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New and Spent Fuel Management Program

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Meeting Agenda

- Introductions
- Purpose & Outcome
- Plant Design Attributes
- New Fuel Storage and Fueling Approach
- Spent Fuel Management Approach
- Open Forum

Purpose and Outcome

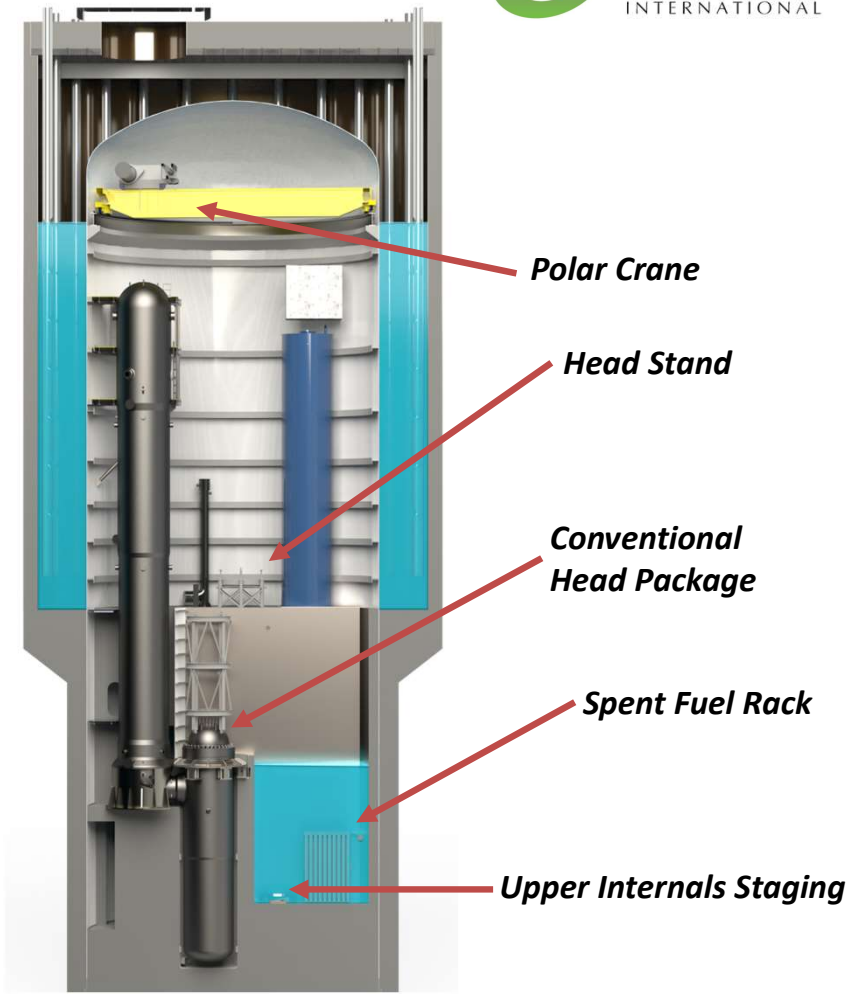
- PURPOSE
  - To provide a high-level overview of the fuel management program for both new and spent fuel assemblies.

- OUTCOME
  - ✓ To obtain feedback from the NRC staff on the licensing assumptions made in the intended program discussed.

- Note – content in this presentation was developed based on the SMR-160 design. Specific numerical values may be updated to reflect the uprated design, but the overall philosophy behind fuel management remains the same.

