

PART 21 REPORT LOG SHEET

1. Subject of Report - GREER VALVE ACTUATORS (SEE LOG SHEET No. 50)

2. Date Verbal Notification Received - 11/15/84 Received By - T. Young

3. Date Information Placed in Daily Report - 11/16/84

4. Name and Address of Person Providing Verbal Notification

a) Name - JOHN KWARTZER

b) Company and Address - 6500 E. SLAUSON AVE.

c) Telephone No. - COMMERCE, CA. 90040

5. Description of Problem - SEE LOG SHEET No. 50

6. Nuclear Facilities Affected - SEABROOK U-2

7. Date 5-day Written Report Due - 11/29/84 ~~2/2/85~~ Date Received - 11/29/84 ~~2/20/85~~

8. Div. Secretary Mail Written Report to HQ's and Other Affected Regions

a) Date Mailed to HQ's Document Control Desk - 2/2/85

b) Date Mailed to Other Regions - I 2/2/85

9. Generic Issue Data Sheet (TI-2500/3) submitted? Yes No

10. Additional Comments -

Part 21 Report Screened by T Young

Date 2/20/85

Cognizant Section Chief: T Young

Date 2/20/85

Region V Form No. 809
Revised 3/13/84

8502270378 850211
PDR ADOCK 05000444
S PDR

Attachment 1

0500 444

IE-19
11

RECEIVED
NRC

GREER HYDRAULICS

6500 EAST SLAUSON AVENUE, CITY OF COMMERCE, CALIFORNIA 90040 (213) 725-0110 (213) 685-6730

1985 FEB 14 AM 10:49

February 11, 1985

REGION V FILE

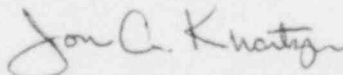
Director of Region V
Nuclear Regulatory Commission
Suite 210
1450 Maria Lane
Walnut, CA 94596

Re: Notification of Failure to Comply or
Existence of a Defect (Section 21 Report)

Gentlemen:

The attached report provides the results of the investigation of a reported defect in Greer valve actuators supplied for use on Seabrook Unit 2. The report also contains the action to be initiated by Greer to correct the defective actuators.

Sincerely,



Jon A. Knartzer
Director of Engineering and
Technical Services

JAK:jb

Enc.

cc: Posi-Seal International, Inc.
H. D. Weeks - Greer
V. Olson - Greer

10CFR21 REPORT

NOTIFICATION OF EXISTENCE OF A DEFECT

Greer Hydraulics
February 11, 1985

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I. Summary

Greer supplied twenty-four valve actuators to Posi-Seal International for use on valves at Seabrook, Unit 2. Two of the actuators were tested by Stearns and Rogers prior to installation at Seabrook. The actuators did not open and close the valves in the required time. The actuators were disassembled and the component parts reviewed. An incompatibility between the ethylene propylene rubber (EPR) components and the lubricant was identified. The incompatibility caused the rubber components to swell, which increased the cycling time for opening and closing the valves.

The actuator components were cleaned and reassembled using Molykote 44 and new EPR components. The Molykote 44 is a Dow Corning lubricant compatible with EPR. The actuators were tested and performed in accordance with the original specification.

The remaining actuators are to be returned to Greer, disassembled, cleaned, and reassembled using Molykote 44 and new EPR components. The units are then to be tested to assure compliance with the original specifications. This action is scheduled to be completed by the end of March 1985.

II. Problem Statement

Greer Hydraulics supplied twenty-four valve actuators (See Appendix A), in early 1983, to Posi Seal International, Inc. for installation by United Engineers and Constructors on various systems of Seabrook Unit 2. Two actuators were tested for cycling speed prior to installation, on November 9, 1984, by Stearns-Rogers Manufacturing, Inc. of Denver, Colorado. The actuators were specified to cycle (opened and closed) in 3 seconds. The cycling speed was 1.8 to 2.3 seconds to open and 19 to 28 seconds to close. All actuators were successfully tested by Greer and Posi Seal prior to shipment to Posi Seal.

