



Commonwealth Edison
1400 Opus Place
Downers Grove, Illinois 60515

November 21, 1990

Dr. Thomas E. Murley
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Attn: Document Control Desk

Subject: Byron Units 1 and 2
Braidwood Units 1 and 2
Environmental Qualification of
Grease Mixtures in the
Main Gear Case of Limitorque Operators
NRC Docket Nos. 50-454/455 & 50-456/457

- Reference: (a) June 23, 1988 letter from S.C. Hunsader to
Dr. T.E. Murley conveying grease mixture
test results
- (b) August 26, 1988 letter from S.C. Hunsader to
Dr. T.E. Murley conveying grease mixture
test results
- (c) November 22, 1988 letter from S.C. Hunsader to
Dr. T.E. Murley containing an assessment by Dr. R. Bolt

Dear Dr. Murley:

The purpose of this letter is to convey the most recent information available regarding Commonwealth Edison's position on the environmental qualification of grease mixtures present in some Limitorque motor operated valve (MOV) gear cases at Byron Station. The letter of Reference (a) provided testing results requested by the NRC staff as a result of environmental qualification concerns arising from grease mixtures present in Braidwood Unit 1 valves. Additional testing results were provided for NRC review in the letter of Reference (b). The test results provided the basis of an operability judgement made for eight Braidwood Unit 1 valves found to contain grease mixtures of 12% to 33% of Sun 50 EP mixed with Exxon Nebula EP-0/EP-1. The letter of reference (c) included relevant information regarding; 1) the grease's physical properties, 2) the testing to verify those properties and 3) the impact of changes in the properties on the grease's lubrication function. It is included as Enclosure 2 for ease of reference.

Enclosure 1 is an internal Commonwealth Edison Company (CECo) memo summarizing the Nuclear Engineering Department's engineering evaluation and conclusions regarding the acceptability of grease mixtures of $\leq 5\%$ Sun 50 EP contained in Exxon Nebula EP-0/EP-1. References (a) and (b) contained test results which are summarized in this enclosure.

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The environmental qualifications of the Exxon Nebula EP-0 and EP-1 is not compromised by the addition of 2% and 5% of Sun 50 EP. Test results and visual examination indicated little difference in performance between pure Nebula EP-0/EP-1 and mixed grease samples containing up to and including 5% Sun 50 EP. The Exxon Nebula EP-0 and EP-1 remains environmentally qualified consistent with the Limitorque requirements. Therefore, there is no need to replace the grease of Limitorque operators containing mixed grease samples of up to and including 5% Sun 50 EP.

Currently, six valves at Byron Station Unit 1 have grease mixtures in excess of 5%. It was determined that a Justification for Continued Operation (JCO) was required for these valves. Documentation of the JCO was supplied to Byron Station by the CECO Nuclear Engineering Department by letter dated November 5, 1990 and was immediately made available to the NRC resident inspector for review. Changeout of the grease mixtures in these valves will be accomplished no later than the next refueling outage for Byron Unit 1. Sampling and testing of these six valves will be performed on a six month frequency to assure no significant degradation of the grease occurs until changeout. Results will be provided to the NRC after sampling and analysis is complete.

Additional documentation is available at Byron Station and/or CECO Nuclear Engineering and can be supplied upon request. Please direct any questions you may have concerning this matter to this office.

Very truly yours,



A.R. Checca
Nuclear Licensing Administrator

Enclosure

cc: Resident Inspector-Byron
Resident Inspector-Braidwood
T. Shia-NRR
R. Pulsifer-NRR
Regional Administrator-RIII

November 7, 1990

To: T. J. Kovach

Subject: Byron Units 1 and 2
Braidwood units 1 and 2
EQ of Mixed Grease in the Main Gear Case of Limitorque Operators

References: June 23, 1988 Letter from S. C. Hunsader to T. E. Murley
regarding Braidwood Unit 1 Limitorque Operator Lubrication

The following provides a summary of the Design Support EQ group evaluation of the effect that mixing small quantities of Sun 50 EP with Exxon Nebula EP-0 or EP-1 has upon the environmental qualification of the EP-0 or EP-1 main gear case lubricant used in Limitorque operators. As discussed below, mixtures of Sun 50 EP that do not exceed 5%, have been evaluated to determine the affect on the environmental qualification of the EP-0 and EP-1 for Limitorque operators at the Byron and Braidwood Stations.

Lubricants that can be used in the Limitorque actuators are identified in the appropriate instruction manual and Lubrication Data Form LC8. The main gearboxes were originally tested and supplied for in-containment applications with Exxon Nebula EP-1 grease. Nebula EP-0 is now supplied for in-containment applications, although Nebula EP-1 can be mixed with or used in place of the EP-0. Limitorque does not recommend mixing the Nebula EP-0 and EP-1 with any other type lubricant.

