NAC Corporate Overview
Proven Nuclear System and Service Solutions

- Independent Subsidiary: Hitachi Zosen USA
- 45 Years in Nuclear Fuel Cycle Consulting
- Three Decades with Numerous Cask Technologies Licensed
- 30 Yrs. of Commercial & Government SF Transportation
- More than 420 Storage and Transport Systems Delivered
- Pioneers in Dry Storage Ultra-High Capacity Systems

Key Highlights:
- Greater than 75% commercial decommissioning site dry storage footprint
- Pioneers in HLW, GTCC and Fuel Storage Integration into MPC dry storage technology
- Pioneers in Transport System Integration (STC-HLW, NAC-LWT 60 Revs.)
“A man that holds a cat by the tail will learn something that he can’t experience in any other way”
Mark Twain

Perspective Based on Unique on U.S. Spent Fuel Storage and Transport Experience

U.S. Spent Fuel Management: Govt. Liabilities
About $550M/yr Now increasing to $700M/yr by 2020

Onsite Dry Storage Casks
- Different designs
- Non-standard
- Long-term
- HBU
- May require repackaging

Disposal Waste Packages

Source: NWTRB
Nuclear Plant Objectives Drive Technology Options

- Fewer Systems Purchased
- Fewer Systems Loaded
- Reduced Operations and Support
- Improved Safety
- Less Impact on Plant Operations
- Schedule Flexibility
- Reduced Worker Dose Exposures
- Fewer Heavy Loads
- Engineering Construction
- Resource Decommissioning Liabilities
- Operations
- Maintenance, Maintenance and Repair
- Fabrication/Construction
- Fewer ST Costs to Maintain & Decom.
- Reduced Worker Dose Exposure
- Fewer Heavy Loads
- Less Impact on Plant Operations
- Schedule Flexibility
- Improved Safety
- Reduced Operations and Support
- Fewer Systems Loaded
- Fewer Systems Purchased

- SHIFT TO ULTRA-HIGH CAPACITY SYSTEM
- STANDARDIZED SMALLER PACKAGES DO NOT ALIGN TO THIS OBJECTIVES

Disposal?

NAC Driven by Balancing Requirements

Nuclear Operators
- Storage Requirements
  - Loading Efficiency
  - Ultra High Capacity Canisters
  - Moderate to High Heat
  - Low doses
  - Long-term storage
  - Life cycle economics

Industry & Regulator
- Transport Requirements
  - Lower Heat (cool time)
  - Lower Doses
  - HBU Transport – retrievability?
  - AAR Standards
  - Transport Integration

DOE/Regulator
- Disposal Requirements
  - Lower Capacity Canisters
  - Lower Heat Load
  - Long term Material limitations
  - Standardized Canister Designs

The U.S. fractured, open market approach to interim spent fuel management has created a misalignment in spent fuel management that makes it more expensive and difficult to re-integrate when it comes to final disposition.
The Life Cycle of a Dry Storage System

<table>
<thead>
<tr>
<th>Years?</th>
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<tbody>
<tr>
<td>Spent Fuel and Canister Internals</td>
</tr>
<tr>
<td>Canister External</td>
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<tr>
<td>0.01% Spent Fuel Pool Water</td>
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<td>(4 days)</td>
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Technology and Materials
- Objective to Optimize Performance, Canister and Cask Materials for Each Phase of the Cask Life Cycle

Life Cycle Considerations
- Common sense ↔ Risk informed factors
- Availability of simple, proven technology and methods for preventative maintenance and to address degradation and recovery
- System integration to minimize impact to overall spent fuel management value chain

A Safe Balanced Approach

- Preventive maintenance, monitoring, mitigating actions, repairs, recovery, etc.
- Universal packaging – Different Waste streams
- Cask diversity is not good.
- Efficient Repackaging to standardized designs
- Incorporate waste forms to maintain disposition options

Ultra-high capacity Efficiency
Fewer Storage and Transport Campaigns
Repurchase to Keep Clean Fuel Disposition Options
System Integration
HBU Logic – Canister is key for HBU Transport

- HBU
  - Treat as Damage: OK to Transport
  - Treat as Intact: OK for NCT
  - Canister Focus – Protect the TSC
  - Storage AMP
  - Transport Cask Performance

Other Conditions: Retrievability?

Protecting the Canister: Storage (AMP) and Transport (Cask Performance)

Protecting the Canister (Storage)

- Pursue proven concepts to mitigate risk factors
- Example: Simple approach to eliminate tensile residual stress factor as a preventive maintenance against SCC

Saline air

Austenite Stainless Steel

Tensile stress

Stainless Steel

Compressive stress

Eliminate one of three factors

No-SCC

SCC
Protecting the Canister (Transport)

- The MAGNASTOR Transportation (10 CFR 71) submittal (MAGNATRAN)
  - Submittal of RAI Responses in December 2014
  - Designed for MAGNASTOR Canister
  - Intended to Envelop All-NAC Canisters Dimensions.

- MAGNATRAN Objectives
  - Achieve Industry Lowest G-loads
  - Integration of other waste forms
  - Evaluate the transport cask of the future
    - Transport Integration Strategy: FIFO, LIFO, etc..

KEY ATTRIBUTE: AT MINIMUM DESIGNED SO THAT DIMENSIONS AND TECHNICAL PARAMETERS CAN ENVELOP ALL NAC CANISTERS

Balanced Approach =Technology Integration

- Incentivize Migration to Higher Capacity or More Efficient Systems
  - Reduce the number of current system designs loaded
  - Lower costs of dry storage by at least 20%
  - Reduce the number of systems to be transported and repackaged
  - Reduce the size of a storage site

- Pursue True Multi-purpose System Configurations
  - Transport ready storage
  - Retains disposal and reprocessing options
  - SF and HLW Integration
  - Addresses issues related to fuel and canister performance

- Universal Transport Cask and Infrastructure
  - 13 dry storage canister designs each with its own transport cask
  - Significant benefits; equipment, training, crews, facilities, etc.
  - Opportunity to include other DOE waste packages

MAGNASTOR
Systems Loaded: 70

DOE West Valley
Systems Needed: 55

MAGNATRAN
Under NRC Review
Few Last Comments

- NAC is an active participant supporting the EPRI ESPC - Collaboration offering candid feedback on some program activities and transfer of sister rods to Idaho.
- Good things have been done under existing authority to advance SF Management in the right direction – We hope DOE continue these evaluations that offer some guidance to navigate some uncertainty.
- Pursue a balanced approach in spent fuel management considering the life cycle risk factors of SF and apply risk informed concepts
- Industry must continue to evaluate options that are consistent with an open disposition strategy – i.e. those actions that don’t inhibit disposition choices. Ex. System integration, other alternatives.
- NRC Guidance is essential for progress.

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