LOUISIANA POWER & LIGHT / 317 BARONNE STREET • P. O. BOX 60340
NEW ORLEANS, LOUISIANA 70160 • (504) 595-3100
MIDDLE SOUTH UTILITIES SYSTEM

May 13, 1988

W3P88-0089
A4.05
QA

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Subject: Waterford 3 SES
Docket No. 50-382
License NPF-38
Mobil SHC-32 Lubricant in Reliance Motors

This is in response to the verbal request by Mr. J.R. Boardman, NRC Region IV, for information regarding the use of Mobil SHC-32 lubricant in Reliance Motors at Waterford 3 SES. Enclosed herewith are the following:

a) Evaluation letter, #W3M84-0446, dated October 15, 1984
b) Mobil Tech Topics, File 10-21

Additionally, the EQ Maintenance Input instructions are being revised to reflect the use of Chevron SRI #2, or equivalent, with the equivalent being the Mobil SHC-32 lubricant in accordance with Plant Lubrication Manual 457000237.

Should further information be needed, please contact L.L. Bass at (504) 467-2791, extension 327.

Very truly yours,

R.F. Burski

R.F. Burski
Nuclear Safety & Regulatory Affairs
Acting Manager

RFB:GEW:ssf

Attachments

cc (w/attach): J.R. Boardman

cc (w/o attach): R.D. Martin, NRC Region IV
J.A. Calvo, NRC-NRR
D.L. Wigginton, NRC-NRR
NRC Resident Inspectors Office
E.L. Blake
W.M. Stevenson

A001
1/1

LOUISIANA POWER & LIGHT / INTER-OFFICE CORRESPONDENCE

MIDDLE SOUTH UTILITIES SYSTEM

October 15, 1984

W3M84-0446

TO: K.W. Cook

FROM: R.P. Barkhurst

SUBJECT: Evaluation of Audit Finding SA-W3-QA-84-39

REFERENCES:
(a) PRE-84P-040 dated September 17, 1984
(b) Licensing Commitment Tracking Log No. LIR 84-072 dated September 14, 1984
(c) QA Audit SA-W3-QA-84-39, Findings 2 and 5
(d) Denkevitz Letter W3K84-2144 dated September 12, 1984
(e) NRC Inspection Report 50-382/84-25 dated July 31, 1984
(f) W3P84-2386 dated September 13, 1984 (K.W. Cook to J.T. Collins)

This letter serves as an update to references (a) and (b) and the followup to plant staff response for corrective step number 3 under 4.a.6 of reference (f).

Project Evaluation Request No. 70023 was closed out and included in CIWA's 010596 and 010597 (copies attached) on October 12, 1984. This documentation justifies the use of Mobil Type SHC-32 lubricant in lieu of the Chevron Type SRI as recommended in the motor vendor manual.

In reviewing the above engineering evaluations and in conducting research on the facts relevant to reference (c), we feel that there are no generic problems with respect to proper lubrication of safety related equipment. We do concede, however, that there are some documentation and inconsistency problems with certain aspects of the plant lubrication program. These problems will be addressed by the additional actions/precautionary efforts indicated in reference (a).

If you need additional information on this subject, please contact Dennis Kruer at extension 3193 or John McGaha at extension 3138.

RBarkhurst

R.P. Barkhurst

RECEIVED
NUCLEAR RECORDS

OCT 17 1984

RPB/JRM/eao

Attachments

ILN: _____

cc: L.F. Storz, S.A. Alleman, D.A. Kruer, P.V. Prasankumar, J.R. McGaha, Nuclear Records, D.V. Gallordoro

MODE 7

WATERFORD NUCLEAR STATION
CONDITION IDENTIFICATION WORK AUTHORIZATION

C11-02

ORIGINATOR SS/CRS

Z	KEYPUNCH USE ONLY	UNIT	Louisiana Power & Light

SYSTEM 1	UNID 2	COMPONENT DESCRIPTION 3	QA TYPE 4
dd	VARIOUS	CCS MOTORS	QUALITY REL. X YES ☐ NO SAFETY REL. X YES ☐ NO

CIWA 5	REQUEST DATE 6					FAILURE STARTED 7					TECH. SPEC. DATE 8					FOLLOW UP TO CIWA 9	STATION MOD NO. 10	PRIORITY 11	12
010596	MO.	DAY	YR.	HR.	MIN.	MO.	DAY	YR.	HR.	MIN.	MO.	DAY	YR.	HR.	MIN.				☐ UNCONT. MAINT. X CONT. MAINT.
HOLD TAG	09	14	84	16	00	09	14	84	16	00								1	

INITIAL PROBLEM OR FAILURE DESCRIPTION 13
(INCLUDE LOCATION)

UNID's CCS-EMTR317A2MS, CCS-EMTR317A3MS, CCS-EMTR317B2MS, CCS-EMTR317B3MS.
Request PE to evaluate the use of MOBILE SCH-32 GREASE IN LIEU OF CHEVRON SRI-2. Please evaluate for possible NON-conformance.

SEE ADDENDUM PAGE ☐

WORK CENTER 14	ELEC.	MECH.	INST.	OTHER	15 CONDITION/EQUIPT. ID TAG ☐ YES X NO	ORIGINATOR 16	EXT.	DEPT.	SS/CRS 17	DATE
	X	☐	☐	☐		T. MOORE	3112	ME		9/14/84

P&S

18 EVALUATION		DISPOSITION		INVALIDATION COMMENTS	P & S SIGNATURE	DATE
☐ INVALID	X NONCONFORMANCE 9/19/84	☐ REWORK	☐ REPLACE			10-12-84
☐ TROUBLE SHOOT	X TECH. EVAL.	☐ REPAIR	☐ USE AS IS			SEE ADDENDUM PAGE ☐
☐ MAINT. ITEM	☐ OTHER				SS/CRS SIGNATURE	DATE

PE

19 DISPOSITION CONCURRENCE YES ☐ NO ☐

CAUSE & CORRECTIVE ACTION/TECH EVALUATION RESULTS

P E SIGNATURE DATE

SEE ADDENDUM PAGE X

WORK PACKAGE

TASK DESCRIPTION 20	DATE DUE 21 MO.	DAY	YR.	DUR. 22	M/SR, PR, P.O. NO. 23

CONTROLS REQUIRED 24	YES	NO
CONFINED SPACE ENTRY		
RADIATION WORK PERMIT		
TAGGING		
RETEST		
INSPECTION		
FIRE PROTECTION PERMIT		
SPECIAL PROCESSES		
CLEANLINESS CONTROL		
HOUSEKEEPING ZONE CHANGE		

PROCEDURES 25

DRAWINGS 26

RETEST PROCEDURES 27

TECHNICAL MANUALS 28

PREPARED BY 31

WORK INSTRUCTIONS 29

NA

SEE ADDENDUM PAGE ☐

APPROVED BY 32 NA DATE

QUALITY GROUP 33 NA

UNT-5-002 FORM W3-1001 Rev. 6-84

CIWA ADDENDUM PAGE	CIWA NO. Ø10596	DATE: 10-12-81	BLOCK NO: 19
	TITLE: PLANT ENGINEERING INPUT		

Reference Documents Used: SPEER 84-021 AND PER 70023 — See Addendum Page

Persons Contacted: R. NAYLOR, ENS; S. STOCKLAGER, RELIANCE; J.M HUMMELL, CHEVRON — See Addendum Page

