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NON-PROPRIETARY PRESENTATIONS

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MEETING OBJECTIVES

1. Provide an overview of the design features of the HI-STORM FW system.
2. Explain the physical design commonality between HI-STORM "FW" and "100" to establish the nexus between the two SARs.
3. Present the applicable design criteria and menu of proposed analyses to ensure that the submittal is complete.

A successful meeting would mean that RAIs (if any) are only on the *details of the analysis models* and that there is no RAI requesting new analyses or evaluations.

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HI-STORM FW SYSTEM OVERVIEW

1. THE HI-STORM FW SYSTEM CONSISTS OF THE HI-STORM FW VVM AND ONE PWR AND ONE BWR MPC DESIGN. HI-TRAC VW IS THE DESIGNATED TRANSFER CASK.

2. HI-STORM FW IS A VERTICAL VENTILATED SYSTEM ENGINEERED TO:
   - MAXIMIZE STORAGE CAPACITY, HEAT LOAD, AND MINIMIZE OCCUPATIONAL DOSE
   - RESISTANT TO DELETERIOUS FLOOD AND WIND

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HI-STORM FW SYSTEM OVERVIEW (cont')

3. MPC-37 AND MPC-89 EMPLOY HONEYCOMB BASKETS AND A COMMON ENCLOSURE VESSEL DESIGN.
4. THE ENCLOSURE VESSEL GEOMETRY IDENTICAL TO THAT IN EXISTING MPCs
5. BACKWARDS COMPATIBLE WITH HI-STORM 100
6. DESIGNATED TRANSPORT CASK (HI-STAR 190) IS BEING LICENSED UNDER IAEA STANDARDS IN UKRAINE.

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DESIGN FEATURES COMMON TO HI-STORM FW AND HI-STORM 100 (DOCKET NO. 72-1014)

1. THE VVM IS MADE FROM TWO CONCENTRIC SHELLS OF STEEL JOINED BY FOUR RADIAL CONNECTORS. A THICK BASEPLATE JOINS BOTH SHELLS AT THE BOTTOM.
2. THE ANNULAR SPACE BETWEEN THE TWO SHELLS IS FILLED WITH PLAIN CONCRETE.
3. THE INLET DUCTS ARE RADIAL OPENINGS LOCATED AT THE BOTTOM OF THE HI-STORM BODY. THE OUTLET DUCTS ARE IN THE TOP LID.
4. THE HI-STORM LIFTING LUGS ARE INTEGRALLY CONNECTED TO THE RADIAL RIBS TO ENSURE MAXIMUM STRUCTURAL STRENGTH UNDER LIFTING AND HANDLING CONDITIONS.

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DESIGN FEATURES COMMON TO HI-STORM FW AND HI-STORM 100 (DOCKET NO. 72-1014)(CONT'D)

5. THE WELDING JOINT DETAILS OF THE MPC ENCLOSURE VESSEL ARE IDENTICAL IN ALL MPCs.
6. THE FUEL BASKET IS OF THE HONEYCOMB GENRE.
7. THE TRANSFER CASK UTILIZES A STEEL/LEAD/STEEL CONFIGURATION WITH AN EXTERNAL DRAINABLE WATER JACKET.
8. THE HI-TRAC BOTTOM LID (REMOVABLE LID) AND ITS REMOVAL MECHANISM ARE IDENTICAL TO DOCKET NO. 72-1014.

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NEXUS WITH HI-STORM 100 SYSTEM FSAR

- TO AVOID CONFUSION IN FUTURE YEARS, TECHNICAL REQUIREMENTS SET DOWN IN THE HI-STORM 100 FSAR WILL BE ADOPTED IN THIS SAR BY REFERENCE. THE COMMON ITEMS ARE:
  - Requirements on plain concrete and its placement
  - Requirements on the FHD
  - Requirements on the supplemental cooling system (SCS)
- FUTURE CHANGES TO THE ABOVE WILL BE CONTROLLED THROUGH DOCKET NO. 72-1014.

