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4) Docket File
AlabamaPower
the southern electric system

August 26, 1986

HED
8/27/86

Docket Nos. 50-348 C
50-364

U. S. Nuclear Regulatory Commission
Region II, Suite 2900
101 Marietta Street N. W.
Atlanta, GA 30323

Attention: Dr. J. N. Grace

Gentlemen:

On August 20, 1986, Alabama Power Company (APCo) was contacted by your staff concerning IE Notice 85-03. The staff's position was that Alabama Power Company should review environmental qualification of Limitorque operators as a result of IE Notice 86-03 and provide justification for continued operation (JCO) if required. The enclosed JCO is being submitted since the specific concern of IE Notice 86-03 cannot be resolved without a complete visual inspection.

There are 104 MOVs in each unit of Farley Nuclear Plant that have environmental qualification requirements. Of the 104 MOVs, 32 are located inside the containment or main steam valve room. All others are located outside containment excluding the main steam valve room.

Limitorque operators within the scope of 10CFR50.49 and located inside containment or the main steam valve room are justified based on: (1) a physical inspection with replacement of wiring as required for selected operators, and (2) the results of an operability analysis that included normal plant operation valve positions and the required accident mitigation and post accident positioning. Limitorque operators within the scope of 10CFR50.49 located in other areas are justified based on the results of analyzing the environmental effects on the operator internal wiring and the control wire failure modes assuming that all internal wiring is insulated with PVC.

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Dr. J. N. Grace
U. S. Nuclear Regulatory Commission

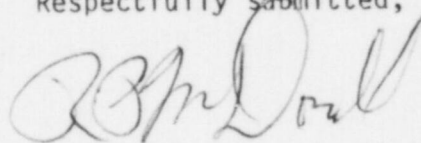
August 25, 1986
Page 2

As a result of this evaluation, it has been determined that the valves which are required to operate during design basis events can be expected to perform their safety functions as required for both of the Farley Nuclear Plant units.

All Limitorque operators (104 in each unit) will be inspected prior to or during the Unit 1 (presently scheduled for October 1986) and Unit 2 (presently scheduled for September 1987) refueling outages. Unqualified jumper wire associated with only the limit switches will be replaced with qualified wire during these outages. If unqualified wire is identified in the torque switch leads, a separate repair plan and schedule will be submitted to the NRC.

If there are any questions, please advise.

Respectfully submitted,



R. P. McDonald

RPM/DHJ:kpc-D-T.S.6

cc: Mr. L. B. Long
Mr. L. S. Rubenstein
Mr. E. A. Reeves
Mr. W. H. Bradford

Evaluation of Potential Deficiencies in
Environmental Qualification of Limitorque Motor
Valve Operator Wiring, NRC IE Information Notice
No. 86-03, dated January 14, 1986
Justification for Continued Operation

1.0 Introduction:

An evaluation has been performed to address the potential concern identified in NRC IE Information Notice No. 86-03 regarding the possible use of unqualified internal jumper wires on safety related valves. The evaluation was performed for all Motor Operated Valves (MOV's) contained in the FNP Environmental Qualification Program Equipment Lists (U-416797 and U-416798). In evaluating the potential problem, consideration was given to the required valve functions and the related accident environmental conditions the valves are expected to encounter for the design basis events, and to the possible physical arrangement and type of valve operator internal wiring.

The evaluation methodology was divided into two parts based on the location of the valve operators and the resulting severity of the design basis accident environmental conditions. For valve operators located inside the Containment (CTMT) or Main Steam Valve Room (MSR), an operability analysis was performed by evaluating the normal plant operation position of each valve, and the required accident mitigation and post accident positioning. For valve operators located outside the CTMT and MSR, the design basis accident environmental conditions are less severe with the primary concern being only radiation degradation due to post LOCA recirculated fluids, as valve operator temperatures are expected to be within normal operating design considerations. Valve operators outside the CTMT and MSR were evaluated by analyzing the environmental effects on the operator internal wiring and the control wire failure modes assuming that all internal control wiring is insulated with PVC. This insulation material is expected to be the worst type that is likely to be found in the Farley Nuclear Plant MOV operators.

As a result of this evaluation, it has been determined that the valves which are required to operate during a design basis event can be expected to perform their safety functions as required for both of the Farley Nuclear Plant units.

2.0 CTMT and MSR Located Motor Operated Valve Operability Analysis:

VALVE FUNCTION/POSITION REVIEW

The normal operating position, required accident mitigation position, and post accident repositioning requirements for each valve were determined by reviewing the current FNP Operating Procedures and Emergency Response Procedures. Table 1 and Table 2 provide a tabulation of the MOV's contained in the FNP Environmental Qualification Program Master List of Environmental Qualified Equipment which are located in the Unit 1 and Unit 2 CTMT or MSR. The normal operating position (NORMAL POSITION), presence of a valve actuation signal for accident mitigation positioning (SAFETY SIGNAL) and the need for post accident repositioning (LONG TERM P. A. OPERN) are indicated in Tables 1 and 2.

During the valve function/position review, several valves were identified for which post accident functions were described in the FSAR. These post accident functions are backup and are not required to mitigate the design basis accident. Justification for not requiring a post accident function is provided below.

Instrument Air to Containment/Post Accident Containment Vent

The post accident venting system consists of the instrument air supply to containment (MOV 3536) and the post accident vent from containment (MOV 3530). FSAR Section 6.2.5 identifies operation of the post accident venting system for combustible gas control in containment. Table 1 and 2 identifies MOV 3536 and MOV 3530 as being locked in the closed position with no long term post accident operation requirement. This is justified since the post accident venting system is a backup to the redundant post LOCA hydrogen recombiners.

The recombiner system incorporates several design features intended to assure the capability of the system to be operable in the event of an accident. Among these are: (1) seismic category I design, (2) protection from missile and jet impingement and (3) redundancy to the extent that no single component failure disables both recombiners.

As stated in NUREG-0117 Supplement 4 (Farley Nuclear Plant SER), "redundant ... recombiners in the containment are the primary means of post-accident combustible gas control. In addition the post-accident venting system is provided as a backup system for the redundant hydrogen recombiners."

The Emergency Response Procedures (ERP's) instruct the operator to verify both post LOCA hydrogen recombiners are in service if containment hydrogen concentration is less than 4%. Since the post accident venting system is a backup system and the ERPs instruct the operator to place the post accident LOCA hydrogen recombiners in service, opening MOV 3536 and MOV 3530 is not required.

RESULTS OF FUNCTION/POSITION REVIEW

Table 1 and Table 2 each have a total of 32 Limitorque MOV's. Of the 32 MOV's per unit, only 9 MOV's are required to change position during the time adverse environmental conditions are expected to exist. The remaining 23 valves are either positioned by a Safety Injection (SIS), Containment Isolation (CIS) or Main Feedwater Pump Trip or else are already in the safety position. The 9 MOVs required to change positions for accident mitigation are listed below.

MOV3660	CTMT Air Sample
MOV3872A	Reactor Cavity Dilution Fan Discharge
MOV3872B	Reactor Cavity Dilution Fan Discharge
MOV3528A	Sample Point 1 to H ₂ Analyzer
MOV3528B	Sample Point 2 to H ₂ Analyzer
MOV3528C	Sample Point 3 to H ₂ Analyzer
MOV3528D	Sample Point 4 to H ₂ Analyzer
MOV3835A	Post Accident Sample H ₂ Analyzer Return
MOV3835B	Post Accident Sample H ₂ Analyzer Return

These 9 MOVs were evaluated by physical inspection and qualified wiring was installed as necessary.

