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VALUE-IMPACT ANALYSIS FOR EXTENSION OF NRC BULLETIN 85-03 TO COVER ALL SAFETY-RELATED MOVS

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Enclosure 3

CRGR PACKAGE SUMMARY (ITEM IV.B, CRGR CHARTER, REVISION 4, APRIL, 1987)

Proposal to Expand Periodic In Situ Testing and Surveillance Requirements for Safety-Related Motor-Operated Valves (MOVs)

(i) The proposed generic letter as it is to be sent out to licensees, is contained in enclosure 1 of the cover memorandum. As proposed, the letter will extend the Bulletin 85-03 program to all safety-related MOVs and position-changeable MOVs in safety related systems. The letter will also contain recommendations for owners to address a list of specific MOV degraded conditions and perform surveillance on a regular schedule.

(ii) Copies of all reference materials quoted or referred to in any of the enclosures to the CRGR package may be obtained from O. Rothberg of the RES/EIB staff, X23816.

(iii) The staff's position that the proposed program does not constitute imposition of new requirements on owners beyond their existing design bases is discussed in the cover memorandum to this enclosure. Owners will have to do more and better testing and surveillance in order to assure that MOVs meet existing NRC requirements and their own licensing bases. The proposed program actions can be justified on a cost-benefit basis, even if they are considered to be backfits.

(iv) The proposed method of implementation of this program is by a generic letter, enclosure 1 of the cover memorandum. OGC, NRR and AEOD concurrence were obtained on the submittal of this package prior to submittal to CRGR.

(v) A Regulatory Analysis covering the proposed program is contained in enclosure 4 of the cover memorandum. Enclosure 4 and enclosure 2 are complementary Enclosure 2 of the cover memorandum contains a value-impact assessment for extending Bulletin 85-03 and contains a PRA and partial regulatory analysis supporting that position. Enclosure 4 contains a deterministic assessment of the complete program and also refers to enclosure 2 for support.

(vi) The proposed program will be applied to all operating power reactors and those under construction.

(vii) Prioritization and scheduling evaluation, for all plant categories, is provided in Enclosure 5 of the cover memorandum.

(viii) As noted at the end of the cover memorandum, there is expected to be a substantial increase in the overall protection of the public health and safety along with a reduction in overall costs to plant owners as the result of implementation of the proposed program.

(ix) Not applicable to this proposed action.

Enclosure 4

REGULATORY ANALYSIS

Proposal to Expand Periodic In Situ Testing and Surveillance Inspection Requirements for Safety-Related Motor-Operated Valves (MOVs)

1. Statement of the Problem

The NRC staff is proposing to issue a generic letter (enclosure 1 to the cover memorandum to CRGR) that will expand testing and inspection of MOVs. In Bulletin 85-03, NRC recommended that owners verify switch settings for safety-related MOVs in the high pressure coolant injection/core spray and emergency feedwater (RCIC for BWR) systems. The extension described in the proposed generic letter will include all safety-related MOVs and those MOVs in safety-related systems that might become mispositioned (position-changeable). A number of root cause degraded conditions will be addressed in the proposed expanded program, in addition to switch settings. The letter will also outline methods acceptable to the NRC staff for demonstrating MOV operability for those MOVs that cannot be tested under design basis pressure or flow.

These actions are necessary to reduce the failure rates of safety-related MOVs and thus prevent safety system failures. Best estimates indicate that the failure rate for safety-related MOVs is about 16 to 29 times the rate assumed in the NUREG-1150 study. These estimates are based on an evaluation of the data obtained from licensees in response to Bulletin 85-03 and from studies of the database of the most utilized signature analysis service company, respectively. Further, a number of root cause degraded conditions for MOVs, in addition to switch settings, have been identified over the past several years. Any of these conditions can result in failure of a MOV to move, or to move completely, to the desired position under design basis conditions.

Until recently, the reliable performance of MOVs was assumed, by all concerned, to be assured by the testing and surveillance standards currently used by the nuclear industry. It is now apparent that this assumption was incorrect and that additional measures must be taken to assure design basis performance of safety-related MOVs.