Logic Used: EVALUATE THE EQUIVALENCY OF MOBIL SHC 32 GREASE AND CHEVRON SRI-2 GREASE WITH REGARD TO LUBRICATING CHARACTERISTICS AND EVALUATE THE SUITABILITY OF MOBIL SHC 32 GREASE FOR THIS APPLICATION.
SEE SPEER 84-021 AND PER 70023 ATTACHED. — See Addendum Page

Determinations/Conclusions: THE MOBIL SHC 32 GREASE IS EQUIVALENT TO CHEVRON SRI 2 GREASE AND IS SUITABLE FOR USE IN THIS APPLICATION.
SEE SPEER 84-021 AND PER 70023 ATTACHED.
See Addendum Page

Additional Retests Required: NONE — See Addendum Page

Any Unreviewed Safety Questions? |_| YES |X| NO IF YES, SEE PE-2-005 Att. 6.3 Step 5B.

Any Potentially Reportable Defect or Nonconplicnace? |_| YES |X| NO IF YES, SEE PE-2-005 Att. 6.3 Step 5A.

Plant Engineer: David Gallodoro 10-12-81 — Sign & Date — 3238 Ext.

Technical Reviewer: J. C. Williams 10/12/81 — Sign & Date

Systems Engineering Department Head: NA — Sign & Date

PROJECT EVALUATION/INFORMATION REQUEST

Page 1 of 1

TO: NS DEPT/PROJ. M. DEPT/ R.F. Burski DEPT ENS
DEPT. MANAGER

FROM: NS DEPT/PROJ. M. DEPT/ A. Pastor DEPT Dale Gallodoro/3238
Systems Engineering ORIGINATOR/TELE. EXT.

PER NO. 70023 SMP NO. _____

START UP SYSTEM N/A OPS SYSTEM N/A

****

DESCRIPTION OF PROBLEM/REQUEST:

The NRC has found in violation, 8425-01, that the plant is using a different grease in our containment fan cooler fan motors than the manufacturer recommends in their manual. (See PER 70156). The plant is responding to this concern by evaluating the grease substitute as equal to or better than that recommended.

We need your E.Q. Engineer, Richard Naylor, to compile a list of the E.Q. Motors, and evaluate the acceptability of the lubricant called for in the Plant lubrication manual, 457001150, for these motors to address an NRC concern about our other E.Q. Motors.

Approved By: [signature] Date 9/21/84 Response Required By: 10/15/84

****

RESPONSE ASSIGNED TO: I&C Naylor

The greases listed above have been evaluated for their lubricating capabilities under harsh environmental conditions. The result verify that the substituted grease SYC-32 is environmentally equivalent and does not invalidate the environmental qualification. Further since the vendor technical information allows for substitution of the lubricant without prior notice & approval the end user can substitute provided adequate technical documentation exist for his specific use.

Prepared By: [signature] Date 9/28/84 Approved by: [signature] Date 10-11-84

****

DISTRIBUTION:	REQ	RESP		REQ	RESP
Sr VP-Nuc Ops	___	___	Spec. Proj. Mgr.	___	___
Nuc.Svcs.Mgr.	___	___	Nuc. Supp. Svcs. Mgr.	___	___
Proj. Mgr.	___	___	Nuc. Saf. Mgr.	___	___
Plant Mgr.	___	___	Tech. Supp. Mgr.	___	___
Completion Mgr.	___	___	Lic. Mgr.	___	___
Eng. Mgr.	___	___	Proj. Files	X	X
Constr. Mgr.	___	___	_____	___	___
_____	___	___	_____	___	___

****

REQ = Request RESP = Response SMP = Station Modification Package

SUBJECT

Engineering evaluation of Chevron SRI-2 grease and mobile temp. 3HC-32 grease for substitution equivilancy in Environmentally Qualified Reliance Electric Motor Bearings.

Specific Review

Determination of equivilancy for substitution of mobiltemp SCH 32 for Chevron SRI-2 grease in containment fan motors.

References

1. Chevron Teknifax: Chevron SRI Grease
2. Mobil Tech Topics - File 13.36 Mobilgrease 28
3. Mobil Tech Topics - File 10.21 lubricants in nuclear plants
4. Mobil oil corp. letter August 22, 1984, radiation testing SCH-32
5. EQ file 4.1W3 - Reliance Electric Motors
6. Lubrication Fundamentals, Mobile Oil Corp. J. George Wills

Waterford 3 SES (W-3)

The containment cooler fans were supplied by Joy Manufacturing Co. (JOY) with Reliance type TEAD frame 449T motors. The fan motor unit was qualified for nuclear use by Joy and Reliance. The qualification report is contained in Environmental Qualification file 4.1W3.

The W3 containment is maintained at 120°F (50°C) for normal environments consideration. For radiation exposure, the total integrated dose is 3.3E7. A specific corrolation of the test report and requirements is contained in file 4.1W3 and is not incorporated here except by reference.

A review of the EQ files relating to lubrication in general showed that in all cases even when a specific oil or grease was used during the qualification testing and was identified the as preferred lubricant the qualifiers of the equipment included the words "or equal" and many specifically listed several oils and greases which they considered equal. The following is a tabulation of specific characteristics of Chevron SRI-2 and Mobil SHC 32.

Grease Property	Chevron SRI	Mobil Temp SHC 32	
NLGI	Grade 2	Grade 1	
Thicker	Polyurea	Non Soap	
Oil base	Refined mineral oil	Synthetic Hydrocarbon	
Additives (inhibitors)	Rust and oxidation	Rust and oxidation	
Temperature Range	-30°C to 175°C	-54°C to 177°C	
Penetration	195 - 265	290 - 340	@ 77°F wked
Drop Point	470 ASTM °F	500 ASTM °F	ASTM D 2265/566
Radiation Resis	2.0E8	3.0E8	15-20% change in penetration
Rubber swell	9%	6%	FTM 3603
Bearing life	150°C (300°F) 3000 hrs 177°C (350°F) 500 hrs	150°C (300°F) 2000 hrs 177°C (350°F) 500 hrs	ASTM D 3336
Approved Substitutes*	Mobil - BRB Shell - Dolian Sun - N - 52X Texico - Premium RB Union - Hitemp 2 Gulf - Unite Exxon Andox	Mobile grease 28	From lubrication manufactures, documentation. These grease meet the grease characteristics for substitution.

From the above data, it can be seem that there is little difference in overall lubricating properties. There is additional data of test on each of the above greases which is not practically tabulated due to different test methods used.

An arrehenious analysis was performed on both of the above greases to determine the long term life due to temperature. Both greases meet and exceed the base requirements for use at W3 elevated temperature.

Conclusion

Based on the detailed review and the comparison of lubricating characteristics in both radiation and temperature degredation mobiltemp SHC 32 is a suitable substitution for Chevron SRI grease which does substantiate and maintain the equipment qualification of the motors.