The two actuators were then disassembled and all components reviewed. All components appeared to be in working order, except the ethylene propylene rubber (EPR) components, which were swollen. It was speculated, after a review with Greer engineering personnel, that an incompatibility with the EPR components and the lubricant existed.

It was decided to repeat the actuator cycle testing on November 20, 1984. The testing was done after each actuator was cleaned and reassembled with new EPR components and Molykote 44, a Dow Corning lubricant compatible with EPR. (See Appendix C). Both actuators were then cycled and determined to be cycling at the specified rate for opening and closing.

Samples of the swollen EPR components and the original lubricant were returned to Greer for analysis. The analysis was performed by Analytical Research Laboratories, Inc. (See Appendix B). The analysis confirmed the incompatibility between the EPR components and the lubricant. The grease originally supplied in the actuators was a petroleum based product incompatible with EPR.

III. Corrective Action

The remaining twenty-two actuators are to be returned to Greer for corrective action. The actuators are to be disassembled, components cleaned, and inspected. The actuators are to be reassembled with new EPR components and Molykote 44. The units are then to be tested to assure compliance with the original purchase order specifications. The repair of the remaining twenty-two units is to be completed by the end of March 1985.

The twenty-four units supplied to Posi Seal International, Inc. are the only units supplied by Greer Hydraulics for use in a nuclear power generating facility. Future actuators requiring EPR components are to be lubricated with Molykote 44 to assure rubber compatibility.

APPENDIX A

Model Number and Quantities of Greer Actuators Supplied
to Posi Seal International, Inc. for Use on Seabrook Unit 2.

<u>Model</u>	<u>Quantity</u>
26062-SR-60	6
26072-SR-60	8
26051-SR-60	3
26061-SR-60	1
33122-SR-60	2
45211-SR-60	4

APPENDIX B

Analytical Research Laboratories, Inc. Report



ANALYTICAL RESEARCH LABORATORIES, INC.

160 TAYLOR STREET, P.O. BOX 2360, MONROVIA, CALIFORNIA 91016

(818) 357-3247

Lab/Shipper
Log Number

124071

Client Greer Hydraulics, Inc.		Work Order 6234-01	P. O. Number SP6394
Material/Sample Identity 2 Packages of Plastic Seals		Rec'd 12-17-84	Due 1-2-85
Requested By Name: Mr. David Broad		Phone:(213) 725-0110	Sample Disposition Return
Report/Ship To: Mr. David Broad Greer Hydraulics, Inc. 6500 E. Slauson City of Commerce, CA 90040			

Nature of Work and Information Desired

Identify Polymers and Greases

Summary of Laboratory Report

Q. C. Level

1

The seals were all made of ethylene/propylene copolymer. The SN 3148-1-2 grease was only a petroleum grease whereas the SN 3146-1-1 grease also contained some silicone grease. Details of the analysis and the analytical procedures are given in the attached report.

As a mutual protection to clients, this report is submitted for the exclusive use of the client to whom it is addressed. This report applies only to the sample(s) tested and is not necessarily indicative of the qualities of apparently similar or identical products. Use of this report, whether in whole or in part, or of any seals or insignia connected therewith, in any advertising or publicity matter, without prior written authorization is prohibited.

Analyst DWK	Book - Page 334 - 48	Approved By 	Date 1 January 1985
Research and Development		Testing	

APPENDIX C

Silicon Lubricant Recommendation

The Dow Corning Molykote 44 silicon lubricant is recommended for use with ethylene propylene. The Molykote does not react with the EPR and therefore the seal swelling that causes actuator slowing is eliminated.

Hydrocarbon based lubricants provide oil that is absorbed into the EPR. The penetration of the oil into the EPR creates swelling that weakens the bond within the cured rubber. The reaction between EPR and hydrocarbon based lubricants is the result of a mutual attraction the materials have for each other because of their similar molecular structures.

Silicon lubricants, on the other hand, have a molecular structure based on silicon and oxygen and are much different from the carbon and hydrogen molecular chain configuration. The molecular differences between the silicon lubricant and the EPR result in no attraction between the two substances.

Actual test results indicate that EPR and other synthetic elastomers shrink from 1 to 2 per cent when in contact with Molykote 44. The shrinkage is not detrimental to the life of Greer valve actuators.



