



# **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.



Krishna P. Singh Technology Campus  
Located in Camden, New Jersey, U.S.A

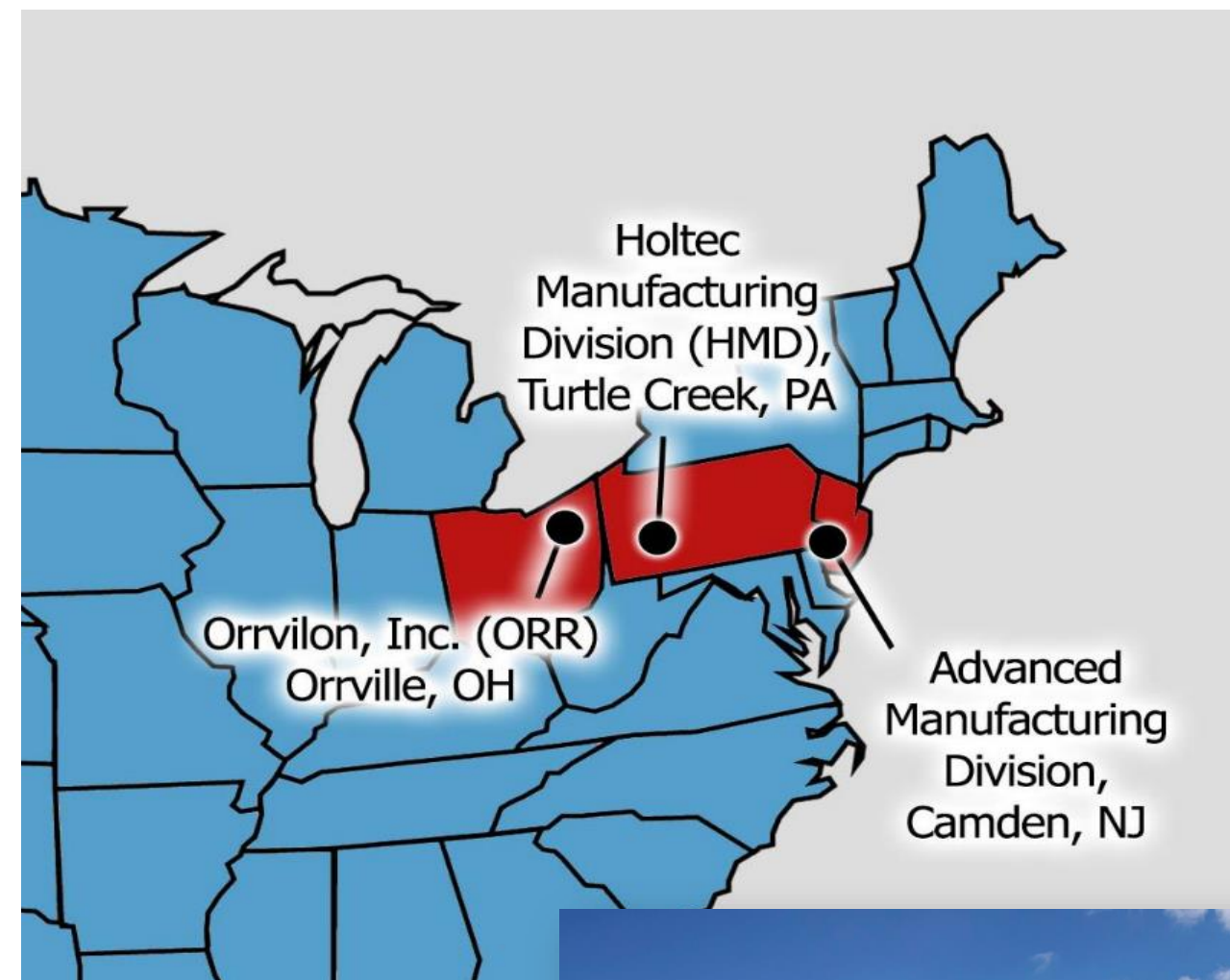
*Holtec is a Vertically Integrated,  
Innovative Technology Leader with  
Unique Approaches to  
Design & Manufacturing*



# Manufacturing Capabilities: Three Major U.S. Manufacturing Plants



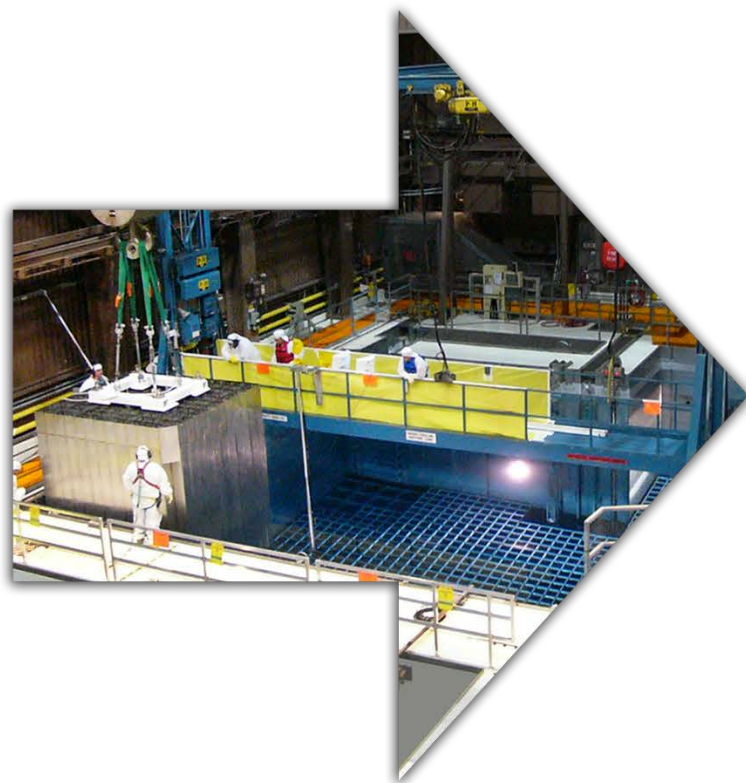
- Holtec Manufacturing Division (HMD)
  - Turtle Creek, PA
- Orrvilon, Inc. (ORR)
  - Orrville, Ohio
- Advanced Manufacturing Division (AMD)
  - Camden, NJ
- 1.4M ft<sup>2</sup> of Total Shop Space