LOUISIANA
POWER & LIGHT/W-3 SES, P.O. Box B, Killona, La. 70066

MIDDLE SOUTH
UTILITIES SYSTEM

September 19, 1984

W3E84-0558

Mr. Scott Stocklager
Reliance Electric
201 Evans Rd.
Suite 406
New Orleans, La. 70123

RE: Instruction Manual B-3645 Substitution of Mobil SHC-32 Grease
For Chevron SRI-2 Grease in Reliance Motor Bearings

Dear Mr. Stocklager:

As a follow-up to your conversation with our Mr. Dale Gallodoro, we are sending you a copy of the documentation proving the suitability of Mobil Mobiltemp SHC-32 Grease as a substitute for the Chevron SRI-2 Grease which you recommend in your instruction manuals. As you recall, you told Dale that Reliance might not be able to stand behind our motors without proper documentation of this substitute grease evaluation.

We would appreciate your contacting us regarding this substitution as soon as you have evaluated its acceptability. If there is anything you need in order to expedite your evaluation, do not hesitate to call Dale Gallodoro at 464-3238.

Please send the results of your evaluation to the return address, attention Dale Gallodoro.

S.A. Alleman
Assistant Plant Manager-Technical Support Services

cc: R.P. Barkhurst, R. Burski, P.V. Prasankumar, A. Pastor, J.R. McGaha, O.D. Hayes, W. Morgan

PROJECT EVALUATION/INFORMATION REQUEST

Page ___ of ___

TO: NS DEPT/PROJ. M. DEPT/ F.N.S. _____ DEPT R. Burski
DEPT. MANAGER

FROM: NS DEPT/PROJ. M. DEPT/ A. Pastor DEPT D. Gallodoro/3238
Systems Engr. ORIGINATOR/TELE. EXT.

PER NO. 70156 SMP NO. NA

START UP SYSTEM 43H & 43A OPS SYSTEM HRA & CCS

****

DESCRIPTION OF PROBLEM/REQUEST:

457000106 and 457000237 are Reliance Motor Vendor Technical Manuals. They now suggest lubricating their motors with chevron SRI-2 grease. Plant Staff is presently using Mobil-Mobil Temp.-SHC-32 grease. A spare part Equivalency evaluation has been done and documented on speer-84-021. Also see Mobil Oil letter dated August 22, 1984 to Dennis Kruer, Plant Lubrication Coordinator. Please make a change to these manuals to allow for substitution of Mobil Temp SHC-32 for Chevron SRI-2.

Approved By: A Pastor Date 9/17/84 Response Required By: 9/21/84

****

RESPONSE ASSIGNED TO: _____

Prepared By: _____ Date _____ Approved by: _____ Date _____

****

DISTRIBUTION:	REQ	RESP		REQ	RESP
Sr VP-Nuc Ops	___	___	Spec. Proj. Mgr.	___	___
Nuc.Svcs.Mgr.	___	___	Nuc. Supp. Svcs. Mgr.	___	___
Proj. Mgr.	___	___	Nuc. Saf. Mgr.	___	___
Plant Mgr.	___	___	Tech. Supp. Mgr.	___	___
Completion Mgr.	___	___	Lic. Mgr.	___	___
Eng. Mgr.	___	___	Proj. Files	X	X
Constr. Mgr.	___	___	_____	___	___
_____	___	___	_____	___	___
_____	___	___	_____	___	___

****

REQ = Request RESP = Response SMP = Station Modification Package

SPEER Number 84-021 Date 9-17-84

SPARE PARTS EQUIVALENCY EVALUATION REPORT

Original Part Description CHEVRON SRI-2 LUBRICATING GREASE

Proposed Equivalent Part Description MOBIL MOBIL SHC-32 GREASE

Requested By DALE V GALLOWAY Ext. 3234

Cognizant Supv. A PASTOR Title System Engr. Dept. Head

A. Physical Characteristics

1. Do dimensional specifications reflect a change from the original? Yes [ ] NO [X]

   If yes, explain _____

2. Will dimensional changes cause working restraints? (Interferences or Accessibility for Installation, Operation, or Maintenace) Yes [ ] NO [X]

   If yes, explain _____

B. Material Specifications

1. Are material specifications same as original? Yes [ ] No [X]

   If no, detail differences THE MOBIL PUMP SHC 32 IS A SYNTHETIC HYDRO CARBON GREASE. THE CHEVRON SRI-2 IS A MINERAL OIL GREASE. SYNTHETICS ARE MORE RESISTIVE THAN MINERAL OILS

2. Is item performance affected due to material changes? Improved [X] Degraded [ ]* No Change [ ]

3. Will system or component performance be affected due to material change? Improved [ ] Degraded [ ]* No Change [X]

Describe basis for determination of item, component, or system performance improvement or degradation. THE MOBIL GREASE 28 IS SYNTHETIC HAS A BETTER NLGI GRADE, A HIGHER PENETRATION VALUE, A UNIFORM VISCOSITY WITH TEMP, AND A HIGHER DROP POINT.

4. Will the material change affect reliability of the item? Improve [X] Degrade [ ]* No Change [ ]

5. Will the material change affect reliability of the system or component? Improve [X] Degrade [ ]* No Change [ ]

Discuss basis for determination of item, system, or component reliability change. THE IMPROVED CHARACTERISTICS MENTIONED IN 3 ABOVE ARE THE BASIS.

C. Design Performance Parameters

1. Are design performance parameters altered? Improved [ ] Degraded [ ]* No Change [X]

Detail any changes (include performance data). _____

D. Seismic Classification Considerations

1. Does the requested item meet seismic requirements? Yes [ ] No [ ]* N/A [X]

E. Environmental Qualification Considerations

1. Does the affected equipment require harsh environmental qualification? Yes [X] No [ ]

2. If yes, does the requested item meet environmental qualification requirements? Yes [X] No [ ] * N/A [ ]

Discuss basis for determination of qualification: THE LETTER FROM MOBIL OIL CORPORATION TO DENNIS MAUER, LUBRICATION COORDINATOR NAS STA, DATED AUGUST 22, 1984 GIVES THE MAXIMUM RADIATION LEVELS WHICH MATCH THE ONES WHICH THE RELIANCE MOTORS IN QUESTION QUALIFIED TO. THIS LETTER IS ATTACHED.

F. Codes and Standards

1. Is the required item produced to the same codes and standards as the original part? Yes [ ] Improved [X] Downgraded [ ] *

[ ] ASME B&PV Code, Section/Issue: _____

[ ] ASTM Standard/Issue: _____

[ ] ANS Structural Welding Code/Issue: _____

[ ] ANSI Standard/Issue: _____

[ ] IEEE Code/Issue: _____

[X] Other: NATIONAL LUBRICATING GREASE INSTITUTE: MOBILTEMP SHC 32 - GRADE 1 CHEVRON SRI-2 - GRADE 2

G. Drawings and Instruction Manuals

1. Do plant drawings need to be changed or revised? Yes [ ] * No [ ]

2. Do plant equipment instruction manuals need to be changed or revised? Yes [X] ** No [ ]

3. The following drawings or instruction manuals are affected by this SPEER and are marked up and attached:

H. Additional Supporting Information

MOBIL HAS INDICATED IN THEIR LETTER THAT THEIR SHC 32 IS INTERCHANGEABLE WITH CHEVRON SRI-2 THE CHANGE-OUT PROCEDURE HAS BEEN MARKED UP AND ATTACHED.