ANALYTICAL RESEARCH LABORATORIES, INC.

160 TAYLOR STREET, P.O. BOX 2360, MONROVIA, CALIFORNIA 91018

(818) 357-3247

Greer Hydraulics, Inc.

Lab Log No. 124071
1 January 1985

Two sets of O-rings and gaskets with small amounts of lubricant on them were submitted by Greer Hydraulics, Inc. for identifications. The sets were identified as SN 3148-1-2 and SN 3146-1-1.

A portion of the grease from each of the two sets was scanned using infrared spectrometry to identify the grease types. The grease from SN 3148-1-2 is a petroleum grease containing only aliphatic hydrocarbons. The grease from SN 3146-1-1 contains the petroleum grease but also contains some silicone grease, possibly as much as 5%.

From each set of O-rings and gaskets, the following were selected for polymer identification; the smallest O-ring, the small gasket, the largest O-ring and the largest gasket. Portions of each of these samples were acetone extracted using method ASTM D297 to remove any grease or plasticizer. The extracted polymer portion was then analyzed using pyrolysis infrared spectrometry. All O-rings and gaskets were made of the same kind of polymer. The polymer is identified as an ethylene/propylene copolymer. This type of polymer is known to be recommended for use with water, silicone oils and greases, dilute acids or alkalis, ketones, alcohols and automotive brake fluids (glycols). It is not recommended for use with petroleum oils or di-ester base lubricants. Since the greases are primarily petroleum greases, poorer performance of the seals might be expected. The presence of some silicone grease in SN 3146-1-1 may give a slightly improved performance.

D. W. Kohlenberger
Senior Research Chemist

APPENDIX D

Molykote 44, Dow Corning Technical Specification

DOW CORNING TESTING INFORMATION

RECEIVED

JAN 29 1985

TELEX OPERATOR

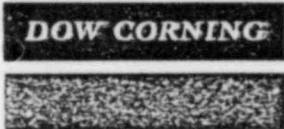
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GREER LSA
TELXP01 006 TELX 006 RDESD23 01/29/85 13.32
DAVE BROAD
GREER HYDRAULICS
6500 EAST SLASSON AVENUE
CITY OF COMMERCE, CA. 90040
TELEX NO. 194.828

IT HAS BEEN OUR EXPERIENCE THAT SYNTHETIC ELASTOMERS
SUCH AS EPR WHEN IN CONTACT WITH MOLYKOTE 44 GREASE WILL
UNDERGO A SHRINKAGE IN THE RANGE OF 1 TO 2 PERCENT WHEN
TESTED ACCORDING TO ASTM 471-68 FOR 70 HRS AT 212 DEGREES
F. GEORGE V. KUBCZAK, DOW CORNING CORP., TECHNICAL SERVICE
AND DEVELOPMENT.

/MRS/1/29/85

Information about Molykote® Silicone Greases



DESCRIPTION

Molykote®33, 41 and 44 greases are silicone lubricating oils with thickeners added. Molykote 33 and 44 greases are thickened with a special lithium soap; Molykote 41 grease is thickened with carbon black.

Designed primarily for use on ball bearings operating under light to moderate loads, these greases will not thin out excessively or gum up. They are resistant to oxidation, moisture and corrosive atmospheres. They are also inert, have good shear stability, and are serviceable over a wide temperature range — Molykote 33 grease from -100 to 400 F (-73 to 204 C); Molykote 41 grease from 0 to 550 F (-18 to 288 C); Molykote 44 grease from -40 to 400 F (-40 to 204 C).

Molykote 33 and 44 greases are available in two consistencies — light and medium. Molykote 41 grease is available in a light consistency, NLGL #2. Molykote 44 grease is also available in a special consistency designed to meet MIL-I-15719A.

