NUREG/CR-4933

Closeout of IE Bulletin 80-19: Failures of Mercury-Wetted Matrix Relays in Reactor Protective Systems of Operating Nuclear Power Plants Designed by Combustion Engineering

Prepared by W.J. Foley, R.S. Dean, A. Hennick

PARAMETER, Inc.

Prepared for
U.S. Nuclear Regulatory
Commission

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NUREG/CR-4933
PARAMETER IE-168

Closeout of IE Bulletin 80-19: Failures of Mercury-Wetted Matrix Relays in Reactor Protective Systems of Operating Nuclear Power Plants Designed by Combustion Engineering

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U.S. Nuclear Regulatory Commission
Washington, DC 20555
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ABSTRACT

The NRC/IE issued IE Bulletin 80-19 initially on July 31, 1980, and issued Revision 1 of the bulletin on August 13, 1980. The bulletin was issued to all licensees and holders of construction permits of power reactors, because of numerous reports about single and multiple failures of C.P. Clare Model HG2X-1011 mercury-wetted matrix relays in reactor protective systems. The concern based on those reports was that the build-up of coincident "failed-closed" failures of certain sets of relays could result in trip failures for off-normal events. Evaluation of utility responses and NRC/Region inspection reports shows that the bulletin can be closed out per specific criteria for 100% of the 123 power facilities with operating licenses or construction permits. In effect, all of the responses and inspection reports apply to Revision 1 of the bulletin. All except the three following facilities either do not have the subject relays in the reactor protective system, or have changed the relays to an acceptable type as a result of the bulletin. An inspection report closed the bulletin for Calvert Cliffs 1 & 2 based on licensee committments to replace the mercury-wetted relays with the dry-contact type. For St. Lucie 1, the licensee elected to continue to use the subject relays and presented acceptable justification.

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CLOSEOUT OF IE BULLETIN 80-19: FAILURES OF MERCURY-WETTED MATRIX RELAYS IN REACTOR PROTECTIVE SYSTEMS OF OPERATING NUCLEAR POWER PLANTS DESIGNED BY COMBUSTION ENGINEERING

INTRODUCTION

In accordance with the Statement of Work in Task Order 021 under NRC Contract 05-85-157-02, this report provides documentation for the closeout status of IE Bulletin 80-19. Documentation is based on the records obtained from the NRC Document Control System.

IE Bulletin 80-19 was issued for action by all licensees and holders of construction permits of power reactors. It was issued initially on July 31, 1980, and was reissued as Revision 1 on August 13, 1980.

The bulletin was issued because of numerous reports of single and multiple relay failures. The particular relays involved were C. P. Clare Model HG2X-1011 mercury-wetted matrix relays. There were two main concerns: (1) the total number of failures yielded a much higher random failure rate than that used in other relay failure estimates (see Appendix A, Page A-3), and (2) the number of multiple failures detected suggested the presence of a common-mode failure mechanism which could result in anticipated transients without scram (ATWS).

For background information and required actions, IE Bulletin 80-19 is included in Appendix A, in both initial and revised forms. Evaluation of utility responses and NRC/Region inspection reports is documented in Appendix B as the basis for bulletin closeout. Utility manhours expended on the bulletin are tabulated in Appendix C. Abbreviations used in this report and associated documents are presented in Appendix D.

SUMMARY

1. The bulletin has been closed out for the following five (5) facilities which have been shut down indefinitely, per Criterion 1 (see Page 3):.

Dresden 1	La Crosse
Humboldt Bay 3	TMI 2
Indian Point 1	

Note: These facilities are not included in the total of 123 mentioned in the Abstract.

