- SRNL is evaluating other locations for processing versus H-Canyon. Unknown if this will be viable
  (b)(5)

Probability of Risk Realization:

(b)(5)
Thorium disposition - Low

H-Canyon operability – Medium
(b)(5)

Risk carried into draft contract: No (defense classification),
Yes (canyon operability), No (thorium) and No (security)
If yes, how will it be addressed in contract:

- (b)(5)
- (b)(5)
- (b)(5)
- (b)(5)

Canyon Flushing

Description:

A typical process in H-Canyon. Flushing will put H-Canyon in a position for either a new mission or for deactiviation. Estimate assumed a ½ year of operation. This must be coordinated with HLW operations.

Potential Impacts:

- Process upset releasing contamination.
- Increased time for flushing.

Mitigation Plans/Actions:

- Ensure proper conduct of operations

Other Alternatives:

- NA

Probability of Risk Realization:

Low

Risk carried into draft contract: Yes
If yes, how will it be addressed in contract:

Contract should include some form of contingency for process upsets and potential unexpected delays (e.g., ice storm).

High Level Waste Operations

Description:

HLW Operations are needed for the receipt of the fission products from the dissolution of the fuel kernels.

Potential Impacts:

- HLW capacity will not exist to allow receipt of the fission products
- Budget not provided to operate HLW system.
- (b)(5)

Mitigation Plans/Actions:

- Coordinate with HLW to ensure capacity and availability
- (b)(5)

Other Alternatives:

- NA

Probability of Risk Realization:

Low

Risk carried into draft contract: No (defense classification); Yes (HLW system available) If yes, how will it be addressed in contract:

- (b)(5) .
- (b)(5)

Storage/Receipt and Infrastructure

Description:

Current estimate assumes that the railroads are adequate and no changes are required for the current security requirements in H-Area. The current storage arrangement in the estimate assumes a new covered pad is constructed in H-Area.

Potential Impacts:

- Railroad upgrades are needed
- Security upgrades are required for storage of the Castor Casks
- Pad cost is under estimated

Mitigation Plans/Actions:

- During the WFO portion, determine any changes required for the railroad to accept the Castor Casks.
- Reach agreement with HSS and EM-40 on the security requirements for storage of the Castor casks.
- During the WFO stage better costs will be developed for a new pad.

Other Alternatives:

- SRS is evaluating the use of existing pads within H-Area with minor upgrades being required.

Probability of Risk Realization:

Low

Risk carried into draft contract: No
If yes, how will it be addressed in contract:

- Resolution should be reached prior to contract signing.

Graphite Pebble Bed Risk Areas Details

Shipping Delays

Description:

Currently Germany is focused on the removal of the AVR fuel only. (b)(5) . If a decision on the THTR fuel is not made in a timely manner it could impact the costs of the project and viability of DOE being able to accept the THTR fuel which would be dependent on both H-Canyon and the HLW system being operational.

Potential Impacts:

- THTR decision is made late after 2018 (impacts ability to receive casks in time for the carbon digestion process and kernel dissolution.)
- Receipt of ships/railcars delayed impacting schedule
- Labor strikes impact ability to move material out of Germany
- Equipment (impact limiters) not available
- (b)(5)

Mitigation Plans/Actions:

- Require a decision on THTR by June 2018 stipulate it in the contract.
- Depending on the schedule delay could only be cost impacts which should be included in the contract.
- (b)(5)

Other Alternatives:

- Edlow is evaluating contracts with ships that are for a determined timeframe (the entire campaign) to mitigate any delays from ships.
- Germans are working on the impact limiters and having them available in quantities to support the project schedule.

Probability of Risk Realization:

Low

Graphite Pebble Bed Risk Areas Details

Risk carried into draft contract: No (THTR), Yes (delays), No (OST determination)
If yes, how will it be addressed in contract:

- Required date for determination of THTR should be included in the contract with associated costs for addressing this fuel.
- Delays should be included in the contract as some portion of contingency both in costs and schedule.
- Determination on if the Alternate Security Protocol is acceptable should be made prior to contract signing.