USES

All three Molykote greases are used to lubricate ball and roller bearings operating under light to moderate loads and at low speeds. Typical applications include:

Molykote 33 grease

- Freezer cart casters, and cold room conveyor equipment
- Electric clock motors
- Maximum-demand meters, power-factor meters, watt-hour meters

MOLYKOTE® 33, 41 AND 44 GREASES

Type,	Molykote 33 and 44 greases	Silicone oil thickened with lithium soap
	Molykote 41 grease	Silicone oil thickened with carbon black
Physical Form	Greases	
Special Properties	Resistant to oxidation, moisture and corrosive atmospheres; good shear stability; wide service temperature range	
Primary Uses	Lubricants for antifriction bearings and plastic and rubber parts	

- Windshield wiper motor gears
- Photographic, optical and surveying equipment
- Oscillographs, geophysical, and light, low-torque instruments

Molykote 41 grease

- Antifriction bearings of high-temperature equipment
- Oven conveyor bearings
- Wheel bearings of core oven carts
- Pumps handling molten salts
- Governor linkage of steam turbines
- Anti-seize for bolts and studs
- Knife-type electric power disconnect switches
- Ball and socket connections of power insulators

Molykote 44 grease

- Kiln preheater fans, oven fans, radiator cooling fans
- Textile slashers and driers
- Conveyor systems

Molykote 33, 41, and 44 greases do not soften or affect most plastics and are used to lubricate plastic gears, bearings and cams, as well as metal and rubber parts. Because

of their low torque requirements, these greases are especially effective in equipment that must start in extreme cold.

Oxidation Resistance

Molykote 33, 41, and 44 greases are recommended for use in units that must remain operable when subjected not only to low and high operating temperatures, but also to severe weathering and oxidation.

The results of a comparison between silicone and organic greases are shown in Figure 1. In these tests, after 500 hours of exposure to oxygen under a pressure of 110 psi and a temperature of 210 F (99 C), in the presence of a brass catalyst, silicone greases cause a pressure drop of only 1.5 psi.

HOW TO USE

General

Conventional grease application methods — brushing, grease gun or automatic applicators — are suitable for use with Molykote 33, 41, and 44 greases. Laboratory tests and field reports indicate that "heavy duty" guns available from such manufacturers as Lincoln-St. Louis are preferred.

TYPICAL PROPERTIES OF MOLKYKOTE 33, 41 AND 44 GREASES

These values are not intended for use in preparing specifications.

	<i>Molykote 33 grease</i>		<i>Molykote 41 grease</i>	<i>Molykote 44 grease</i>	
	<i>Light</i>	<i>Medium</i>		<i>Light</i>	<i>Medium</i>
Color	Pink/Gray ¹	Pink/Gray ¹	Black	Amber	Amber
Thickener	Lithium soap	Lithium soap	Carbon black	Lithium soap	Lithium soap
Penetration, ² worked					
60 strokes	300	260	280	300	260
Bleed, after 24 hrs at					
300 F (149 C), ³ percent	3.5	2.0	5.0 ⁴	4	2.5
Evaporation, after 24 hrs at					
300 F (149 C), ³ percent	2.0	2.0	3.0 ⁴	1.5	1.0
Dropping Point, degrees	410 F (210 C)	410 F (210 C)	None	400 F (204 C)	400 F (204 C)
Dirt Count ⁵	Pass	Pass	N/A	Pass	Pass
Temperature Range, degrees	-100 to 400 F (-73 to 204 C)	-100 to 400 F (-73 to 204 C)	0 to 550 F (-17 to 288 C)	-40 to 400 F (-40 to 204 C)	-40 to 400 F (-40 to 204 C)
Specific Gravity at 77 F (25 C) ..	0.97	0.97	1.14	1.05	1.05
Bomb Oxidation, ⁶ pressure drop after 500 hrs at 210 F (99 C), psi	2.0	2.0	—	2.0	2.0
Water Washout Resistance, ⁷ loss percent	0.5	0.5	0.5	0.5	0.5
Thermal Conductivity:					
cal/sec/cm ² /°C/cm	0.00028	0.00028	—	0.00028	0.00028
BTU/hr/ft ² /°F/in	8.13	8.13	—	8.13	8.13
Specific Heat:					
cal/gm/°C	0.379	0.379	0.368	0.368	0.368
BTU/lb/°F	0.379	0.379	0.368	0.368	0.368
High Temperature Bearing Performance, hrs at 10,000 rpms, 6-lb radial load, 204 bearing at 400 F (204 C), Weibull B ₅₀	—	320	Not Recm'd	—	800
Max. DN Value (Bore Size in mm x rpm)	150,000-200,000	150,000-200,000	75,000	150,000-200,000	150,000-200,000

¹The dye in Molykote 33 changes color on standing; this color change does not affect the serviceability of the grease.

