

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION  
RELATING TO MIXED GREASES WITH GREATER THAN 5% UNQUALIFIED  
CONTAMINANT IN LIMITORQUE VALVE OPERATORS  
COMMONWEALTH EDISON  
BRAIDWOOD STATION - UNITS 1 AND 2

## 1.0 INTRODUCTION

By letters dated August 26 and September 2, 1988, the licensee provided information on Limitorque valve operators with mixed grease (i.e., greater than 5% unqualified grease as a contaminant). Eight valve operators were found to have a heavy mixture (12% to 33% by weight) of unqualified grease (SUN EP 50). The qualified grease is Exxon Nebula EP-0 or EP-1. Samples of Exxon EP-0 and EP-1 greases mixed with 25%, 50% and 75% (by weight) of unqualified Sun EP 50 grease were irradiated at  $2 \times 10^5$  Rads and  $2 \times 10^6$  Rads gamma to determine the effect of radiation on their lubricating properties, as measured by standard penetration testing. Penetration tests were performed before and after irradiation to measure changes in the consistency of the grease mixture. Dropping point measurements (temperature at which the first drop of fluid separates from grease in a standard apparatus) were also made to determine lubricating characteristics.

In our SER relating to compatibility of greases in Limitorque valve operators (reference 1) we concluded that qualified grease with trace quantity of contaminant (2% or less) can be used in Braidwood Unit 1 and 2 Limitorque valve operators since at these concentrations the mixed grease is compatible and will withstand the post-accident environment. This conclusion was based upon acceptance criteria for penetration tests for the grease mixtures that were within  $\pm 30$  points of the midpoint range of the two qualified Limitorque valve operator greases (Exxon Nebula EP-0, penetration range 355-385 and Exxon Nebular EP-1, penetration range 310-340). The penetration test acceptance band was therefore 295 to 400 points. We also allowed interim operation of Braidwood Unit 1 with operators containing 2 to 5% contaminant based on the commitment that these operators will be regreased with qualified grease during the next refueling outage (May 1989) and upon confirmation of no expected degradation of the mixed grease in a radiatic environment of up to  $2 \times 10^6$  Rads. By letter dated June 23, 1988, the licensee provided radiation test data which showed that there was no apparent effect on lubrication properties for grease mixtures of 2 to 5% contaminant.

## 2.0 EVALUATION

We have evaluated the information provided by the licensee and have determined that the radiation test data on grease mixtures with greater than 25% unqualified grease provides inconclusive evidence to make a judgment on the operability of Limitorque valve operators following an accident. In fact, the radiation test data raises more questions than it answers. As an example, the inboard containment isolation valve for component cooling return from the number 1 seal on the reactor coolant pumps, valve 1CC9438, closes within 40 seconds after initiation of a main steam line break. The environmental conditions at valve closure are 300°F containment temperature and  $6 \times 10^5$  Rads. This radiation exposure considers a normal 3 year dose in addition to the accident environment. In the August 26, 1988 licensee letter, Table B indicates that 25% Sun/75% EP-1 had a loss in fluidity as demonstrated by a penetration of 241 (54 points below the minimum

of 295 for qualified grease) for an exposure of  $2 \times 10^5$  Rad. Valve 10C9438 had a grease mixture of 33% Sun/66% EP-0 or EP-1 (mixture not tested) and radiation exposure  $6 \times 10^5$  Rads (exposure not tested). Would radiation tests of a 33% Sun/66% EP-0 or EP-1 grease mixture at  $6 \times 10^5$  Rads yield worked penetration test of less than the 241 points for the 25% Sun/75% EP-1? Information has not been provided by the licensee on the effect of less fluid grease on valve operability. The Limatorque manufacturer recommends qualified EP-0 or EP-1 which are more fluid greases. Furthermore, the licensee did not provide information on the affects of the 300°F accident temperature environment, in combination with the radiation exposure. This may significantly affect lubrication properties.

The test data in the licensee letter dated August 26, 1988 seems to indicate that lower-radiation exposures may have a more deleterious effect on lubrication properties than higher exposures, as indicated by increases in lubricating properties at  $2 \times 10^6$  Rads after a decrease at  $5 \times 10^5$  Rads. This test data suggests that a bounding or enveloping case may not be applicable. In order to make a credible judgment on valve operator operability with a heavy mixture of unqualified grease in the qualified grease, an environment qualification test should be conducted to expose the valve operator to the predicted accident environment followed by operability testing.

The Limatorque manual (reference 2) and EPRI lubrication guide (reference 3) caution against mixing greases with different soap bases in valve operators (as is the case of SUN EP 50 in Exxon EP-0 or EP-1). Mixed greases may be incompatible and may create problems which can effect lubricating capabilities.

### 3.0 CONCLUSIONS

Based on the above evaluation, we conclude that there is insufficient information to determine the post accident operability of Limatorque valve operators containing mixed grease with greater than 5% unqualified contaminant. Therefore, adequate assurances do not exist that Braidwood Units 1 and 2 valve operators with more than 5% grease contaminant would have been able to perform their intended function following a Design Basis Accident.

### 4.0 REFERENCES

1. NUREG-1002, Safety Evaluation Report Braidwood, Units 1 & 2, Supplement #6, dated May 1988
2. Bulletin SMB1-82C, Limatorque Type SMB Instruction and Maintenance Manual
3. EPRI NP-4916, Lubrication Guide, Robert O. Bolt, dated January 1987