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ISFSI PAD

- APPLICABLE CODE ACI-318 (05)
- CLASSIFIED AS IMPORTANT-TO-SAFETY
- LOAD COMBINATIONS IDENTICAL TO THE 72-1014 DOCKET (INCLUDES DEAD LOAD, LIVE LOAD, AND EARTHQUAKE, NOT SETTLEMENT)
- NO LIMIT SPECIFIED FOR MAXIMUM OR DIFFERENTIAL "SETTLEMENT" AS IS THE CASE IN ALL STORAGE DOCKETS AT PRESENT.
- A REFERENCE PAD DESIGN IS PROVIDED AND ANALYZED FOR STRUCTURAL COMPLIANCE USING A REFERENCE EARTHQUAKE.
- THE ISFSI PAD FOR A SPECIFIC SITE WILLCONTINUE TO BE DESIGNED IN ACCORDANCE WITH THE "FW" SYSTEM SAR AS IS REQUIRED AT PRESENT.

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MPC DESIGN

- MPC ENCLOSURE VESSEL DESIGNED TO MEET SECTION III CLASS 1 WITH CERTAIN NRC-APPROVED ALTERNATIVES (IDENTICAL TO THE HI-STORM 100 MPCs)
- LID-TO-SHELL WELD IDENTICAL TO ALL PREVIOUS MPCs. THEREFORE, LEAKAGE FROM THE CONFINEMENT BOUNDARY IS NOT CREDIBLE.
- FUEL BASKET MADE OF METAMIC-HT IN AN EGG-CRATE CONFIGURAION (SIMILAR TO F-37 AND F-32 FUEL BASKETS IN HI-STAR 180).
- AVERAGE CELL WALL PLASTIC DEFORMATION IN THE FUEL BASKET LIMITED TO 1 mm UNDER ALL ACCIDENT EVENTS (FACTORED IN THE CRITICALITY ANALYSIS).

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STRESS ANALYSIS FOR PRESSURE

DESIGN CONDITION LOADS APPLY ONLY TO THE MPC PRESSURE VESSEL

1. DESIGN PRESSURE IS DEFINED AS THE PRESSURE THAT EXCEEDS THE OPERATING PRESSURE IN THE MPC UNDER “NORMAL” CONDITIONS OF STORAGE.
2. DESIGN TEMPERATURE IS SELECTED AS THE METAL TEMPERATURE THAT EXCEEDS THE OPERATING TEMPERATURE OF THE PRESSURE PART.
3. AN ACCIDENT CONDITION LIMITING PRESSURE AND TEMPERATURE IS DEFINED AND TREATED AS “LEVEL D” LOADING FOR THE MPC PRESSURE VESSEL.

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HEAVY LOAD HANDLING

- LOADED HI-STORM AND HI-TRAC SHALL ALWAYS BE CARRIED IN THE VERTICAL ORIENTATION (NO HORIZONTAL HANDLING).
- ALL HEAVY LOAD HANDLING OUTSIDE THE PART 50 STRUCTURE (I.E., WITHIN PART 72 SCOPE) SHALL BE BY SINGLE-FAILURE-PROOF CASK TRANSPORTER.
- ALL LIFTING DEVICES SHALL MEET NUREG-0612 AND ANSI 14.6 STRESS LIMITS (IDENTICAL TO THE REQUIREMENT IN DOCKET NO. 72-1014).

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HEAVY LOAD HANDLING (CONT’D)

- THEREFORE, A DROP ACCIDENT WITHIN THE PART 72 SCOPE OF OPERATIONS IS *NOT* CREDIBLE.
- HOWEVER, TO PROVIDE GUIDANCE FOR A CREDIBLE DROP INSIDE THE PART 50 FACILITY, LS-DYNA MODELS OF HI-TRAC VW AND HI-STORM FW WILL BE INCLUDED N THE SAR, AND A REPRESENTATIVE DROP PROBLEM ANALYZED. ACCEPTANCE CRITERIA FOR THE PART 50 DROP EVENT WILL BE IN ACCORDANCE WITH THE PLANT’S LICENSING COMMITMENTS.
- THERE WILL BE NO “CARRY-HEIGHT LIMITS” IN THE CoC.

ACCIDENT CONDITIONS WITH STRUCTURAL INTEGRITY CONSEQUENCES

1. NON-MECHANISTIC TIP-OVER OF HI-STORM FW

MODEL

- PAD ASSUMED TO BE ESSENTIALLY RIGID
- USE LS-DYNA
- INITIAL CONDITION SAME AS DOCKET NO. 72-1014
- ANALYZE THE TALLEST AND HEAVIEST HI-STORM FW IDENTIFIED IN THE SAR

ACCIDENT CONDITIONS WITH STRUCTURAL INTEGRITY CONSEQUENCES (CONT'D)

1. NON-MECHANISTIC TIP-0VER (CONT'D)

ACCEPTANCE CRITERIA

- MPC REMAINS CONTAINED INSIDE THE CASK AT ALL TIMES.
- THE (SHIELDING SAFETY) AVERAGE LATERAL PLASTIC DEFORMATION OF THE BASKET PANELS LESS THAN 1 mm.
- THE LOSS OF SHIELDING IN THE OVERPACK IS MINIMAL.
- THE CONFINEMENT BOUNDARY IS NOT BREACHED.