2. The bulletin has been closed out for the following 117 facilities which do not have the subject relays in the reactor protection system (Criterion 2, see Page 3):

Arkansas 1,2	Grand Gulf 1	Rancho Seco 1
Beaver Valley 1,2	Haddam Neck	River Bend 1
Bellefonte 1,2	Harris 1	Robinson 2
Big Rock Point 1	Hatch 1,2	Salem 1,2
Braidwood 1,2	Hope Creek 1	San Onofre 1,2,3
Browns Ferry 1,2,3	Indian Point 2,3	Seabrook 1,2
Brunswick 1,2	Kewaunee	Sequoyah 1,2
Byron 1,2	LaSalle 1,2	Shoreham
Callaway 1	Limerick 1,2	South Texas 1,2
Catawba 1,2	McGuire 1,2	St. Lucie 2
Clinton 1	Millstone 1,3	Summer 1
Comanche Peak 1,2	Monticello	Surry 1,2
Cook 1,2	Nine Mile Point 1,2	Susquehanna 1,2
Cooper Station	North Anna 1,2	TMI 1
Crystal River 3	Oconee 1,2,3	Trojan
Davis-Besse 1	Oyster Creek 1	Turkey Point 3,4
Diablo Canyon 1,2	Palisades	Vermont Yankee 1
Dresden 2,3	Palo Verde 1,2,3	Vogtle 1,2
Duane Arnold	Peach Bottom 2,3	WNP 1,2,3
Farley 1,2	Perry 1,2	Waterford 3
Fermi 2	Pilgrim 1	Watts Bar 1,2
FitzPatrick	Point Beach 1,2	Wolf Creek 1
Fort St. Vrain	Prairie Island 1,2	Yankee-Rowe 1
Ginna	Quad Cities 1,2	Zion 1,2

3. The bulletin has been closed out for the following three (3) facilities where the subject relays have been replaced with the acceptable dry-contact type (Criterion 3, see Page 3):

Fort Calhoun 1	Maine Yankee	Millstone 2

4. The bulletin has been closed out for St. Lucie 1 where the licensee elected to continue use of the subject relays and presented acceptable justification in the response (Criterion 4, see Page 3).

5. The bulletin has been closed out for Calvert Cliffs 1 & 2 based on licensee committments to replace the subject relays with the acceptable dry contact type (Criterion 5, see Page 3).

CONCLUSIONS

1. Only reactors supplied by Combustion Engineering were equipped with the subject C. P. Clare Model HG2X-1011 relays (see summary items 3, 4 and 5 above).

2. All requirements of the bulletin have been met; there are no remaining areas of concern.

CRITERIA FOR CLOSEOUT OF BULLETIN

1. The facility has been shut down indefinitely or permanently.

2. The response is a declaration that the facility has no C.P. Clare Model HG2X-1011 mercury-wetted relays in the logic matrix of the reactor protective system (RPS).

3. The response and an NRC/Region inspection report indicate that (a) C.P. Clare Model HG2X-1011 mercury-wetted relays in the logic matrix of the RPS were replaced with qualified relays of a different design and (b) surveillance of the Model HG2X-1011 relays was performed in the interim in compliance with Action Item 2 of the bulletin.

4. Justification for using the C. P. Clare Model HG2X-1011 mercury-wetted relays in the logic matrix of the RPS was presented in the licensee response in accordance with Action Item 3 of the bulletin, and an NRC/Region inspection report indicates that the justification is acceptable.

5. The response and an NRC/Region inspection report indicate licensee committment (a) to replace C.P. Clare Model HG2X-1011 mercury-wetted relays in the logic matrix of the RPS with qualified relays of a different design and (b) to perform surveillance of the Model HG2X-1011 relays in the interim in compliance with Action Item 2 of the bulletin.

APPENDIX A

Background Information and Required Actions

Notes:

1. For actions required by the bulletin, refer to Page A-4.

2. In effect, all of the utility responses and NRC/Region inspection reports apply to Revision 1 of the bulletin (see Page A-3). This observation is correct even when the response precedes the date of issue of Revision 1.