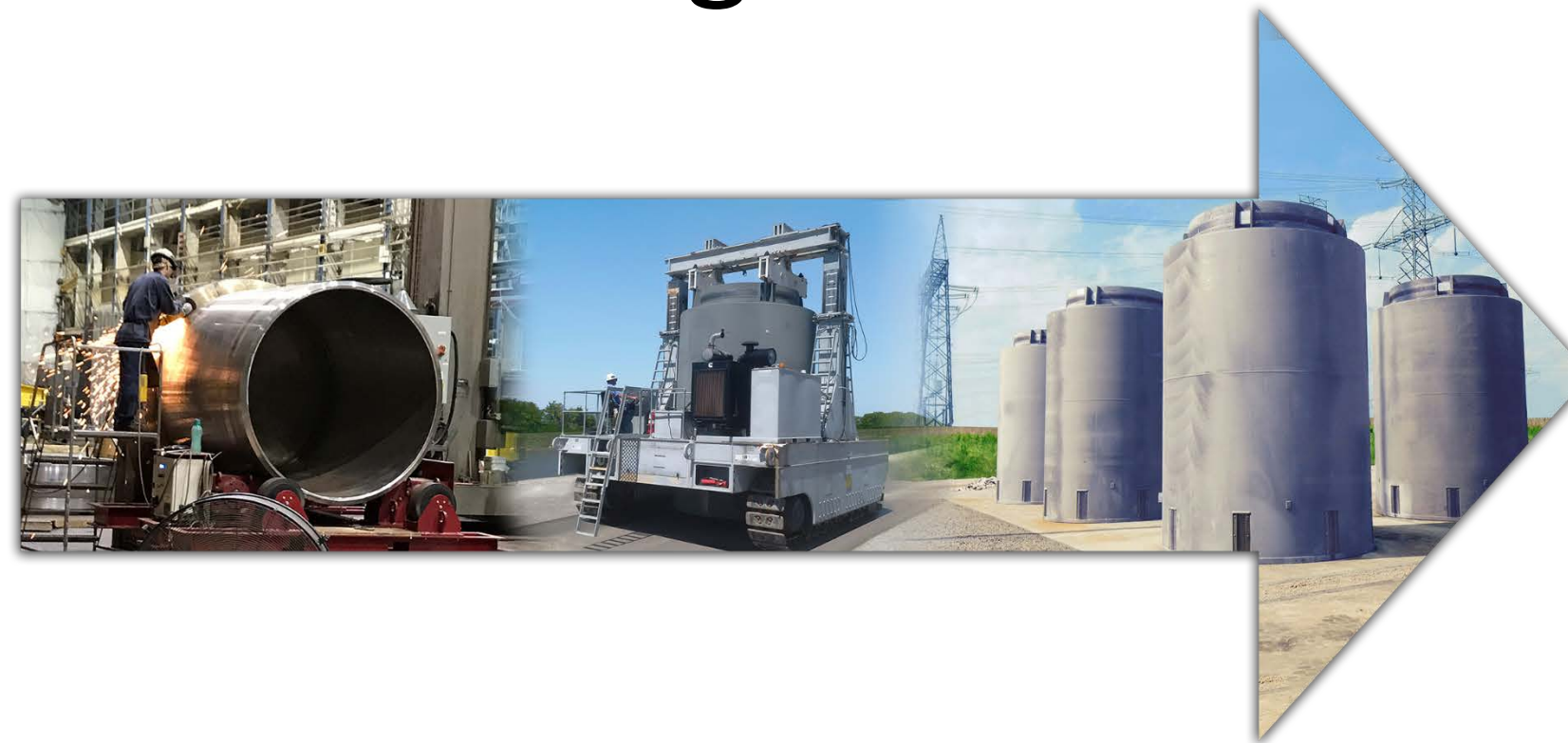


# Core Business Activities

- 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



Wet Spent  
Fuel Storage



Dry Spent  
Fuel Storage



Decommissioning



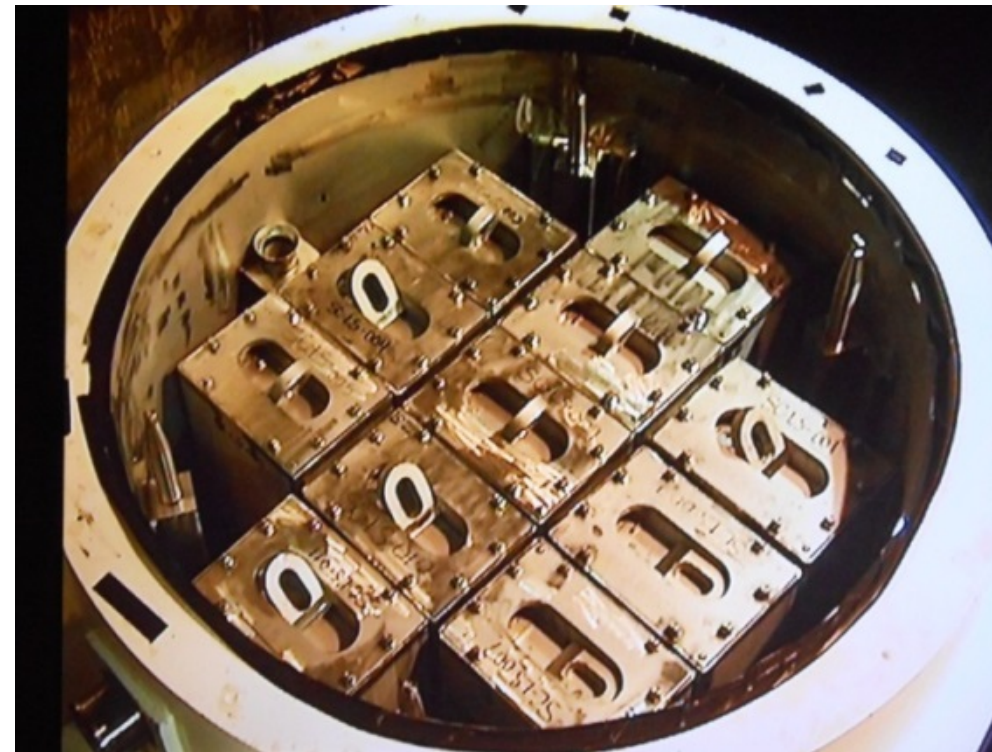




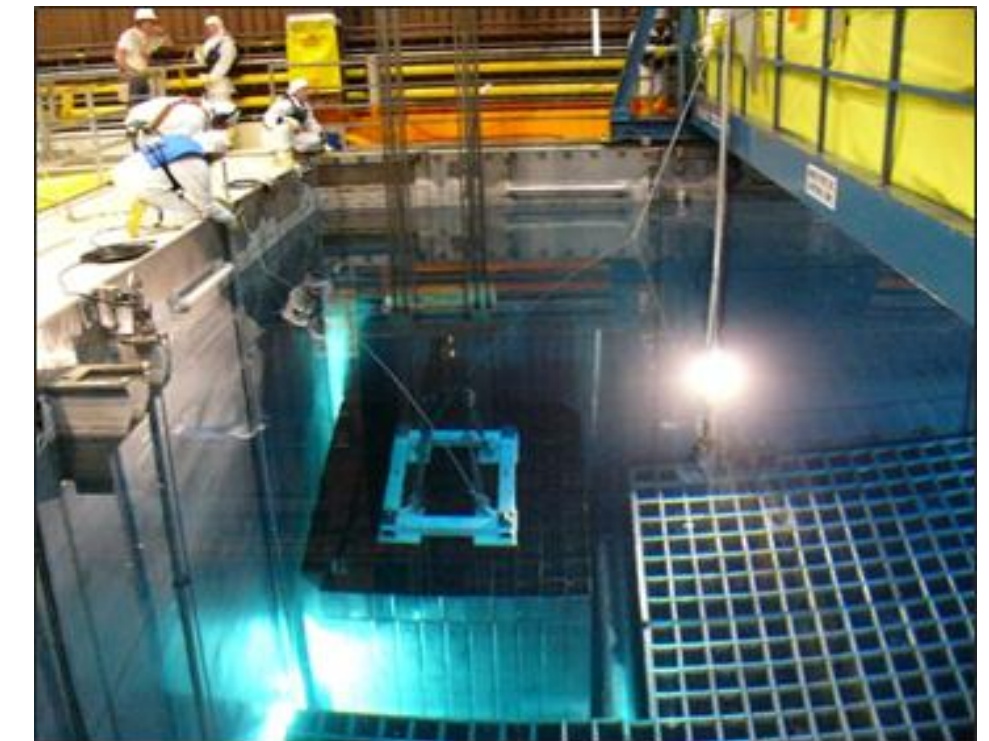
# Holtec is a Global Leader in Used Nuclear Fuel and Waste Management Technologies



**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*



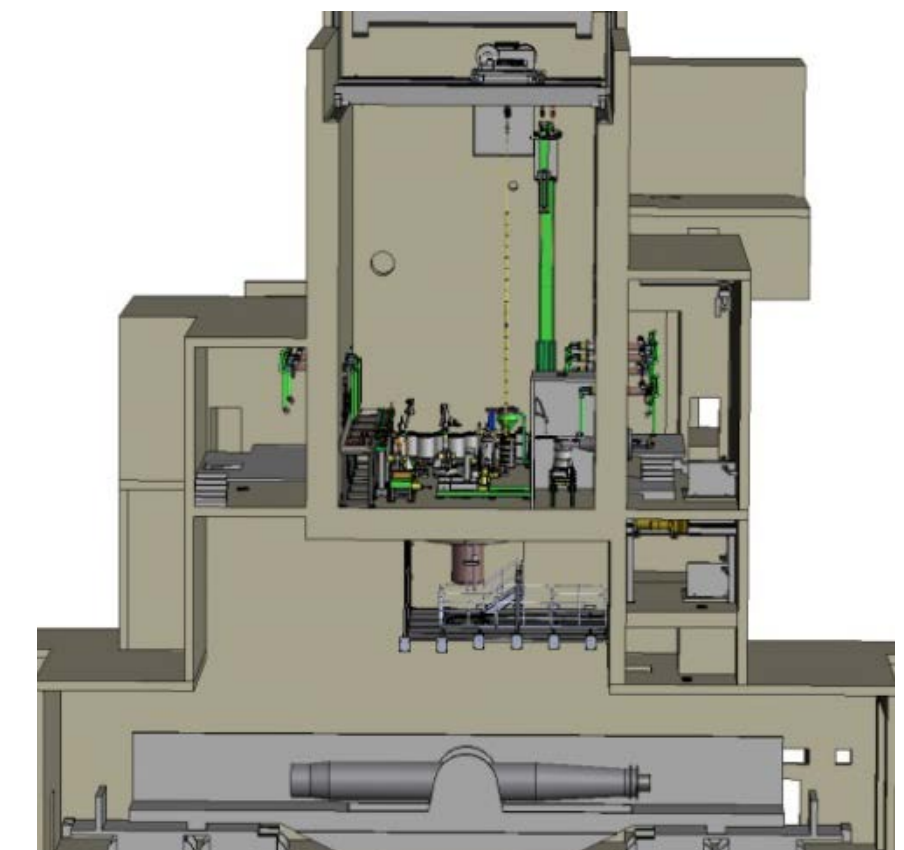
**High Capacity Fuel Storage Racks**  
*installed at over 100 NPPs in 7 countries totaling over 170,000 SFAs (AP-1000, ABWR, APWR, APR-1400)*



