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1	1	Design Authority L. H. Goldmann R3-86			SNF Project Files R3-11
		Design Agent			
1	1	Cog.Eng. K. E. Smith K E Smith 10/9/98 R3-86			
1	1	Cog. Mgr. J. D. Cloud 10-11-98 R3-86			
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K. E. Smith K E Smith 10/9/98 Signature of EDT Originator — Date	Authorized Representative for Receiving Organization — Date	J. D. Cloud 10-11-98 Design Authority/ Cognizant Manager — Date	Ctrl. No. N/A KES 10/29/98 [ ] Approved [ ] Approved w/comments [ ] Disapproved w/comments

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Multi-Canister Overpack Inservice Inspection and Maintenance

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DE&S Hanford, Inc., Richland, WA 99352
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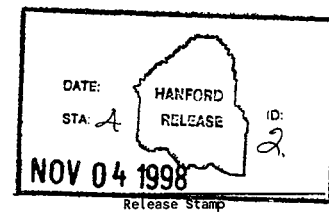
Abstract: The factors to be considered in establishing inservice inspection and maintenance requirements for the Multi-Canister Overpack (MCO) include evaluating the likelihood of degradation to the MCO pressure boundary due to erosion and corrosion, reviewing commercial practice for NRC licensed spent nuclear fuel storage systems, and examining the individual MCO components for maintenance needs. Reviews of the potential for MCO erosion and corrosion conclude that neither will pose a threat to the MCO pressure boundary. Consistent with commerical practice for spent fuel storage systems, the MCO closure weld will be helium leak tested prior to placement in interim storage. Beyond the CSB facility related monitoring plans (radiological monitoring, emissions monitoring, vault cooling data, etc.), no inservice inspection or maintenance of the MCO is required during interim storage.



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Issue Closure Package

Issue: **MCO Inservice Inspection and Maintenance**

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MULTI-CANISTER OVERPACK

INSERVICE INSPECTION AND MAINTENANCE

Introduction

After removal of water during the cold vacuum drying operation and placement of the welded cover cap over the mechanical closure, the Multi-Canister Overpack (MCO) will be placed in interim storage at the Canister Storage Building (CSB) for up to 40 years. Although the MCO is stored passively with no moving parts in an environmentally benign atmosphere, the need for inservice inspection and maintenance should be evaluated and documented. The factors to be considered in establishing inservice inspection and maintenance requirements for the MCO include evaluating the likelihood of degradation to the MCO pressure boundary due to erosion and corrosion, reviewing commercial practice for NRC licensed spent nuclear fuel storage systems, and examining the individual MCO components for maintenance needs.

Discussion

A. Erosion and Corrosion

Water both external and internal to the MCO will be removed at the Cold Vacuum Drying Facility (CVDF). Following completion of the CVD process, the MCO will be dry since the water vapor inside the MCO will be consumed by the bare uranium metal. During interim storage, potential interactions between the CSB storage tube material, the MCO, and water are precluded as the storage tubes are kept dry. The MCO sees no erosion during interim storage since it will only experience convective air currents on the outside of the MCO and flow of the captured ambient gasses inside the MCO. These gentle currents are powered by a fraction of the radiolytic decay heat of the fuel and do not result in velocities sufficient to cause erosion.

Corrosion aspects of the MCO materials have been considered in the design documentation (Reference 1). The two main areas of concern include inter-granular corrosion of the welded areas of the stainless steel shell and base metal corrosion. The enabling features for inter-granular corrosion include (1) halogen availability, (2) water availability at the heat affected zone, and (3) sensitization of the heat affected areas of the weld materials. Steps have been taken to assure that these enablers are appropriately absent from the MCO before and after the CVD process.

Materials in contact with the MCO during manufacturing and operations activities are prescribed to be of low halogen content. This low halogen requirement begins with the manufacture of the MCO and continues through to the operations of the CVD and the CSB. After cold vacuum drying is complete, essentially no water is available for use in galvanic conductivity or mass

transport of corrosion reactants or products inside the MCO. Later in the CSB, the storage tubes are kept dry and water is not allowed in contact with the MCOs. To minimize the potential for sensitization of weld heat affected zones, low carbon content stainless steels are used to assist in the precipitation control of chromium carbides in the material. These three preventitive measures combined with properly developed and implemented weld procedures will effectively assure that inter-granular corrosion of the welds and heat affected areas will not occur.