The post LOCA hydrogen analyzer sample flow path isolation valves (MOV 3528A, B, C and D, and MOV 3835 A and B) are normally locked in the closed position. Subsequent long term operations for the purpose of placing the hydrogen analyzers in service is addressed in the emergency response procedures. However, these long term operations are not essential to mitigate design bases events. Manual post accident containment atmosphere sampling capability is provided via a system which is not dependent on the post LOCA hydrogen analyzer flow path. Emergency response procedures provide for obtaining and analyzing grab samples if the post LOCA hydrogen analyzers are not functional.

CONCLUSION OF OPERABILITY ANALYSIS

It can be concluded that 23 of the 32 MOV's in each unit will be in or achieve their safety function position for accident mitigation prior to the occurrence of a significantly degraded environmental condition. The remaining 9 MOV's in each unit will require long term post accident repositioning. As a result, further evaluation by physical inspection was performed on these 9 MOV's and qualified wiring was installed as necessary.

Subsequent valve operator internal wiring failures if postulated to occur due to long term post accident environmental conditions will not result in spurious repositioning of the MOV's due to the presence of open control circuit interlock contacts located outside the harsh environment.

3.0 Analysis of Environmental Effects on the Internal Control Wiring for Motor Operated Valves Located Outside the CTMT and MSR:

Environmental Effects on PVC Insulation:

Tables 3 and 4 provide tabulations of the MOV's contained in the FNP Environmental Qualification Program Master List of Environmental Qualified Equipment which are located outside the CTMT and MSR for Unit 1 and Unit 2. It is the intent of this discussion to demonstrate that the temperature and radiation conditions in the Auxiliary Building (outside the containment and main steam valve room) will not degrade the PVC insulation to an extent which could disable the operation of these valves.

The minimum size of conductor used on such applications is #14AWG, 600V grade wire.

Temperature:

The normal maximum design ambient temperature outside the containment is 104F (40 C). The wires in the control circuit of the motor operated valve actuator are normally de-energized and carry no current. These wires are energized with 120VAC 60 Hz only when operating the valve and may carry less than 1 ampere for a duration of 1 minute or less. The self generated heat in such a short duration is not likely to cause any significant temperature rise. The only part of the circuit which could be continuously energized is the indicating light circuit that uses 120V AC or 125V DC and will carry less than 0.2 amperes. A #14AWG conductor is capable of carrying more than 15 amperes at 600V and as such the indicating light circuit will have no significant temperature rise.

Radiation:

The post accident radiation doses for the areas outside the containment are expected to be significantly lower than the inside containment dose of 50M rads. Although PVC insulation is susceptible to radiation degradation, it has only mild to moderate damage up to 5E7 rads (see attached figure C-1 from EPRI Report NP1558). Attached Page 3-11 from EPRI Report EPRI NP-2129 indicates that the PVC insulation will have a loss of only 50% elongation for an exposure of 8E7 rads. This demonstrates that the wiring in the MOV actuators outside the containment will have no significant damage due to post accident radiation.

Control Wire Failure Modes: Opens, Shorts, Grounds

Opens, shorts, and grounds of the control circuit wiring within the MOV will not cause inadvertent operation of the associated MOV.

Although open circuits and high resistance connections may be caused by the incorrect termination of control circuit wiring, the generic industry use of multistrand wiring with installation performed using controlled crimping tools and terminal lugs adequately prevents these types of hypothesized failures from occurring. In addition, open circuits will not occur as a result of control wire conductor failure/operation caused by current flow since the currents will be so low in MOV control circuits.

Circuit shorts and grounds (including both high and low impedance conditions) may hypothetically occur as a result of gross electrical insulation breakdown or as a result of insulation leakage currents sufficient to cause misoperation of the valve control circuit. Gross electrical breakdown is typically considered as one end (flashover or very low impedance shorts) of the spectrum of leakage current effects which may cause circuit inoperability or misoperation for the control voltage levels in question. Such gross electrical breakdown could only occur due to direct conductor-to-conductor, or conductor-to-ground contact. Phenomena such as thermal runaway and dielectric breakdown will not occur due to the control circuit's low voltage and current requirements. (Dielectric breakdown without substantial loss of mechanical properties can occur in medium and high voltage applications.) Such direct shorts are possible only where conductor breakthrough occurs as a result of cable insulation damage. In order for conductor breakthrough to occur, cable insulation must be damaged to the degree necessary to expose the inner conductor to direct contact with adjacent conductors or other metallic components at ground potential.

Conductor breakthrough will typically only occur in two cases. The first case exists when substantial insulation embrittlement due to radiation or thermal damage combines with mechanical abrasion or agitation of the wire causing insulation material to crumble and break-off from the conductor. The second occurs when extremely high temperatures, or for certain materials radiation degradation, cause the insulation material to soften. This softening when combined with mechanical pressure may permit the conductor to become exposed.

Under the operational and environmental stresses which may be experienced by the MOV control circuit wiring, neither type of conductor breakthrough should result. Extensive and severe thermal and radiation degradation is required to cause the level of insulation embrittlement which would permit insulation loss due to the minor vibration forces experienced during valve operation. Such severe embrittlement and loss of elongation typically occur in insulating materials only with radiation levels one or more orders of magnitude above the material's threshold dose. Control wire insulation softening and flow will also not exist due to the types of cable insulation typically used in the nuclear power industry (including PVC). For the insulation types typically used by the industry, the material softening temperatures are considerably higher than the temperatures likely to be found in the limit switch compartment. It can therefore be reasonably concluded that conductor breakthrough will not occur for typical valve control wiring.

The configuration of the individual control wires within the limit switch compartment greatly minimizes the probability of the individual conductors achieving contact with grounded components or other exposed conductors. The use of individual multistranded insulated wires, rather than multiconductor cables, creates insulating air spaces between the wires. These spaces greatly minimize the potential for the intimate conductor-to-conductor contact which is necessary to cause direct shorting or grounding.

Control Circuit Failure Modes Analysis:

Based on the typical circuit design (see Figure 1) used in the plant, control wire shorts or grounds within the MOV limit switch compartment will not reposition the valves erroneously. In these circuits, energization of both the open and close contactors is prevented by the normally open control switch contacts utilized in both circuit legs. This inherent circuit protection against shorts results from the use of momentary spring-return-to-normal control switch contacts with contactor seal-in. Therefore MOV's that are actuated are properly positioned prior to any insulation degradation which may occur during DBE environments, cannot be spuriously repositioned due to degradation of the control wiring.

The same is true for the valves with automatic signal actuation, which have a contact in parallel to the hand switch and seal-in contact.

For valves which require actuation, either automatically or manually during the most severe DBE environmental effects, only extremely low cable Insulation Resistance (IR) values can potentially affect valve performance. Hypothetically, should shorts of sufficiently low IR occur in parallel with limit switches and/or torque switches in the MOV control circuit, overtorquing and possibly overtravel of the valve stem may result. For valves which are limit switch seated with torque switch backup, both the limit and torque switches must be shunted by control wiring shorts in order for sufficient overtorquing and overtravel to affect the valve's safety function. As analyzed above, the extreme level of control wiring degradation necessary to produce such low IR values is a low probability occurrence.