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT
WASHINGTON, D.C. 20555

July 31, 1980

IE Bulletin No. 80-19

FAILURES OF MERCURY-WETTED MATRIX RELAYS IN REACTOR PROTECTIVE SYSTEMS OF OPERATING NUCLEAR POWER PLANTS DESIGNED BY COMBUSTION ENGINEERING

BACKGROUND:

This bulletin addresses the failures of mercury-wetted relays used in the logic matrix of the reactor protective system (RPS) of nuclear power plants designed by Combustion Engineering (C-E). Except for Arkansas Nuclear One Unit 2 and Palisades, both of which use dry-contact matrix relays, the NRC understands that all other operating C-E plants use C.P. Clare Model HG2X-1011 mercury-wetted matrix relays in the RPS.

Mercury-wetted matrix relays manufactured by the Adams and Westlake Company were initially used in the Palisades plant; however, because of repeated failures of these relays, they were subsequently replaced with relays having dry-contacts. GTE, the manufacturer of these dry-contact relays, however, has since discontinued their production. Thus, although the dry-contact relays used at Palisades have performed without a failure since they were installed, they are not available for the other operating nuclear power plants designed by C-E.

OPERATING EXPERIENCES AND EVALUATION:

To date, operating nuclear power plants designed by C-E have reported thirty-one (31) failures of mercury-wetted relays used in the logic matrix of the RPS.

Most of the reported failures were "failed-closed" type (i.e., the type that could inhibit a reactor trip), and four of the reported events involved multiple failures (i.e., three relay failures were detected during two tests; two other failures were detected during two different tests). Because of the redundancy within the RPS, no reported event would have prevented a reactor trip; however, the build-up of coincident "failed-closed" failures of certain sets of relays could result in trip failures for off-normal events.

The number of single and multiple relay failures reported gives rise to two concerns: (1) the total number of failures yields a much higher random failure rate than that used in other relay failure estimates*, and (2) the number of

* Other relay failure estimates include (1) WASH-1400, "Reactor Safety Study", NRC, October 1975; (2) IEEE Std 500-1977,"IEEE Guide to the Collection and Presentation of Electrical, Electronic, and Sensing Component Reliability Data for Nuclear Power Generating Stations", IEEE, New York; and (3) NUREG/CR-0942, "Nuclear Plant Reliability Data System, 1978 Annual Reports of Cumulative System and Component Reliability", NRC.

multiple failures detected suggests the presence of a common-mode failure mechanism. Such a common-mode failure mechanism could result in the build-up of specific "failed-closed" failures which, in turn, could result in anticipated transients without scram (ATWS). Thus, the relatively high random failure rate and the suggested common-mode failure mechanism, indicate that plants using mercury-wetted matrix relays in the RPS are more susceptible to scram failures than predicted in other studies.

ACTIONS TO BE TAKEN BY HOLDERS OF CONSTRUCTION PERMITS OR OPERATING LICENSES FOR NUCLEAR POWER FACILITIES:

1. Review your facility to determine whether or not mercury-wetted relays are used in the RPS. If no such relays are used, you should submit a negative declaration to this effect and you need not respond to the remaining items in this bulletin. Your negative declaration shall be submitted to the appropriate NRC regional office within thirty (30) days of the date of this bulletin and a copy forwarded to the Director, Division of Reactor Operations Inspection, Office of Inspection and Enforcement, NRC, Washington, D. C. 20555.

2. Licensees of operating nuclear power plants using mercury-wetted relays in the RPS should increase the frequency of their surveillance tests. Until further notice, or until the mercury-wetted relays have been replaced with qualified relays of a different design, surveillance testing of the relays shall be initiated within ten (10) days of the date of this bulletin and repeated at intervals not exceeding ten (10) days thereafter. Upon detecting a failed relay, the failed unit shall be replaced with a qualified dry-contact relay or a new mercury-wetted relay. (The removed relay shall not be reused in the RPS.)

3. Nuclear power facilities which are using or whose design includes the use of mercury-wetted matrix relays in the RPS shall submit either their plans and schedules for replacing the mercury-wetted relays with qualified relays of a different design, or justification for using the mercury-wetted relays. Responses to this item shall be submitted to the offices listed in Item 1, above, within ninety (90) days of the date of this bulletin.

