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SUBJECT: Part 21 rept re defect in Limitorque valve motor operator
 Model SMB-2 w/soft worm shaft clutch gear assembly.

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WASHINGTON PUBLIC POWER SUPPLY SYSTEM

P.O. Box 968 • 3000 George Washington Way • Richland, Washington 99352

April 26, 1989
G02-89-070

Docket No. 50-397

Mr. T. E. Murley, Director
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Gentlemen:

Subject: **NUCLEAR PLANT NO. 2**
 10CFR PART 21 REPORT

This is a 10CFR Part 21 report submitted in accordance with the requirements of 10CFR Part 21 by Mr. G. D. Bouchey, Director, Licensing & Assurance. The address of the Washington Public Power Supply System is:

Washington Public Power Supply System
PO Box 968
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Richland, Washington 99352

Questions concerning this report should be referred to Mr. S. L. Washington, Compliance Supervisor (509) 377-2080. The verbal notification of this 10CFR Part 21 was made on April 20, 1989 by Mr. C. M. Powers, WNP-2 Plant Manager to Mr. S. A. Richards, Chief, Engineering Section, NRC Region V.

The basic component which contained the defect is a Limitorque valve motor operator model SMB-2 with a "soft" worm shaft clutch gear assembly. On February 10, 1989 the model SMB-2 valve motor operator on the High Pressure Core Spray (HPCS) pump containment suppression pool water supply suction valve (HPCS-V-15) failed during a surveillance test. Operation of this valve is necessary to mitigate the consequences of an accident and; therefore, this valve motor operator meets the 10CFR Part 21 definition of a basic component.

When the valve motor operator (HPCS-MO-15) was manufactured, the split spacer (See Figure 1) of the worm shaft clutch gear assembly was not installed as required. This is a deviation in a delivered component which was installed and operated at WNP-2. This defect caused the motor operator to fail such that the valve would not operate, except by manual operation (which was very difficult).

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This defect could create a substantial safety hazard in that a valve motor operator could fail to operate during accident conditions when required to perform a safety function. HPCS-V-15 is required to operate in both the close and open directions to perform the following safety functions: 1) the valve is required to automatically open when the condensate storage tank low water level setpoint is reached to align the HPCS pump with the containment suppression pool water supply, 2) the valve is required to also automatically open when the suppression pool high water level setpoint is reached to protect the containment from overpressurization during accident conditions, and 3) the valve is required to close by remote manual action for containment isolation for a pipe break in the HPCS System. The failure of this valve motor operator is classified as a major degradation of safety related equipment.

The nature of the failure is as follows. With the split spacer not installed (See Figure 1), the set screws installed through the worm shaft clutch gear sleeve had no surface to press against and hold the worm shaft clutch gear assembly together. When the worm shaft clutch was positioned for manual operation the worm shaft clutch gear sleeve worked its way off the worm shaft clutch gear (See Figure 2). When the motor operator was re-engaged the worm shaft clutch gear sleeve would catch on the worm shaft clutch gear splines which forced the sleeve lugs against the clutch, and the clutch against the handwheel clutch pinion assembly. Because the clutch is spring loaded, both the motor and manual clutch lugs would slide over each other causing excessive wear. In addition, the worm shaft clutch gear was pressed against the split ring and split ring retainer. Eventually the split ring retainer failed and the split ring fell into the valve motor operator assembly. After this occurred, the clutch gear and clutch gear sleeve separated sufficiently to allow the sleeve to spin freely (i.e. not catch on the splines). In this condition the motor operator would not work. At the time the motor operator failed, the handwheel manual operation was sporadic due to the wear on the clutch/manual lugs.

This failure can only occur for valve motor operators with a "soft" worm shaft clutch gear assembly. The "soft" clutch gear assembly is usually specified for fast acting valves and is different from the normal "hard" worm shaft clutch gear assembly because it consists of two pieces, the clutch gear and the clutch gear sleeve, whereas the hard clutch is a single machined piece. Therefore, we believe this failure is limited to the "soft" worm shaft clutch gear assembly.

The following is the sequence of the 10CFR Part 21 investigation.

- 1) The root cause evaluation of the failure was completed on February 15, 1989.
- 2) The valve motor operator manufacturer was contacted on February 14, 1989. The manufacturer representative agreed with our conclusion. He stated that they had not previously experienced this type of failure.
- 3) The Institute of Nuclear Power Operations (INPO) Nuclear Plant Reliability Data System (NPRDS) was surveyed and no failures of this type were identified.