**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*

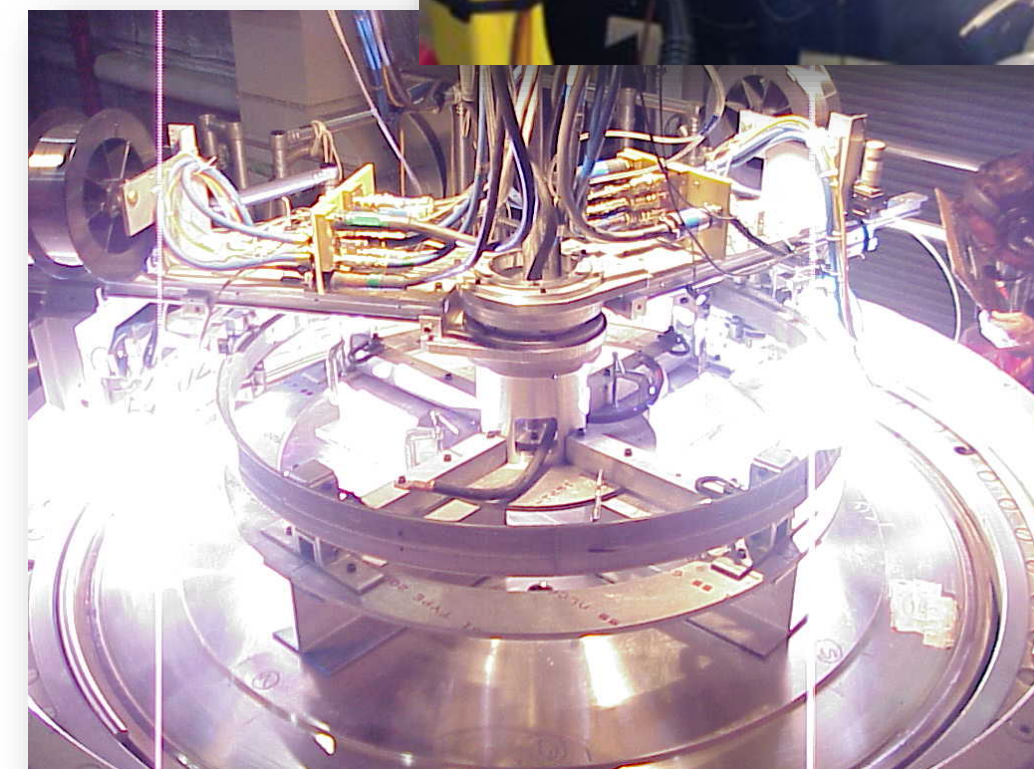
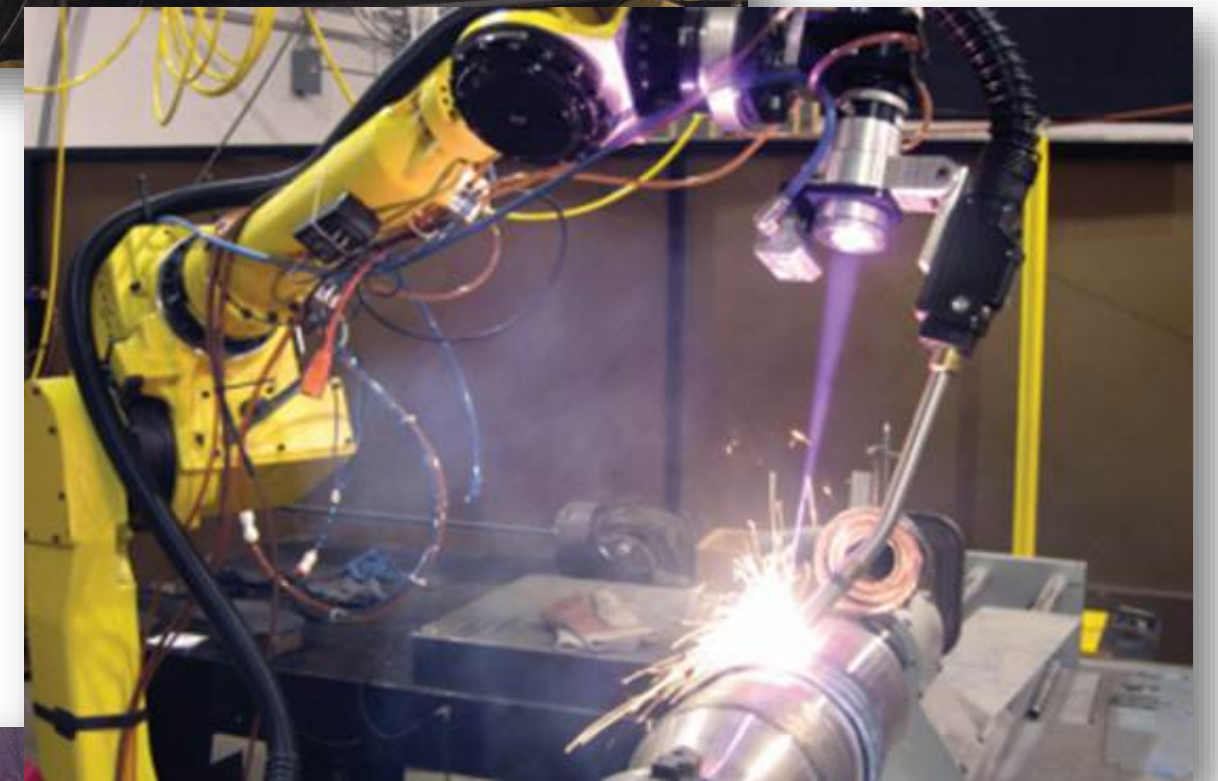