MOVs are present in virtually every fluid processing system in every nuclear power plant. Over 90 percent of the valve operators were made by one company, (Limitorque of Lynchburg, Virginia). Identical operators are used in parallel trains and in series valves in individual trains of virtually all safety-related and non-safety-related fluid systems. The operators function in the same operating, maintenance and physical environment, in most cases. These common mode aspects cannot be reliably quantified, however, as a matter of engineering judgment, their impact is large.

Each MOV is a complex electro-mechanical assembly whose operation affects and is affected by the function of other electrical, electronic, mechanical, and fluid systems in the plant. A very large number of plant events involved failure of MOVs as either initiators or contributors. It would be difficult to

identify another single class of components with a greater potential effect on safety in a nuclear plant.

2. Objective

The objective of this proposed action is to increase the assurance that all safety-related motor-operated valves will perform their required safety function under design basis conditions and to increase assurance that position-changeable MOVs in safety systems will not interfere with safety system operation.

3. Alternatives

a. Take no further action.
b. Limit the explicit test and inspection requirements of the draft generic letter to switch settings only for all safety related and position-changeable MOVs.
c. Take actions as noted in the enclosed draft generic letter to include consideration of the failure modes listed as well as switch settings.

4. Consequences

a. Costs and Benefits of Alternatives

The alternative to take no further action was rejected based on both probabilistic and deterministic assessments of safety-related MOV failure rates. The problem is not restricted to only those MOVs covered by Bulletin 85-03. The available data indicates that failure rates of Bulletin 85-03 MOVs and non-Bulletin 85-03 MOVs are comparable.

The B&W Owners Group, as well as each of its individual members, is committed to a program to extend Bulletin 85-03 requirements to all safety related motor operated valves. Duke Power has made a similar commitment for each of its plants. At least one licensee (Rancho Seco) has committed to signature analysis testing of all MOVs in its plant, both safety-related and non-safety related. Other individual licensees have extended their 85-03 programs beyond the scope of the Bulletin 85-03 required MOVs. In each case, the desire to assure safety is, no doubt, also prompted by the sound economic basis for the increased testing of the additional valves.

The value/impact analysis (NUREG/CR-5140) enclosed with this regulatory analysis indicates that the cost of implementing the proposed program will be less than the monetary benefits. Disregarding core melt considerations and even public health considerations, the program is cost-effective in terms of plant availability improvement. If public health or core melt are considered, the benefits are dramatic. Limiting the scope of the program to switch settings is not reasonable or necessary. It is now known that switch settings are only one aspect of the problem of assuring MOV operability. Numerous LERs and, as a result, NRC Bulletins, Notices and Circulars, have been written to address MOV problems. Many of these problems are being detected by owners in their efforts to adjust switch settings. In many cases the previously identified problems recurred when the MOVs were not

closely monitored. The program outlined herein will contain recommendations that owners take measures to assure that at least the noted degraded conditions are corrected or prevented. It is most likely that owners will adopt signature analysis procedures in order to comply with the proposed generic letter, as an extension of their programs to comply with Bulletin 85-03. The degraded conditions noted in the proposed generic letter are readily identifiable by the test methods normally used, by inspection, by analysis, by examination of records, or by a combination of these techniques. The diagnostic and other techniques currently available to the industry are sufficient to address all of the degraded conditions outlined in the generic letter. Since the benefits to be gained from properly functioning MOVs outweigh any program implementation costs, there is no reason not to identify and correct all known pertinent degraded conditions.

b. Impacts on other Requirements

There are no known conflicting impacts on IST requirements, Bulletin 85-03 requirements or any other NRC requirements for any of the alternatives listed in paragraph 3 above. The program outlined herein is to be supplementary to both IST requirements and Bulletin 85-03 requirements.

Several nuclear industry organizations are now in the process of producing documents addressing maintenance and/or testing of MOVs. The American Society of Mechanical Engineers (ASME), Committee on Operation and Maintenance (O&M) is producing a document (OM-8) entitled "Startup and Periodic Performance Testing of Electric Motor Operators on Valve Assemblies in Nuclear Power Plants." The Electric Power Research Institute (EPRI), Nuclear Maintenance Assistance Center (NMAC) is producing both a maintenance guide and an applications guide for motor operated valves. The Institute of Electrical and Electronics Engineers (IEEE), Nuclear Power Engineering Committee, Working Group 3.3 is producing a paper on " . . . Recommended Maintenance Practices for Electric Motor Operated Valve Actuators in Nuclear Power Generating Stations." All of these efforts will provide guidance that will assist owners to implement the requirements of the generic letter. It is also expected that the generic letter will lead to more focused and coordinated industry efforts in this area. The proposed program should not impact current industry efforts, with perhaps the exception of OM-8. OM-8 will not be finished for at least a year (and perhaps longer). Further, it is not known how OM-8 will be integrated, if at all, into the ASME Code, and thus the extent of impact of the proposed generic letter on OM-8 remains unclear.