Approved by GAO, B180225 (R0072); clearance expires July 31, 1980. Approval was given under a blanket clearance specifically for identified generic problems.

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT
WASHINGTON, D.C. 20555

August 13, 1980

IE Bulletin No. 80-19
Revision 1

FAILURES OF MERCURY-WETTED MATRIX RELAYS IN REACTOR PROTECTIVE SYSTEMS OF OPERATING NUCLEAR POWER PLANTS DESIGNED BY COMBUSTION ENGINEERING

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2. Licensees of operating facilities using the above relays in the logic matrix of the RPS should increase the frequency of their surveillance tests. Until further notice, or until the mercury-wetted relays have been replaced with qualified relays of a different design, surveillance testing of the relays shall be initiated within ten (10) days of the date of this bulletin and repeated at intervals not exceeding ten (10) days thereafter. The additional surveillance testing applies when operability of the RPS is required by the Technical Specification. Upon detecting a failed relay, the failed unit shall be replaced with a qualified dry-contact relay or a new mercury-wetted relay. (The removed relay shall not be reused in the RPS.) R1 R1 R1 R1

3. Nuclear power facilities which are using or whose design includes the use of the above relays in the logic matrix of the RPS shall submit either their plans and schedules for replacing the mercury-wetted relays with qualified relays of a different design, or justification for using the mercury-wetted relays. Responses to this item shall be submitted to the offices listed in Item 1, above, within ninety (90) days of the date of the original version of this bulletin, July 30, 1980. R1 R1

Approved by GAO, B180225 (R0072); clearance expires July 31, 1980. (Application for renewal pending before GAO.) Approval was given under a blanket clearance specifically for identified generic problems.

APPENDIX B

Documentation of Bulletin Closeout

TABLE B.1 BULLETIN CLOSEOUT STATUS

Facility	Utility	Docket	Facility Status	NRC Region	NSSS	AE	Utility Response Date	Inspection Report and Date	Closeout Status and Criterion
Arkansas 1	AP&L	50-313	OL	IV	B&W	Bech	08-08-80		Closed 2
Arkansas 2	AP&L	50-368	OL	IV	C-E	Bech	08-08-80		Closed 2
Beaver Valley 1	DLC	50-334	OL	I	W	S&W	08-18-80		Closed 2
Beaver Valley 2	DLC	50-412	OL	I	W	S&W	08-29-80		Closed 2
Bellefonte 1	TVA	50-438	CP	II	B&W	TVA	09-04-80		Closed 2
Bellefonte 2	TVA	50-439	CP	II	B&W	TVA	09-04-80		Closed 2
Big Rock Point 1	CPC	50-155	OL	III	GE	Bech	08-28-80		Closed 2
Braidwood 1	CECO	50-456	OL	III	W	S&L	08-29-80		Closed 2
Braidwood 2	CECO	50-457	CP	III	W	S&L	08-29-80		Closed 2
Browns Ferry 1	TVA	50-259	OL	II	GE	TVA	08-29-80		Closed 2
Browns Ferry 2	TVA	50-260	OL	II	GE	TVA	08-29-80		Closed 2
Browns Ferry 3	TVA	50-296	OL	II	GE	TVA	08-29-80		Closed 2
Brunswick 1	CP&L	50-325	OL	II	GE	UE&C	08-19-80		Closed 2
Brunswick 2	CP&L	50-324	OL	II	GE	UE&C	08-19-80		Closed 2
Byron 1	CECO	50-454	OL	III	W	S&L	08-29-80		Closed 2
Byron 2	CECO	50-455	OL	III	W	S&L	08-29-80		Closed 2
Callaway 1	UE	50-483	OL	III	W	Bech	08-29-80		Closed 2
Calvert Cliffs 1	BG&E	50-317	OL	I	C-E	Bech	10-30-80	80-14(10-01-80) 81-02(03-10-81) 81-18(11-02-81)	Closed 5
Calvert Cliffs 2	BG&E	50-318	OL	I	C-E	Bech	10-30-80	80-13(10-01-80) 81-02(03-10-81) 81-17(11-02-81)	Closed 5
Catawba 1	DUPCO	50-413	OL	II	W	DUPCO	08-28-80		Closed 2
Catawba 2	DUPCO	50-414	OL	II	W	DUPCO	08-28-80		Closed 2
Clinton 1	IP	50-461	OL	III	GE	S&L	08-26-80		Closed 2
Comanche Peak 1	TUGCO	50-445	CP	IV	W	G&H	09-08-80		Closed 2
Comanche Peak 2	TUGCO	50-446	CP	IV	W	G&H	09-08-80		Closed 2