**Hot Cell Facilities and Equipment**  
*contracted for handling and conditioning fuel at Chernobyl NPP*



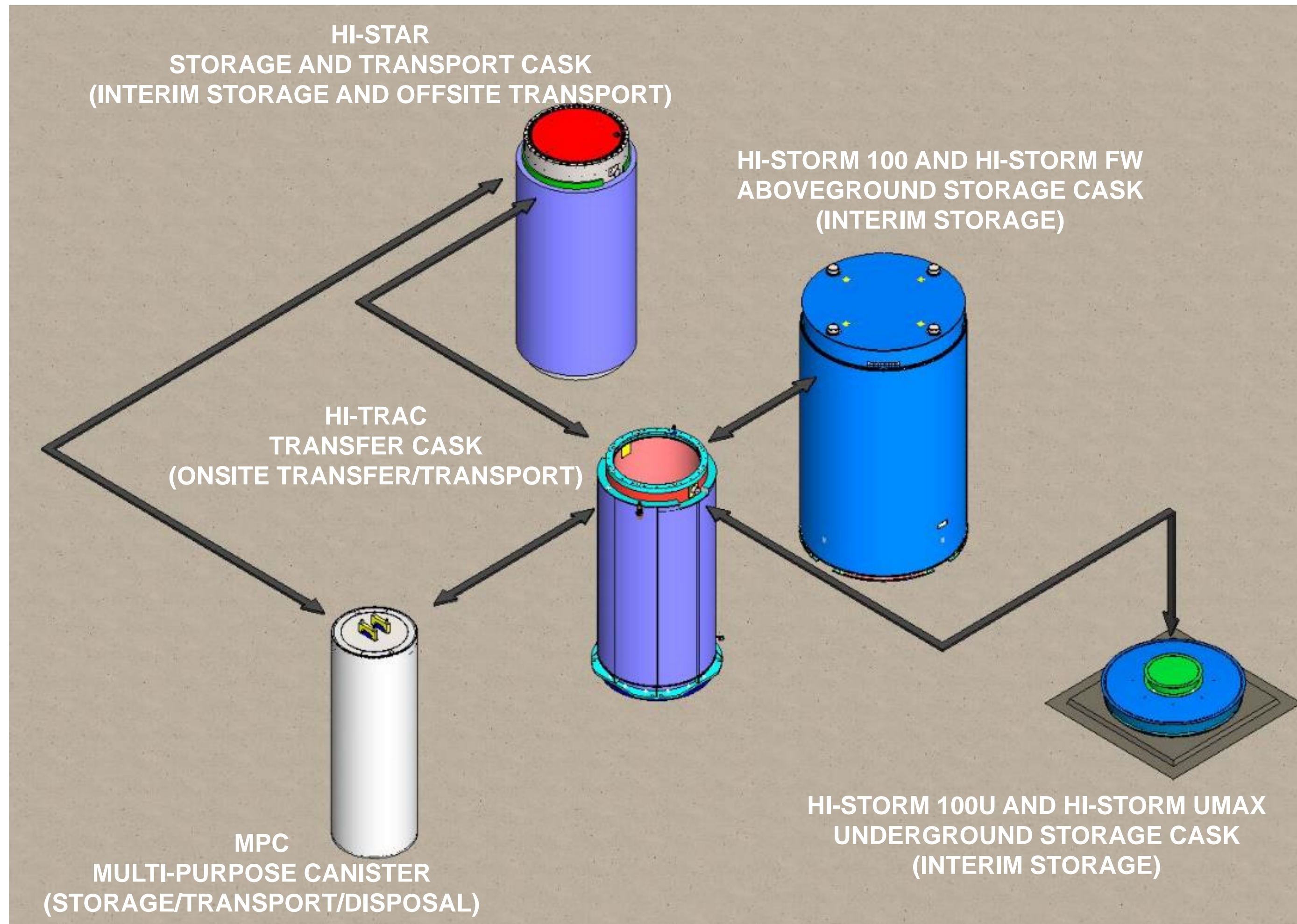
# Holtec Innovations

- 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*



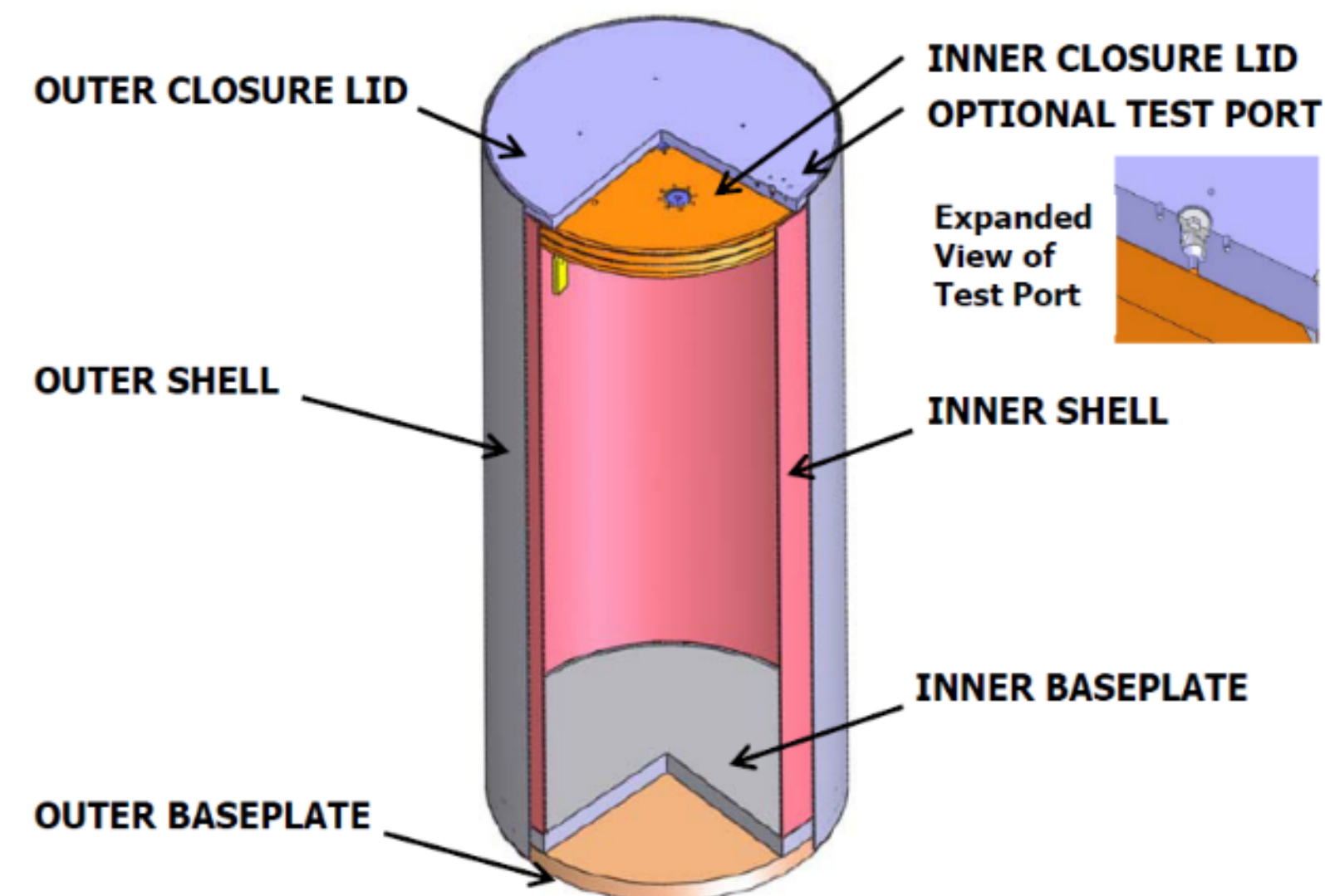


# Holtec's Canister Technology

- 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



**Holtec's Single Wall Canister**



**Holtec's Double Wall Canister**