Those PORV block valves that are not currently classified as safety-related would be included in this program at a later date, if approved as part of the resolutions of Generic Issue 70, "PORV and Block Valve Reliability."

RES is conducting full flow and full pressure tests of MOVs in support of Generic Issue 87, "Failure Of HPCI Steam Line Without Isolation". One purpose of the test program is to verify that MOV actuator sizes are properly determined for those MOVs designed to close against design basis pipe break conditions. Another purpose is to develop a basis for evaluating in situ tests to assure MOV operability under those conditions. The resolution of

GI-87 could result in additional recommendations for test or surveillance for that limited number of MOVs that are required to function under design-basis pipe break conditions.

c. Constraints

The only known regulatory constraint on the extension of testing and inspection, as advocated, is contained in 10 CFR 50.55a(g)(4) which states, in part, that ASME Code Class 1, 2 and 3 components shall meet the inservice testing requirements set forth in Section XI of the ASME Code. One might interpret that provision to mean that Section XI testing is the only inservice testing that can be mandated without rulemaking by NRC in order to demonstrate safety related valve operability. Such an interpretation would support alternative a. of paragraph 3 above, that is, to take no further action on the generic letter and propose a revision to the regulations.

It must be observed that Bulletin 85-03 now imposes additional testing and surveillance requirements on some safety-related MOVs, in addition to that required by Section XI of the ASME Code. Further, 10CFR50.55a(a)(1) indicates that safety-related MOVs are to be tested and inspected to quality standards commensurate with the importance of the safety function to be performed. The importance of the functions of safety-related MOVs may vary but their operability should be assured in all cases by virtue of the fact that these components are safety-related. Since it is known that Section XI stroke-timing testing does not assure design basis operability of MOVs, additional testing and surveillance procedures must be adopted. There are no different regulatory constraints on alternatives b. or c. of paragraph 3 above. The overall cost to the industry of either of these alternatives is expected to be minimal, at worst, and therefore the program scope should not be constrained to correction of switch settings.

5. Decision Rationale

When Bulletin 85-03 was originally conceived in 1985, strong consideration was given at that time to imposing the bulletin requirements on all safety related MOVs. It was decided to recommend additional testing on only those systems selected, and then monitor results. Those results indicate, quite conclusively, that the Bulletin recommendations should be applied to all safety related MOVs. Supplement 1 of Bulletin 85-03 was recently issued to clarify the NRC's position that position-changeable MOVs were to be included in the Bulletin recommendations for those MOVs covered by the bulletin. The projected design basis failure rates for MOVs addressed by Bulletin 85-03 were found to be between 16 to 29 times greater than previously estimated for design basis conditions. The available data indicates that failure rates for other safety-related MOVs would be similar.

Other lessons learned from both Bulletin 85-03 replies, as well as investigations of numerous events involving MOVs, were that switch settings are both a source of failure and a symptom of failure and that switch settings are also not the only source of MOV failure. Therefore, it is

necessary to address a number of deficiencies, misadjustments, and degraded conditions that have occurred in motor operated valves. Most, if not all, of these conditions are discussed in previous Bulletins and Notices or industry reports (INPO, EPRI). All of the listed conditions can be detected and corrected or prevented by periodic inspection, examination of records, Section XI testing, signature analysis testing, regular maintenance, engineering analysis, or a combination of these techniques. The objective is to allow plant owners maximum flexibility to address MOV operability problems using their own methods.

Although no expansion of the program outlined in the draft generic letter is anticipated at this time, it may be necessary to make minor adjustments based on experience after implementation. Some relaxation of testing requirements, or time interval between tests, or both could possibly be allowed after the program is implemented. NRC should survey plant programs after about 5 years from the date of the generic letter in order to make a determination of licensee progress.