NOTE: If a * block is checked, a SMR must be initiated.
IF A *** BLOCK IS CHECKED, A PER MUST BE INITIATED.

☒ This evaluation has determined that the part(s) is equivalent to original plant design and no SMR is required. PER 70156 has been initiated

☒ This evaluation has determined that the part(s) is equivalent to original plant design but that an SMR should be initiated. SMR Number NA. PER Number 70156.

QP 9/17/84

☐ This evaluation has determined that the part(s) represents a change to plant design and an SMR is required. SMR Number _____.

Prepared By: Carl Gallodoro — Date: 9-17-84

Reviewed By: G Pal — Systems Engineering Dept. Head — Date: 9/17/84

Quality Review By: E. E. Steinert — Plant Quality — Date: 9-18-84

Approved By:** _____ — Plant Security Superintendent — Date: _____

Approved By: A Alleman — Asst. Plant Manager-Plant Technical Services — Date: 9-18-84

cc: Manager, Nuclear Projects

** Approval required for changes to security equipment or physical security barriers.

Mobil Oil Corporation

SOUTHWEST COMMERCIAL DIVISION

5151 BELT LINE ROAD SUITE 600
DALLAS TEXAS 75240

August 22, 1984

Mr. Dennis Kruer
Louisiana Power & Light
Waterford #3
Hwy 18
Taft, Louisiana 70066

Subject: Radiation Testing - Mobiltemp SHC 32

Dear Mr. Kruer:

Per your telephone request of this date, following is the Radiation Exposure information on Mobiltemp SHC 32:

Product	Date tested	Maximum Rad Levels
Mobiltemp SHC 32	1983	3×10^8 (note 1)

Note 1: Value based on 15-20% chance in penetration.

For your information, gamma irradiation studies were carried out in a 5MW reactor under static conditions immediately after reactor shutdown. Typical dosage rate varied between 2×10^8 rad/hour to 2×10^6 rad/hour.

As concerning your question about using Mobiltemp SHC 32 in Reliance Motors that are environmentally qualified, we offer the following comment.

To the best of our knowledge, per your Mr. John McGaha, the Reliance equipment in question was environmentally qualified by the manufacturer using Chevron SRI #2 grease. Per Reliance, environmental qualification requires the continued use of all components in service during the EQ process.

Although Reliance is not EQ'ed with Mobiltemp SHC 32, a satisfactory substitute for Chevron SRI #2 is Mobiltemp SHC 32. Due to the nature of this product we would expect equal, if not superior, performance to SRI #2.

Should you require additional information or have any questions, please feel free to contact either myself or Tom Mehl.

Sincerely,

R. K. Brawner
Territory Manager

T. H. Mehl
Lubrication Engineer

Approved:

R. C. Morrow
Chief Engineer

RKB-THM/slw
3428L

INDUSTRIAL PRODUCTS

Lubricating Greases (continued)

Turex® Wheel Mounting Compound is a blended product of boiled linseed oil and white lead. It is designed to assist in the assembly and disassembly of railroad car wheels and axles. It is approved against the Association of American Railroads' specification as illustrated in the Wheel and Axle Manual.

Gargoyle® Grease B No. 2 is an amber colored, lime soap cup grease of smooth buttery texture. It is suited to the lubrication of bearings operating under low torque conditions. This makes it particularly suitable for belt conveyors, especially on long outdoor installations subjected to low temperatures.

Mobil® Block Grease Medium and **T** are hard greases furnished in block form for use in the grease pockets of plain bearings. Within the temperature range for which each is recommended, they maintain their consistency, have minimum tendency to char or glaze in service, and are uniformly consumed. Two grades are marketed for temperatures ranging from 80°F to 350°F (27°C to 177°C) and higher:

Mobil Block Grease Medium
Mobil Block Grease T

Mobilith® 21 and **22** smooth, high temperature lithium complex multipurpose greases were developed for use in industrial applications, having an operational range from −30°F (−34°C) to 350°F (177°C). They have a dropping point of 500°F. The combination of a stable soap base, high quality mineral oil and a very effective additive package provides excellent mechanical stability, high resistance to oxidation, good rust protection and excellent break-away torque. The greases do not contain extreme pressure additives.

Mobilplex® 44 semifluid EP grease was developed for the lubrication of gear cases on underground mining equipment where high oil leakage rates exist. This product has exceptional oxidation stability and excellent corrosion prevention properties. It is not recommended for use in gear cases at temperatures below 32°F (0°C) as it would be too stiff for proper distribution and channeling may occur.

Mobilplex 45, 46, 47 and **48** calcium EP complex, multiservice greases will satisfy all applications except eccentric bearings or where excessive vibration is a major consideration. The greases may be dispensed by any common dispensing method except spring loaded grease cups or central systems where infrequent cycle times are involved. Low-cycle rate central systems require special engineering consideration. As a result of the addition of special EP materials, these greases have high load carrying ability. In addition, they have excellent chemical and structural stability up to operating temperatures of 300°F (149°C). They will adsorb water which will affect their consistency depending on the percentage adsorbed. **Mobilplex 45, 46, 47** and **48** are resistant to washout by water, emulsions or mild acids. They are recommended for use in plain and antifriction bearings.

Mobiltemp® SHC 32 nonsoap, synthetic-hydrocarbon base fluid provides extremely low breakaway and running torque values, resists water washout and maintains

Lubricating Greases (continued)

consistency over a wide operating range. In addition, it provides long service life due to its superior resistance to oxidation and exhibits good antiwear characteristics. **Mobiltemp SHC 32** is recommended for the lubrication of plain and rolling element bearings, splines, screws and some enclosed gearing with temperature ranges from −65°F to 350°F (−54°C to 177°C).

Mobiltemp 0, 1 and **2** nonsoap high temperature greases, with good dispersing properties, are designed for industrial applications where the service range of conventional greases may be exceeded, or cycling from normal to extremely high temperatures may occur. These greases contain effective oxidation and rust inhibitors, have excellent resistance to water washing and are recommended for the lubrication of bearings operating continuously at temperatures in the 300°F (149°C) range.

Mobiltemp 78 nonsoap grease is used where high temperatures and heavy loads are encountered in sleeve and antifriction bearings. It contains MoS_2 (molybdenum disulfide) which imparts "staying power" in those situations where the grease itself has been depleted in use and where only the MoS_2 remains to prevent wear until more grease is applied. This grease has shown outstanding ability to lubricate such components as conveyor bearings on high temperature ceramic and paint baking ovens, rotary steam joints on paper machine dryers and calenders, and antifriction bearings on preconditioning drums of paper corrugators. Its ability to resist thinning at temperatures up to 500°F (260°C) makes it especially suited for high temperature applications.