- 4) A review of WNP-2 Maintenance records determined that no Supply System activities related to this valve motor operator could have caused this defect. This review was completed on April 10, 1989.
- 5) The 10CFR Part 21 review was completed on April 19, 1989 and presented to the Plant Operating Committee (POC) on April 19, 1989. Following the POC recommendation, the Plant Manager concluded that this failure of a basic component was reportable per the requirements of 10CFR Part 21.

The Supply System has 29 Limitorque Model SMB-2, SB-2, SMB-3, SB-3, and SMB-4 valve motor operators of which the purchase specification required "soft" clutches. Of the 29 valve motor operators, 14 are used on safety related valves (these valves are listed in Appendix A). In addition, according to Limitorque other SMB-2 through SMB-5 and SB-2 through SB-5 valve motor operators could be supplied with "soft" clutches even though not specified on the purchase order. There are 48 valve motor operators in this category of which 12 are used on safety related valves. The 12 safety related valves are listed in Appendix B.

The review of WNP-2, vendor, and industry history of limitorque operators found no similar failures; therefore, the current assessment is that this is a singular isolated failure. However, the following corrective actions are planned to ensure the operability of these motor operators.

- 1) During the upcoming Refueling and Maintenance Outage the safety related valves listed in Appendices A and B will be manually operated (See discussion below).
- 2) The Plant procedure for maintenance and repair of Limitorque valve motor operators will be revised to include instructions for inspecting the worm shaft clutch gear assembly anytime a motor operator is disassembled.
- 3) Cautions will be added to appropriate Plant procedures regarding disposition of valves found difficult to operate manually (See discussion following).

Even with the split spacer not installed this type of failure requires additional circumstances. When positioned for motor operation the worm shaft clutch gear and sleeve are held together by the clutch spring pressure and cannot separate. Only when positioned for manual operation, when the spring pressure on the worm shaft clutch gear assembly is relieved, can the gear and sleeve separate. The safety related valves listed in Appendices A and B are normally positioned for motor operation and are only manually engaged during maintenance and ASME Section XI Valve Position Indication (VPI) testing. A characteristic of this failure was the degradation of the handwheel clutch pinion assembly which made manual operation difficult. If during the above maintenance and testing activities a valve is found difficult to operate manually, the worm shaft clutch gear assembly will be inspected.

We informed Limitorque Corporation on February 14, 1989 that this failure was considered a potential 10CFR Part 21. The worm shaft clutch gear assembly components recovered from the HPCS-MO-15 are being sent to Limitorque for evaluation. Limitorque will also be formally notified of this 10CFR Part 21 Report.

Very truly yours,



G. D. Bouchey, Director
Licensing & Assurance

SLW/bk
Attachments

cc: JB Martin - NRC RV
NS Reynolds - BCP&R
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APPENDIX A
SAFETY VALVES WITH SPECIFIED SOFT-
CLUTCHES

VALVE	VALVE LOCATION	MOTOR OPERATOR MODEL NUMBER
HPCS-V-15	HPCS-P-1 SUCTION SUPPLY FROM SUPPRESSION POOL	SMB-2-60
HPCS-V-4	HPCS-P-1 DISCHARGE TO RPV	SMB-4-200
LPCS-V-5	LPCS-P-1 DISCHARGE TO RPV	SMB-3-100
MS-V-146	MAIN STEAM ISOLATION TO AUXILIARIES	SMB-4-250
RCIC-V-63	INBOARD TURBINE STEAM SUPPLY ISOLATION	SMB-2-60(MOD)
RHR-V-16A	LOOP A SUPPLY TO UPPER DRYWELL SPRAY	SB-2-80
RHR-V-16B	LOOP B SUPPLY TO LOWER DRYWELL SPRAY	SB-2-80
RHR-V-17A	LOOP A SUPPLY TO UPPER DRYWELL SPRAY	SB-2-80
RHR-V-17B	LOOP B SUPPLY TO LOWER DRYWELL SPRAY	SB-2-80
RHR-V-42A	LOOP A LPCI TO RPV	SB-3-150
RHR-V-42B	LOOP B LPCI TO RPV	SB-3-150
RHR-V-42C	LOOP C LPCI TO RPV	SB-3-150
RHR-V-53A	RHR LOOP A SHUTDOWN COOLING TO RPV	SMB-2-60
RHR-V-53B	RHR LOOP B SHUTDOWN COOLING TO RPV	SMB-2-60(MOD)