Base metal corrosion of the MCO pressure boundary materials also has been reviewed (Reference 1). The above mentioned measures of low halogen availability and an absence of free water in contact with the MCO materials during interim storage assure a very low general corrosion rate for the MCO pressure boundary.

An additional review of the potential for MCO degradation due to corrosion related mechanisms was performed by the Technical Assistance Group (TAG) on behalf of the U.S. Department of Energy, Richland Operations (RL) (Reference 2). The TAG review considered general corrosion, as well as localized corrosion phenomena including intergranular attack, stress corrosion cracking, hydrogen embrittlement, and pitting/crevice corrosion. The TAG review concludes that corrosion does not pose a threat to the MCO pressure boundary.

Because neither erosion nor corrosion will cause sufficient material loss to threaten the integrity of the MCO pressure boundary during interim storage at the CSB, inservice inspections to ascertain material erosion or corrosion are not planned.

B. Commercial Spent Nuclear Fuel Practice

The CSB facility has documented various monitoring and inspection functions to be performed in HNF-2332, "CSB Monitoring Strategy." Although the specific monitoring program to be applied to the MCOs is under review and will likely vary from that described in this document, the document does outline other facility monitoring programs including facility radiological surveys, CSB vault cooling data, select CSB storage tube monitoring, HVAC system data, and radioactive emissions monitoring data.

The NRC has published draft Standard Review Plans as NUREG-1536 for Dry Cask Storage Systems, and NUREG-1567 for Spent Fuel Dry Storage Facilities. While NUREG-1536 suggests routine periodic visual surface and weld inspections of the storage cask, neither document addresses inspection requirements for the spent fuel inner container, which is loaded in the storage cask.

In order to understand how the NRC guidelines have been applied in practice, a review of inservice inspection requirements contained in licensing documents for various commercial spent nuclear fuel storage systems was performed by Mr. Alan Hosler of SAIC. The survey results are presented in the table below:

Concept	Document	Comments Relative to Inservice Inspection and Surveillance Requirements
Foster Wheeler Energy Applications	EA-86/20, Rev 1A	Section 10.2.3.14 of EA-86/20 states that the SST shield plug seals should be inspected for material degradation at a 5-year minimum interval. Section 10.2.3.11 requires weekly inspection of the air inlets.
Pacific Nuclear Fuel Services (PNFS)-VECTRA, NUHOMS (Calvert Cliffs, HB Robinson) In the PNFS design the spent fuel is loaded into a dry storage container (DSC) which is then seal welded. The DSC is stored in horizontal storage module.	NUH-003, Rev 2 and BGE-01-126, Rev 1	The NUS generic application (NUH-003) requires, in Section 10.2.3, that visual inspection of the HSM air inlets and outlets be performed every 4 days. The NRC=s SER for Calvert Cliffs requires the inspection every 24 hours and after high winds (reference to high winds is missing from the Calvert Cliffs technical specifications). The materials license for Calvert Cliffs exempts the licensee from the provisions of 10 CFR 72.122(i) with respect to providing instrumentation and control systems for the DSC and HSM during storage operations. The license requires that the results of the one-time helium leak rate testing of the closure welds should not exceed 10^{-4} atm-cc/s. The technical specifications for HB Robinson requires that the an HSM have a loaded DSC removed at 5 and 10 years for visual inspection of the interior concrete surface of the HSM. The technical specifications also provide the utility the options to install thermocouples in some or all DSCs and HSMs but the installation is not a requirement of the technical specifications.
Pacific Sierra Nuclear (PSN) (Palisades) In the PSN design the spent fuel is loaded into a multi-assembly sealed basket (MSB) which is then seal welded. The MSB is stored in a ventilated concrete cask (VCC).	PSN-CPC-0114.002 and PSN-89-001, Rev 2A NRC SER, 3/29/91	PSN 89-001, Section 9.2 and the CPCo SAR, Section 10.2.3, require annual visual inspection of the cask exterior surface for chipping, spalling, or other surface defects and weekly inspection of the air vents. The NRC=s SER for the PSN design requires on a one-time basis after 5 and 10 years that all internal surfaces of one VSC be inspected to identify potential airflow blockage and material degradation. As the MSB is a seal-welded system, the NRC only requires the one-time helium leak test of each MSB closure weld (10^{-4} atm-cc per second at a pressure differential of 0.5 atmospheres).
Transnuclear (TN-40) Northern States Power - Prairie Island In the TN design fuel is loaded into the storage cask. The TN-40 design uses a single closure lid incorporating two metallic O-ring seals.	Prairie Island ISFSI SAR	Section 10.3.8 requires a visual surveillance of the ISFSI on a quarterly basis to determine no significant damage or deterioration of the exterior of the casks has occurred. The Prairie Island technical specifications require that the results of the one-time helium leak rate testing of the closure should not exceed 10^{-5} atm-cc/s (as opposed to 10^{-4} for the seal-welded cask). The technical specifications for Prairie Island require that the pressure between the cask double seals be checked daily at the alarm board to ensure the helium atmosphere in the cask is maintained.
Castor V/21 Virginia Power B Surry The Castor V/21 is a metal cask with a bolted closure	Surry Materials License	The technical specifications included with the materials license for Surry requires a pressure switch monitor the interlid pressure with a setpoint of 4 bar. TLDs are to be located on the boundary of the ISFSI and they are to be read on a quarterly basis. No other ISI requirements are established in the technical specifications.
Public Service Co. of Colorado - Fort St. Vrain	Fort St. Vrain SAR and SER	Section 10.1.2 for the SAR requires no surveillance of the fuel storage container (FSC). However, the Fort St. Vrain technical specifications require sampling and testing of the metal O-ring seals. This is applied to a sample of 6 FSCs at a 5-year interval. The technical specifications for Fort St. Vrain also require inspection of the cooling inlets and outlets every seven days.