In addition to the risk assessments outlined in enclosure 2 to the cover memorandum, current NRC regulations provide ample justification for the additional testing and inspections recommended.

Criterion 1, "Quality Standards and Records," of Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50, "Licensing of Production and Utilization Facilities," requires, in part, that components important to safety be designed, fabricated, erected and tested to quality standards commensurate with the importance of the safety functions to be performed. Where generally recognized codes and standards are used they shall be identified and evaluated to determine their applicability, adequacy, and sufficiency and shall be supplemented or modified as necessary to assure a quality product in keeping with the required safety function.

Criterion 4, "Environmental and Missile Design Bases," of Appendix A to 10 CFR Part 50 requires, in part, that components important to safety be designed to accommodate the effects of and be compatible with the environmental conditions associated with normal operation, maintenance, testing, and postulated accidents, including loss-of-coolant accidents.

Criterion 18, "Inspection and Testing of Electric Power Systems," of Appendix A to 10 CFR Part 50 requires, in part, that electric power systems important to safety be designed with capability to test periodically the operability and functional performance of their components.

Criterion 21, "Protection System Reliability and Testability," of Appendix A to 10 CFR Part 50 requires, in part, that the protection system shall be designed for high functional reliability and in-service testability commensurate with the safety functions to be performed.

Criterion XI, "Test Control," of Appendix B, "Quality Assurance Criteria of Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR Part 50

requires, in part, that a test program be established to ensure that systems and components perform satisfactorily in service and that the test program include operational tests during nuclear power plant operation.

Section 3.2.1, "Post-Maintenance Testing (All Other Safety-Related Components)," of the enclosure to Generic Letter 83-28, dated July 8, 1983, "Required Actions Based on Generic Implications of Salem ATWS Events," requires that: "Licensees and applicants shall submit a report documenting the extending of test and maintenance procedures and Technical Specifications review to assure that post-maintenance operability testing of all safety-related equipment is required to be conducted and that the testing demonstrates that the equipment is capable of performing its safety functions before being returned to service."

The testing and inspections that are outlined in the proposed generic letter are required in order to meet the objectives of the above outlined NRC requirements.

6. Implementation

a. Schedule for Implementing the Proposed Requirement

Each owner will be requested to accomplish the following steps for each plant in accordance with the proposed program. (Note: All times are from the date of the generic letter.)

1. Submit a letter to NRC within 90 days committing to accomplish the program.
2. Perform a design basis review within two years or one refueling outage, whichever is longer, in accordance with item a. of the generic letter, to determine design basis conditions for all MOVs in the program.
3. Set up the program within two years or one refueling outage, whichever is longer, to implement the program described in the generic letter.
4. Have the program outlined in step 3 above in place and fully implemented within 3 years or two refueling outages, whichever is longer, for operating plants. Have the program outlined in step 3 above in place and fully implemented within 3 years or by issuance of an operating license, whichever is longer, for plants under construction.
5. Submit a letter to NRC indicating that the required program is operational.
6. Verify switch settings and perform other tests or inspections to identify and correct the degradations outlined in the generic letter within three years or two refueling outages, whichever is longer, and then every three years or two refueling outages, whichever is longer, thereafter.

These dates and time limits are based on experience with replies to Bulletin 85-03 as well as the need to resolve the problem on a timely but realistic schedule. Consideration was given to the fact that owners now have a program in place and experience in MOV testing

based on Bulletin 85-03, but that the program will require testing and increased inspection of about five to ten times as many MOVs.

b. Relationship to Other Existing or Proposed Requirements

Safety related MOVs are periodically exercised to measure stroke-time in accordance with Section XI of the ASME Code which, in turn, is invoked by 10 CFR 50.55(a)g. The stroke-timing test may be accomplished quarterly or at cold shutdown, or at refueling outages, or never, depending on the status and service of the MOV. The program outlined in the generic letter is to be done in parallel with stroke-timing testing and no conflict is known to exist. The stroke-timing test is insufficient to verify the design basis operability of MOVs for a number of reasons, however, that test does lubricate the valve and may also minimize binding of the seat and disk. The test also serves to indicate an inoperable condition under no load conditions.

The testing of MOVs previously conducted under Bulletin 85-03 should not have to be repeated under the proposed generic letter provisions. Those owners that have extended their programs beyond the scope of Bulletin 85-03 will be able to use the results of their efforts to meet the requirements of the generic letter. Accordingly, the generic letter requirements will not result in wasted effort on the part of those owners that went beyond the original Bulletin 85-03 program.

