NSP

NORTHERN STATES POWER COMPANY

MINNEAPOLIS, MINNESOTA 55401

October 27, 1976

Mr Victor Stello, Director
Division of Operating Reactors
U S Nuclear Regulatory Commission
Washington, DC 20555

Dear Mr Stello:

MONTICELLO NUCLEAR GENERATING PLANT
Docket No. 50-263 License No. DPR-22

References: (a) NSP letter, L O Mayer to V Stello, dated January 22, 1976, "Off-Site Shipment of Spent Fuel"

(b) NSP letter, L O Mayer to V Stello, dated February 13, 1976, "Off-Site Shipment of Spent Fuel"

(c) NSP letter, L O Mayer to V Stello, dated June 16, 1976, "Off-Site Shipment of Spent Fuel"

Off-Site Shipment of Spent Fuel

In references (a) through (c) we presented detailed plans for the shipment of spent fuel from the Monticello Nuclear Generating Plant. With one exception, all aspects of our proposed fuel shipping plans have been accepted by your staff. The remaining open item concerns the safety of handling the shipping cask in the equipment hatch area.

We reported in reference (a) that the shipping cask will be positioned over the southeast corner compartment wall while the cask is being hoisted to the 1027'-8" elevation. Other precautions to be taken during this operation were reported on page 5 of reference (c). The crane pre-lift checkouts, as reported in section 6.2 of reference (a), will provide additional assurance for safe cask handling at all locations.

Based on the precautions noted above, it is our opinion that the probability of a cask drop at any location is negligible, particularly in light of the limited time interval for which this plan will be used. In reference (c) we stated that the proposed interim plan would be needed for approximately a four-year

period. Since that submittal, we have issued a purchase order for the procurement of a redundant crane trolley. Based on an estimated delivery time of one year, the interim spent fuel shipping plan would be needed for approximately eighteen months.

Our evaluation of the cask drop in the equipment hatch also shows that the effects on the health and safety of the public would be negligible. Under the most probable circumstances of a cask drop; i.e., a vertical drop onto the corner compartment wall, it is not likely that both the torus and RHR would be rendered inoperable. The corner compartment wall would absorb the impact of the cask and prevent widespread damage of the floor and surrounding equipment. Under worst case conditions, however, it is conceivable that the torus and RHR systems could be damaged sufficiently to prevent their use in the ensuing plant shutdown and cooldown.

We have determined that a complete shutdown and cooldown can be completed without the torus and RHR systems. In this situation, the normal plant cooldown procedure can be utilized until steam generation in the vessel has been terminated. At this time, the reactor vessel would be flooded up to the level of the main steam lines. Reactor water would then be recirculated to the main condenser through main steam line drains and the turbine bypass line. The mechanical vacuum pump would be used to maintain a vacuum in the condenser. The condensate pump would be used to supply water to the reactor vessel and to recirculate water over the condenser tubes through the condensate recirculation line. Detailed procedures for cooldown without the RHR system will be prepared prior to conducting cask handling operations. These procedures will be available at the site for inspection by Region III Inspection and Enforcement personnel.

The worst case cask drop in the equipment hatch would pose operational problems, as stated above, but would have a negligible effect on the health and safety of the public. The consequences of this accident are well below those of other accidents for which the plant was designed.

One member of your staff identified a possible event which he felt could possibly result in a cask drop accident. The event identified was a sudden application of the hoist brakes, caused by a loss of power to the crane. A very conservative analysis of this event is shown in the attachment to this letter. This analysis demonstrates that an adequate factor of safety on the cask yoke would be present in the event of a loss of power to the crane while moving the load at the maximum speed of the crane. It should be noted that on page 5 of reference (c) it was stated that hoisting speeds would be restricted to no greater than 5 fpm.

Our detailed evaluation of the equipment hatch drop case was extended to the cask movement path reported in reference (a). It was concluded that this path did not offer any additional protection and, in fact, may be detrimental due to the additional movements required. It was, therefore, concluded that it would be

safer to move directly west from Point A, until the cask is in line with Travel Path F-G, and then move directly north to the cask laydown pad. This travel path will involve less handling time and further reduce the probability of handling errors.

The referenced spent fuel shipping plans have been generated at considerable time and expense to Northern States Power Company. Based on our review of the regulatory positions on this subject, it is our opinion that all requirements have been complied with. For all postulated cask drop cases we have demonstrated acceptable consequences or that the plant can be safety shut down without compromising the health and safety of the public. A prompt resolution of this matter is respectfully requested so that the capability to off-load a complete core loading into the spent fuel pool may be restored at the earliest possible time.

Yours very truly,

L. O. Mayer

L O Mayer, PE
Manager of Nuclear Support Services

LOM/ak

cc: J G Keppler
G Charnoff
MPCA
Attn: J W Ferman

Attachment to NSP-NRC
Letter Dated October 27, 1976

Dynamic Load on Crane Hoist

ANALYSIS ASSUMPTIONS

1. A 50,000 lb load is being lowered at its maximum rate of 15 fpm.

2. The length of rope available for stretch during the impulse loading is 5'-6", the distance between block sheave pins when the hook eye is at the upper most travel at elevation 1049'-6".

3. The reeving is equally stressed. Each of the 12 rope parts has an effective cross-sectional area of 0.513 in^2.

4. The rope breaking strength is 105,000 lb with elastic modulus of 15×10^6 psi for well broken-in rope.

5. The hoist brakes stop the downward motion of the rope instantaneously. No sag, deflection or rotation occurs in the hoist drive train (i.e., rigid hoist).

