UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION SUPPORTING APPROVAL OF CRANE MODIFICATIONS AND USE OF 70 TON SPENT FUEL SHIPPING CASK IF-300 NORTHERN STATES POWER COMPANY MONTICELLO NUCLEAR GENERATING PLANT DOCKET NO. 50-263

Introduction

In its January 22, 1976 submittal, the Northern States Power Company (NSP) proposed an interim program which would use the existing Monticello overhead crane handling system for offsite shipment of spent fuel. Further, NSP stated that the proposed interim program would be replaced with a permanent cask handling program once the long term program had been completed and implemented.

With certain qualifications, e.g., limiting cask weight to 25 tons, the NRC, by letter dated January 25, 1977, concluded that the proposed interim cask handling program was acceptable.

On November 22, 1976, NSP completed its study of the permanent cask handling program and submitted a description of its proposed crane modifications and a safety analysis of the proposed 85 ton (rated load) reactor building crane system. In addition, on February 28, 1977, NSP responded to an NRC request for certain additional information, regarding the proposed reactor building crane system. NSP proposed to handle the 70 ton IF-300 spent fuel shipping cask with the modified reactor building overhead crane.

Discussion and Evaluation

The reactor building overhead crane system is required for handling heavy loads during refueling operations and during operations involving the offsite shipment of spent fuel. The heaviest load that has to be handled during refueling operations is comparable to the 70 ton IF-300 spent fuel shipping cask. However, this load is only handled when the plant is in a cold shutdown condition. Further, NSP states that sufficient diversity in equipment exists to maintain the reactor in a cold shutdown condition should any one of the refueling loads be dropped. Therefore, this operation does not pose a significant safety hazard.

An analysis previously submitted by NSP indicates that the plant's structures are not capable of withstanding the drop of a 70 ton shipping cask. However, the interim program for offsite shipment of spent fuel was limited to the use of a 25-ton cask. The travel path of the cask between the transporter, laydown area, and the spent fuel pool cask loading area was established by the licensee. This travel path passes over those portions of the structure most capable of withstanding a cask drop accident. If the carrying height of the cask above the operating floor does not exceed six inches, the structures are capable of withstanding the drop of a 25-ton cask as indicated by NSP analyses. Figure 3-1 (attached) shows the travel path of the cask in relation to the supporting members below the operating floor.

In its November 22, 1976 submittal, NSP proposed to upgrade the overhead crane system by making certain modifications. These modifications will consist of replacing the existing trolley and hoisting system. Within the constraints of available space and requirements relative to performance, movement and weight, the new trolley and redesigned hoisting system will, where practical, provide a dual load path, single-failure-proof hoisting system which complies with the provisions of draft NRC Regulatory Guide 1.104, "Overhead Crane Handling Systems for Nuclear Power Plants." The non-redundant components, e.g., main hook, load block, shafts and structures will have increased load safety factors to reduce the likelihood of their failure.

A new trolley will be required to accommodate the new main hoist within the existing space, clearance and safety requirements without restricting its lifting capacity of travel envelope.

The double drum main hoist will use a unique quad-support reeving system. Two redundant parallel spur gearing and speed reducers will be provided to deliver power to both ends of the dual main hoist cable drums. Each power train has been designed for the duty cycle and projected life of the crane. Both gear trains will be mechanically connected to one another via the main hoist motor shafting. A failure in either of the two power trains would not result in loss of control of load. Following a postulated failure and the removal of any obstructions resulting from the failure, the system would still be capable of performing the lowering and hoisting functions.

A drum retention structure will be incorporated with each of the drums to provide backup support in the event of a postulated drum shaft, bearing or machinery support failure.

The number of main hoist holding brakes has been increased from two to three. Each brake is designed to hold 125 percent of the hoist motor torque at base speed. The brakes will be set upon: (1) loss

of electrical power to the brakes; (2) reduction of the hoist motor voltage to 70 volts; (3) the actuation of either the upper or lower hoist travel limit switches; or (4) the loss of power to the main hoist motor. The circuitry has been arranged such that the brakes will be sequentially applied with a 0.5 second delay interval for the second and third brakes.

The reeving system consists of four 6 x 37 EIPS-IWR 7/8 inch diameter wire ropes. The proposed system has a minimum factor of safety of 5:1 under rated load. Due to reeving and equalizer systems, should any one rope fail the load will be maintained in a safe, stable condition by the remaining three wire ropes.

The reeving is such that one end of each of the four rope sections terminates at one of the two load equalizer floating pistons. The two equalizers are double acting hydraulic cylinders which equalize the cable loads and compensate for normal rope stretch by slow movement of the floating hydraulic pistons. Movement of the floating piston causes hydraulic fluid to flow from one end of the cylinder to the other end through a velocity limiting device. In the event of a postulated failure of one rope, the velocity of the hydraulic fluid being moved from one end of the hydraulic cylinder to the other side creates a large pressure drop. Therefore, the hydraulic cylinder will act as a dashpot which reduces the shock of transferring its load to the remaining intact ropes. Switches have been provided to detect abnormal displacement of the floating pistons. When these switches are actuated, the hoist system will be deactivated and the holding brakes set.

Due to the existing plant structural limitations and lift height requirements, the maximum wire rope interior fleet angle will be two degrees twenty minutes rather than the one and one-half degrees recommended in Regulatory Guide 1.104, but is less than the two degrees thirty minutes allowed in AISE Standard No. 6, "Specification for Electric Overhead Traveling Cranes for Steel Mill Service." Further, to assure the integrity of the rope NSP will perform rope inspection, replacement, and maintenance in accordance with ANSI B 30.2-1967, "Safety Code for Overhead and Gantry Cranes". At the rated load of 85 tons, the non-redundant main hoist hook, load block trunnion, hook nut, hook thrust bearing, upper sheave nest supoort structure and load blocks will have a factor of safety of 10:1.