Additional protection against valve damage due to overtravel can be provided by the MOV circuit thermal overloads located within the motor control center. When such overloads are sized in accordance with standard industry practice, overload (OL) tripping will result within 7 to 10 seconds under the stalled rotor conditions which exist as a result of operator overtravel. Overload operation can, therefore, provide further protection which will minimize the potential of any shorts to cause valve failures due to overstroking.

4.0 SUMMARY

For valve operators located inside the Containment or Main Steam Valve Room, the operability analysis has demonstrated that 23 of the 32 MOV's in each unit will be positioned in or achieve their safety function position for accident mitigation prior to the occurrence of a significantly degraded environmental condition. The remaining 9 MOV's in each unit will require long term post accident repositioning. As a result, further evaluation by physical inspection was performed on these 9 MOV's and qualified wiring was installed as necessary. Subsequent valve operator internal wiring failures if postulated to occur due to long term post accident environmental conditions will not result in spurious repositioning of the MOV's due to the presence of open control circuit interlock contacts located outside the harsh environment. The remainder of the valves located outside the Containment or Main Steam Valve Room are in plant areas where the local environmental conditions do not exceed the combination of environmental conditions which could cause significant degradation of the operator internal control wiring.

It can be concluded based on these analyses that continued operation with these valves in their present condition does not constitute a safety hazard.

Tables and Graphs of Rad. Endur. Data

Table C-1 (Continued)

Epoxy Identification	Total Integrated Exposure ^(a)
Scotchcast 212	1 x 10 ⁹ rads (C) gamma 1.1 x 10 ¹⁶ n/cm ² (E > 0.5 MeV)
Stycast 1095	1 x 10 ⁸ rads (C) gamma 2 x 10 ¹³ n/cm ² (E > 0.1 MeV)
Stycast 2651 MM	4.4 x 10 ⁶ rads (C) gamma 3.3 x 10 ¹⁵ n/cm ² (E > 0.1 MeV)
12-007	1.8 x 10 ⁶ rads (C) gamma 1.5 x 10 ¹⁵ n/cm ² (E > 0.1 MeV)
412-M	1 x 10 ⁹ rads (C) gamma 1.1 x 10 ¹⁶ n/cm ² (E > 0.5 MeV)
420-A	1 x 10 ⁹ rads (C) gamma 1.1 x 10 ¹⁶ n/cm ² (E > 0.5 MeV)
1126A/B	1.8 x 10 ⁶ rads (C) gamma 1.5 x 10 ¹⁵ n/cm ² (E > 0.1 MeV)
CF-8793	9.4 x 10 ⁷ rads (C) gamma 3.8 x 10 ¹³ n/cm ² (E > 0.1 MeV)
CF-8794	1.0 x 10 ⁸ rads (C) gamma 4.0 x 10 ¹³ n/cm ² (E > 0.1 MeV)
Unidentified (Mineral filled)	5.8 x 10 ¹⁰ n/cm ² (E = 1.0 MeV)

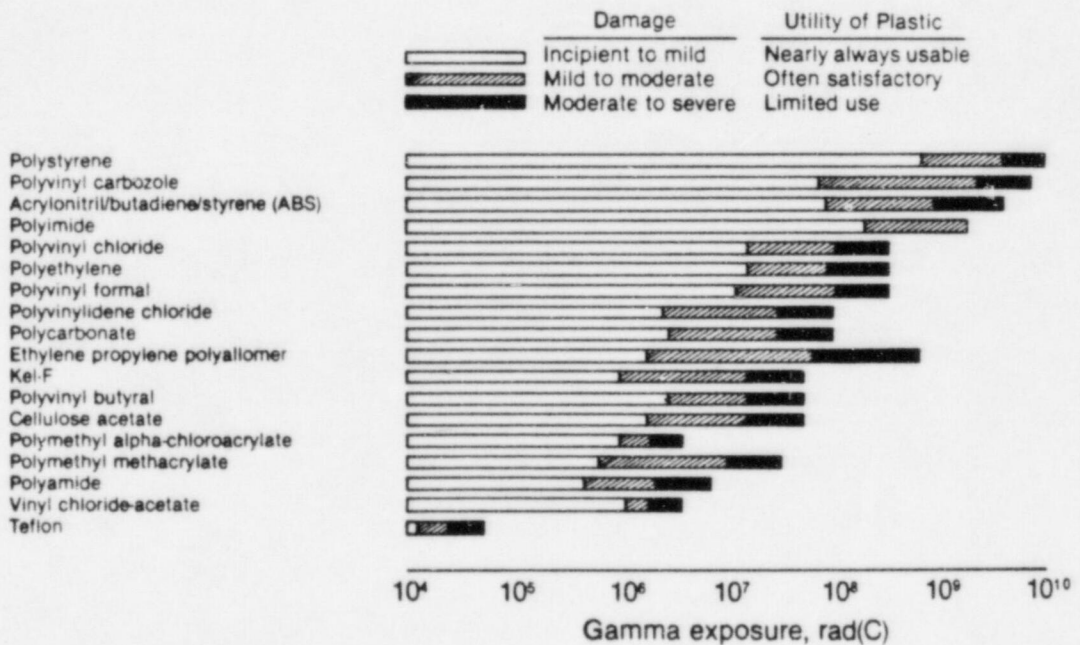


Figure C-1.
Relative Radiation Resistance of Thermoplastic Resins
(From Ref. 747, p. 3-7)

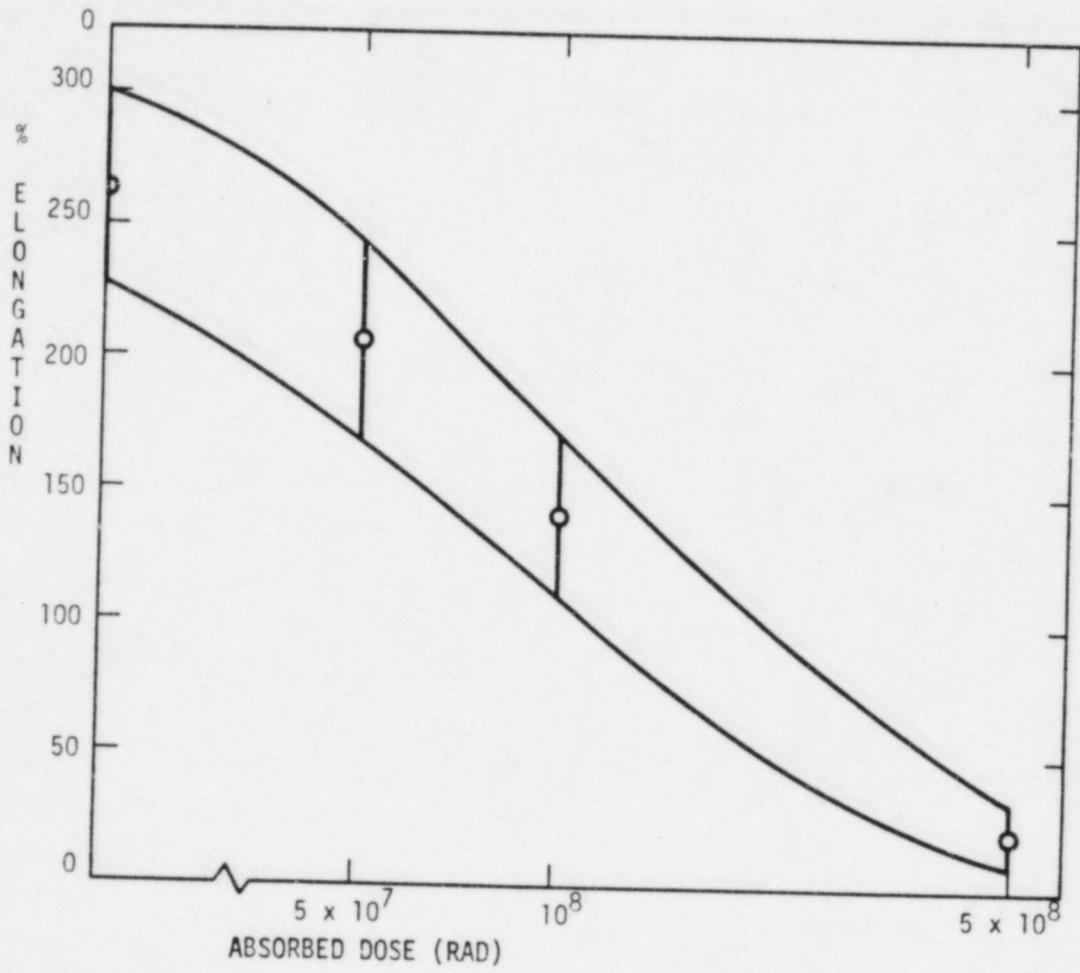
Polyvinyl Chloride, Plasticized/threshold - 5×10^5 rads/temperature at break. Reference 8 reports that DC resistivity of one PVC cable insulation was affected after 5×10^6 rads and sensitivity to hot water and steam was increased above this value. Large decreases in oxidation resistance were noted above 5×10^6 .