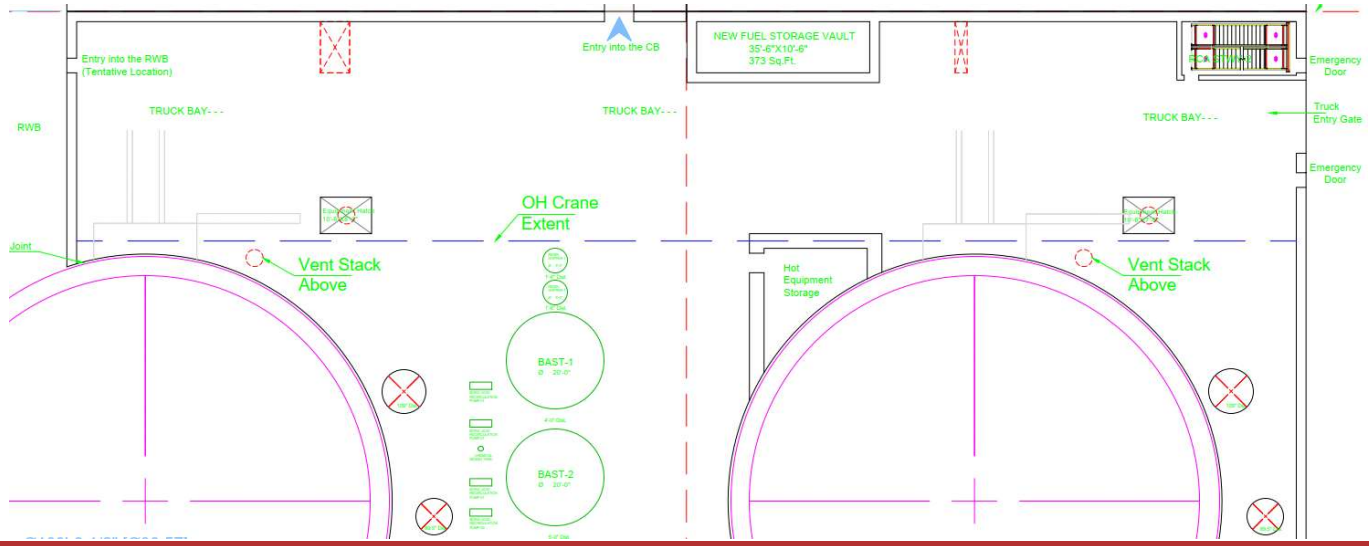
Plant Design Attributes

- The SMR-160 will use traditional PWR 17”x17” fuel assemblies with a standard 12 foot active fuel length
- The Core contains 57 fuel assemblies.
- The Spent Fuel Pool (SFP) resides inside the Containment Structure (CS) with 150 cell locations.
- The dry New Fuel Storage Rack (NFSR) is in the Radiologically Controlled Area (RCA) of the Reactor Auxiliary Building (RAB) and contains 44 cell locations.
- The Multi-Purpose-Canister MPC-37 which is qualified under 10CFR72 and 10CFR71 for storage and transport of 37 PWR fuel assemblies, will be used for transferring fresh fuel into the SFP/CS and spent fuel out of the SFP/CS
- The RCA is equipped with a rail system for a Low-Profile Transporter (LPT) to transfer an MPC-37 in and out of containment.
- The Spent Fuel Pool has a designated location for placing the MPC-37.
- A refueling cycle will consist of around 19 new fuel assemblies.
- Spent Fuel dry cask storage campaigns are intended to only be performed when an MPC-37 can be filled completely.
- All fuel movements between the Core, SFP, and MPC-37 can only be accomplished with the Reactor Cavity flooded.
  - Core offload and reload
  - New fuel transfer from the MPC-37 to the SFP or to the Core
  - Spent fuel transfer from the SFP to dry cask storage using the MPC-37



New Fuel Handling

- New fuel will be transported into the Radiologically Controlled Area (RCA) of the Reactor Auxiliary Building (RAB) via the truck entrance. Normal receipt is within 2 months of the refueling outage.
- The fuel assemblies will be inspected and stored in the dry NFSR
- For refueling, the new fuel assemblies (nominally 19) will be transferred to an MPC-37 and transported via a Low-Profile Transporter (LPT) on guided rails into Containment
- The MPC will be filled with Borated water and lifted by the Containment Polar Crane and lowered into the SFP.
- The new fuel may either be kept in the MPC until core reload or be moved to the SFP rack, which would allow for loading spent fuel for dry cask campaign operations in the MPC.