See notes on Page B-6.

TABLE B.1 (contd)

Facility	Utility	Docket	Facility Status	NRC Region	NSSS	AE	Utility Response Date	Inspection Report and Date	Closeout Status and Criterion
Cook 1	IMECO	50-315	OL	III	W	AEPSC	09-02-80		Closed 2
Cook 2	IMECO	50-316	OL	III	W	AEPSC	09-02-80		Closed 2
Cooper Station	NPPD	50-298	OL	IV	GE	B&R	08-06-80		Closed 2
Crystal River 3	FPC	50-302	OL	II	B&W	Gilb	08-21-80		Closed 2
Davis-Besse 1	TECO	50-346	OL	III	B&W	Bech	08-26-80		Closed 2
Diablo Canyon 1	PG&E	50-275	OL	V	W	PG&E	11-25-80		Closed 2
Diablo Canyon 2	PG&E	50-323	OL	V	W	PG&E	11-25-80		Closed 2
Dresden 1	CECO	50-010	SDI	III	GE		08-29-80		Closed 1
Dresden 2	CECO	50-237	OL	III	GE	S&L	08-29-80		Closed 2
Dresden 3	CECO	50-249	OL	III	GE	S&L	08-29-80		Closed 2
Duane Arnold	IELPCO	50-331	OL	III	GE	Bech	08-29-80		Closed 2
Farley 1	APCO	50-348	OL	II	W	SS	08-29-80		Closed 2
Farley 2	APCO	50-364	OL	II	W	SS	08-29-80		Closed 2
Fermi 2	DECO	50-341	OL	III	GE	S&L	09-02-80		Closed 2
FitzPatrick	PASNY	50-333	OL	I	GE	S&W	08-12-80		Closed 2
Fort Calhoun 1	OPPD	50-285	OL	IV	C-E	G&H	10-21-80	81-14(07-23-81)	Closed 3
Fort St. Vrain	PSCC	50-267	OL	IV	GA	S&L	09-08-80		Closed 2
Ginna	RG&E	50-244	OL	I	W	Gilb	08-27-80		Closed 2
Grand Gulf 1	MP&L	50-416	OL	II	GE	Bech	09-17-80 10-21-80		Closed 2
Haddam Neck	CYAPCO	50-213	OL	I	W	S&W	08-26-80		Closed 2
Harris 1	CP&L	50-400	OL	II	W	Ebas	08-29-80 09-17-80		Closed 2
Hatch 1	GPC	50-321	OL	II	GE	Bech	08-29-80		Closed 2
Hatch 2	GPC	50-366	OL	II	GE	Bech	08-29-80		Closed 2
Hope Creek 1	PSE&G	50-354	OL	I	GE	Bech	09-17-80		Closed 2
Humboldt Bay 3	PG&E	50-133	SDI	V	GE	Bech	09-04-80		Closed 1

See notes on Page B-6.

