MEMORANDUM TO: R. W. Borchardt
Executive Director for Operations

FROM: Eric J. Leeds, Director
Office of Nuclear Reactor Regulation

SUBJECT: COMPLETION OF GENERIC SAFETY ISSUE 186, "POTENTIAL RISK AND CONSEQUENCES OF HEAVY LOAD DROPS IN NUCLEAR POWER PLANTS"

The Office of Nuclear Reactor Regulation (NRR) has completed its actions supporting closure of Generic Issue (GI) 186, "Potential Risk and Consequences of Heavy Load Drops in Nuclear Power Plants." The Nuclear Regulatory Commission (NRC) opened GI 186 to address a concern related to the measures to protect against the heavy load drops. The concern was based on the limited measures to protect against heavy load drops established during the resolution of Unresolved Safety Issue (USI) A-36, "Control of Heavy Loads near Spent Fuel," and the introduction of frequent spent fuel storage cask handling activities that posed greater potential for significant plant damage. Staff activities supporting closure include endorsement of an industry initiative clarifying the licensing basis for control of heavy loads, development of supplemental inspection guidance, endorsement of an industry standard for design of highly reliable overhead cranes, and reemphasis of existing regulations and guidance related to control of heavy loads.

The NRR staff had requested the Office of Nuclear Regulatory Research (RES) to reevaluate the resolution of USI A-36 (Reference 1). In accordance with Management Directive 6.4, "Generic Issues Program," RES screened the issue, classified it as GI 186, performed a technical assessment, briefed the Advisory Committee on Reactor Safeguards, and, transferred the issue to NRR for resolution. The RES staff documented the technical assessment and basis for recommendations in NUREG-1774 (Reference 2), "A Survey of Crane Operating Experience at U.S. Nuclear Power Plants from 1968 through 2002," dated July 2003. In the memorandum transferring GI-186 to NRR for resolution (Reference 3), the RES staff recommended the following:

1. Evaluate the capability of various rigging components and materials to withstand rigging errors (e.g., absence of corner softening material, acute angle lifts, shock from load shifts, and postulated human errors). As appropriate, issue necessary guidelines for rigging applications.
2. Endorse ASME [American Society of Mechanical Engineers] NOG-1, "Rules for Construction of Overhead and Gantry Cranes (Top Running Bridge, Multiple Girder)," for Type I cranes as an acceptable method of qualifying new or upgraded cranes as single-failure-proof. As appropriate, issue guidance endorsing the standard.
3. Reemphasize the need to follow NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants," Phase I guidelines involving good practices for crane operations and load movements. Continue to assess implementation of heavy load controls in safety significant applications through the Reactor Oversight Process.

ENCLOSURE

The NRR staff implemented these recommendations. The staff implemented the third recommendation through issuance of Regulatory Issue Summary (RIS) 2005-25 (Reference 4), "Clarification of NRC Guidelines for Control of Heavy Loads," issued October 31, 2005, which included a discussion of NRC heavy load handling guidelines and their relationship to operating experience described in NUREG-1774 and related inspection findings. The staff addressed the first and second recommendations in Revision 1 to Section 9.1.5, "Overhead Heavy Load Handling System" (Reference 5), of NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants." In this revision, the staff issued revised guidelines to improve the ability of slings used in single-failure-proof handling system applications to withstand rigging errors and to endorse the use of ASME NOG-1 (2004) as an acceptable method of qualifying new or upgraded cranes as single-failure-proof. The staff issued Supplement 1 to RIS 2005-25 (Reference 6), "Clarification of NRC Guidelines for Control of Heavy Loads," to notify stakeholders of the change in guidelines. In Supplement 1 to RIS 2005-25, the staff also described previously endorsed standards applicable to heavy load drop consequence analyses and regulatory expectations regarding implementation of safety analysis report change control requirements for heavy load handling activities.

Separately, during inspection of reactor vessel head replacements in the mid-2000's, NRC inspectors identified discrepancies between constraints described in reactor vessel head lift procedures and the assumptions used in evaluations of the consequences of a postulated reactor vessel head drop, which had been submitted to the NRC. These discrepancies included non-conservative differences in the maximum lift heights, the weight of the reactor vessel head assembly, and the medium present above the reactor vessel flange (i.e., air instead of the assumed height of water). Resolution of these discrepancies resulted in refueling outage delays at several units, in part due to a lack of clarity with respect to the licensing basis related to reactor vessel head lifts. Subsequent to these outage delays and NRC issuance of Supplement 1 to RIS 2005-25, the Nuclear Energy Institute proposed an industry-wide initiative (Reference 7) to ensure that heavy load lifts continue to be conducted safely and that plant licensing bases accurately reflect plant practices. The staff accepted the industry proposal and held several public meetings with industry representatives to support implementation. The staff incorporated activities related to the industry initiative within the scope of GI-186.