As a result of the identification of grease mixtures in Limitorque Operators at Braidwood Station in March, 1988, PWR Engineering established a testing program to determine the effect of mixing different quantities of Sun 50 EP with Exxon Nebula EP-0 and EP-1. This was accomplished by comparing the physical properties of Exxon Nebula EP-0 and EP-1 containing in each case 2% and 5% Sun 50 EP against the physical properties of pure Exxon Nebula EPO and EP-1. To evaluate the effect upon environmental qualification, the test program subjected samples of mixed and unmixed grease to radiation environments of 2×10^5 and 2×10^8 Rads. During May and June, 1988, samples were radiation tested at Wyle Labs. ASTM D-1403 Penetration tests were performed before and after testing to measure changes in consistency of the grease mixtures. Dropping point measurements (the temperature at which the first drop of fluid separates from grease in a standard apparatus) were also made.

Any sample in which the worked penetration values, between mixed and unmixed samples, which resulted in a change of less than 30 points were considered to be compatible based on the following:

- a) The EPRI NP-4916 "Lubrication Guide" which defines compatibility as "a change of no more than 30 points (1 point = 0.1mm) in ASTM worked penetration on mixing."
- b) The NLGI definition of incompatibility which states:
 "Two lubricating greases show incompatibility where a mixture of the products shows physical properties or service performance which are markedly inferior to those of either of the greases before mixing. Performance or properties inferior to one of the products and superior to the other may be due to simple mixing and would not be considered as evidence of incompatibility."

The tables below show the results of penetration tests for mixtures containing 2% and 5% Sun 50 EP with Exxon Nebula EP-0 and EP-1.

Exxon Nebula EP-0
Worked Penetration ASTM D-1403*

Radiation Exposure	100% EP-0	2% Sun 98% EP-0	Change	5% Sun 95% EP-0	Change
0	395	395	0	392	-3
2 x 10E5	362	388	+26	388	+26
2 x 10E8	407	410	+3	407	0

Exxon Nebula EP-1
Worked Penetration 60 Strokes ASTM D-1403*

Radiation Exposure	100% EP-1	2% Sun 98% EP-1	Change	5% Sun 95% EP-1	Change
0	327	339	+12	332	+5
2 x 10E5	309	328	+19	324	+15
2 x 10E8	395	407	+12	407	+12

*Penetration values provided are converted to full scale (ASTM D-217) penetration values.

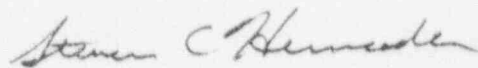
In all cases, the penetration results are within the EPRI NP-4916 "Lubrication Guide" criteria of no more than 30 points difference indicating compatible grease, when compared to 100% EP-0 and 100% EP-1 at radiation levels of zero, 2×10^5 , and 2×10^8 Rads. The penetration values of the mixtures change (either up or down) in a similar fashion as the 100% Exxon product.

Overall, the test results show that under environmental conditions of zero, 2×10^5 , and 2×10^8 Rads, mixtures of 2% and 5% Sun 50 EP in Exxon Nebula EP-0 and EP-1 will not impact the lubricating qualities of the Exxon product. This continues to allow the Limitorque operator to operate and perform its intended function. As a result, the environmental qualification of the Exxon Nebula EP-0 and EP-1 is not compromised by the addition of 2% and 5% of Sun 50 EP. The Exxon Nebula EP-0 and EP-1 remains environmentally qualified consistent with the Limitorque requirements.

For assessing the effects of thermal aging on mixed grease, drop point and penetrant testing of the samples was evaluated. These tests, following thermal aging, indicate that the mixed and unmixed greases perform similarly. Thus, there is no effect on thermal performance of the grease with the presence of Lithium. Since the lubricating performance has been demonstrated to follow the same trend of degradation as that of pure Nebula EP-1, the qualification testing performed by Limitorque on Nebula EP-1 is not compromised by the presence of Lithium in the mixed grease cases.

There has been no visual indication of a chemical reaction taking place as evidenced by normal consistency, and the absence of hardening, softening or separation. During sampling, the station utilizes BFP FS-28 to record data on the general consistency, color, presence of foreign matter (contaminants), and water. This data is recorded on BFP FS-28-T1. As a result of Fuel Handling Foreman Review there have been no abnormalities noted with respect to the above variables for all valves with the exception of two. Those two, which had indications outside the norm, were then chemically analyzed and found to have less than 2% Li content. It can be concluded from the visual results documented, that no chemical reaction is taking place in the gear box which would lead to premature hardening or softening of the grease. These valves have all been in service for a minimum of 5 years at Byron.

Should you have any questions, please call me at Ext. 7492.


S. C. Hunsader
Corporate EQ Coordinator
Design Support Group

ZDESIGN/230
SCH/blm

cc: N. P. Smith
T. Schuster