Moreover, "two blocking" redundant hoist limit switches, actuated by the load block, will be provided to preclude excessive cable loads from being developed due to the lower load block contacting the upper load block. To avoid a "load hangup" while lifting any critical load

in the equipment hatch, the bridge and trolley will be properly positioned for the lift and then power will be locked out on these drives during the time of the lift. Further, additional protection against overload conditions has been provided by incorporating two overload sensing devices on each half of the redundant reeving system. These load cells will trip the main hoist motor and set the holding brakes should the load reach 125 percent of design rated load.

To prevent overspeed, an overspeed switch will be incorporated in the existing main hoist control system which will trip the hoist drive motor and set the holding brakes.

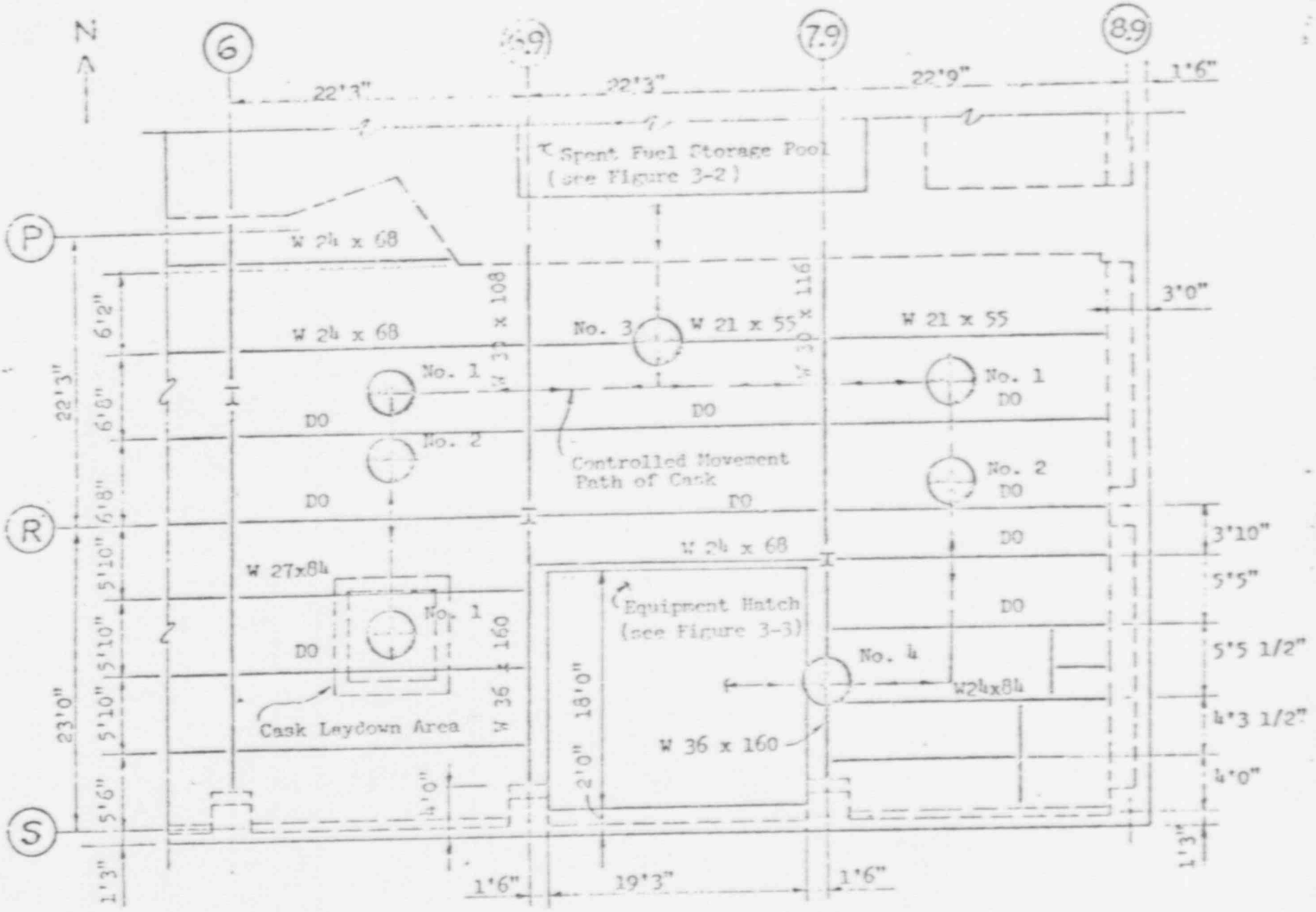
Inspection and testing will be carried out on a periodic basis as required by ANSI B30.2.0 and OSHA Part 1910, Section 1910.179.

To provide further assurance that a postulated cask drop accident will not occur when handling the IF-300 cask, NSP states they will only use the redundant IF-300 cask handling yoke.

Conclusion

We find that NSP's proposed modifications to the reactor building crane has incorporated all the provisions of draft Regulatory Guide 1.104 that are practical for the Monticello design. We conclude that in addition to the proposed modifications to the reactor building crane, the licensee has proposed adequate measures to preclude the occurrence of a cask drop accident and to mitigate its effect in the very unlikely event that it should occur. Therefore, the proposed permanent modifications to the reactor building overhead crane are acceptable.

Date: MAY 19 1977



Postulated cask drop location with bottom end impact

STRUCTURAL FRAMING PLAN
FOR THE OPERATING FLOOR AT ELEVATION 1027'-8"

FIGURE 3-1