New Fuel Storage Rack

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New Fuel Questions

- Are there any challenges foreseen with using the MPC, licensed under Part 72 for spent fuel storage, for new fuel transportation into the Containment?
  - Are there specific regulations governing this transportation evolution?

- Assuming the borated water will be added to the MPC inside Containment, will a temporary lid be necessary for transportation from the RAB to Containment?

Containment Layout

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Refueling Approach [[

- Simplified sequence, similar to current PWRs

  Prep: cool and depressurize RCS with RHR, remove RPV head, flood SFP to refuel level

  1. New fuel brought in with LPT with MPC-37 (on-site transfer cask)
  2. MPC-37 filled with borated water and submerged in spent fuel pool
  3. Whole core is discharged to SFP racks
  4. 2/3 of prior cycle (~38x) and 1/3 new fuel loaded to core (~19x), shuffled
  5. After aging 2 cycles, same MPC-37 used to remove spent fuel
- Comparison to current PWRs
  - ✓ No fuel transfer canal or separate in-containment rack
  - ✓ Conventional fuel bridge
  - ✓ Integrated HI-STORM UMAX dry fuel storage system

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Outage Evolution

Year	Initial SFP Inventory	MPC Loading into SFP	Reactor to SFP	**Max SFP Inventory**	SFP to MPC to ISFSI	Post Outage SFP Inventory	Assemblies able to be placed in Dry Cask	Batch 1	Batch 2	Batch 3	Batch 4	Batch 5	Batch 6	Batch 7	Batch 8
7	36					57		17	19	21					
8	36					57		17	19	21					
R4	57	17	57	**131**		74	36	17	19	21	17				
9	57					74		17	19	21	17				
10	57					74		17	19	21	17				
R5	74	19	57	**150**	37	56	57	17	19	21	17	19			
11	74					56				20	17	19			
12	74					56				20	17	19			
R6	56	21	57	**134**	37	40	37			20	17	19	21		
13	56					40						19	21		
14	56					40						19	21		
R7	40	17	57	**114**		57	19					19	21	17	
15	40					57						19	21	17	

- It is assumed that dry cask campaigns are preformed only when an MPC-37 can be filled. There are cases around the nominal 19 (+/-2) refueling strategy and the expected required decay time for MPC limits where SFP inventory approaches capacity.
- It is understood additional cells need to be available for leaking fuel, old excore instruments, filters, etc.
- To optimize the critical path for dry cask storage operations during the defueled window:
  - When space permits, the new fuel is transferred from the MPC to the SFP rack
  - The full core is offloaded to the SFP
- An alternative solution is to maintain the new fuel in the MPC until core reload and perform fuel movement directly from the MPC to the core. In this case SFP inventory maintains sufficient margin for normal refueling operations. Dry cask operations will be performed after core reload.

Spent Fuel Management

- After sufficient time for decay based on MPC limits, the spent fuel will be transferred to the MPC in the SFP and lifted to the LPT on the containment rails to be transported into the RAB. Dry Cask Operations will continue in the RAB for dry storage at the onsite UMAX Independent Spent Fuel Storage Installation (ISFSI).
  - The MPC used to transfer new fuel into the SFP for refueling will be used as the spent fuel canister.
  - Spent fuel decay heat is based on a 0.3% rated thermal power with an average burnup of 60 GWd/MTU (nominal peaking value) and lower enriched fuel assemblies to present a larger, conservative value.
  - Decay heat curves are evaluated using the SCALE program.

Refueling Questions

- After the MPC is lowered into the SFP with the new fuel assemblies, can the new fuel remain in the MPC until the core is reloaded?
- Can the spent fuel assemblies allocated for dry cask storage be transferred to the MPC as the new fuel is transferred to the SFP rack? This would result in a mix of spent fuel and new fuel in the MPC until all the new fuel is transferred to the SFP rack.

Open Forum

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