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DEFENSE NUCLEAR FACILITIES SAFETY BOARD

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January 21, 2004

The Honorable Linton Brooks
Administrator
National Nuclear Security Administration
U. S. Department of Energy
1000 Independence Avenue, SW
Washington, DC 20585-0701

Dear Ambassador Brooks:

The staff of the Defense Nuclear Facilities Safety Board (Board) recently conducted a review of hoisting and rigging operations, equipment, and safety documentation at the Nevada Test Site (NTS). The Board's staff focused on reviewing hoisting and rigging practices at the Device Assembly Facility, U1a Complex, G-tunnel, and the Radiological Waste Management Complex. The Board's staff noted two shortcomings that should be addressed to ensure equipment relied upon for safety is appropriately maintained.

- Documented Safety Analyses are being developed at NTS that include postulated events involving mechanical insults and drops of nuclear devices and materials. Several of the postulated accident scenarios could result in significant radiological or chemical exposures to workers and therefore, appear to warrant safety-significant controls. However, the hoisting and rigging equipment involved in many of these scenarios has not been classified as safety-significant.
- NTS does not appear to have a formalized process to compare the maintenance recommendations of a manufacturer, typically found in the equipment's owners manual, to the facility's maintenance procedures or routine inspection program. Equipment maintenance and inspection requirements are credited as reducing risk for some systems relied upon for safety.

An issue report on this review is enclosed for your information and use as appropriate.

Sincerely,

John T. Conway
Chairman

c: The Honorable Beverly Ann Cook
Ms. Kathleen A. Carlson
Mr. Mark B. Whitaker, Jr.

Enclosure

DEFENSE NUCLEAR FACILITIES SAFETY BOARD

Staff Issue Report

December 22, 2003

MEMORANDUM FOR: J. K. Fortenberry, Technical Director

COPIES: Board Members

FROM: D. Kupferer

SUBJECT: Review of Hoisting and Rigging at the Nevada Test Site

This report documents a review of the hoisting and rigging program at the Nevada Test Site (NTS) conducted by the staff of the Defense Nuclear Facilities Safety Board (Board). The staff focused on reviewing the organization, management, and procedures related to hoisting and rigging practices at the Device Assembly Facility (DAF), U1a Complex (U1a), G-tunnel, and the Radiological Waste Management Complex (RWMC), including the storage and disposal sites at Areas 3 and 5.

General. Personnel representing the National Nuclear Security Administration's (NNSA) Nevada Site Office (NSO), Bechtel Nevada (BN), Los Alamos National Laboratory (LANL), and Lawrence Livermore National Laboratory (LLNL) participated in the review. The specific topics covered during the review included:

- Standards and codes required by contract and implemented in the hoisting and rigging program by BN, LANL, and LLNL at NTS;
- Hazard and accident analyses related to hoisting and rigging equipment and the safety classification of that equipment;
- Overview of hoisting and rigging operations including discussions of critical lifts;
- Training and qualification program for personnel involved in hoisting and rigging operations;
- Standards, codes, and industry guidance relevant to the procurement and installation of NTS hoisting and rigging equipment, including cranes, hoists, and below-the-hook lifting devices; and
- Standards, codes, and industry guidance relevant to the testing and maintenance of NTS hoisting and rigging equipment, including cranes, hoists, and below-the-hook lifting devices.

The Board's staff also participated in facility walk-downs at DAF, U1a, and Area 3 radiological waste disposal operations, to examine hoisting and rigging equipment. The walk-downs included observing on-going hoisting and rigging operations.

Overall, the hoisting and rigging program at NTS has identified most of the appropriate industry codes and guidance. However, the Board's staff noted two shortcomings that should be addressed to ensure equipment relied upon for safety is appropriately maintained: (1) the majority of hoisting and rigging equipment is not currently classified as safety-significant despite the fact that some equipment is credited in the documented safety analyses and relied upon for worker safety, and (2) manufacturer's recommendations are not consistently applied in the ongoing maintenance and inspection program. A noted strength of the hoisting and rigging program at NTS is the diligence demonstrated at tracking the certifications of hoisting and rigging personnel.

Hoisting and Rigging Standards, Codes, and Industry Guidance. Identifying hoisting and rigging standards and codes is complicated at NTS due to the organizational structure of the site's facilities and programs. In general, BN provides hoisting and rigging support to LANL and LLNL programs and is therefore responsible for the operation, maintenance, inspection, and certification of cranes and hoists. The exception to that generality is that LANL or LLNL will periodically ship hoisting and rigging equipment to NTS for use with a particular nuclear device.

BN Company Directive (CD) CD-0444.070, *Hoisting Apparatus, Cranes, and Conveyors*, is the upper tier document for hoisting and rigging equipment procured and operated by BN. CD-0444.070 flows down to other CDs and Organizational Procedures (OP). BN references the appropriate industry codes, Federal regulations, and Department of Energy (DOE) standards in the CDs and OPs (with the possible exception of ASME NUM-1, *Rules for Construction of Cranes, Monorails, and Hoists*, and ASME NOG-1, *Rules for Construction of Overhead and Gantry Cranes*). However, BN personnel did not demonstrate strong understanding of the requirements and guidance described within these codes, regulations, and standards.