Enclosure 5

PRIORITIZATION AND SCHEDULING EVALUATION

Proposal to Expand Periodic In Situ Testing and Surveillance Requirements for Safety-Related Motor-Operated Valves (MOVs)

The following information is offered in accordance with the CRGR Charter, item IV.B.(vii):

(a) Statement of the specific objectives that the proposed action is designed to achieve;

The objective is to assure that licensees and applicants maintain, inspect and test safety-related MOVs so that the MOVs will be demonstrated to be capable of performing their safety-related function. This objective is compatible with Commission regulations as noted in Appendices A and B of 10CFR50 as well as Commission policy as outlined in Section 3.2 of Generic Letter 83-28, "Required Actions Based on Generic Implications of Salem ATWS Events."

(b) General description of the activity that would be required by the licensee or applicant in order to complete the action;

Licensees and applicants would extend the program outlined in Bulletin 85-03 to all safety related MOVs. The 85-03 program now covers only high pressure coolant injection/core spray and emergency feedwater systems (RCIC for BWRs) and position-changeable MOVs for those systems. Position-changeable valves that could interfere with a safety system's operation by actuation and subsequent failure are also to be included in the expansion of scope as proposed herein.

For each valve operator the owner would verify that switch settings are appropriate for the condition of the MOV and also address on a periodic schedule, by analyses, inspection and test, a specific list of degraded conditions that have been commonly encountered and would, if not corrected, compromise the operability of the MOV.

(c) Potential change in the risk to the public from the accidental off-site release of radioactive material;

As noted in NUREG/CR-5140 (enclosure 2 of the cover memorandum), the best estimate of net averted public risk and occupational exposure is 1.056×10^6 person-rem. The low estimate is 1.85×10^5 person-rem. Even the low estimate of averted risk would justify the adoption of the proposed resolution.

(d) Potential impact on radiological exposure of facility employees;

The value/impact analysis indicates the following overall occupational exposure estimates:

ATTRIBUTE	ESTIMATE		
	High	Best	Low
Accident Occupational Exposure	6.57×10^4	5.83×10^3	3.91×10^2
Operational Occupational Exposure	6.40×10^3	1.92×10^3	-2.89×10^3
Total Exposure	7.21×10^4	7.75×10^3	-2.50×10^3

A positive number indicates dose avoidance. A negative number indicates a dose increase. All figures are person-rem.

(e) Installation and continuing costs associated with the action, including the cost of facility downtime or the cost of construction delay;

There will be an overall net cost benefit associated with implementation of this program. The value/impact analysis indicates the following dollar savings associated with:

1. Industry implementation
2. Industry operation
3. NRC Development
4. NRC Implementation
5. NRC Operations

Estimates of total savings for 127 plants over 25 years are:

Low - $355 million
Best - $418 million
High - $453 million.

This is due primarily to estimated decreased industry operational costs. If one adds additional factors, such as plant availability improvement, the savings are even greater.

(f) The potential safety impact of changes in plant or operational complexity, including the relationship to proposed and existing regulatory requirements and staff positions;

No physical changes in the plant are anticipated to be required by the proposed program. Normal plant operations associated with starting, running or shutting down the reactor are expected to be enhanced by the increased operational reliability of safety-related and position-changeable MOVs.

The owner's program for in situ testing and maintenance will require increased training of personnel as well as increase coordination of test and maintenance efforts.

(g) The estimated resource burden on the NRC associated with the proposed action and the availability of such resources;

The burden on NRC headquarters is expected to be minimal because the owners will not be required to submit programs for review. NRR manpower resource constraints dictate this approach. NRC Regional Offices may, as part of their audit program, review the individual plant programs, implementation procedures and results. A Temporary Instruction, produced to assure uniform review procedures in the Regional Offices, would be useful and would require headquarters efforts. SRP Section 3.9.6, "Inservice Testing of Pumps and Valves" must also be revised to incorporate the requirements of the Generic Letter.