Scission or crosslinking may predominate, depending on temperature and oxidizing conditions. Plasticizers and additives are not generally known for commercial materials, but a fairly large range of radiation resistances occur for different materials (Figure 3-1). Reference 48 reports results for 4 and 20-mil samples of Geon 8630 irradiated in air at room temperature. The 4-mil sample lost approximately 20% of original tensile strength after 7×10^6 rads, but retained less than 50% after 1×10^8 rads. The 20-mil sample lost less than 20% of original tensile strength at 1×10^8 rads. Elongation of the 4-mil sample was reduced 20% by 1×10^7 rads. 7×10^7 rads were required for the same change in elongation of the 20-mil sample. Similar indications of extensive oxidation effects were observed with 4-mil samples of Geon 8640 irradiated in air and vacuum. In air, tensile strength was decreased approximately 20% by 7×10^6 rads and 50% by 1×10^8 rads. Elongation decreased 20% at 2×10^7 rads and 50% at 8×10^7 rads. In vacuum, tensile strength was reduced 20% by 7×10^7 rads and elongation was reduced 20% by 6×10^7 rads. References 21 and 39 note marked differences in thermal properties of irradiated PVC. A reduction in the melting temperature of the polymer occurs in air (but not in vacuum). Reduction of the temperature at break of samples heated under constant stress was noted for samples after 5×10^5 rads. After 1.1×10^7 rads, a 30-40°C reduction in temperature at break was achieved. The rate of HCL evolution is affected by the temperature during and subsequent to irradiation. $G_{HCL} = 5.41$ (-90°C), = 13 (30°C), = 23 (70°C) after 2×10^7 rads. Diffusion and permeability constant are increased by irradiation but may decrease again at higher doses. Crosslinking is inhibited in air, but may be enhanced by inclusion of polyfunctional materials, such as polyethylene glycol dimethacrylate. The temperature-oxidation resistance of commercial materials will vary with the effectiveness of free radical scavengers and antioxidants.

Polyvinyl Fluoride/threshold approximately 10^7 rads/elongation. DuPont R-20 exhibits approximately 20% loss of elongation at 2×10^7 rads and 50% loss at 5×10^7 rads. Tensile strength was not appreciably affected below 1×10^8 rads. Sample thickness and dose rate were not given.⁴⁸ Polyvinyl fluoride is also marketed as Tedlar. Radiation resistance is probably less at elevated temperatures. One electron irradiation at 60°C to 1.8×10^9 rads resulted in severe physical

Figure 3-1

"SIMILAR" PVC CABLES IRRADIATED AT 20-40°C



Data for cables from 38 manufacturers
(From Reference 50)