6. Only rope stretch is permitted.

ANALYSIS METHOD

Using an Energy Balance approach, the kinetic energy of the cask during lowering will be converted into stored energy due to rope stret . Thus

$U_k = U_s$ when the drum suddenly stops

where $U_k = \frac{WV^2}{2g}$ the cask kinetic energy

and $U_s = \frac{KX^2}{2}$ the stored energy in rope

Terms are defined by:

W = cask weight	K = spring constant of rope
U = energy	X = incremental rope stretch
V = cask velocity	g = gravitational constant

The rope force is obtained from Hooke's Law

$$F = KX = \frac{EA}{L} X$$

where

F = incremental force on system

E = rope modulus

A = total rope area

L = rope length

Solving for X in energy equation and substituting Hooke's Law gives:

$$F = \left(\frac{2EAU_k}{L} \right)^{1/2}$$

where $U_k = \frac{WV^2}{2g}$

The total load P on the system is the dynamic load + static load. Thus

$$P = W + F$$

RESULTS

Variables: $L = 5.5$ ft

$A = 12\ (.513) = 6.156\ in^2$

$W = 50{,}000$ lb

$V = 15$ ft/min $= .25$ ft/sec

$g = 32.2\ ft/sec^2$

$E = 15 \times 10^6\ lb/in^2$

Conservative Analysis

$$U = \frac{WV^2}{2g} = \frac{50{,}000\ (.25)^2}{2\ (32.2)} = 48.5 \text{ ft-lb}$$

$$F = \sqrt{\frac{2\ EAU}{L}} = \sqrt{\frac{2\ (15 \times 10^6)\ 6.156\ (48.5)}{5.5}}$$

F = 40,350 lb
TOTAL LOAD P = W + F = 90,350 lb

Conclusion: Yoke Static Safety Factor is

$$= \frac{156{,}000 \text{ lb}}{52{,}000 \text{ lb}} = 3.0$$

Yoke Dynamic Safety Factor (DSF) is

$$= \frac{156{,}000 \text{ lb}}{90{,}000 \text{ lb}} = 1.73$$

T~unnion Static Safety Factor (each) is

$$= \frac{148,000}{26,000} = 5.7$$

Trunnion Dynamic Safety Factor (each) is

$$= \frac{148,000}{45,000} = 3.3$$

Realistic Analysis

L (min) = 8 ft (Bottom of cask at elevation 1028' -2")
L (max) = 88 ft (Cask lowered to 935' elevation)
V = 5 ft/min = .09 ft/sec

L = 8 ft

$$F = Fo\left(\frac{V}{Vo}\right)\sqrt{Lo/L} = 40,350\left(\frac{.09}{.25}\right)\sqrt{\frac{5.5}{8.0}}$$

$$= 12,040$$

$$W+F = 62,040$$

$$DSF = \frac{156,000}{62,040} = 2.51$$

L = 88 ft

$$F = 40,350\left(\frac{.09}{.25}\right)\sqrt{\frac{5.5}{88}} = 3,632$$

$$W+F = 53,632$$

$$DSF = \frac{156,000}{53,632} = 2.91$$

NRC FORM 195 (2-76)

U.S. NUCLEAR REGULATORY COMMISSION

NRC DISTRIBUTION FOR PART 50 DOCKET MATERIAL

DOCKET NUMBER: 50-263

FILE NUMBER:

TO: Mr Stello

FROM: Northern States Pwr Co
Minneapolis, Mn
L O Mayer

DATE OF DOCUMENT: 10-27-76

DATE RECEIVED: 10-29-76

☒ LETTER ☐ NOTORIZED
☒ ORIGINAL ☒ UNCLASSIFIED
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PROP

INPUT FORM

NUMBER OF COPIES RECEIVED: 1cc

DESCRIPTION

Ltr re their 1-22-76 ltr....trans the following:

PLANT NAME: Monticello

ENCLOSURE

Off-Site Shipment of spent fuel............

(40 cys encl rec'd)

ACKNOWLEDGED

DO NOT REMOVE

FOR ACTION/INFORMATION — ENVIRO 10-29-76 ehf

SAFETY		ENVIRO
✓ ASSIGNED AD:		ASSIGNED AD:
✓ BRANCH CHIEF:	Ziemann (5)	BRANCH CHIEF:
✓ PROJECT MANAGER:	Snaider	PROJECT MANAGER:
✓ LIC. ASST.:	Diggs	LIC. ASST.:

INTERNAL DISTRIBUTION

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✓ OELD		LAINAS	
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MIPC	MACCARRY	KIRKWOOD	ERNST
CASE	KNIGHT		BALLARD
HANAUER	SIHWEIL	OPERATING REACTORS	SPANGLER
HARLESS	PAWLICKI	STELLO	
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PROJECT MANAGEMENT	REACTOR SAFETY	OPERATING TECH.	GAMMILL
BOYD	ROSS	✓ EISENHUT	STEPP
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MELTZ		✓ GRIMES	VOLLMER
HELTEMES	AT & I	✓ McGough	BUNCH
SKOVHOLT	SALTZMAN		✓ J. COLLINS
	RUTBERG		KREGER

EXTERNAL DISTRIBUTION

			CONTROL NUMBER
✓ LPDR: Minneapolis, Mn	NAT LAB:	BROOKHAVEN NAT LAB	
✓ TIC:	REG. VIE	ULRIKSON (ORNL)	
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ASLB:	CONSULTANTS		10928
✓ ACRS 16 CYS ~~HOLDING~~/SENT To LA Diggs w/all extras			

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