ACCIDENT CONDITIONS WITH STRUCTURAL INTEGRITY CONSEQUENCES (CONT'D)

2. FIRE AROUND A LOADED "FW"

- FIRE SOURCE IDENTICAL TO DOCKET NO. 72-1014
- USE FLUENT FOR THERMAL ANALYSIS
- ACCEPTANCE CRITERIA
- PEAK CLADDING TEMPERATURE BELOW THE ISG-11 LIMITS
- MINIMAL LOSS OF SHIELDING
- THE OVERPACK'S METAL STRUCTURE REMAINS BELOW 50% OF THE MELTING POINT OF STEEL TO MAINTAIN STRUCTURAL INTEGRITY.

ACCIDENT CONDITIONS WITH STRUCTURAL INTEGRITY CONSEQUENCES (CONT'D)

3. TORNADO MISSILES

TORNADO-GENERATED MISSILES		
MISSILE DESCRIPTION	MASS (kg)	VELOCITY (MPH)
Automobile	1800	126
Rigid solid steel cylinder (8 in. diameter)	125	126
Solid sphere (1 in. diameter)	0.22	126

ACCIDENT CONDITIONS WITH STRUCTURAL INTEGRITY CONSEQUENCES (CONT'D)

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4. FLOOD

- COMPUTE THE PERMISSIBLE FLOOD FLOW VELOCITY THAT WILL NOT MAKE THE CASK SLIDE OR TIP-OVER. USE STATIC EQUILIBRIUM METHODS.
- USE TALLEST AND MOST LIGHT-WEIGHT HI-STORM FW FOR QUALIFICATIONS.
- CASK-TO-PAD FRICTION COEFFICIENT AS SPECIFIED IN DOCKET NO. 72-1014.

ACCIDENT CONDITIONS WITH STRUCTURAL INTEGRITY CONSEQUENCES (CONT'D)

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5. EARTHQUAKES

LOW INTENSITY EARTHQUAKES

- THE COMBINATION OF MAXIMUM PERMISSIBLE VERTICAL AND HORIZONTAL ZPAs AT THE ISFSI PAD DETERMINED USING THE PROCEDURE SET DOWN IN DOCKET NO. 72-1014.
- THE INEQUALITY IS WRITTEN WITH THE HEIGHT OF THE C.G. OF THE CASK AS THE PARAMETER (IDENTICAL TO DOCKET NO. 72-1014).

ACCIDENT CONDITIONS WITH STRUCTURAL INTEGRITY CONSEQUENCES (CONT'D)

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HIGH INTEGRITY EARTHQUAKES

- USE THE DYNAMIC ANALYSIS APPROACH ENDORSED IN DOCKET NO. 72-1014 CoC.
- MODEL THE HI-STORM FW CONTAINING THE MPC AS A SIX-DEGREE-OF-FREEDOM FREESTANDING BODY. THE ANALYSIS WILL BE SITE-SPECIFIC AND WILL USE VISUAL-NASTRAN (CONSISTENT WITH THE CURRENT PRACTICE).

ACCIDENT CONDITIONS WITH STRUCTURAL INTEGRITY CONSEQUENCES (CONT'D)

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6. ACCIDENT CONDITIONS (CONNECTION TO THERMAL-HYDRAULIC ANALYSIS)

- ASSUME NON-MECHANISTICALLY THAT 100% OF THE RODS IN STORAGE HAVE RUPTURED, RESULTING IN 100% OF FILL GAS AND 30% OF THEORETICALLY AVAILABLE RADIOACTIVE GASES RELEASED.
- THE THERMAL-HYDRAULIC ANALYSIS WILL PROVE THAT THE ACCIDENT CONDITION INTERNAL DESIGN PRESSURE (200 PSI) IS NOT EXCEEDED.
- THE ENCLOSURE VESSEL MUST MEET THE LEVEL D SERVICE CONDITION STRESS INTENSITY LIMITS OF "NB".