Monticello Nuclear Generating Plant
Spent Fuel Storage Dye Penetrant Test Issue

2016 INMM
31st Spent Fuel Management Seminar

January 12, 2016
Monticello Nuclear Generating Plant

- Boiling Water Reactor
- NSSS – General Electric
- Operating License Issued September 8, 1970
- Current Licensed Power 2004 MWt
- Net Power Output ~665 MWe
- Renewed Operating License Issued November 8, 2006
- Operating License Expires September 8, 2030
Spent Nuclear Fuel Management Plan

• Maintain a minimum of 664 available locations in the Spent Fuel Pool
  – Enables one full core offload capability (484 spaces)
  – Allows efficient pre-staging of new fuel in pool (180 spaces)

• 2013 Goal – Load 10 AREVA TN NUHOMS® 61 BTH Dry Shielded Canisters (DSC)
  – Loading DSCs 11 – 20
  – Experienced Contractor hired to perform “Pool-to-Pad” loading campaign
AREVA TN NUHOMS®
61 BTH DSC
AREVA TN NUHOMS® 61 BTH DSC
AREVA TN NUHOMS® 61 BTH DSC
Monticello Independent
Spent Fuel Storage Installation
The structural lid weld should be examined by ultrasonic testing (UT) or other volumetric methods. Review the applicant’s evaluation of the critical flaw size using the linear-elastic fracture mechanics methodology based on service temperature, dynamic fracture toughness, and critical design stress parameters, as specified in Section XI of the ASME Code.

Progressive surface examinations, utilizing dye penetrant testing (PT) or MT, are permitted only if unusual design and loading conditions exist. In addition, a stress-reduction-factor of 0.8 is imposed on the weld strength of the closure joint to account for imperfections or flaws that may have been missed by progressive surface examinations. The weld design should be approved by the NRC on a case-by-case basis.
“All DSC closure welds except those subjected to full volumetric inspection shall be dye penetrant tested in accordance with the requirements of the ASME Boiler and Pressure Vessel Code Section III, Division 1, Article NB-5000. The liquid penetrant test acceptance standards shall be those described in Subsection NB-5350 of the Code.”
DSC Closure Welds
DSC Closure Welds

Total of 11 Closure Welds
Exam OTCP-to-Shell weld (DSC-15 shown)
“On 10/17/2013 at approximately 1530 NDE was performed on the final pass of the Dry Shielded Canister Outer Top Cover Plate. An NRC inspector observed part of this activity and questioned the ISFSI project team if the dwell and development times were sufficient to meet procedural requirements.”

- Identified during closure weld on DSC 16 while viewing activity from Remote Monitoring Station
- DSCs 11 – 15 loaded and placed in HSMs
All loading activities captured and stored on video
Immediate Response to NRC Question

- Stop Work Order issued
- Video review for showed numerous failures to adhere to required dwell times and other violations of procedural requirements. PT documentation did not match recorded video.
- Operations declares DSCs 11 – 16 Inoperable, Not Meeting Technical Specifications
- Review of results of final process to ensure adequate confinement (Helium Leak Test) showed all six DSCs had passed
- Root Cause Evaluation Team Chartered
NRC Office of Investigation
Notice of Apparent Violations – July 23, 2015

• Control of Special Processes – NRC determined that the contractors apparently willfully failed to follow procedures

• Completeness and accuracy of information – contractors apparently completed PT examination forms with inaccurate information

• Control of purchased material, equipment and services – licensee apparently did not assess the effectiveness of the control of quality by contractors
Apparent Violations Response Options

- Provide a written response to Apparent Violations, or
- Predecisional Enforcement Conference, or
- Alternative Dispute Resolution

Opted for Alternative Dispute Resolution
Met with NRC on October 15, 2015
Confirmatory Order – December 21, 2015

- Restore DSC 11-16 to compliance by ~May 2021
- Plan for restoring DSCs provided to NRC by ~November 2016
  - Annual updates to NRC
- Training for all first line supervisors & above by April 2016
- Evaluate effectiveness of improvements in oversight by December 2016
- Provide industry presentations on event and lessons learned by June 2017
- Provide industry article on event and lessons learned by December 2016

No violations will be issued to Xcel Energy
Xcel Energy Actions

Exemption Request

• Reviewed Remedy Options
  – Unload fuel from DSCs 11-16
  – Effect repair of DSCs 11-16
  – Request Exemption to Tech Spec Requirements from NRC

• Chose Exemption Request
  – Evaluation to show additional margin available beyond Stress Allowable Reduction Factor of 0.8 from ISG-15
  – During NRC review identified that knowledge of the physical quality of welds was not known
  – Withdrew Exemption Request

• Worked with AREVA to develop ability to inspect OTCP and majority of ITCP welds with Phased Array Ultrasonic Test
Xcel Energy Actions

Phased Array Ultrasonic Test

Monticello, DSC-16, Phased Array UT Examination Results of the Inner and Outer Top Cover Lid Welds

- 4 Lifting Points
- Outer Top Cover Plate
- Spacers
- Inspection Ring
- Cable Management Mast
Phased Array Ultrasonic Test
Xcel Energy Actions

Phased Array Ultrasonic Test (PAUT) Results

• Indications identified in OTCP & ITCP welds

Finite Element Analysis (FEA)

• Results of PAUT were analyzed by AREVA TN using a Finite Element Analysis Model
• Analysis showed adequate margin to support new Exemption Request

Exemption Request

• Exemption request with results of PAUT and FEA submitted to NRC in September 2015, under review
Lessons Learned

Root Cause Evaluation Result

“Xcel Energy management has not implemented adequate controls and ownership to ensure performance by the prime contractor meets Xcel Energy standards and expectations.”
Lessons Learned

Warning Signs

• Industry experienced “Pool-to-Pad” contractor
• Relied on review of performance audit conducted by another utility
• 2nd campaign conducted by “Pool-to-Pad” contractor at MNGP, first campaign completed in 2008 with challenges
• Contractor Level II NDE Inspectors’ lack of experience
• Contractor Level III NDE Inspector minimal time onsite
Lessons Learned

Oversight of Loading
Corrective Actions for Oversight of Loading

Revised Loading Procedures

• Requires Concurrent Verification of all procedural steps related to AREVA TN NUHOMS® 61 BTH DSC Technical Specifications

• Added Quality Control Hold Points to ensure Nuclear Oversight is in attendance to witness all Dye Penetrant Tests

• Requires Operations Shift Supervisor to review all actions related to AREVA TN NUHOMS® 61 BTH DSC Technical Specifications immediately following completion of procedural steps to ensure compliance with requirements
Other Changes to Oversight of Spent Fuel Activities

Project Oversight Governance Changes to Strengthen Barriers

• Expanded Project Oversight Plans to cover all phases of projects
• Created separate Project Oversight Plans for each site providing greater detail on implementation oversight and oversight responsibilities
• Strengthened oversight of vendor selection and qualification
• Successfully completed loading campaign at Prairie Island during 2015