FIGURE-1 SHT 1 OF 2

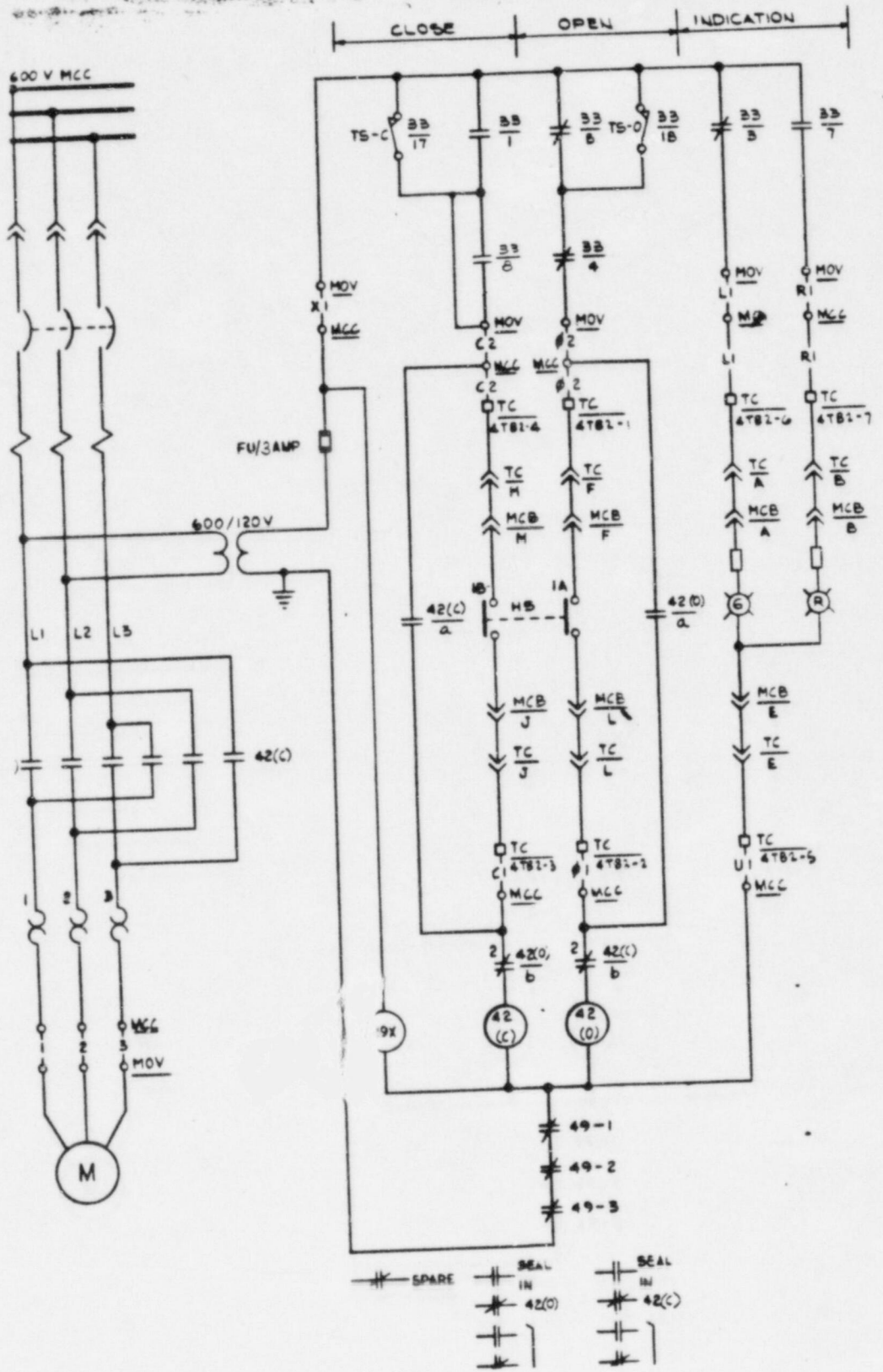


FIGURE-1 SHT 2 OF 2

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LIMIT SWITCH CONTACT DEVELOPMENT				
CONT	VALVE POSITION			FUNCTION
	FULL OPEN		FULL CLOSED	
1	██████			BY PASS CKT
2	██████			SPARE
3		██████	██████	GIL
4		██████	██████	OPEN LIMIT
5			██████	BY PASS CKT
6			██████	MONITOR LIGHT GROUPS
7	██████	██████		RL
8	██████	██████		CLOSED LIMIT
9	██████			SPARE
10	██████			SPARE
11		██████	██████	SPARE
12		██████	██████	SPARE
13			██████	SPARE
14			██████	MONITOR LIGHT ALM
15	██████	██████		SPARE
16	██████	██████		SPARE

██████ CONTACT CLOSED

- 17) CLOSING TORQUE SWITCH INTERRUPTS CONTROL CIRCUIT IF MECHANICAL OVERLOAD OCCURS DURING CLOSING CYCLE
- 18) OPENING TORQUE SWITCH INTERRUPTS CONTROL CIRCUIT IF MECHANICAL OVERLOAD OCCURS DURING OPENING CYCLE

Table 1 MOV OPERATORS FOR UNIT-1 E Q PROGRAM - INSIDE CTMT OR MSR

MOV NUMBER	FUNCTION	LOCATION	EXPOSED TO STM ENVIR	RADIATION LE61 RADS	NORMAL POSITION	SAFETY SIGNAL	LONG TERM P & OPEN	P&I D REF	ELEM REF	REMARKS
MOV8701A-A	RHR PUMP INLET	CTMT	Y	50.00	NC	N	N	5041	7572	R ONLY LIMIT SWITCH
MOV8702A-A	RHR PUMP INLET	CTMT	Y	50.00	NC	N	N	5041	7569	R ONLY LIMIT SWITCH
MOV7660-A	CTMT AIR SAMPLE	CTMT	Y	50.00	NO	Y	Y	5010/2	7660	CIS PHASE A TO CLOSE, SAMPLE IHR POST ACCIDENT
MOV3318B-A	CTMT TO ATMOS DIFF	CTMT	Y	50.00	NO	Y	N	5010/2	7660	CIS PHASE A TO CLOSE
MOV8909A-A	ACCUM TANK DISC	CTMT	Y	50.00	LO	Y	N	5038/2	7051	SIS TO OPEN
MOV8808B-B	ACCUM TANK DISC	CTMT	Y	50.00	LO	Y	N	5038/2	7052	SIS TO OPEN
MOV8808C-A	ACCUM TANK DISC	CTMT	Y	50.00	LO	Y	N	5038/2	7053	SIS TO OPEN
MOV8112-A	RCP SEAL LEAKOFF TO SW HN	CTMT	Y	50.00	NO	Y	N	5039/1	7567	CIS PHASE A TO CLOSE
MOV3872A-A	REAC CAV OIL FAN DISC	CTMT	Y	50.00	NC	Y	Y	5019	7208	AUTO OPEN SIGNAL SHIN AFTER SIS
MOV3872B-B	REAC CAV OIL FAN DISC	CTMT	Y	50.00	NC	Y	Y	5019	7209	AUTO OPEN SIGNAL SHIN AFTER SIS
MOV3530-B	P ACCOT CTMT VENT OUTLET	CTMT	Y	50.00	LC	N	N	5019	7635	
MOV3536-B	INSTA AIR SPLY TO CTMT AT CTMT	CTMT	Y	50.00	LC	N	N	5019	7635	
MOV3528A-A	SMPL PT 1 TO H2 ANALYZER	CTMT	Y	50.00	LC	N	Y	5019	7635	
MOV3528B-A	SMPL PT 2 TO H2 ANALYZER	CTMT	Y	50.00	LC	N	Y	5019	7635	
MOV3528C-B	SMPL PT 3 TO H2 ANALYZER	CTMT	Y	50.00	LC	N	Y	5019	7635	
MOV3528D-B	SMPL PT 4 TO H2 ANALYZER	CTMT	Y	50.00	LC	N	Y	5019	7635	
MOV3835A-A	P A SMPL H2 ANALY RETURN	CTMT	Y	50.00	LC	N	Y	5019	7635	
MOV3835B-B	P A SMPL H2 ANALY RETURN	CTMT	Y	50.00	LC	N	Y	5019	7635	
MOV3232A-B	HN FD WTR CHK VLV	MSR	Y	50.00	NO	N	N	5073	7622	AUTO CLOSE ON HFWD TRIP
MOV3232B-B	HN FD WTR CHK VLV	MSR	Y	50.00	NO	N	N	5073	7622	AUTO CLOSE ON HFWD TRIP
MOV3232C-B	HN FD WTR CHK VLV	MSR	Y	50.00	NO	N	N	5073	7622	AUTO CLOSE ON HFWD TRIP
MOV3350A-A	AFW TO S6	MSR	Y	50.00	LO	N	N	5007	7627	1EB 05-03
MOV3350B-A	AFW TO S8	MSR	Y	50.00	LO	N	N	5007	7627	1EB 05-03
MOV3350C-A	AFW TO S6	MSR	Y	50.00	LO	N	N	5007	7627	1EB 05-03
MOV3131-A	RCP MTR CLR SW DISC	CTMT	Y	50.00	NO	Y	N	5003/2	7612	CIS PHASE A TO CLOSE

LEGEND FOR NORMAL POSITION

NC - Normally Closed
 NO - Normally Open
 LO - Valve in Open Position with Operator Control Power or Motor Power Administratively Removed.
 LC - Valve in Closed Position with Operator Control Power or Motor Power Administratively Removed.