# Multi-Purpose Canister (MPC)

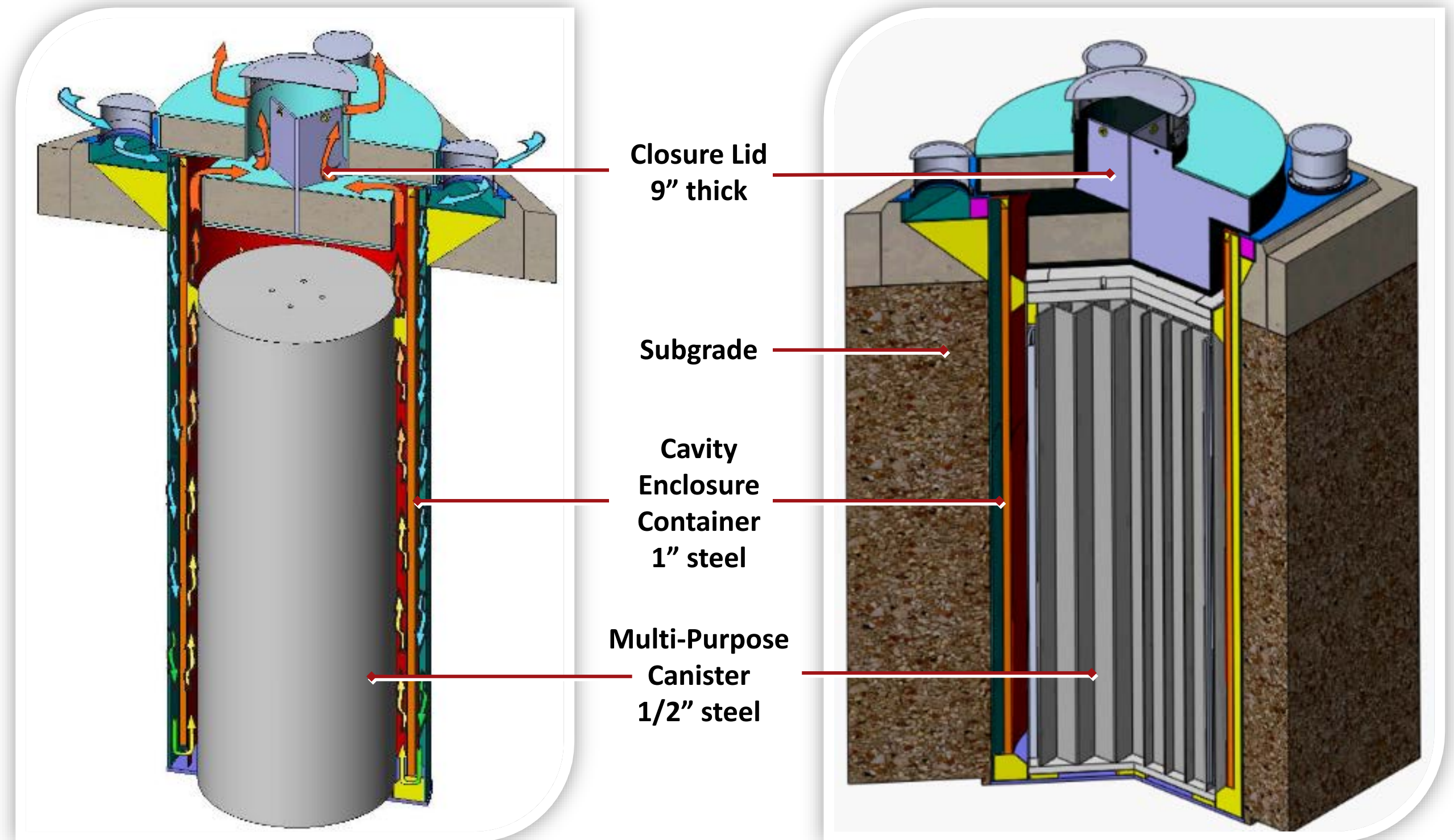
- HI-STORM 100 System:
  - ✔ MPC-24, MPC-32, MPC-68
- HI-STORM FW System:
  - ✔ MPC-37, MPC-89
- All stainless construction
- HI-STORM 100: Fixed Neutron Poison Material
- HI-STORM FW: Basket is Entirely Made of Neutron Poison Material
- MPC has no bolted closure or mechanical seals
- 100 Year Service 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