With the benefit of public interactions with the NRC staff, industry developed NEI 08-05 (Reference 8), "Industry Initiative on Control of Heavy Loads," Revision 0, July 2008. To support the initiative, NEI 08-05 includes guidelines for the following activities:

- Managing the risk associated with maintenance involving movement of heavy loads
- Performing best-estimate consequence analyses for postulated reactor vessel head drops
- Establishing single-failure-proof equivalence for handling systems when used for reactor vessel head lifts
- Updating the description of heavy load handling programs in the safety analysis report

By letter dated September 5, 2008, the NRC staff issued its safety evaluation addressing NEI 08-05 guidelines (Reference 9). The NRC staff also notified stakeholders of the safety evaluation through issuance of RIS 2008-28 (Reference 10), "Endorsement of Nuclear Energy Institute Guidance for Reactor Vessel Head Heavy Load Lifts," December 1, 2008. The industry initiative prescribed implementation of most guidelines by the first refueling outage beginning after July 1, 2008. The initiative specified that the safety analysis report be updated to include the basis for conducting safe heavy load movements in the update following that refueling

outage. Thus, the staff expects that licensees for all operating reactors completed implementation activities associated with the initiative by January 2011.

The staff determined that adequate verification activities have been completed to provide reasonable assurance of continued safe handling of heavy loads at nuclear power plants. These verification activities include voluntary implementation of supplemental inspection guidance (Reference 11) by region-based inspectors and sampling of updated safety analysis reports to establish that changes consistent with the industry initiative have been completed.

The staff met with the ACRS Subcommittee on, on XXXXX XX, 2011, and with the main Committee on XXXXX XX, 2011, to discuss the staff's technical basis for resolution of GI 186. In a letter dated XXXXX XX, 2011, to R.W. Borchardt, NRC Executive Director for Operations, the ACRS agreed […] (Reference 12). Therefore, the ACRS supports the closeout of GI 186.

Based on the above, the staff concludes that actions have been implemented to provide reasonable assurance of future safe handling of heavy loads. In particular, the description of the safe handling of heavy loads, which was included in the facility safety analysis report as part of the industry initiative, and the change control requirements applicable to the safety analysis report provide regulatory control over the handling of heavy loads that is equivalent to that provided for other operations of comparable safety significance. Thus, the staff concludes the safety concerns associated with GI-186 have been adequately addressed and the GI is closed.

References

1. Memorandum from B. Sheron to A. Thadani, "Proposed Generic Safety Issue -Potential Risk and Consequences of Heavy Load Drops in Nuclear Power Plants" (ADAMS Accession No. ML003714155), US NRC, April 19, 1999.

2. NUREG-1774, "A Survey of Crane Operating Experience at U.S. Nuclear Power Plants from 1968 through 2002," (ADAMS Accession No. ML032060160), July 2003.

3. Memorandum from A. Thadani to J. Dyer, "Proposed Recommendations for Generic Issue (GI)-186, "Potential Risk and Consequences of Heavy Load Drops in Nuclear Power Plants"," (ADAMS Accession No. ML03310301), US NRC, November 12, 2003.

4. Regulatory Issue Summary 2005-25, "Clarification of NRC Guidelines for Control of Heavy Loads," (ADAMS Accession No. ML052340485), October 31, 2005.

5. Section 9.1.5, Revision 1, "Overhead Heavy Load Handling System," (ADAMS Accession No. ML070380201) of the "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," NUREG-0800, March 2007.

6. Regulatory Issue Summary 2005-25, Supplement 1, "Clarification of NRC Guidelines for Control of Heavy Loads," (ADAMS Accession No. ML071210434), May 29, 2007.

7. Letter from A. R. Pietrangelo, Vice President, Regulatory Affairs, Nuclear Energy Institute, to J. E. Dyer, Director, Office of Nuclear Reactor Regulation, USNRC, "Industry Initiative on Heavy Load Lifts" (ADAMS Accession No. ML072670127), August 14, 2007.

8. NEI 08–05, “Industry Initiative on Control of Heavy Loads,” Revision 0 (ADAMS Accession No. ML082180684), July 2008.

9. Letter from W. Ruland, Director, Division of Safety Systems, NRR, USNRC, to T. Houghton, Director, Strategic Regulatory Programs, Nuclear Generation Division, NEI, ”Industry Initiative on Control of Heavy Loads,” (ADAMS Accession No. ML082410532) September 5, 2008.

10. Regulatory Issue Summary 2008-28, “Endorsement of Nuclear Energy Institute Guidance for Reactor Vessel Head Heavy Load Lifts,” (ADAMS Accession No. ML082460291), December 1, 2008.

11. Operating Experience Smart Sample: (OpESS) FY2007-03, Revision 2, “Crane and heavy lift inspection, supplemental guidance for IP-71111.20,” (http://www.nrc.gov/reactors/operating/ops-experience/opess/2007/ss07-03r2.pdf) September 12, 2008.

12. To be issued.