APPENDIX B
SAFETY VALVES POTENTIALLY WITH A
SOFT-CLUTCH

VALVE	VALVE LOCATION	MOTOR OPERATOR MODEL NUMBER
HPCS-V-10	TEST RETURN FROM HPCS-P-1 TO COND STOR TANK	SMB-3-150
HPCS-V-11	TEST RETURN FROM HPCS-P-1 TO COND STOR TANK	SMB-3-150
HPCS-V-23	TEST RETURN FROM HPCS-P-1 TO SUPPRESSION POOL	SMB-4-150/C215M
LPCS-V-12	LPCS-P-1 TEST RETURN TO SUPPRESSION POOL	SMB-3-60
RCIC-V-22	RCIC-P-1 TEST RETURN TO CONDENSATE STOR TANK	SMB-2-60
RHR-V-21	LOOP C TEST RETURN TO SUPPRESSION POOL	SMB-3-80
RHR-V-24A	LOOP A TEST RETURN TO SUPPRESSION POOL	SMB-3-80
RHR-V-24B	LOOP B TEST RETURN TO SUPPRESSION POOL	SMB-3-80
RHR-V-48A	RHR-HX-1A BYPASS	SMB-3-80
RHR-V-48B	RHR-HX-1B BYPASS	SMB-3-80
RHR-V-8	RHR SHUTDOWN COOLING SUCTION ISOLATION	SMB-2-80
RHR-V-9	RHR SHUTDOWN COOLING SUUCTION ISOLATION	SMB-2-60