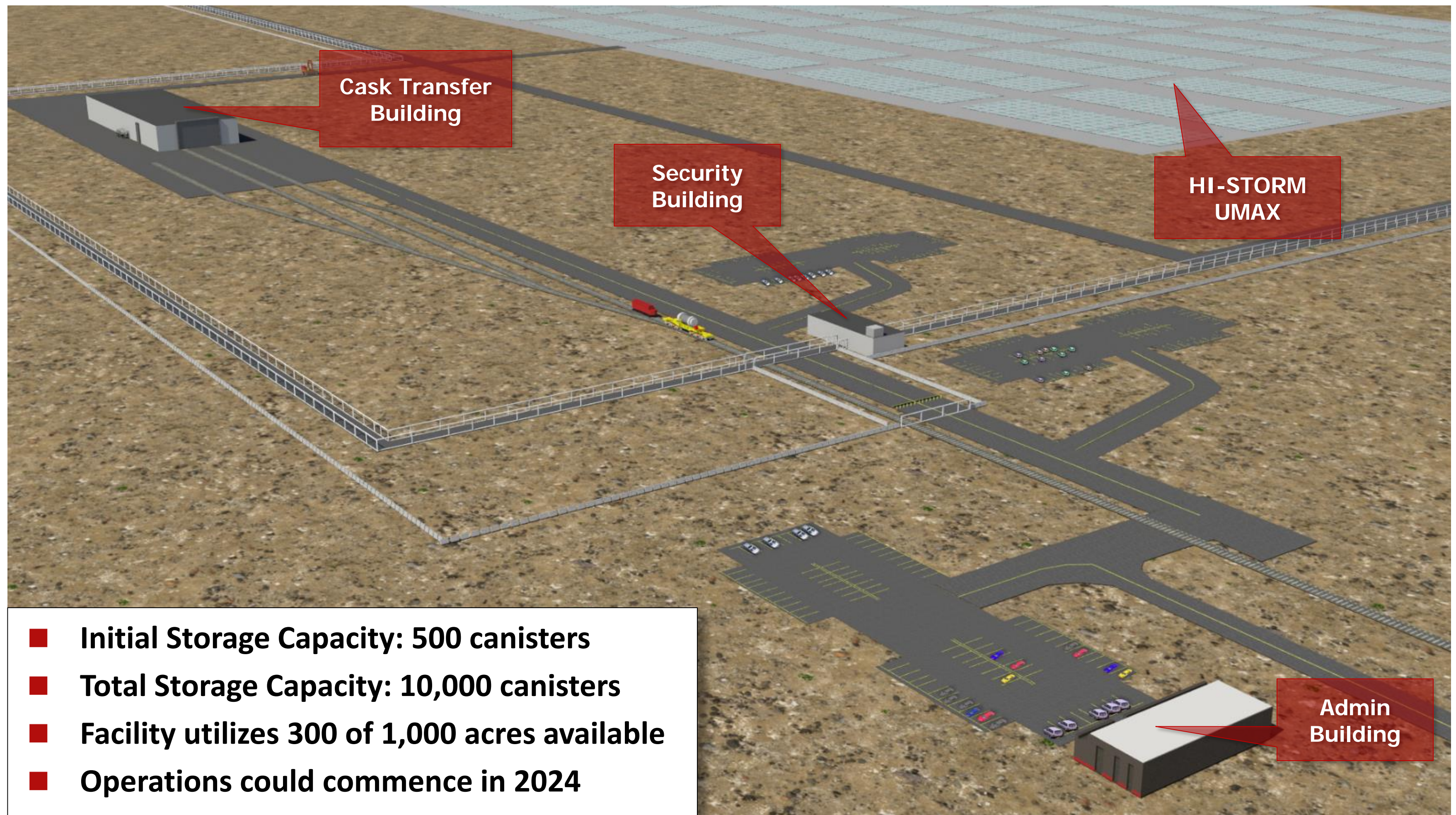
- Operational Advantages
  - ✔ Ergonomic
- Maximizes Security
  - ✔ Facility is visually inconspicuous
  - ✔ Profile < 2 ft. tall
  - ✔ Less visible target from the air
  - ✔ Reduced visibility from public land
  - ✔ No area of obstructed view
- Maximizes Safety
  - ✔ Minimize dose to environment & crew
  - ✔ 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