²ASTM D 217

³Determined with equipment described in MIL-S-8660B.

⁴Determined using 392 F (200 C).

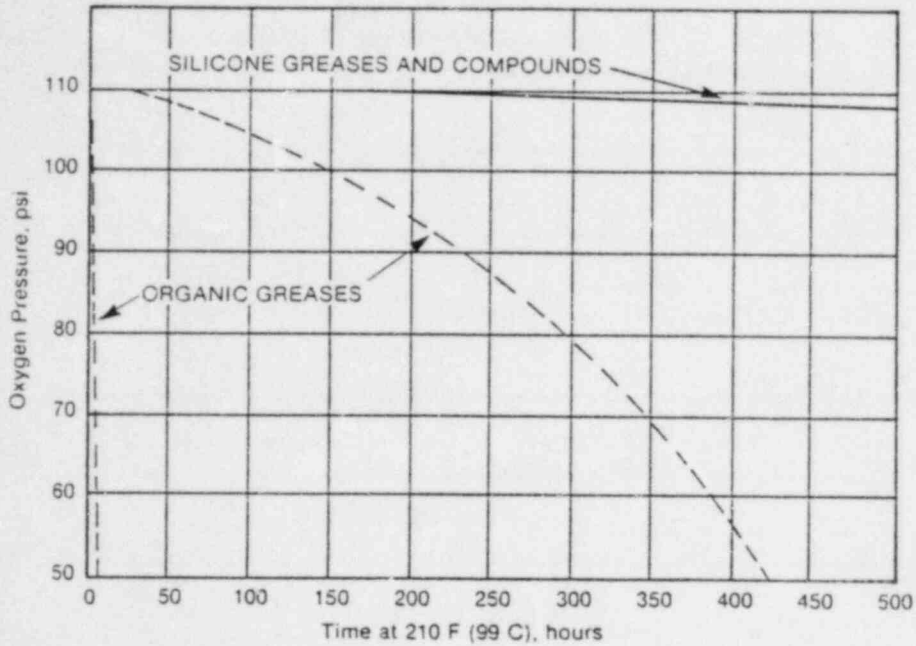
⁵MIL-I-15719A and Amendment I.

⁶ASTM D 942

⁷MIL-I-15719A

Specification Writers: Please contact Dow Corning Corporation, Midland, Michigan, before writing specifications on these products.

FIGURE I: OXIDATION RESISTANCE OF SILICONE GREASES



NOTE: Extra care should be taken at all times to prevent dirt from contaminating the lubricant. These greases should be packed with a clean metal or ebonite spatula. They should not be applied to surfaces that are to be painted. Molykote 41 grease should not be used with highly loaded ferrous metal bearing combinations, especially where sliding friction is encountered.

CAUTION

Temporary discomfort may be produced from eye contact with Molykote 33, 41 and 44 greases.

SHIPPING LIMITATIONS

None.

STORAGE AND SHELF LIFE

When stored at or below 90 F (32C), Molykote 33, 41 and 44 greases have a shelf life of 18 months from date of shipment.

DOW CORNING CORPORATION
MATERIAL SAFETY DATA SHEET

EMERGENCY PHONE NO: (517) 496-5900

SECTION I

PRODUCT NAME OR NUMBER: MOLYKOTE(R) 44 GREASE - ALL GRADES

MANUFACTURERS NAME: DOW CORNING CORPORATION
ADDRESS: SOUTH SAGINAW ROAD, MIDLAND MI 48640

PROPER SHIPPING NAME(49 CFR 172.101): NONE
D.O.T. HAZARD NAME(49 CFR 172.101): NONE
D.O.T. ID NO(49 CFR 172.101): N.A.
D.O.T. HAZARD CLASS (49 CFR 172.101): NONE
RCRA HAZARD CLASS*(40 CFR 261): NONE
E.P.A. PRIORITY POLLUTANTS (40 CFR 122.53): NONE
HEALTH (NFPA): 1 FLAMABILITY (NFPA): 1 REACTIVITY (NFPA): 0
CAS. NO.: MIXTURE DCWC: 76
GENERIC DESCRIPTION: SILICONE
* IF DISCARDED

SECTION II HAZARDOUS INGREDIENTS

None present	%:	TLV (units):
	%:	TLV (units):

SECTION III HEALTH HAZARD DATA HEALTH (NFPA) 1

EFFECTS OF OVEREXPOSURE: May cause temporary discomfort to eyes.

