Update on Spent Fuel Management Activities at Holtec

35th INMM Spent Fuel Management Seminar
Spent Fuel Management Activities

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SNF Management Activities

Discussion Topics

- Holtec Overview
- Holtec Innovations
- Canister-Based Aboveground and Belowground Systems
- Regionalized Loading to Accelerate Decommissioning
- HI-STAR 100MB Dual Purpose/Dual Use
- Allowance of Candidate Heat Load Patterns Without Amendment Request
Holtec International: Corporate Profile

- Established in 1986
- Robust safety program
- Strong and effective quality assurance program
- Impeccable on-time delivery record
- Excellent financial strength
- Backlog: 4.0 Billion USD +
- No history of long-term debt
- Self-financed company growth and R&D
- Business mix:
  - ✓ 90% Nuclear power & nuclear waste
  - ✓ 5% Fossil power - combined cycle
  - ✓ 5% Renewables - solar, wind, etc.

Holtec is a Vertically Integrated, Innovative Technology Leader with Unique Approaches to Design & Manufacturing

Krishna P. Singh Technology Campus
Located in Camden, New Jersey, U.S.A
Manufacturing Capabilities:
Three Major U.S. Manufacturing Plants

- Holtec Manufacturing Division (HMD)
  - Turtle Creek, PA
- Orrvilon, Inc. (ORR)
  - Orrville, Ohio
- Advanced Manufacturing Division (AMD)
  - Camden, NJ

- 1.4M ft² of Total Shop Space
Core Business Activities

- Safe & secure used fuel storage & transport technologies
- Heat transfer equipment
- SMR-160 small modular reactor
- Battery Energy Storage System
- Decommissioning of retired nuclear plants
- Consolidated interim storage
Holtec’s Worldwide Dry Storage and Transport Experience

1,368 Systems Loaded

118 Nuclear Plants Worldwide Rely on Holtec’s Technology for Spent Fuel Storage & Transport; 67 Domestic, 51 International
Holtec is a Global Leader in Used Nuclear Fuel and Waste Management Technologies

Nuclear Fuel Storage and Transport
over 1,368 systems loaded with more than 67,900 SFAs (many more on order)

Operational and Decommissioning Waste Storage and Transport
in use at Jose Cabrera in Spain and LaSalle, Quad Cities, and Dresden in USA

High Capacity Fuel Storage Racks
installed at over 100 NPPs in 7 countries totaling over 170,000 SFAs (AP-1000, ABWR, APWR, APR-1400)

Ancillary Equipment
drying, lifting, handling, operating equipment for nearly all projects

Damaged Fuel and Waste Containers
(made from stainless or neutron absorber)
over 100 loaded and 44,000 on order for CHNPP

Hot Cell Facilities and Equipment
contracted for handling and conditioning fuel at Chernobyl NPP
Holtec Innovations

- Having our own manufacturing facilities provides us with the ideal basis to develop and implement safety improvements in design and manufacturing.

- Example: Ongoing focus on developing technologies to reduce the risk of stress corrosion cracking in safety related components.
  - Reduction of overall amount of welds and heat input per weld for canisters.
  - Laser Peening of welds.
  - Development of new welding technologies such as hybrid laser welding to combat aging related issues in dry storage.
Holtec’s HI-STORM Canister-based Systems
Aboveground and Belowground Systems

- HI-STAR
  STORAGE AND TRANSPORT CASK
  (INTERIM STORAGE AND OFFSITE TRANSPORT)

- HI-TRAC
  TRANSFER CASK
  (ONSITE TRANSFER/TRANSPORT)

- MPC
  MULTI-PURPOSE CANISTER
  (STORAGE/TRANSPORT/DISPOSAL)

- HI-STORM 100 AND HI-STORM FW
  ABOVEGROUND STORAGE CASK
  (INTERIM STORAGE)

- HI-STORM 100U AND HI-STORM UMAX
  UNDERGROUND STORAGE CASK
  (INTERIM STORAGE)
Holtec’s Canister Technology

- Provides containment of fuel, fuel debris, or non-fuel hardware and waste
- Canisters are protected by “Overpacks” during storage, onsite transfer, and offsite transport
- Benefits of Canisters
  - Welded lids provide highest level of protection of material
  - Canisters are transportable without repackaging
  - Fuel handled one time
  - Contents are retrievable using weld removal technology
- Only provider of Double Wall Canisters (DWCs)
  - Developed for Chernobyl damaged fuel
  - Two independent barriers to protect contents
  - Interior stainless-steel canister is protected from the environment
  - Allows for leak test verification if required by monitoring shell-to-shell gap
  - Over 350 DWCs on order between EDF and Chernobyl
Multi-Purpose Canister (MPC)