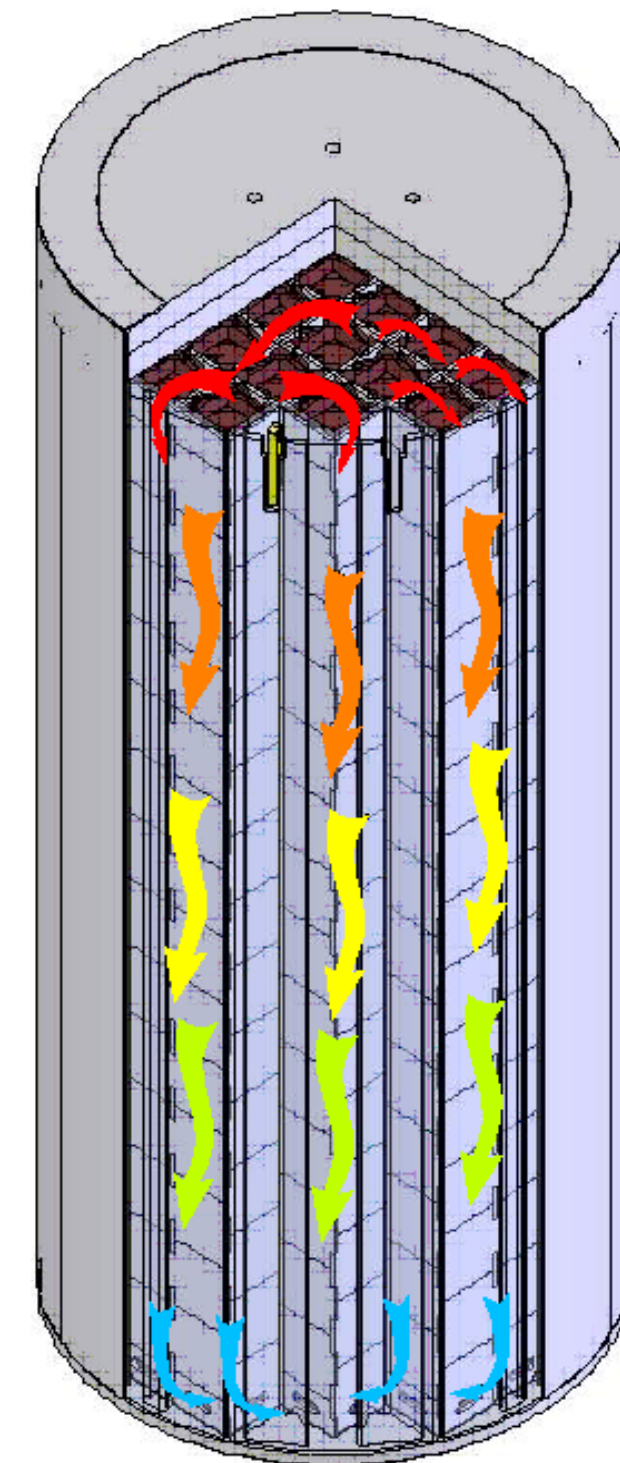
- All of Holtec's MPCs offer regionalized loading schemes, where either 2 or 3 concentric regions or groups of cells that are specified with different performance parameters in terms of heat loads, burnups and cooling times