Mobilux® EP 0, EP 1 and **EP 2** unleaded lithium 12 hydroxystearate EP greases satisfy the need for multipurpose extreme pressure products to lubricate both antifriction and plain bearings, under wet and dry conditions, in the temperature range of −20°F to 250°F (−29°C to 121°C). Their smooth texture and excellent low temperature pumping characteristics make these products ideal for central dispensing systems. Their superior resistance to oxidation is combined with the ability to protect against corrosion of copper alloys and the rusting of steel even in the presence of alkaline water.

Mobilux EP 023 unleaded, semifluid, lithium 12 hydroxystearate EP grease was developed for the lubrication of gear cases found on underground coal mining equipment.

Mobilux EP 111 EP lithium grease is a black, tacky grease made from an extremely heavy base oil and contains an oil soluble molybdenum disulfide additive package. **Mobilux EP 111** resists centrifugal separation of oil from the soap at extremely high rotating speeds, making this grease particularly well suited for the lubrication of heavily loaded and misaligned gear couplings.

Mobilux EP Arctic® unleaded, semifluid, lithium 12 hydroxystearate EP grease is designed for low-temperature applications, down to −50°F ambient. It performs well in centralized grease systems on shovels and other mining equipment operating during cold winter months at mining locations.

SUS @ 40°C = 510
SUS @ 100°C = 64.5

LUBRICATING GREASES — INDUSTRIAL

Product	Grease Characteristics: NLGI Grade	Soap Type	Penetration at 77°F Worked	Struct	Color ASTM	Mineral Oil Viscosity: SUS at 100°F	Mineral Oil Viscosity: SUS at 210°F	Drop Pt. ASTM °F
Timken OK Load — 35 Lb								
Mobilplex 48	2-3	Calcium EP Complex	240-270	Smooth	Med. Br.	400-450	—	500
Timken OK Load — 35 Lb								
Mobiltemp SHC 32	1	Nonsoap	290-340	Smooth	Red	Synthetic Hydrocarbon	—	500
[illegible]	2		[illegible]			[illegible]	[illegible]	490
Mobiltemp 0	0	Nonsoap	355-385	Smooth	Br. Gr.	1200-1500	—	500
Mobiltemp 1	1	Nonsoap	290-340	Smooth	Br. Gr.	2448	155	500
Mobiltemp 2	2	Nonsoap	260-310	Smooth	Br. Gr.	2448	155	500
Mobiltemp 78	1	Nonsoap	290-340	Smooth	Gray Black	2448	155	500
Contains Molybdenum Disulfide								
Mobilux EP 111	1	Lithium Lead	310-340	Smooth w/Tack	Black	—	200/225	340
Mobilux EP Arctic		Lithium Hydroxy Stearate		Semi-fluid	Dk. Br.	80-85	—	—
Brookfield Viscosity cPs (No. 4 Spindle — 20 rpm at 77°F) — 5000/7000								
Mobilux EP 0	0	Lithium Plus EP	355-385	Smooth	Brown	750	80	340
Mobilux EP 023	000	Lithium Plus EP		Semi-fluid	Med. Br.	—	120	—
Brookfield Viscosity cPs (No. 4005 Spindle, 20 rpm) — 9000/11000								

DOCUMENTATION OF
TELEPHONE COMMUNICATIONS

DATE: 9-17-84 TIME: 15:00 A.M., P.M.

PARTY CALLING: Dale V. Gallodoro (Name) LP&L (Company)

PARTY ANSWERING: Jim Hummell (732-6700) (Name) Chevron Lube-Oil/Grease Division (Company)

SUBJECT: Chevron SRI-2 Characteristics and Equivalency to MobilTemp SHC-32 FILE:

SUMMARY: (INCLUDING DECISIONS AND OR COMMENTS)

I asked Jim Hummell if he could give me some characteristic of their SRI-2 grease for comparison to MobilTemp SHC-32.
He gave me the following information:

Characteristic	Value
NLGI Grade	2
Penetration at 77°F	195-265 Wked
Viscosity SUS @100°F	510
Viscosity SUS @210°F	645
Drop Point ASTM°F	470

He said that this grease is designed for motor bearing with excessive heat loads, however, he could not say whether MobilTemp SHC-32 would be suitable substitute without a study on teh specific application.

I will use the data to compare the two greases using a spec.

Ed Bauman

ACTION REQUIRED:

DISTRIBUTION:

DOCUMENTATION OF
TELEPHONE COMMUNICATIONS

DATE: 9-17-84 TIME: 3:30 A.M., P.M.
Typed 9-18-84

PARTY CALLING: Scott Stocklager (733-5010) (Name) Reliance Electric (Company)

PARTY ANSWERING: Dale Gallodoro (Name) LP&L (Company)

SUBJECT: Use of Mobil Mobiltemp SHC-32 Grease in Reliance Motors (1E) in Place of Chevron SRI-2

FILE: W3E84-0616

SUMMARY: (INCLUDING DECISIONS AND OR COMMENTS)

Scott Stocklager returned my call of earlier that day. He told me that he was told of my concern of substituting Mobil Temp SHC-32 for Chevron SRI-2 in their Class 1E Motors.

I discussed with him my findings on the characteristics of the two Greases and told him that LP&L's evaluations showed that Mobiltemp SHC-32 was the better Grease of the two.

He said he could not make any decision about the equivalency of the Greases on the phone, but if I would send him the documentation we used to evaluate the substitution he would get in touch with me if reliance had any problems with it. He said, if the documentation is in order and, it could be proven that Mobiltemp SHC-32 is a suitable substitute for Chevron-SRI-2, that no problems should occur.

Dale Gallodoro 9-17-84

ACTION REQUIRED:

DISTRIBUTION:

CIWA WORK PACKAGE PLANNING SHEET

LCIWA NO. 0/0596 SYSTEM CCS UNID NO. Various DATE RECEIVED 9/14/84

OPENING REVIEW INITIAL/DATE		CLOSING REVIEW INITIAL/DATE
	☒ WORK PACKAGE PLANNER	☒
	☐ SPARE PARTS GROUP	
	☒ PLANNER/SCHEDULER	☒
	☐ PLANT ENGINEERING	☐
	☐ CHEMISTRY	
	☐ HEALTH PHYSICS	
	☐ FIRE PROTECTION	
	☒ MAINTENANCE SUPERVISOR	☒
	☒ QUALITY CONTROL	

COMPONENT CCS Motors

DATE DUE

WORK LOCATION AND DESCRIPTION

Unid's CCS-Emtr 317A2MS, CCS-Emtr 317A3MS, CCS-Emtr 317B2MS, CCS-Emtr 317B3MS. Request PE to evaluate the use of Mobile SCH-32 grease in lieu of Chevron SRI-2. Please evalubate for possible non-conformance.

DOCUMENTATION

☐ RELEASE/STA NO. ☐ MHS FORM ☐ FMCS

☐ HWP(FP-I-001) NO. ☐ OJT FORM ☐ WSDS

☐ HWP(FP-I-002) NO. MM NO.

☐ RWP NO. PR. NO.

☐ CSWP NO. PO. NO.

☐ CCF NO. MSR

DRAWING NO.

