Operating Experience Smart Sample: (OpESS) FY2007-03, Rev. 2
"Crane and heavy lift inspection, supplemental guidance for IP-71111.20"
(Revision 2 was issued 9/12/2008)

Highlighted hyperlinked documents should be active if clicked from Word.

SOURCE DOCUMENTS:

1) IP-71111.20, "Refueling and other Outage Activities:" basic inspection guidance on reviewing crane heavy loads is referenced in this IP (Section 03.01 Review of Outage Plan: "for handling of heavy loads"). This OpE Smart Sample forwards additional inspection guidance related to crane and heavy lift activities.

2) EGM 2007-006, "Enforcement Discretion for Heavy Load Handling Activities," provides interim enforcement guidance during industry implementation of an initiative addressing heavy load handling activities. http://www.nrc.gov/reading-rm/basic-ref/enf-man/app-a.html

3) NEI 08-05, "Industry Initiative on Control of Heavy Loads," Revision 0, provides industry developed guidelines for implementation of the initiative with respect to management of risk, performance of reactor head drop consequence analysis, establishment of single failure proof crane equivalence, and updating the safety analysis report. (ADAMS Accession No. ML082180666)

4) NRC Staff Safety Evaluation addressing NEI 08-05, "Industry Initiative on Control of Heavy Loads," Revision 0, provides the staff position regarding industry developed guidelines for implementation of the initiative. Through the safety evaluation, the NRC staff has endorsed the methods in NEI 08-05 for the specified applications, with certain exceptions and clarifications. (ADAMS Accession No. ML082410532)

CORNERSTONES:

Initiating Events (50%) / Mitigating Systems (25%) / Barrier Integrity (25%)

APPLICABILITY:

All license holders of operating commercial nuclear reactors.

OBJECTIVES:

1) Support NRC review of licensees' activities related to heavy lifts and crane inspections.
2) Ensure safety by comparing current heavy lifting procedures with licensees' commitments, including the industry-wide commitment to implement the initiative on control of heavy loads.
3) Document any inspection findings in the quarterly inspection report.

INSPECTION GUIDANCE:

This OpESS will be inspected using: IP-71111.20, "Refueling and other Outage Activities." Review the Source Documents (listed/ linked above) to obtain a general understanding of the concerns. Implementation

of this OpESS by resident or regional inspection staff is voluntary. Implementation should be based on availability of resources for IP-71111.20 and either an indication of potential issues affecting the control of heavy loads or a lack of recent inspection of this area.

The following inspection activities will help inspectors ensure that heavy lifting evolutions at their facilities are being performed in a manner consistent with safety and with the industry-wide commitment to implement the industry initiative on control of heavy loads. The activities will also help provide information to headquarters for follow-up (see heavy load technical support contact information below).

NOTE: Figure 1 provides a flowchart for identification of issues related to control of heavy loads.

1. Determine whether the crane used to lift the reactor vessel head is "single-failure-proof" or had been evaluated as equivalent to "single-failure-proof." (Note: many BWRs with Mark I and II containments have single-failure-proof cranes; no PWR polar cranes are fully single-failure-proof. In the response to the Generic Letters (GL 80-113 and GL 81-07) addressing "Control of Heavy Loads," some licensees classified the polar crane as equivalent to "single-failure poof" based on modifications to reduce the risk of "two-blocking" and other potential causes of load drops.) Section 3 of NEI 08-05 provides guidelines acceptable to the NRC staff for establishing the reactor building crane as equivalent to single failure proof for reactor vessel head lifts only. Review the licensee's basis and other documentation designating the crane as "single-failure-proof" or equivalent.

2. Verify that the licensee has a preventive maintenance program in place based on vendor recommendations for their type of crane (i.e. single-failure-proof or non-single-failure-proof), and that crane testing and inspection procedures are completed prior to use (i.e., yearly or just before use) for reactor disassembly, [per ANSI/ASME B30.2 "Overhead and Gantry Cranes (Top Running Bridge, Single or Multiple Girder, Top Running Trolley Hoist.)"] Review licensee's implementation of crane preventive maintenance, and testing and inspection procedures prior to reactor disassembly/head lift. A "sampling" of the licensee's actual performance of the crane testing and inspection procedure should be reviewed by direct observation, if possible, during the outage. Also verify that the special lifting device used for reactor vessel head lifts is tested consistent with the applicable standard (typically, ANSI/ANS N14.6, "Standard for Special Lifting Devices for Shipping Containers Weighing 10,000 pounds (4,500 kg) or More for Nuclear Materials").

3. Verify reactor vessel head lift procedures conform to an acceptable safety basis. Acceptable safety bases include: (1) use of a single-failure-proof crane or equivalent conforming to the guidelines in Section 3 of NEI 08-05, (2) a valid load drop analysis conforming to the guidelines in Section 2 of NEI 08-05, or (3) an interim analysis supporting lifts over flooded refueling cavities until the licensee completes the actions necessary to conform to items (1) or (2), as specified in a letter to NEI dated May 27, 2008 (ADAMS Accession No. ML081410597). Where a valid load drop analysis is available, consider reviewing the following aspects of the licensee's load drop analysis:

3.a. Verify that the licensee's load drop analysis bounds their lifting procedures with regard to maximum lift height of the reactor vessel head over the reactor vessel. An actual ("sampling") verification that the licensee is following these procedural limits (including horizontal safe load paths) should also be confirmed by direct observation during a reactor vessel head lift, if possible, during the outage. Compare the height assumed in the load drop analysis with that listed in the procedural limitation to verify commitments are met.