- ✓ 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



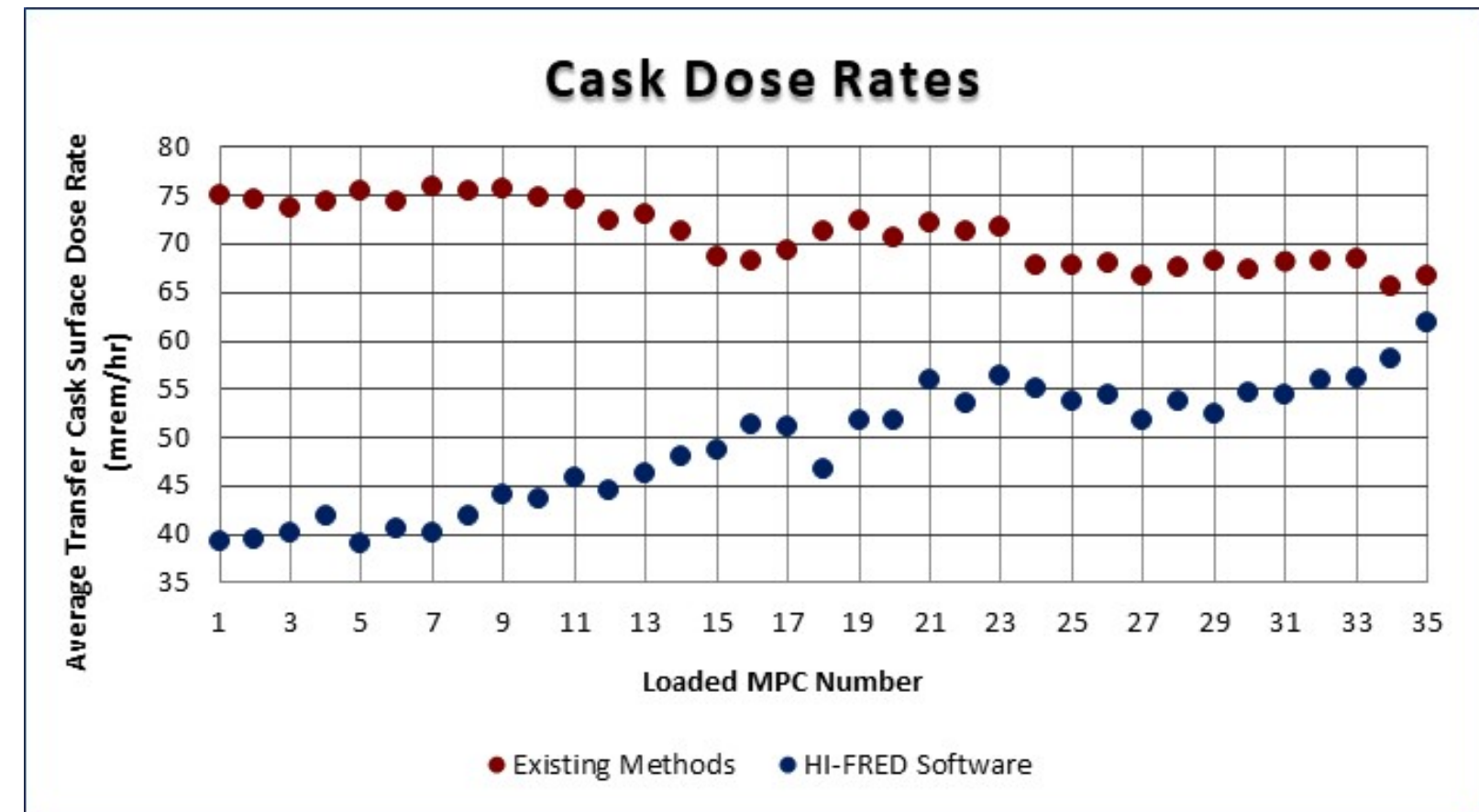
Holtec MPC



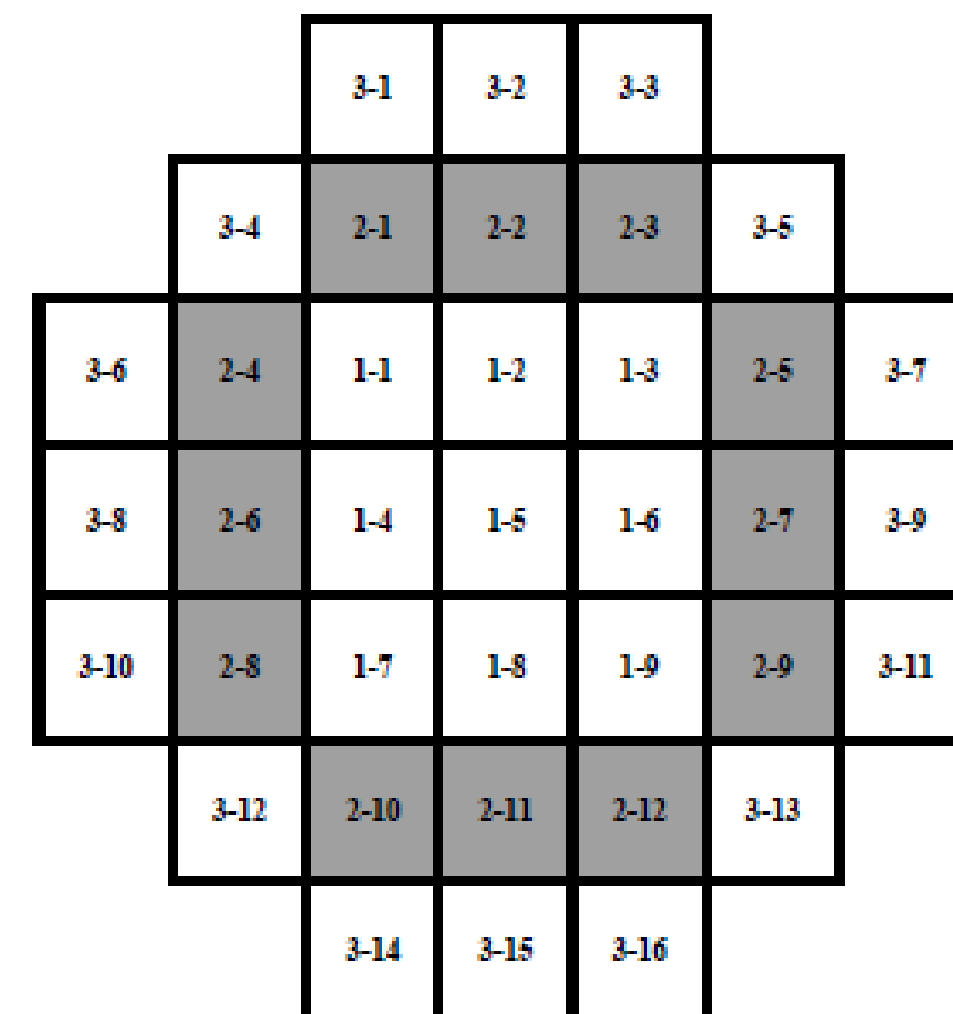
# Regionalized Loading allows for Accelerate Decommissioning

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



## HI-FRED Dose and Schedule Loading Optimization Software

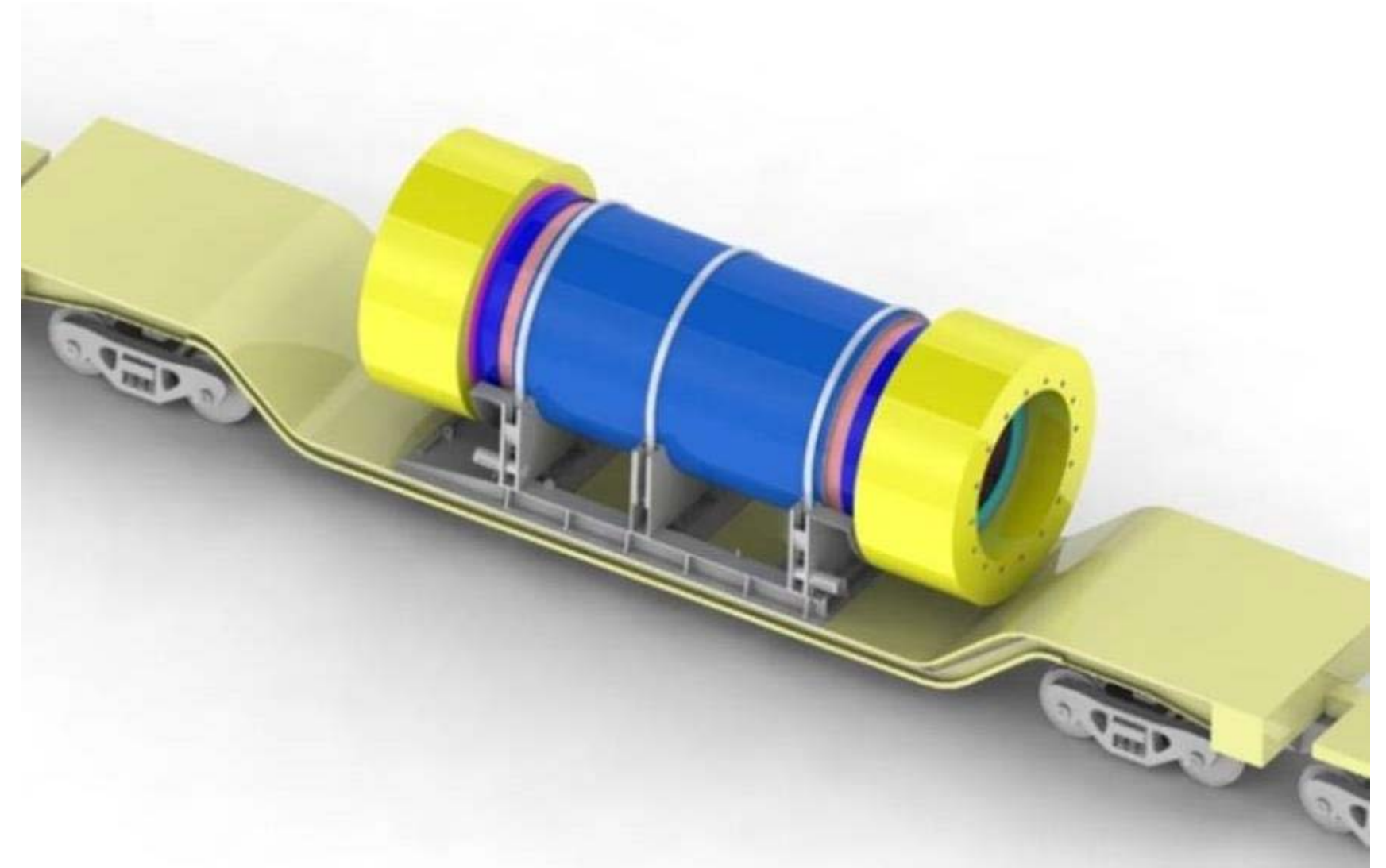


## Loading Plans for Rapid Defueling



# 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.



*Illustration of HI-STAR 100MB  
typical transport configuration*



# 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!



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