(h) The potential impact of differences in facility type, design or age on the relevancy and practicality of the proposed action;

It is obviously expected that older plants, which have older MOVs may discover more inoperable MOVs or deteriorated MOVs than newer plants. Several plants that have large numbers of Rotork operators may require special attention due to variations in the maintenance and examination procedures for these operators. There is not expected to be much variation in overall impact on BWRs versus PWRs or on individual types of each, and there is no reason to break down the impact by such classifications as part of the resolution of this issue.

(i) Whether the proposed action is interim or final and, if interim, the justification for imposing the proposed backfit on an interim basis;

The actions proposed are considered final allowing for minor modifications based on experience and improvements in monitoring techniques.

ENCLOSURE 6

FINAL REPORT STATUS OF IEB 85-03
SUMMARY BY PLANT NAME
AS OF
JULY 29, 1988

PLANT NAME	UTILITY REPLY	TOTAL NUMBER VALVES	NUMBER BYPASS SWITCH CHANGED	NUMBER TORQUE SWITCH CHANGED	NUMBER LIMIT SWITCH CHANGED	NUMBER OTHER DEFECTS	NUMBER INOP VALVES	PER CENT INOP VALVES
ARKANSAS 1	02/29/88	34	0	34	0	1	19	55.88
ARKANSAS 2	02/29/88	41	0	39	0	0	11	26.83
BEAVER VALLEY 1	04/18/88	24	0	0	0	0	0	0.00
BEAVER VALLEY 2	07/31/87	16	7	10	0	11	0	0.00
BRAIDWOOD 1	01/15/88	16	0	0	0	0	0	0.00
BRAIDWOOD 2	01/15/88	16	0	0	0	0	0	0.00
BRUNSWICK 1	05/25/88	25	0	0	0	0	0	0.00
BRUNSWICK 2	05/25/88	26	0	16	0	0	0	0.00
BYRON 1	01/15/88	16	2	0	0	0	0	0.00
BYRON 2	01/15/88	16	5	0	0	0	0	0.00
CALVERT CLIFFS 1	01/28/88	12	0	10	0	0	0	0.00
CALVERT CLIFFS 2	01/28/88	12	0	3	0	0	0	0.00
CLINTON 1	03/02/87	23	14	12	6	20	0	0.00
CRYSTAL RIVER 3	02/15/88	17	1	2	2	17	0	0.00
DAVIS-BESSE 1	04/22/87	165	26	0	19	164	17	10.30
DIABLO CANYON 1	09/14/87	27	0	19	0	0	0	0.00
DIABLO CANYON 2	09/14/87	27	0	19	0	0	0	0.00
DRESDEN 2	01/15/88	8	0	6	0	0	1	12.50
DRESDEN 3	01/15/88	8	0	7	0	0	0	0.00
DUANE ARNOLD	01/15/88	24	0	18	12	17	0	0.00
FERMI 2	11/17/87	33	0	15	0	0	1	3.03
FITZPATRICK	01/15/88	20	0	12	0	3	2	10.00
FORT CALHOUN 1	08/07/87	8	6	8	2	0	0	0.00
FORT ST. VRAIN	01/14/88	13	13	0	0	13	0	0.00
GINNA	07/08/88	30	30	29	2	30	25	83.33
GRAND GULF 1	02/27/88	23	0	15	0	0	0	0.00
HADDAM NECK	06/27/88	14	0	10	0	0	2	14.29
HARRIS 1	03/04/87	28	0	0	0	0	0	0.00
INDIAN POINT 2	02/26/88	13	0	11	0	0	1	7.69
INDIAN POINT 3	01/15/88	10	10	9	4	3	0	0.00
KEWAUNEE	01/04/88	18	0	18	0	18	3	16.67
LASALLE 1	01/15/88	18	0	1	0	0	0	0.00
LASALLE 2	01/15/88	19	0	7	0	0	0	0.00
LIMERICK 1	11/17/87	34	0	0	0	0	8	23.53
MAINE YANKEE	12/15/87	20	0	19	0	20	0	0.00
MILLSTONE 1	06/27/88	9	0	8	0	0	0	0.00
MILLSTONE 2	06/27/88	23	0	7	0	0	6	26.09
MILLSTONE 3	06/27/88	33	0	32	0	0	12	36.36
MONTICELLO	03/15/88	19	10	11	10	0	0	0.00
NINE MILE POINT 1	09/18/86	32	26	5	1	9	0	0.00
NINE MILE POINT 2	11/13/87	21	0	13	0	0	0	0.00
NORTH ANNA 1	01/04/88	25	25	24	0	0	1	4.00
NORTH ANNA 2	01/04/88	25	25	24	0	0	2	8.00
OCONEE 1	01/14/88	14	14	12	14	0	3	21.43
OCONEE 2	01/14/88	14	14	11	14	0	2	14.29