3.b. Verify that the load drop analysis (and any associated procedures) have been updated to reflect any significant change in the weight of the heavy load to be lifted or in the capability of the crane to carry such loads. A new reactor head may weigh more than the head weight considered in the load drop analysis, or the addition of lead shielding or permanent structures to the existing reactor vessel head may add significant weight.

3.c. Verify that the licensee's load drop analysis bounds its lifting procedures with regard to medium (i.e., water or air) through which the drop would occur. Verify the licensee's procedural limits regarding medium through which a dropped load would travel are bounded by its load drop analysis.

3.d. Verify that the methodology and acceptance criteria used in recent load drop analysis are consistent with Section 2 of NEI 08-05 (Note: Existing analyses previously subject to NRC licensing review or detailed inspection should be evaluated considering the guidance of NRR Office Instruction LIC-202, "Managing Plant-Specific Backfits and 50.54(f) Information Requests."). The staff considers the more conservative acceptance criteria of Appendix F, "Rules for Evaluation of Service Loadings with Level D Service Limits," to the American Society of Mechanical Engineers' Boiler and Pressure Vessel Code, Section III, Division 1, acceptable for the reactor coolant system piping and reactor vessel when using the analytical methods proposed in the industry guidance. Inspectors should notify NRR staff of otherwise technically adequate analyses providing a best-estimate evaluation of the consequences of a postulated reactor vessel head drop that do not fully satisfy the guidance specified in Section 2 of NEI 08-05.

REPORTING INSPECTION RESULTS / TIME CHARGES / ADDITIONAL ISSUES:

NEI 08-05, "Industry Initiative on Control of Heavy Loads," Revision 0, provides guidelines for implementation of an industry initiative related to control of heavy loads. Licensees that implement the initiative consistent with NEI 08-05 prior to the first outage after July 1, 2008, are performing in a manner consistent with industry-wide goals for the initiative. Inspectors should inform the NRR technical contact listed below of licensees that fail to satisfy the goals for the initiative to support future discussions with NEI. In addition, these licensees also fail to satisfy the conditions for enforcement discretion described in EGM 2007-06 and, therefore, may be subject to enforcement for past performance deficiencies related to control of heavy loads.

The safety significance of a potential reactor vessel head drop depends on the reliability of the handling system (i.e., the crane and the attached lifting device) and the potential consequences of a drop. The reliability of a well operated and maintained handling system is high, which limits the significance of deficiencies in the load drop analysis. However, performance deficiencies affecting the reliability of the handling system in holding the reactor vessel head may have greater safety significance. Multiple performance deficiencies that either significantly affect the reliability of the handling system or affect both the reliability of the handling system and the validity of the head drop consequence evaluation should be evaluated using the process described in NRR Office Instruction LIC 504, "Integrated Risk-Informed Decision-Making Process for Emergent Issues."

Reactor vessel head removal, in addition to many other heavy load handling activities, could be classified as a maintenance activity. The reactor vessel and attached piping performs a shutdown coolant inventory retention function that is significant to public health and safety. Many of the commitments related to heavy loads handling at each nuclear power plant are measures that manage the increase in risk that results from heavy load handling. Therefore, conformance with many of the heavy loads handling commitments are necessary to comply with the requirements of 10 CFR 50.65(a)(4) with regard to managing the risk associated with heavy load movements in support of maintenance activities. In addition, Appendix A, Typical Procedures for Pressurized Water Reactors and Boiling Water Reactors," to Regulatory Guide 1.33, "Quality Assurance Program Requirements (Operation)," lists removal of the reactor head as Item 9.d (6). Accordingly, these procedures are subject to the requirements of Criterion V, "Instructions, Procedures, and Drawings," of Appendix B to 10 CFR Part 50 and, at many facilities, technical specification administrative controls related to the establishment, maintenance, and implementation of these procedures. Finally, the requirements of 10 CFR 50.59 and 10 CFR 50.71(e) apply to changes to the safety analysis report and the content of updates to the safety analysis report, respectively. These regulatory requirements have been used as the basis for violations related to heavy load handling activities.

Consequently, findings involving commitments that affect handling system reliability may be evaluated relative to the requirements of 10 CFR 50.65(a)(4). Findings related to procedural constraints on handling of the reactor vessel head may be evaluated relative to the requirements of technical specification administrative control requirements related to the reactor vessel head removal procedure or Criterion V of Appendix B to 10 CFR Part 50. The NRC staff safety evaluation of NEI 08-05 provides the staff position regarding industry developed guidelines for implementation of the initiative, and procedures established and implemented based on evaluations consistent with the staff position are acceptable. In addition, analyses that are inconsistent with the staff position, but that have previously been accepted by the staff (tacitly or through express evaluations or inspections), should be evaluated for acceptability using the guidance of NRR Office Instruction LIC-202, "Managing Plant-Specific Backfits and 50.54(f) Information Requests."

Document any inspection findings, as applicable, in an integrated inspection report and reference the OpESS number and title (example: "Review of Operating Experience Smart Sample (OpESS) FY2007-03, Crane and heavy lift inspection, supplemental guidance for IP-71111.20." Consistent with IMC 0612, licensee-identified performance deficiencies of very low safety significance and minor findings would not be documented in the inspection report.

Inspection time for this OpESS is to be charged to the baseline procedure under which it is being documented (IP-71111.20), along with any routine preparation and documentation time charges.

Additional issues and questions related to this OpESS may be documented in the NRR Inspector Community Forum. It is important to use the related number (OpESS FY2007-03) posting area in any Inspector Forum communication for future search capability and follow-up by other inspectors and the NRR Operating Experience Branch / Inspection Program Branch.

FIGURE 1 – Flowchart for Control of Heavy Loads Inspection