NSO and BN could benefit from participating in DOE's Hoisting and Rigging Technical Advisory Committee (HRTAC). The HRTAC is an advisory body that supports policy efforts aimed at ensuring the safe performance of hoisting and rigging activities at DOE and NNSA facilities through the review and resolution of identified generic hoisting and rigging safety issues. HRTAC circulates information to DOE site offices regarding recent equipment failures and both corrective and preventive maintenance recommendations. The following DOE site offices and their associated contractors are currently involved in HRTAC in some capacity: Savannah River Operations Office, Livermore Site Office, Idaho Operations Office, Kansas City Site Office, Chicago Operations Office, and the Richland Operations Office.

Safety Classification of Equipment. Safety-class structures, systems, and components (SSCs) are defined in Title 10, U.S. Code of Federal Regulations, Part 830, *Nuclear Safety Management*, (10 CFR 830) and DOE Standard 3009, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses*, (DOE-STD-3009-94) as "structures, systems, or components including portions of process systems, whose preventive and mitigative function is necessary to limit radioactive hazardous material exposure to the public, as

determined from the safety analyses.” Safety-significant SSCs are defined in 10 CFR 830 and DOE-STD-3009-94 as “structures, systems, or components which are not designated as safety-class SSCs but whose preventive or mitigative function is a major contributor to defense in depth and/or worker safety as determined from safety analyses.” DOE-STD-3009-94 continues, “as a general rule of thumb, safety-significant SSC designations based on worker safety are limited to those SSCs whose failure is estimated to result in a prompt worker fatality or serious injuries or significant radiological or chemical exposures to workers.”

Documented safety analyses are being developed at NTS that include postulated events involving mechanical insults and drops of nuclear devices and materials. Several of the postulated accident scenarios could result in significant radiological or chemical exposures to workers and therefore appear to warrant a safety-significant controls. However, the hoisting and rigging equipment involved in many of these scenarios has not been classified as safety-significant. Defense-in-depth controls do exist to mitigate the consequences of some postulated events.

For example, the documented safety analysis for the RWMC includes an evaluation of a scenario in which an inner container is dropped as it is being removed from an overpack container during intrusive sampling activities. This event has been defined as an anticipated event that would have significant consequences (Severity-of-Consequence Level A) to the worker. Two specific controls are in place to reduce the potential consequences to the worker associated with the event: (1) the equipment design, including design of the drum hoist; and (2) a maintenance, testing, and inspection program. These controls effectively reduce the Severity-of-Consequence Level of this event from an unmitigated consequence of Level A (significant) to a mitigated consequence of Level B (moderate). However, the safety designation of the drum hoist is defense-in-depth, as opposed to safety significant. In addition, some of the inner containers involved in the aforementioned drop scenario are unvented. The consequences associated with dropping an unvented container have not been analyzed.

A second example exists at U1a. Subcritical Experiment (SCE) devices could be involved in drops or mechanical insults that could result in worker injury or radiological exposure. For instance, a nuclear-certified crane is used to lower SCE devices into U1a tunnels and has been designated safety significant due to the possibility of crane failure resulting in significant consequences to the co-located worker. In some cases, a man/small equipment lift is used to lower SCE devices into the U1a tunnels, as opposed to the nuclear-certified crane. While potential failure of the man-lift does not pose a high risk to the public, failure of the man-lift is inherently dangerous with respect to the facility worker. During staff-to-staff discussions with BN, the Board’s staff learned that none of the hoisting and rigging equipment underground in U1a has been designated safety class or safety significant, including the man-lift.

A third example is the hoisting and rigging equipment that is to be used in G-tunnel. Again, during staff-to-staff discussions, the Board’s staff learned that none of the hoisting and rigging equipment that is to be used as part of G-tunnel’s mission is currently being considered either safety significant or safety class. This equipment could potentially be used to transport nuclear explosive devices, including damaged nuclear weapons and improvised nuclear devices. Any failure of the hoisting and rigging equipment while handling these devices or weapons could

result in severe consequences to the public and workers, including public exposure to radioactive/hazardous materials.

Maintenance Procedures. NTS does not appear to have an established process to compare the maintenance recommendations of the manufacturer (typically found in the equipment owner's manual) to the facility's maintenance procedures for hoisting and rigging equipment. Equipment maintenance and inspection requirements are credited as reducing risk for some safety systems. The manufacturer's recommendations should be reviewed individually to determine if a maintenance recommendation should be adopted as part of a routine inspection program. If some of the manufacturer's recommendations are determined to be unnecessary, the rationale to exclude that particular recommendation from the facility's maintenance program should be technically reviewed and documented.

Currently, the NTS hoisting and rigging program does not utilize a systems engineering approach, in that no person or group is responsible for tracking and trending equipment maintenance and deficiencies. Such trending could be used to help establish a predictive maintenance program to achieve increased reliability.

Training of Personnel. Training of hoisting and rigging personnel is, in part, regulated by the local union. The union is requiring personnel involved in hoisting and rigging to be certified through the Southern California Crane and Hoisting Certification Program. Recertification is required every three years. It appears that BN is appropriately tracking the training certifications and certification expirations of the hoisting and rigging personnel.