MANUAL NO.

PROCEDURES

INFO/DATA SHEETS

TEST REQUIRED

NOTES:

☐ SECTION IX ☐ ISI ☐ TECH SPEC ☐ PM ☐ VIB ☐ LUBE

CS VB

WHERE	WPP1100	PE1100					
DATE	9/14/84	9/14/84					

CCF = CLEANLINESS CONTROL FORM
CSWP = CONFINED SPACE WORK PERMIT
FMCS = FILLER METAL CONTROL SHEET
HWP = HOT WORK PERMIT (FIRE PROTECTION PERMIT)
MHS = MAINT. HISTORY FORM
MSR = MATERIAL/SERVICES REQUEST
RWP = RADIATION WORK PERMIT
WSDS = WELDING SPECIFICATION DATA SHEET

MODE 1

WATERFORD NUCLEAR STATION
CONDITION IDENTIFICATION WORK AUTHORIZATION

Louisiana Power & Light — Middle South Utilities System

C11-02

ORIGINATOR

Z	KEYPUNCH USE ONLY	UNIT

SYSTEM 1	UNID 2	COMPONENT DESCRIPTION 3	QA TYPE 4
HRA	VARIOUS	HRA MOTORS	QUALITY REL. [X] YES [ ] NO SAFETY REL. [X] YES [ ] NO

CIWA 5	REQUEST DATE 6	FAILURE STARTED 7	TECH. SPEC. DATE 8	FOLLOW UP TO CIWA 9	STATION MOD NO. 10	PRIORITY 11	12
01105917001	MO. 11 DAY 14 YR. 84 HR. 16 MIN. 00	MO. 09 DAY 14 YR. 84 HR. 15 MIN. 00	MO. DAY ! YR. HR. MIN.			1	[ ] UNCONT. MAINT. [X] CONT. MAINT.

INITIAL PROBLEM OR FAILURE DESCRIPTION 13 (INCLUDE LOCATION)

UNIDS HRAEMTR311A2BS, HRAEMTR311A2DS, HRAEMTR311B2BS, HRAEM311B2DS
Request PE to evaluate the use of Mobil SHC-32 Grease in lieu of Chevron SRI-2. Please evaluate for possible non-conformance

SEE ADDENDUM PAGE [ ]

WORK CENTER 14	ELEC.	MECH.	INST.	OTHER	15 CONDITION/EQUIPT. ID TAG [ ] YES [X] NO	ORIGINATOR 16	EXT.	DEPT.	SS/CRS 17	DATE
	[ ]	[ ]	[ ]	[X] PE		T. MOORE	3112	ME		9/14/84

P&S

18 EVALUATION
- [ ] INVALID
- [ ] TROUBLE SHOOT
- [ ] MAINT. ITEM
- [ ] NONCONFORMANCE
- [X] TECH. EVAL.
- [ ] OTHER

DISPOSITION
- [ ] REWORK
- [ ] REPAIR
- [ ] REPLACE
- [ ] USE AS IS

INVALIDATION COMMENTS

P&S SIGNATURE: [signature] DATE: 10-12-84

SEE ADDENDUM PAGE [ ]

SS/CRS SIGNATURE DATE

PE

19 DISPOSITION CONCURRENCE YES [ ] NO [ ]

CAUSE & CORRECTIVE ACTION/TECH EVALUATION RESULTS

P E SIGNATURE DATE

SEE ADDENDUM PAGE [X]

WORK PACKAGE

TASK DESCRIPTION 20	DATE DUE 21 MO. DAY YR.	DUR. 22	M/SR, PR, P.O. NO. 23

CONTROLS REQUIRED 24	YES	NO
CONFINED SPACE ENTRY		
RADIATION WORK PERMIT		
TAGGING		
RETEST		
INSPECTION		
FIRE PROTECTION PERMIT		
SPECIAL PROCESSES		
CLEANLINESS CONTROL		
HOUSEKEEPING ZONE CHANGE		

PROCEDURES 25

DRAWINGS 26

RETEST PROCEDURES 27

TECHNICAL MANUALS 28

PREPARED BY 31

WORK INSTRUCTIONS 29

NA

SEE ADDENDUM PAGE [ ]

APPROVED BY 32 DATE: NA

QUALITY GROUP 33: NA

UNT-6-002 FORM WS-1001 Rev. 6-84

CIWA ADDENDUM PAGE	CIWA NO. 010597	DATE: 10-12-84	BLOCK NO: 19
	TITLE: PLANT ENGINEERING INPUT		

Reference Documents Used: SEE SPEER 84-021 AND PER 70023 — See Addendum Page

Persons Contacted: R. NAYLOR, ENS; S. STOCKLAGER, RELIANCE; JIM HUMMELL, CHEVRON — See Addendum Page

Logic Used: EVALUATE THE EQUIVALENCY OF MOBIL SHC 32 GREASE AND CHEVRON SRI-2 GREASE WITH REGARD TO LUBRICATING CHARACTERISTICS AND EVALUATE THE SUITABILITY OF MOBIL SHC 32 GREASE FOR THIS APPLICATION. SEE SPEER 84-021 AND PER 70023 ATTACHED. — See Addendum Page

Determinations/Conclusions: THE MOBIL SHC-32 GREASE IS EQUIVALENT TO CHEVRON SRI-2 GREASE AND IS SUITABLE FOR USE IN THIS APPLICATION. SEE SPEER 84-021 AND PER 70023 ATTACHED. — See Addendum Page

Additional Retests Required: NONE — See Addendum Page

Any Unreviewed Safety Questions? [ ] YES [X] NO IF YES, SEE PE-2-005 Att. 6.3 Step 5B.

Any Potentially Reportable Defect or Nonconplicnace? [ ] YES [X] NO IF YES, SEE PE-2-005 Att. 6.3 Step 5A.

Plant Engineer: [signature] 10-12-84 — Sign & Date — 3238 Ext.

Technical Reviewer: J. D. Williams Jr. 10/12/84 — Sign & Date

Systems Engineering Department Head: NA — Sign & Date

Mobil Tech Topics

ISSUED BY THE
COMMERCIAL MARKETING DEPARTMENT
OF MOBIL OIL CORPORATION

File: 10-21

LUBRICANTS IN NUCLEAR PLANTS

The advent of nuclear energy has added a new dimension to the requirements of lubricants and other petroleum products in industrial applications. Equipment in the nuclear industry — research and power reactors; fuel processing machinery; conveyors, manipulators, cranes, etc., in irradiation facilities; viewing windows and shield doors in hot cells; and heat exchange units — all require oils, greases, and organic fluids to perform conventional and special functions in radiation atmospheres.

Nowhere are the operating conditions of radiation, temperature, and atmosphere more demanding than in the power reactor field. At the outset of the nuclear power industry, equipment was designed to operate without conventional petroleum lubricants because little was known of the behavior of petroleum products under irradiation and the exact severity of the application was overestimated. This placed a design and economic burden on nuclear power generation. As experience was gained in operation of these plants, the original position was reconsidered. First, specific operating parameters (Table I) of radiation flux, temperature, etc., were obtained which realistically established the requirements and, secondly, research in the radiation resistance of petroleum materials showed that conventional lubricants could withstand doses up to 10^7-10^8 rads. This has led to an increase of the use of petroleum lubricants in new generation plants.