THRESHOLD LIMIT VALUE OF PRODUCT: Not applicable

EMERGENCY AND FIRST AID PROCEDURES: Flush with water.

SECTION IV FIRE AND EXPLOSION HAZARD DATA FLAMMABILITY (NFPA) 1

FLASH POINT (Method Used): Open Cup above 250°F/121°C

FLAMMABLE LIMITS IN AIR, % BY VOLUME: Lower: Not applicable
Upper: Not applicable

EXTINGUISHING MEDIA: Carbon dioxide or foam.

SPECIAL FIRE FIGHTING PROCEDURES: Self contained breathing apparatus and protective clothing should be worn in fighting fires involving chemicals.

UNUSUAL FIRE AND EXPLOSION HAZARDS: None known to Dow Corning.

(R) INDICATES REGISTERED OR TRADEMARK NAME OF DOW CORNING CORPORATION

DOW CORNING CORPORATION
MATERIAL SAFETY DATA SHEET

NAME OR NUMBER: HOLYKOTE(R) 44 GREASE - ALL GRADES
SECTION VIII SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (SPECIFY TYPE): NONE SHOULD BE NEEDED.

VENTILATION

LOCAL EXHAUST: NONE SHOULD BE NEEDED.
SPECIAL: NONE KNOWN TO DOW CORNING.
MECHANICAL (GENERAL): RECOMMENDED.
OTHER: NONE KNOWN TO DOW CORNING.

PROTECTIVE GLOVES: NONE SHOULD BE NEEDED.

EYE PROTECTION: PROPER EYE PROTECTION SHOULD BE WORN IN ANY TYPE OF INDUSTRIAL OPERATION.

OTHER PROTECTIVE EQUIPMENT: AS REQUIRED BY YOUR COMPANY.

SECTION IX SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING: USE REASONABLE CARE.

OTHER PRECAUTIONS: NONE KNOWN TO DOW CORNING.

NOTE: NONE

THIS DATA IS OFFERED IN GOOD FAITH AS TYPICAL VALUES AND NOT AS A PRODUCT SPECIFICATION. NO WARRANTY, EITHER EXPRESS OR IMPLIED, IS HEREBY MADE. THE RECOMMENDED INDUSTRIAL HYGIENE AND SAFE HANDLING PROCEDURES ARE BELIEVED TO BE GENERALLY APPLICABLE. HOWEVER, EACH USER SHOULD REVIEW THESE RECOMMENDATIONS IN THE SPECIFIC CONTEXT OF THE INTENDED USE AND DETERMINE WHETHER THEY ARE APPROPRIATE.

PREPARED BY: L C VANVOLKINBURG

DATE: JANUARY 22, 1985

LAST REVISED: JANUARY 19, 1981

PREVIOUS REVISION DATE: OCTOBER 24, 1979

(R) INDICATES REGISTERED OR TRADEMARK NAME OF DOW CORNING CORPORATION

APPENDIX D

**Names and Addresses of Organizations Involved in
Resolving Defect.**

1. Analytical Research Laboratories, Inc.
160 Taylor Street
P. O. Box 2360
Monrovia, CA 91016

2. Greer Hydraulics
6500 East Slauson Ave.
City of Commerce, CA 90040

3. Posi-Seal International
Routes 49 & U.S. 95
No. Stonington, Ct. 06359

4. Stearns & Rogers
4500 Cherry Creek Drive
Denver, CO. 80217

5. United Engineers and Constructors
30 S. 17th Street
P. O. Box 8223
Philadelphia, PA 19101