GENERAL LEGEND

N - No
 Y - Yes
 CTMT - Containment Building
 MSR - Main Steam Valve Room
 SIS - Safety Injection Signal
 CIS - Containment Isolation Signal

Table 1. MOV OPERATORS FOR UNIT-1 E Q PROGRAM - INSIDE CTMT OR MSR

MOV NUMBER	FUNCTION	LOCATION	EXPOSED TO STM ENVIR	RADIATION (E6) RADS	NORMAL POSITION	SAFETY SIGNAL	LONG TERM P A OPERM	P&I D REF	ELEM REF	REMARKS
MOV3441A-B	CTMT CLR SW DISC	CTMT	Y	50.00	NO	Y	N	5003/1	7633	SIS TO OPEN
MOV3441B-B	CTMT CLR SW DISC	CTMT	Y	50.00	NO	Y	N	5003/1	7633	SIS TO OPEN
MOV3441C-A	CTMT CLR SW DISC	CTMT	Y	50.00	NO	Y	N	5003/1	7633	SIS TO OPEN
MOV3441D-A	CTMT CLR SW DISC	CTMT	Y	50.00	NO	Y	N	5003/1	7633	SIS TO OPEN
MOV3046-B	CCW DISC RCP TH BARR	CTMT	Y	50.00	NO	Y	N	5002/2	7618	CIS PHASE B TO CLOSE
MOV3238-N	CTMT LEAK RATE TEST	MSR	N	50.00	NO	N	N	5010	7620	ONLY LIMIT SWITCH
MOV3239-N	CTMT LEAK RATE TEST	MSR	N	50.00	NO	N	N	5010	7620	ONLY LIMIT SWITCH

USE LSTWD INDEX ILSTWD

Table 2 MOV OPERATORS FOR UNIT-2 E Q PROGRAM - INSIDE CTMT OR MSR

MOV NUMBER	FUNCTION	LOCATION	EXPOSED TO STM ENVIR	RADIATION (E6) RADS	NORMAL POSITION	SAFETY SIGNAL	LONG TERM P A	DEI D OPERM REF	ELEM REF	REMARKS
MOV8701A-A	RHR PUMP IMLET	CTMT	Y	50 00	NC	N	N	5041	7572	ONLY LIMIT SWITCH
MOV8702A-A	RHR PUMP IMLET	CTMT	Y	50 00	NC	N	N	5041	7569	ONLY LIMIT SWITCH
MOV3660-A	CTMT AIR SAMPLE	CTMT	Y	50 00	NO	Y	Y	5010/2	7488	CIS PHASE A TO CLOSE, SAMPLE 1 HR POST ACCIDENT
MOV3318B-A	CTMT TO ATMOS DIFF	CTMT	Y	50 00	NO	Y	N	5010/2	7488	CIS PHASE A TO CLOSE
MOV8808A-A	ACCUM TANK DISC	CTMT	Y	50 00	LO	Y	N	5038/2	7051	SIS TO OPEN
MOV8808B-B	ACCUM TANK DISC	CTMT	Y	50 00	LO	Y	N	5038/2	7052	SIS TO OPEN
MOV8808C-A	ACCUM TANK DISC	CTMT	Y	50 00	LO	Y	N	5038/2	7053	SIS TO OPEN
MOV8112-A	RCP SEAL LEAKOFF TO SW HX CTMT	CTMT	Y	50 00	NO	Y	N	5039/1	7587	CIS PHASE A TO CLOSE
MOV3872A-A	REAC CAV DIL FAN DISC	CTMT	Y	50 00	NC	Y	Y	5019	7208	AUTO OPEN SIGNAL SMIN AFTER SIS
MOV3872B-B	REAC CAV DIL FAN DISC	CTMT	Y	50 00	NC	Y	Y	5019	7208	AUTO OPEN SIGNAL SMIN AFTER SIS
MOV3530-B	P ACCDT CTMT VENT OUTLET	CTMT	Y	50 00	LC	N	N	5019	7635	
MOV3536-B	INSTR AIR SPLY TO CTMT AT CTMT	CTMT	Y	50 00	LC	N	N	5019	7635	
MOV3528A-A	SHPL PT 1 TO H2 ANALYZER	CTMT	Y	50 00	LC	N	Y	5019	7635	
MOV3528B-A	SHPL PT 2 TO H2 ANALYZER	CTMT	Y	50 00	LC	N	Y	5019	7635	
MOV3528C-B	SHPL PT 3 TO H2 ANALYZER	CTMT	Y	50 00	LC	N	Y	5019	7635	
MOV3528D-B	SHPL PT 4 TO H2 ANALYZER	CTMT	Y	50 00	LC	N	Y	5019	7635	
MOV3835A-A	P-A SHPL H2 ANALY RETURN	CTMT	Y	50 00	LC	N	Y	5019	7635	
MOV3835B-B	P-A SHPL H2 ANALY RETURN	CTMT	Y	50 00	LC	N	Y	5019	7635	
MOV3232A-B	HR FD WTR CHK VLV	MSR	Y	50 00	NO	N	N	5073	7622	AUTO CLOSE SIGNAL ON HWP TRIP
MOV3232B-B	HR FD WTR CHK VLV	MSR	Y	50 00	NO	N	N	5073	7622	AUTO CLOSE SIGNAL ON HWP TRIP
MOV3232C-B	HR FD WTR CHK VLV	MSR	Y	50 00	NO	N	N	5073	7622	AUTO CLOSE SIGNAL ON HWP TRIP
MOV3350A-A	AFW TO SB	MSR	Y	50 00	LO	N	N	5007	7627	IEB 85-03
MOV3350B-A	AFW TO SB	MSR	Y	50 00	LO	N	N	5007	7627	IEB 85-03
MOV3350C-A	AFW TO SB	MSR	Y	50 00	LO	N	N	5007	7627	IEB 85-03
MOV3131-A	RCP WTR CLR SW DISC	CTMT	Y	50 00	NO	Y	N	5003/2	7612	CIS PHASE A TO CLOSE

LEGEND FOR NORMAL POSITION

- NC - Normally Closed
- NO - Normally Open
- LO - Valve in Open Position with Operator Control Power or Motor Power Administratively Removed.
- LC - Valve in Closed Position with Operator Control Power or Motor Power Administratively Removed.

GENERAL LEGEND

- N - No
- Y - Yes
- CTMT - Containment Building
- MSR - Main Steam Valve Room
- SIS - Safety Injection Signal
- CIS - Containment Isolation Signal

Table 2 MOV OPERATORS FOR UNIT-2 E Q PROGRAM - INSIDE CTMT OR MSR

MOV NUMBER	FUNCTION	LOCATION	EXPOSED TO STM ENVIR	RADIATION (E6) RADS	NORMAL POSITION	SAFETY SIGNAL	LONG TERM P A OPEN	PEI D REF	ELEM REF	REMARKS
MOV3441A-B	CTMT CLR SW DISC	CTMT	Y	50 00 MD	Y	N		5003/1	7633	SIS TO OPEN
MOV3441B-B	CTMT CLR SW DISC	CTMT	Y	50 00 MD	Y	N		5003/1	7633	SIS TO OPEN
MOV3441C-A	CTMT CLR SW DISC	CTMT	Y	50 00 MD	Y	N		5003/1	7633	SIS TO OPEN
MOV3441D-A	CTMT CLR SW DISC	CTMT	Y	50 00 MD	Y	N		5003/1	7633	SIS TO OPEN
MOV3046-B	CCW DISC RCP TH BARR	CTMT	Y	50 00 MD	Y	N		5002/2	761R	CIS PHASE B TO CLOSE
MOV3238-N	CTMT LEAK RATE TEST	MSR	N	50 00 MC	N	N		5010	7620	ONLY LIMIT SWITCH
MOV3239-N	CTMT LEAK RATE TEST	MSR	N	50 00 MC	N	N		5010	7620	ONLY LIMIT SWITCH