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PLANT NAME	UTILITY REPLY	TOTAL NUMBER VALVES	NUMBER BYPASS SWITCH CHANGED	NUMBER TORQUE SWITCH CHANGED	NUMBER LIMIT SWITCH CHANGED	NUMBER OTHER DEFECTS	NUMBER INOP VALVES	PER CENT INOP VALVES
OCONEE 3	01/14/88	14	14	12	14	0	2	14.29
PALISADES	01/15/88	24	0	23	0	0	2	8.33
PALO VERDE 1	01/15/88	33	0	26	0	0	0	0.00
PALO VERDE 2	01/15/88	33	0	26	0	0	0	0.00
PALO VERDE 3	01/15/88	33	0	31	0	0	0	0.00
PERRY 1	03/31/88	24	11	19	0	21	3	12.50
POINT BEACH 1	06/30/88	21	0	0	0	0	0	0.00
POINT BEACH 2	06/30/88	21	0	0	0	0	0	0.00
PRAIRIE ISLAND 1	04/08/88	21	0	19	0	0	0	0.00
PRAIRIE ISLAND 2	04/08/88	21	0	19	0	0	1	4.76
QUAD CITIES 1	01/15/88	12	0	11	0	0	2	16.67
QUAD CITIES 2	01/15/88	12	4	9	0	0	2	16.67
RANCHO SECO	01/19/88	32	18	14	0	23	1	3.12
RIVER BEND 1	02/17/88	21	1	7	3	4	1	4.76
SALEM 1	01/05/88	17	0	9	0	0	0	0.00
SALEM 2	01/05/88	17	0	12	0	0	0	0.00
SAN ONOFRE 1	09/01/87	12	1	3	0	0	1	8.33
SAN ONOFRE 2	09/01/87	23	22	11	0	0	1	4.35
SAN ONOFRE 3	09/01/87	23	20	20	0	0	0	0.00
SEABROOK 1	11/30/87	30	7	5	6	22	0	0.00
SEQUOYAH 1	02/12/88	21	0	11	0	0	3	14.29
SEQUOYAH 2	02/12/88	21	0	16	0	0	1	4.76
SOUTH TEXAS 1	06/10/88	19	0	0	0	0	0	0.00
SOUTH TEXAS 2	06/10/88	19	0	0	0	0	0	0.00
ST. LUCIE 1	01/14/88	29	0	23	0	0	0	0.00
ST. LUCIE 2	01/14/88	29	0	26	0	0	0	0.00
SUMMER 1	10/06/87	14	0	2	0	0	0	0.00
SUSQUEHANNA 1	01/12/88	22	11	11	11	10	6	27.27
SUSQUEHANNA 2	01/12/88	22	1	12	0	5	4	18.18
TMI 1	06/25/87	12	10	12	1	1	0	0.00
TROJAN	12/15/87	35	1	26	3	35	2	5.71
TURKEY POINT 3	01/14/88	14	0	14	0	0	0	0.00
VOGTLE 1	09/04/87	50	0	0	0	32	0	0.00
WATERFORD 3	12/21/87	20	4	19	0	16	0	0.00
WNP 2	12/18/87	21	0	20	0	0	4	19.05
WOLF CREEK	01/14/88	34	34	27	34	0	2	5.88
ZION 1	01/15/88	35	0	5	0	0	2	5.71
ZION 2	01/15/88	35	0	0	0	0	1	2.96
*** Total ***		1965	387	996	158	495	157	

Caution - A zero entry for the number of switch changes or for the number of other defects does not necessarily mean that none occurred. It probably means that the licensee simply did not report any data on the topic. To be sure, see the Comments Report for the facility.

For the 83 plants reporting to date:
6.89 is the average failure rate in percent.
13.0488 is the standard deviation of the failure rate in percent.

For the 36 plants reporting inoperable valves to date:
15.88 is the average failure rate in percent.
15.8752 is the standard deviation of the failure rate in percent.