Effects of Radiation

The additional environmental factor of radiation in nuclear applications affects lubricants in much the same manner as heat. Both are modes of energy, and lubricants, like all organic materials, undergo major structural changes when certain thresholds of absorbed energy are reached. We know that petroleum products undergo thermal cracking and polymerization at certain temperatures and, likewise, that cleavage and crosslinking of molecules occurs at certain radiation dosage thresholds.

Two measurement methods are utilized to express the radiation energy. One measures the quantity of energy to which the material is exposed and is called the roentgen; the other is the amount of energy which the material absorbs and is called the rad. For gamma radiation, the exposure unit, the roentgen, is defined as the quantity of electromagnetic radiation which imparts 83.8 ergs of energy to one gram of air.

The radiation dosage of a material is defined as an absorption of 100 ergs of energy from any type of radiation by one gram of material. Actually, absorbed energy will vary with the type of radiation, and the effect will depend on the material exposed. However, for gamma radiation, one rad absorbed is approximately equivalent to 1.2 roentgens of radiation dosage. The rad is useful for comparing the equivalent energy of mixed radiation fluxes but does not distinguish between types.

From a radiation damage standpoint, one rad of neutron flux causes ten times more biological damage to living tissues than an equivalent absorbed energy of gamma rays. For petroleum products, however, the dosage, as measured by such effects as viscosity increase, is practically equivalent for the two types.

The general levels of radiation damage are as follows:

Dosage (Roentgens)	Effect
200 to 800	Lethal to humans
< than 5 million	Negligible to petroleum products
5 million to 10 billion	Damaging to petroleum products
> 10 billion	Survived by only most resistant organic structures

Based on experimental work to date, the damage to petroleum products may be summarized as shown below. It must be appreciated, however, that the intensity of these effects or, in fact, the incidence of one or more of these will depend on the amount of absorbed energy, the exact composition of the specific petroleum material, and environmental conditions such as temperature, pressure, and gaseous composition of the atmosphere. The effects are as follows:

1. Liquid products (fuels and oils) darken and acquire an acrid, oxidized odor.
2. Hydrogen content decreases and density increases.
3. Gases evolve such as hydrogen and light hydrocarbons.
4. Physical properties change, higher and lower molecular weight materials are formed, and olefin content increases.
5. Viscosity and viscosity index increases.
6. Polymerization to solid state may occur.

Properties of Irradiated Materials

The physical and chemical properties of hydrocarbon fluids which make them important as lubricants change during irradiation to varying degrees based on their chemical composition and the presence of additives. Investigations have shown that both carbon-hydrogen and carbon-carbon bonds can be broken by radiolysis and that the former change is more readily achieved due to the lower bond dissociation energy required. The dissociated or ionized molecules can condense, rearrange, form olefins, or be destroyed depending on the environment.

Since most petroleum lubricants are combinations of saturated and unsaturated aliphatics and aromatic compounds, the reactions of these principal hydrocarbon classes have been studied under the influence of ionizing radiation. These studies (Table II) indicate that, as would be suspected, unsaturated hydrocarbons are most reactive and aromatics are least affected. Saturated compounds fall somewhere between the two extremes. The results are expressed as G values, that is, the number of molecules reacting or produced for each 100 ev of ionizing radiation.

METHODS OF EVALUATION. Petroleum lubricants and synthetic organic fluids have been evaluated for radiation resistance, and the mechanism of radiolysis studied using various radiation sources. These include encapsulated cobalt-60 isotopes, spent fuel elements, swimming pool reactors, material testing reactors, Van de Graff accelerators, and electron linear accelerators.

The evidence of radiation stability, or conversely, the amount of radiation damage, is measured using conventional physical and chemical analyses and comparing the results with the unirradiated material. In addition, standard performance tests are performed both on the previously irradiated material and as a dynamic procedure during irradiation.

PERFORMANCE TESTING. While the chemical and physical tests indicate the resistance to change of the oil or grease under irradiation, for an evaluation of the actual lubricating ability of the material, it is necessary to conduct performance tests under conditions simulating the intended use. To date, a large majority of the radiation stability evaluations have been conducted on samples statically irradiated and subjected to performance testing after irradiation. This is especially true of fluid lubricants. Greases have been tested by static irradiation followed by dynamic performance tests and by dynamic testing during irradiation. Appreciable differences have been found in performance between the static and dynamic irradiation of greases. It has been found that two greases successfully lubricated irradiated antifriction bearings at elevated temperatures at double the radiation dose necessary to damage them severely under static conditions at room temperature. Little has been done to evaluate oils under dynamic irradiation conditions, but it is reasonable to expect similar anomalies.

Petroleum Oil Irradiation

Extensive studies have been made on the radiation stability of crude stocks and refined lubricating oils with and without additive packages. Crudes with high sulfur content and other components, e.g., metallic poryphyrin complexes, which act as protection against radiolysis, showed better radiation stability than the refined products using the same crudes. Additional studies were made on a range of petroleum oils representative of typical paraffinic, naphthenic, and aromatic materials varying in sulfur content. These data show that as the aromatic content increases, the viscosity increase is less in almost a linear relationship. The effect of sulfur content is similar but more marked. Further, it was noted that radiation damage appears greatest for oils having the highest initial viscosity.

In summary, high quality conventional lubricating oils are suitable for doses up to 10^8 rads. Further radiation resistance can be formulated into a good quality petroleum oil by use of antirads such as radical scavengers or aromatic structures (Fig. 1).