Table 3 : MOV OPERATORS FOR UNIT-1 E.Q PROGRAM - OUTSIDE CMT & MSR

MOV NUMBER	FUNCTION	LOCATION	EXPOSED TO STN ENVIR	NORMAL POSITION	SAFETY REL SIGNAL	ELEM REF.	REMARKS
MV08706A-A	RHR WK DISC TO CHB PUMP	128	N	LC	N	5041	7570
MV08706B-B	RHR WK DISC TO CHB PUMP	128	N	LC	N	5041	7640
MV08099B-B	LHS1 TO RCS CKLD LFB	223	N	MD	N	5038/2	7407
MV08099A-A	LHS1 TO RCS CKLD LFB	223	N	MD	N	5038/2	7407
MV08077A-A	LHS1 CROSSOVER	223	N	MD	N	5038/2	7571
MV08077B-B	LHS1 CROSSOVER	223	N	MD	N	5038/2	7571
MV08111A-A	CTMT SUMP OUTLET-RHR	131	N	MC	Y	5038/2	7132 ENCAPSULATED
MV08111B-B	CTMT SUMP OUTLET-RHR	128	N	MC	Y	5038/2	7134 ENCAPSULATED
MV08172A-A	CTMT SUMP OUTLET-RHR	131	N	MC	Y	5038/2	7773
MV08172B-B	CTMT SUMP OUTLET-RHR	129	N	MC	Y	5038/2	7773
MV08080A-A	RHR PUMP INLET-RWST	131	N	MD	N	5038/2	7644
MV08080B-B	RHR PUMP INLET-RWST	129	N	MD	N	5038/2	7644
MV08080B-B	LHS1 TO RCS HOTLES	223	N	LC	N	5038/2	7782
MV08268A-A	CTMT SUMP OUTLET-SPRAY	113	N	MC	N	5038/3	7639 ENCAPSULATED
MV08268B-B	CTMT SUMP OUTLET-SPRAY	124	N	MC	N	5038/3	7190 ENCAPSULATED
MV08270A-A	CTMT SUMP OUTLET-SPRAY	113	N	MC	N	5038/3	7191
MV08270B-B	CTMT SUMP OUTLET-SPRAY	124	N	MC	N	5038/3	7192
MV08270A-A	CTMT SPRAY PUMP DISC	111	N	MC	Y	5038/3	7568
MV08270B-B	CTMT SPRAY PUMP DISC	125	N	MC	Y	5038/3	7568
MV08177A-A	CTMT SPRAY PUMP INLET	111	N	MD	N	5038/3	7638
MV08177B-B	CTMT SPRAY PUMP INLET	125	N	MD	N	5038/3	7638
MV03318A-B	CTMT TO ATMOS DIFF	184	N	MD	Y	5010/2	7689
MV03361B-B	PERTR ROOM FILT SYS	317	N*	MD	N	5022	7283
MV03361A-A	PERTRM ROOM FILT SYS	317	N	MD	N	5022	7283
MV03362B-B	PERTRM ROOM FILT SYS	317	N	MD	Y	5022	7281

Table 3 : MOV OPERATORS FOR UNIT 1 F & PROGRAM - OUTSIDE CINT & MCR

MOV NUMBER	FUNCTION	LOCATION	EXPOSED TO SYM FWHIR	NORMAL POSITION	SAFETY SIGNAL	PEI D REF	ELEM READBS
MOV1376A-A	PENETR ROOM FILT SYS	317	N	MO	Y	5039/2	7281
MOV1376A-B	BIT DISC	223	N	MC	Y	5039/1	7614 IEB 85-03
MOV1376B-A	BIT DISC	223	N	MC	Y	5039/1	7614 IEB 85-03
MOV1376B-B	BIT INLET	172	N	MC	Y	5039/1	7614 IEB 85-03
MOV1376C-A	BIT INLET	172	N	MC	Y	5039/1	7614 IEB 85-03
MOV1376C-B	WMS1 TO RCS COULES	184	N	MC	N	5039/1	7607
MOV1376D-A	WMS1 TO RCS HOTLES	223	N	LC	N	5039/1	7782
MOV1376D-B	WMS1 TO RCS HOTLES	184	N	LC	N	5039/1	7782
MOV1376E-A	SEAL INJ FILT INLET	173	N	MO	N	5039/2	7616
MOV1376E-B	RCP SEAL LEAKOFF TO SW HX	223	N	MO	Y	5039/1	7634
MOV1376F-A	CHG PUMP TO REGEN HX	223	N	MO	Y	5039/2	7606 IEB 85-03
MOV1376F-B	CHG PUMP TO REGEN HX	223	N	MO	Y	5039/2	7606 IEB 85-03
MOV1376G-A	CHG PUMP MINIFLOW	181	N	MO	N	5039/2	7600 IEB 85-03
MOV1376G-B	CHG PUMP MINIFLOW	174	N	MO	N	5039/2	7600 IEB 85-03
MOV1376H-A	CHG PUMP MINIFLOW	173	N	MO	N	5039/2	7600 IEB 85-03
MOV1376H-B	BORIC ACID INJ SYS	172	N	MC	N	5039/2	7601
MOV1376I-A	CHG PUMP SUCTION HOR	181	N	LO	N	5039/2	7606 IEB 85-03
MOV1376I-B	CHG PUMP SUCTION HOR	175	N	LO	N	5039/2	7606 IEB 85-03
MOV1376J-A	CHG PUMP SUCTION HOR	175	N	LO	N	5039/2	7606 IEB 85-03
MOV1376J-B	CHG PUMP SUCTION HOR	175	N	LO	N	5039/2	7606 IEB 85-03
MOV1376K-A	CHG PUMP DISC HOR	181	N	LO	N	5039/2	7782 IEB 85-03
MOV1376K-B	CHG PUMP DISC HOR	175	N	LO	N	5039/2	7782 IEB 85-03
MOV1376L-A	CHG PUMP DISC HOR	175	N	LO	N	5039/2	7606 IEB 85-03
MOV1376L-B	CHG PUMP DISC HOR	173	N	LO	N	5039/2	7606 IEB 85-03
MOV1376M-A	RUCT SUCTION	172	N	MC	Y	5039/2	7603 IEB 85-03

Table 4 : MOV OPERATORS FOR UNIT-2 E Q PROGRAM - OUTSIDE CTMT & MSR

MOV NUMBER	FUNCTION	LOCATION	EXPOSED TO STM ENVIR	NORMAL POSITION	SAFETY SIGNAL	P&I REF	ELEM REF	REMARKS
MOV8706A-A	RHR WX DISC TO CHB PUMP	2128	N	LC	N	5041	7370	
MOV8706B-B	RHR WX DISC TO CHB PUMP	2128	N	LC	N	5041	7840	
MOV8888A-B	LHSI TO RCS COOLER	2223	N	NO	N	5038/2	7607	
MOV8888B-A	LHSI TO RCS COOLER	2223	N	NO	N	5038/2	7607	
MOV8887A-A	LHSI CROSSOVER	2223	N	NO	N	5038/2	7571	
MOV8887B-B	LHSI CROSSOVER	2223	N	NO	N	5038/2	7571	
MOV8811A-A	CTMT SUMP OUTLET-RHR	2131	N	NC	Y	5038/2	7132	ENCAPSULATED
MOV8811B-B	CTMT SUMP OUTLET-RHR	2129	N	NC	Y	5038/2	7134	ENCAPSULATED
MOV8812A-A	CTMT SUMP OUTLET-RHR	2131	N	NC	Y	5038/2	7773	
MOV8812B-B	CTMT SUMP OUTLET-RHR	2129	N	NC	Y	5038/2	7773	
MOV8809A-A	RHR PUMP INLET-RVST	2131	N	NO	N	5038/2	7644	
MOV8809B-B	RHR PUMP INLET-RVST	2129	N	NO	N	5038/2	7644	
MOV8899-B	LHSI TO RCS HOTLEG	2223	N	LC	N	5038/2	7782	
MOV8826A-A	CTMT SUMP OUTLET-SPRAY	2113	N	NC	N	5038/3	7639	ENCAPSULATED
MOV8826B-B	CTMT SUMP OUTLET-SPRAY	2124	N	NC	N	5038/3	7190	ENCAPSULATED
MOV8827A-A	CTMT SUMP OUTLET-SPRAY	2113	N	NC	N	5038/2	7191	
MOV8827B-B	CTMT SUMP OUTLET-SPRAY	2124	N	NC	N	5038/2	7192	
MOV8820A-A	CTMT SPRAY PUMP DISC	2111	N	NC	Y	5038/3	7568	
MOV8820B-B	CTMT SPRAY PUMP DISC	2125	N	NC	Y	5038/3	7568	
MOV8817A-A	CTMT SPRAY PUMP INLET	2111	N	NO	N	5038/3	7638	
MOV8817B-B	CTMT SPRAY PUMP INLET	2125	N	NO	N	5038/3	7638	
MOV3319A-B	CTMT TO ATMOS DIFF	2194	N	NO	Y	5010/2	7689	
MOV3361B-B	PENTRN ROOM FILT SYS	2317	N	NO	N	5022	7283	
MOV3361A-A	PENTRN ROOM FILT SYS	2317	N	NO	N	5022	7283	
MOV3362B-B	PENTRN ROOM FILT SYS	2317	N	NO	Y	5022	7281	

