Inspections & Operating Experience (OpE)

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Nondestructive Examinations for Cask Closure Welds

Division of Spent Fuel Management

Regulatory Conference 2014

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Introduction

- The purpose of this presentation is to provide an overview of nondestructive examinations (NDE) for cask closure welds and recent operating experience involving dye penetrant testing (PT) in the field.
- Success for this presentation is to have a good interaction and dialogue during the panel discussion with interested stakeholders related to NDE operating experience.

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Agenda

- Background Overview
- Inspection Operating Experience
- Summary of Inspection Results
- Inspection Oversight

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Background Overview

- 10 CFR 72.158 Control of Special Processes:
  - The licensee, applicant for a license, certificate holder, and applicant for a Certificate of Compliance (CoC) shall establish measures to ensure that special processes, **including welding**, heat treating, and **nondestructive testing**, are controlled and accomplished by qualified personnel using qualified procedures in accordance with applicable codes, standards, specifications, criteria, and other special requirements.
- 10 CFR 72.236(e):
  - The spent fuel storage cask must be designed to provide redundant sealing of confinement systems.

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Background Overview

- 10 CFR 72.236 (j):
  - The spent fuel storage cask must be inspected to ascertain that there are no cracks, pinholes, uncontrolled voids or other defects that could significantly reduce its confinement effectiveness.
- Verification of confinement weld integrity
- Inspection of these weld should follow the ASME code requirements of full volumetric and/or progressive surface examinations as applicable.

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Background Overview

- Consensus Codes & Standards for the design, fabrication, welding, & inspection of dry cask storage systems:
  - American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Code, Sections III, V, IX, and XI
  - American Welding Society (AWS)
- Specific to closure welds for stainless steel designs
  - ASME Section III, NB-5350 for Liquid Penetrant (PT) Examination
  - ASME Section V, Article 6, Liquid Penetrant Examination

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Background Overview

- Interim Staff Guidance for austenitic stainless steel designs
  - Interim Staff Guidance (ISG) ISG-15 and ISG-4, Revision 1 provided applicants with information on how the staff would review the canister lid and closure welds.
  - The ISGs noted that radiographic (RT) inspection was the preferred method for cask closure welds. However, the staff noted that RT may not be practical for field closure welds with fuel in the cask. Ultrasonic examination (UT) was the next preferred inspection.

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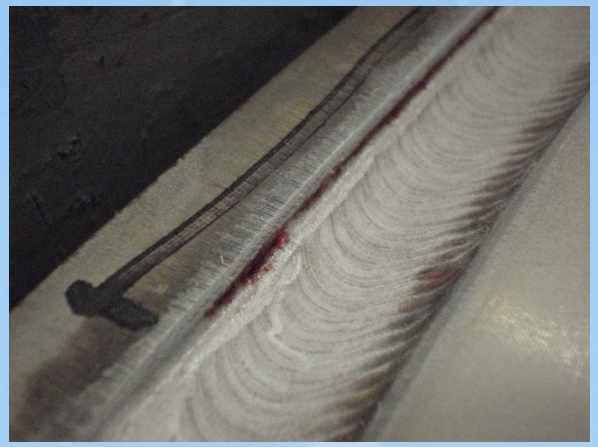
Background Overview

- Non-volumetric progressive surface examinations
  - Penetrant (PT) examination or magnetic particle testing (MT) for unusual designs and loading conditions that exist.
  - A stress reduction factor of 0.8 was imposed on the weld strength of the closure joint to account for imperfections or flaws that may be missed by a progressive surface examination

Liquid Penetrant Testing - How does it work?

- A liquid with high surface wetting characteristics is applied to the surface of a component under test
- The penetrant “penetrates” into surface breaking discontinuities via capillary action and other mechanisms
- Excess penetrant is removed from the surface and a developer is applied to pull trapped penetrant back to the surface
- With good inspection technique, visual indications of surface discontinuities present become apparent



Liquid Penetrant Procedure Qualification and Requirements

- Prior to performing the examination, a procedure should be developed and qualified.
- Prerequisites
  - Temperature, typically 40°F up to 125°F
  - Environmental conditions
  - Lighting
  - Surface condition considerations
  - Qualified Personnel

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Inspection Results

- The qualified personnel did not record all relevant and non-relevant indications or evaluate which one was rejectable as specified in the governing ASME Code prior to completing reports
- The approved PT procedures did not have adequate instructions and/or acceptance criteria for the use developers within certain temperature ranges in accordance with manufactures' recommendations
- Personnel did not perform the dye penetrant examinations in accordance with approved procedures

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Oversight

- Part 72, Subpart G - Quality Assurance related regulations for NDE and contractor oversight are as follows:
  - 72.154, Control of purchased material, equipment and services; and
  - 72.158, Control of special processes.
- General Licensee's using their Part 50 License
  - Appendix B, Criterion VII
  - Appendix B, Criterion IX

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Oversight

- NRC Generic Communications
  - NRC Information Notice 2010-08, Welding and Nondestructive Examination Issues
  - NRC Information Notice 2013-21, Welding Problems During Fabrication of Reactor Plant Components

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Questions