Spent Fuel Management Activities

Orano TN: Dry Storage and much more

Michael D. Beal
Director, Business Development
Overview of Orano TN
A strategic focus on the nuclear fuel cycle business

- Mining
- Uranium conversion and enrichment
- Used fuel recycling
- Nuclear logistics
- Dismantling and services
- Engineering
Technology Advancements in Dry Fuel Storage

Technology Advancements from Orano TN:

- HSM-MX Horizontal Storage Module
- EOS System Transportation
- Aging Management
- Virtual Reality / Visualization
- Methodologies / Automation

Designs to optimize efficiency and improve Dry Fuel Storage
Pool to Pad: Field Services

9 campaigns – 61 systems – 11 months of loading

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<th>Site</th>
<th>2018 Loading</th>
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2019 Campaigns: ~70 Systems
Pool to Pad Overview

TN has been performing Pool To Pad Operations since 2006

TN supported over 30 Sites

TN has become the Industry Standard of how to Safely and Effectively deliver P2P Services based on our Proprietary “Pool To Pad Playbook” (SPM 5.3)

Safety, Site Knowledge and DOR are key to a successful campaign

Orano TN’s P2P Organization and NUHOMS University are what set us apart

Technical Human Performance and Safety are factored into training
Pool to Pad Improvements

Orano TN is constantly looking for ways to improve:
- Reinforcement of the P2P Organization
- Training and Project Staffing
- Investing in Equipment
- Strengthening our Processes
- Improving Campaign and Offload Times

TN locks arms with each of our sites, providing a highly trained, fully qualified team for P2P services to deliver a safe, quality, error-free job...consistently
MATRIX HSM-MX
Horizontal Storage Module

Why was MATRIX Designed

• Space is at a premium at utilities
• Cost of the site ISFSI expansion, excavation, engineered back-fill, and cost of the pad is a concern
• Designed with Beyond Design Basis Events in mind: Floods and Seismic
• Extended storage will be an issue that needs addressing

Based on market concerns: Many sites will benefit from the innovative and space saving HSM-MX
MATRIX HSM-MX
Horizontal Storage Module

MATRIX Update

**Licensing submitted Q2-2018**
- Supports EOS37 and EOS89
- Previous Legacy DSCs
- Universal HSM

**Loading Equipment**
- Loading Cask (LC) & Retractable Roller Tray (RRT)
- Designed and under Fabrication

**HSM-MX Mock Up**
- HSM-MX Training Module completed Q1-2019
- Facilitate Lessons Learned
- Critical Step for upcoming projects
- Improve design/analysis capabilities

**MATRIX HSM-MX is a showcase of Orano TNs innovative culture**
MATRIX HSM-MX
Horizontal Storage Module

Design Background
Cast In Place
Greatly Reduced Footprint
Reduced Dose Rates
Increased Seismic Capability
Reduced Pad & Approach Slab Construction Costs
Designed with Beyond Design Basis Events
Aging Management features built in
Can be used on existing pads regardless of current technology
Compact Footprint for Operating or Decommissioned sites

MATRIX HSM-MX is a true industry game changer
Focus on Waste & Decommissioning Capabilities

Waste management services

« Pool to pad » or « pool to disposal » services
Onsite support to load and unload wastes from reactors

Turnkey pool cleanout services
Control Rod Blades volume reduction
Rack and irradiated hardware removal
Operating sites waste removal for storage

Transport services
Transport to storage sites
Fleet of transport packaging: TN-RAM, TN-MW, MP197HB

Decommissioning activities

Waste, reactor components and internals packaging, loading and transfer to interim storage sites

Technical expertise to WCS for unloading interface and capabilities

Technical, logistics and packaging assessment for UNF retrieval at shut down sites in preparation to future shipments

Support for railcar development

2018
TN-RAM2 mobilization
Continue TN-MW family development to transport additional waste forms

2019
MP197HB mobilization
Ready for transport of GTCC canisters

2020
Continue developing a modular and consistent fleet of casks

2021
Support UNF transport demonstrations and pilot UNF transports
Radwaste Rail Transport
AAR S-2043 Atlas Railcar

The cask railcar, called Atlas Railcar, is intended to be used for large-scale transport of used nuclear fuel and GTCC LLW, to interim and eventual permanent storage/disposal facilities in commercially available transport casks.

A total of 17 different transport casks will be hauled by the Atlas railcar by utilization of specific cask cradles for each cask design.

Objective: DOE and Orano Federal Services design and fabricate prototype cask and buffer railcars for nuclear material transportation.
Aging Management & Inspection

Aging Management Program Inspection Requirements:

Parameters Monitored or Inspected
Various Surface Conditions

Detection of Aging Effects
Method or Technique: Remote visual (general condition by VT-3; specific areas by VT-1 or equivalent)

Frequency
Following initial 20-year Inspection, at least once every 5 years ± 1 year

Sample Size
One or more DSCs at each ISFSI site unless bounded by another site’s prior inspections

Inspections: How do we get there?
General Area Crawlers / Robots
DSC “Canister” Inspections
Qualified Visual Exams
Further Development of AMP Tooling

Keys to Successful Tooling
ALARA
Cost Effective Methodology
Tooling - fit as many designs as possible
Design input from inspectors
Qualify techniques and procedures with performance demonstrations
Video and image capture for timely reporting and resolution of findings
Consistent and repeatable exams to develop the basis for acceptance of Surrogate Exams

Orano TN performed (3) Aging Management Inspections in 2017
Interim Storage Partners Update

Project Update:

Interim Storage Partners LLC, JV between WCS and Orano, finalized in 2 QTR 2018

Project Environmental impacts analyzed with storage of 40,000 MTHM in canisterized storage systems

8 separate phases; storage of up to 5,000 MTHM in each phase

License for 40 years with follow on renewals

Initial SAR includes selected TN NUHOMS and NAC International storage systems which prioritize shutdown sites

Visit: https://interimstoragepartners.com/faqs

CISF is ~14,000 acres and will be a complimentary neighbor to WCS
Summary

Orano TN provides a full compliment of services for the Nuclear Fuel Cycle
Technology Advancements that benefit Dry Fuel Storage
Full Compliment of Pool To Pad Services for Operating and Shut Down Sites
Investing in developing our people today, for tomorrow
MATRIX HSM-MX – A true game changer for the DFS market
Full offering of Transport, Waste and Decommissioning Capabilities
Breakthrough Railcar work with the DOE
Real World Aging Management Program & Inspection Services
Consolidated Interim Storage Facility (CISF) with ISP

Orano is truly giving nuclear energy its full value
orano

Giving nuclear energy its full value