Table 4 : MDV OPERATORS FOR UNIT-2 E Q PROGRAM - OUTSIDE CINT & MSR

MDV NUMBER	FUNCTION	LOCATION	EXPOSED TO STM ENVIR	NORMAL POSITION	SAFETY SIGNAL	REL D REF	ELFM REMARKS
MDV0807A	DENTR ROOM FILT SYS	2317	N	MD	Y	5022	7281
MDV0808A	BIT DISC	2223	N	MC	Y	5038/1	7614 IEB 85-03
MDV0808B	BIT DISC	2223	N	MC	Y	5038/1	7614 IEB 85-03
MDV0809A	BIT IMLET	2172	N	MC	Y	5038/1	7614 IEB 85-03
MDV0809B	BIT IMLET	2172	N	MC	Y	5038/1	7614 IEB 85-03
MDV0809S	WHS1 TO RCS COOLER	2184	N	MC	N	5038/1	7607
MDV0809A	WHS1 TO RCS HOTLER	2223	N	LC	N	5038/1	7782
MDV0809B	WHS1 TO RCS HOTLER	2184	N	LC	N	5038/1	7782
MDV0810S	SEAL INJ FILT IMLET	2173	N	MD	N	5039/2	7616
MDV0810B	RCP SEAL LEAKOFF TO SW WK	2223	N	MD	Y	5039/1	7674
MDV0810A	CHG PUMP TO REGEN W/	2223	N	MD	Y	5039/2	7608 IEB 85-03
MDV0810B	CHG PUMP TO REGEN W/	2223	N	MD	Y	5039/2	7608 IEB 85-03
MDV0810C	CHG PUMP MINIFLOW	2181	N	MD	N	5039/2	7608 IEB 85-03
MDV0810D	CHG PUMP MINIFLOW	2174	N	MD	N	5039/2	7608 IEB 85-03
MDV0810E	CHG PUMP MINIFLOW	2173	N	MD	N	5039/2	7608 IEB 85-03
MDV0810F	BORIC ACID INJ SYS	2172	N	MC	N	5039/2	7681
MDV0810A	CHG PUMP SUCTION HDR	2175	N	LO	N	5039/2	7606 IEB 85-03
MDV0810B	CHG PUMP SUCTION HDR	2175	N	LO	N	5039/2	7606 IEB 85-03
MDV0810A	CHG PUMP SUCTION HDR	2175	N	LO	N	5039/2	7606 IEB 85-03
MDV0810B	CHG PUMP SUCTION HDR	2175	N	LO	N	5039/2	7606 IEB 85-03
MDV0812A	CHG PUMP DISC HDR	2181	N	LO	N	5039/2	7782 IEB 85-03
MDV0812B	CHG PUMP DISC HDR	2175	N	LO	N	5039/2	7782 IEB 85-03
MDV0813A	CHG PUMP DISC HDR	2175	N	LO	N	5039/2	7606 IEB 85-03
MDV0813B	CHG PUMP DISC HDR	2173	N	LO	N	5039/2	7606 IEB 85-03
LCV0815B-A	RWS1 SUCTION	2172	N	MC	Y	5039/2	7603 IEB 85-03

Table 4 : MOV OPERATORS FOR UNIT-2 E Q PROGRAM - OUTSIDE CTMT & MSR

MOV NUMBER	FUNCTION	LOCATION	EXPOSED TO STM ENVIR	NORMAL POSITION	SAFETY SIGNAL	P&ID REF.	ELEM REF	REMARKS
LCV01150-B	RVST SUCTION	2172	N	NC	Y	5030/2	7631	IEB 05-03
MOV3740-B	P ACCOT CTMT VENT OUTLET	2223	N	LC	N	5019	7626	
MOV3739A-A	SMPL PT 1/2 DISC	2223	N	LC	N	5019	7626	
MOV3739B-B	SMPL PT 3/4 DISC	2223	N	LC	N	5019	7626	
MOV3745A-A	P ACCOT SMPL FAN DISC	2223	N	LC	N	5019	7626	
MOV3745B-B	P ACCOT SMPL FAN DISC	2223	N	LC	N	5019	7626	
MOV3019A-A	CTMT CLR SW INLET	2223	N	NO	Y	5003/1	7613	
MOV3019B-A	CTMT CLR SW INLET	2223	N	NO	Y	5003/1	7613	
MOV3019C-B	CTMT CLR SW INLET	2223	N	NO	Y	5003/1	7613	
MOV3019D-B	CTMT CLR SW INLET	2223	N	NO	Y	5003/1	7613	
MOV3024A-A	CTMT CLR SW DISC	2223	N	NC	Y	5003/1	7613	
MOV3024B-A	CTMT CLR SW DISC	2223	N	NC	Y	5003/1	7613	
MOV3024C-B	CTMT CLR SW DISC	2223	N	NC	Y	5003/1	7613	
MOV3024D-B	CTMT CLR SW DISC	2223	N	NC	Y	5003/1	7613	
MOV3029A-A	CTMT CLR SW DISC	2223	N	NO	N	5003/1	7629	
MOV3029B-A	CTMT CLR SW DISC	2223	N	NO	N	5003/1	7629	
MOV3029C-B	CTMT CLR SW DISC	2223	N	NO	N	5003/1	7629	
MOV3029D-B	CTMT CLR SW DISC	2223	N	NO	N	5003/1	7629	
MOV3135-B	RCP HTR CLR SW INLET	2223	N	NO	Y	5003/2	7636	# ONLY LIMIT SWITCH
MOV3134-B	RCP HTR CLR SW DISC	2223	N	NO	Y	5003/2	7636	# ONLY LIMIT SWITCH
MOV3052-A	CCW INLET RCP TH BARR	2223	N	NO	Y	5002/2	7625	# ONLY LIMIT SWITCH
MOV3102-A	CCW DISC RCP TH BARR	2223	N	NO	Y	5002/2	7610	# ONLY LIMIT SWITCH