- HI-STORM 100 System:
  - ✔ MPC-24, MPC-32, MPC-68
- HI-STORM FW System:
  - ✔ MPC-37, MPC-89
- All stainless construction
- HI-STORM 100: Fixed Neutron Poison Material
- HI-STORM FW: Basket is Entirely Made of Neutron Poison Material
- MPC has no bolted closure or mechanical seals
- 100 Year Service Life
- Honeycomb basket maximizes structural strength, heat transfer, and shielding
- ASME Section III, Class 1 (subsection NB) compliant
Holtec’s Below-grade Dry Storage Technology (HI-STORM UMAX)

- Passive heat rejection
- Capacity to store 37 spent PWR fuel assemblies or 89 spent BWR fuel assemblies
- Canister is entirely below grade
- Size – HI-STORM UMAX is licensed to store canisters up to 75 ¾ inches in diameter, and up to 213 inches tall
- 22 ft. deep x 11 ft. wide
HI-STORM UMAX Characteristics

- Operational Advantages
  - Ergonomic

- Maximizes Security
  - Facility is visually inconspicuous
  - Profile < 2 ft. tall
  - Less visible target from the air
  - Reduced visibility from public land
  - No area of obstructed view

- Maximizes Safety
  - Minimize dose to environment & crew
  - Virtually immune to environmental disasters - hurricanes, floods, tornados, earthquakes
  - Designed to withstand crashing aircraft or on-site fire without any radiological consequences

HI-STORM UMAX at Callaway
HI-STORE Site Layout

- Initial Storage Capacity: 500 canisters
- Total Storage Capacity: 10,000 canisters
- Facility utilizes 300 of 1,000 acres available
- Operations could commence in 2024
Regionalized Loading

All of Holtec’s MPCs offer regionalized loading schemes, where either 2 or 3 concentric regions or groups of cells that are specified with different performance parameters in terms of heat loads, burnups and cooling times.

- **HI-STORM 100:** 2 Regions
  - Inner – Hotter Fuel
  - Outer – Colder fuel

- **HI-STORM FW:** 3 Regions
  - Inner – Medium fuel
  - Intermediate – Hotter Fuel
  - Outer – Colder Fuel
Regionalized Loading allows for Accelerate Decommissioning

Traditionally D&D was restricted by the removal of spent nuclear fuel having to remain in the spent fuel pool for a minimum of five (5) years during cooling period. Decommissioning the balance of plant can be concluded in roughly a 5-year window (PWR/BWR)

- Holtec’s dry storage and transport systems are now licensed for post-reactor cooling times as low as 24 months
- Holtec has developed software, procedures, processes, and specialized equipment for rapid defueling service
- Reactor internals segmentation may be conducted within the 3-year window
- Decommissioning the balance of plant can be concluded in roughly a 5-year window
The USNRC Certifies HI-STAR 100MB

- A dual purpose and dual use cask
  - capable of transport and on-site storage
  - capable of holding both unpackaged and canisterized fuel)
- Ability to ship contents packaged in an MPC or in a bare basket
- Transport both moderate burn-up and high burn-up fuel in the various sizes employed in light water reactors
- Transport fuel with as little as 3 ½ years of decay after discharge from the reactor.
- Certification of HI-STAR 100MB includes the high capacity canister, MPC-32M, and “bare baskets” F-24M and F-32M, all using Metamic-HT as basket material for optimal performance.
- Cask sized to hold any canister loaded in the industry up to 68-1/2 inches in diameter, almost every canister commissioned into dry storage in the US before 2014.
Topical Report for Allowance of Candidate Heat Load Patterns Without Amendment Request

- Approval of a Suitable Methodology Permitting Licensee Qualification of Candidate Heat Load Patterns Without License Amendment

- The Intent of Above is to:
  - Address Emerging Needs in a Timely Manner Consistent with Safety
  - Facilitate Management and Optimization of Fuel Inventories with Intent to Maximize ALARA
  - Avoid Undue Engagement of Regulatory Resources.
Summary of Approach

- Input Loading Pattern
- Acceptance Criteria
  - ✓ Peak Cladding Temperature
  - ✓ Component Temperatures
  - ✓ MPC Pressure
- Methodology
  - ✓ Based on FSAR
  - ✓ Presented in Topical Report
- Additional Restrictions in LAR (per cell / canister heat load limits)
- Relationship to other disciplines
Thank You!