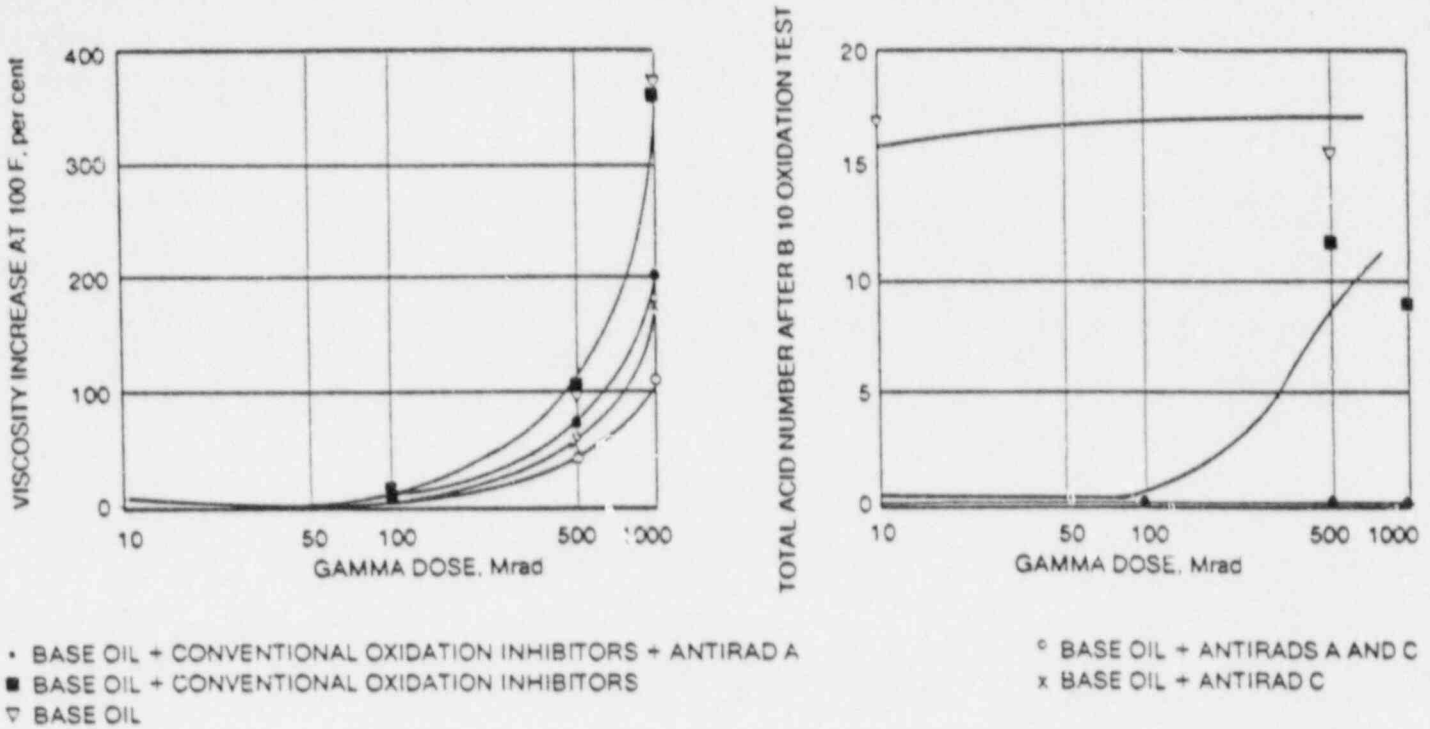

FIG. 1 — EFFECT OF ANTIRADS ON VISCOSITY AND OXIDATION

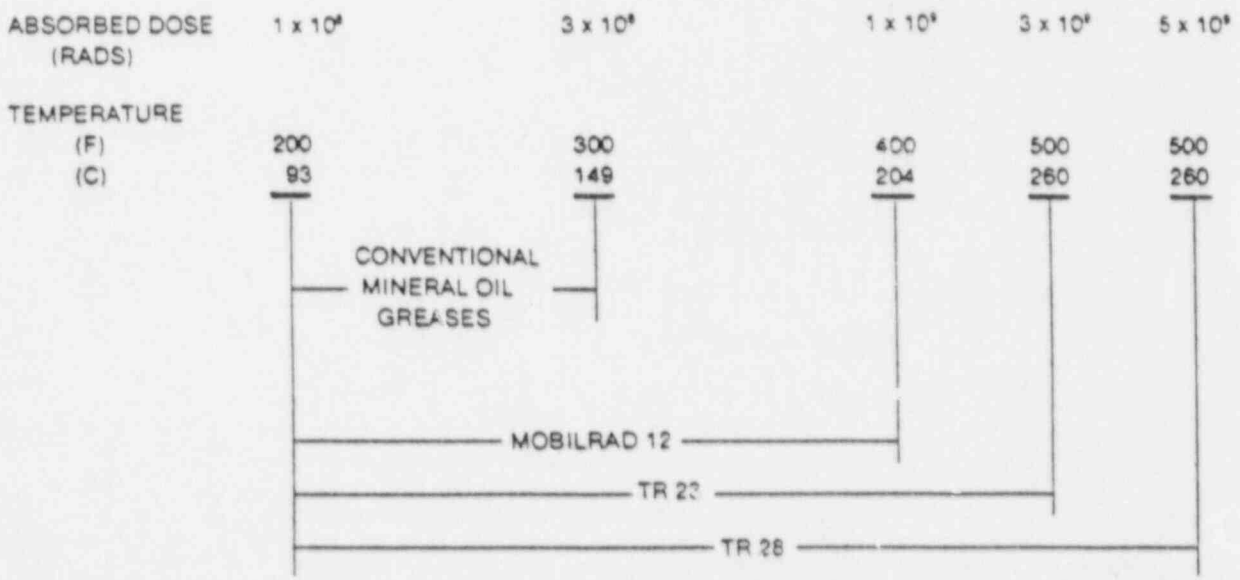

FIG. 2 — EFFECTIVE RANGES OF RADIATION RESISTANT GREASES

Grease Irradiation

The damage caused by high energy radiation on greases is a dual effect. Initially, the radiation attacks the thickening structure causing separation and fluidity. Following this continued irradiation causes polymerization of the base oil to the original thickened condition and finally solidification. The precise pattern of change is dependent on the type of thickener, the gel structure, and the radiation stability of the thickener and base oil.

Various nonsoap thickeners are available which form good radiation resistant greases with both mineral oil and synthetic fluid bases (Fig. 2). These thickeners may be grouped as follows:

1. Modified clays and silicas – Typical of the modified clays are Bentone 34 and Baragel, which are formed by a cation exchange reaction between a montmorillonite clay and a quatenary ammonium salt.
2. Dye pigments – Organic toners or dye pigments are utilized as grease thickeners; for example, indathrene.
3. Organic thickeners – Typical of this type are the substituted aryl ureas characterized by the diamide-carbonyl linkage

TABLE I

Nuclear Reactor Systems

Estimated Dose to Components – Rads/Yr(1)

Component	Pressurized Water Reactor	Boiling Water Reactor	Organic Moderated Reactor	Liquid Metal Cooled Reactor	Gas Cooled Reactor
Control Rod Mechanisms	10^5-10^8	10^8 max	10^6-10^8	0-10^5	10^3-10^5
Fuel Handling Devices	10^6-10^7	–	–	0-10^6	10^2-10^5
Primary Coolant Pumps	10^6-10^7	10^6-10^7	0-10^2	Negligible	10^3 max
Auxiliary Pumps	10^4-3 x 10^6	10^4-3 x 10^6	0-10^2	0-10^6	10^4 max
Auxiliary Motors, etc.	10^5-3 x 10^7	10^5-10^7	–	–	10^4 max
Turbogenerator and auxiliaries	Negligible to 10	400-800	Negligible to 25	Negligible to 25	Negligible to 5 x 10^3

(1) The rad, a unit of dose, is the absorption of 100 ergs of radiation energy per gram of material.

TABLE II

Summary of Radiation Changes in Organic Compounds

	G Values		
	Saturated Hydrocarbons	Unsaturated Hydrocarbons	Aromatic Hydrocarbons
Polymerization	None	10-10,000	None
Cross Linking	1	6-16	2
H_2 Evolution	2-6	1	0.04-0.4
CH_4 Evolution	0.06-1	0.1-0.4	0.001-0.8
Destruction of irradiated Material	4-9	6-2000	1

G = Molecules produced, destroyed, or reacted per 100 electron volts of energy absorbed.