Most commercial casks are neither instrumented nor connected to the facility with surveillance or control channels. For commercial spent fuel canisters that rely on a final welded boundary similar to the MCO, a one-time helium leak test of the final closure weld is required. Subsequent inspections to verify weld integrity or leaktightness are not specified. Commercial spent fuel canisters requiring periodic (every 5 years) inspection for leaktightness are those that employ dual mechanical seals, which is not the case for the MCO. The final closure weld on the MCO will be helium leak tested to 1×10^{-7} scc/sec. This approach is consistent with commercial spent nuclear fuel practice.

No commercial spent fuel storage facilities are applying ASME section XI to the systems or facilities. ASME Section XI "Rules for Inservice Inspection of Nuclear Power Plant Components" is written for operating nuclear reactors. Application of ASME Section XI is not a requirement for the MCO and would be inconsistent with commercial practice.

C. Maintenance

In accordance with the MCO Performance Specification, HNF-S-0426, the MCO is designed to minimize the need for preventative maintenance throughout its design life. Once the cover cap is welded over the mechanical closure at the CSB, the functioning components of the MCO, such as the seals, rupture disk, and process valve plugs are inactive and no longer accessible for repair/replacement. As such, there are no components of the MCO that require maintenance during interim storage.

Conclusion

Beyond those facility related items mentioned in the CSB monitoring plan, no inservice inspection or maintenance of the MCO is required while the MCOs are in storage at the CSB. Degradation of the MCO pressure boundary due to erosion and corrosion is highly unlikely. Consistent with commercial spent nuclear fuel storage practice, the MCO final closure weld will be helium leak tested prior to placement in storage.

References

1. HNF-S-0426, "Specification for the Spent Nuclear Fuel Multi-Canister Overpack", Revision 4

2. Memo, R. G. Ballinger, TAG, to Phil Loscoe, RL, "Comments Related to D.A. Powers Trip Report, Corrosion Issues", dated March 20, 1998.

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Subject: MCO ISSUE PAPERS PER ATTACHED DISTRIBUTION INDEX

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The Multi-Canister Overpack Issue papers listed below are being distributed as a package to facilitate future reference and use by SNF Project personnel. The following issue papers are attached:

1. HNF-2876, Oxygen Gettering Issue Closure Package
2. HNF-3265, MCO Number of Shield Plug Ports
3. HNF-3399, MCO Necessity of the Rupture Disk
4. HNF-3267, MCO Dual Pressure Rating
5. HNF-3293, MCO Ultrasonic Examination of Closure Weld
6. HNF-3354, MCO Monitoring Issue Closure Package and HNF-3312, MCO Monitoring Activity Description
7. HNF-3292, MCO Sealing Configuration
8. HNF-3266, MCO Design Pressure Rating
9. HNF-3255, ASME Code Requirements for MCO Design and Fabrication
10. HNF-3398, MCO Inservice Inspection and Maintenance
11. HNF-3420, MCO Internal HEPA Filters
12. HNF-3036, Low Reactive Surface Area Issue Closure Package
13. HNF-3270, MCO Pressure Testing