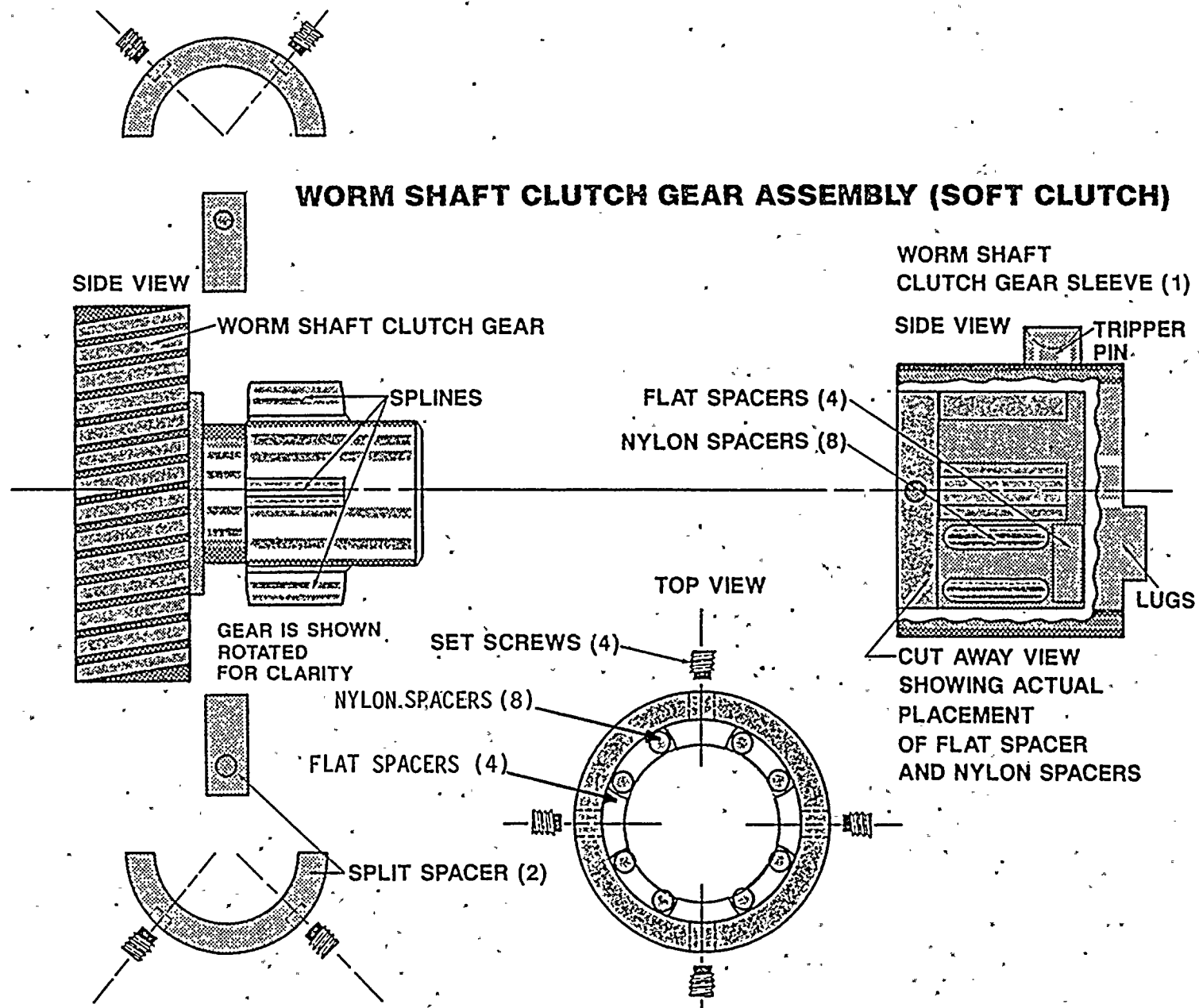
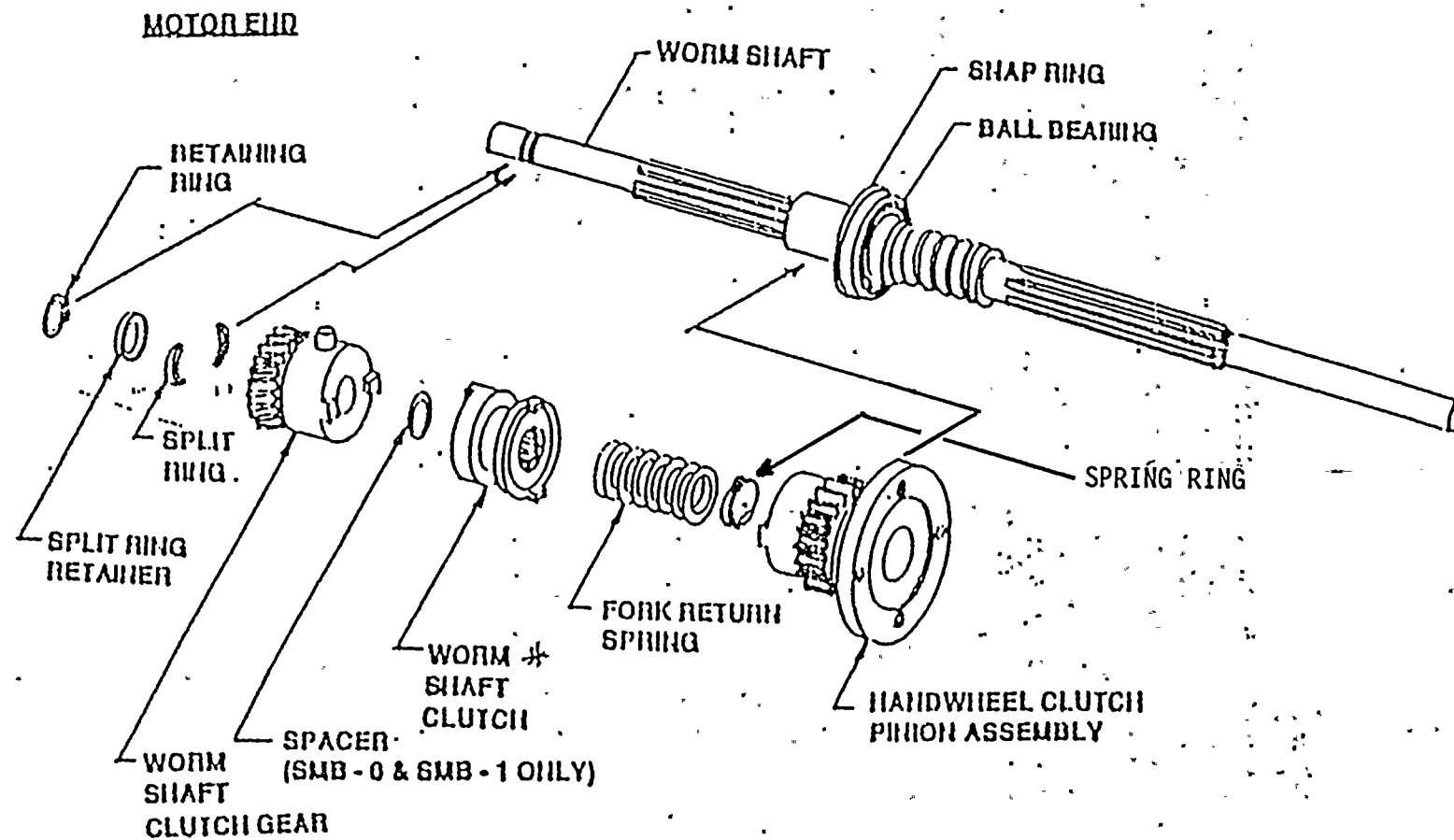


FIGURE 1

Worm Shaft Components SMB - 0 thru SMB - 4



*Worm shaft clutch shown
180° out of position

FIGURE 2