TABLE B.1 (contd)

Facility	Utility	Docket	Facility Status	NRC Region	NSSS	AE	Utility Response Date	Inspection Report and Date	Closeout Status and Criterion
Indian Point 1	ConEd	50-003	SDI	I	B&W	Con Ed	08-30-80		Closed 1
Indian Point 2	ConEd	50-247	OL	I	W	UE&C	08-30-80		Closed 2
Indian Point 3	PASNY	50-286	OL	I	W	UE&C	08-08-80		Closed 2
Kewaunee	WPS	50-305	OL	III	W	PS&E	09-04-80		Closed 2
La Crosse	DPC	50-409	SDI	III	Allis	S&L	08-08-80		Closed 1
LaSalle 1	CECO	50-373	OL	III	GE	S&L	08-29-80		Closed 2
LaSalle 2	CECO	50-374	OL	III	GE	S&L	08-29-80		Closed 2
Limerick 1	PECO	50-352	OL	I	GE	Bech	08-26-80		Closed 2
Limerick 2	PECO	50-353	CP	I	GE	Bech	08-26-80		Closed 2
Maine Yankee	MYAPCO	50-309	OL	I	C-E	S&W	10-21-80	80-14(10-22-80) 81-12(06-15-81)	Closed 3
McGuire 1	DUPCO	50-369	OL	II	W	DUPCO	08-28-80		Closed 2
McGuire 2	DUPCO	50-370	OL	II	W	DUPCO	08-28-80		Closed 2
Millstone 1	NNECO	50-245	OL	I	GE	Ebas	08-26-80		Closed 2
Millstone 2	NNECO	50-336	OL	I	C-E	Bech	10-20-80 03-16-82	83-06(03-15-83)	Closed 3
Millstone 3	NNECO	50-423	OL	I	W	S&W	09-05-80		Closed 2
Monticello	NSP	50-263	OL	III	GE	Bech	08-26-80		Closed 2
Nine Mile Point 1	NMP	50-220	OL	I	GE	NMP	08-27-80		Closed 2
Nine Mile Point 2	NMP	50-410	OL	I	GE	S&W	09-08-80		Closed 2
North Anna 1	VEPCO	50-338	OL	II	W	S&W	08-27-80		Closed 2
North Anna 2	VEPCO	50-339	OL	II	W	S&W	08-27-80		Closed 2
Oconee 1	DUPCO	50-269	OL	II	B&W	DUPCO/ Bech	08-22-80		Closed 2
Oconee 2	DUPCO	50-270	OL	II	B&W	DUPCO/ Bech	08-22-80		Closed 2
Oconee 3	DUPCO	50-287	OL	II	B&W	DUPCO/ Bech	08-22-80		Closed 2
Oyster Creek 1	JCP&L/GPUN	50-219	OL	I	GE	B&R	08-13-80		Closed 2

See notes on Page B-6.

TABLE B.1 (contd)

Facility	Utility	Docket	Facility Status	NRC Region	NSSS	AE	Utility Response Date	Inspection Report and Date	Closeout Status and Criterion
Palisades	CPC	50-255	OL	III	C-E	Bech	08-19-80		Closed 2
Palo Verde 1	APSCO	50-528	OL	V	C-E	Bech	09-02-80		Closed 2
Palo Verde 2	APSCO	50-529	OL	V	C-E	Bech	09-02-80		Closed 2
Palo Verde 3	APSCO	50-530	LPTL	V	C-E	Bech	09-02-80		Closed 2
Peach Bottom 2	PECO	50-277	OL	I	GE	Bech	08-27-80		Closed 2
Peach Bottom 3	PECO	50-278	OL	I	GE	Bech	08-27-80		Closed 2
Perry 1	CEI	50-440	OL	III	GE	Gilb	08-18-80		Closed 2
Perry 2	CEI	50-441	CP	III	GE	Gilb	08-18-80		Closed 2
Pilgrim 1	BECO	50-293	OL	I	GE	Bech	08-08-80		Closed 2
Point Beach 1	WEPCO	50-266	OL	III	W	Bech	08-29-80		Closed 2
Point Beach 2	WEPCO	50-301	OL	III	W	Bech	08-29-80		Closed 2
Prairie Island 1	NSP	50-282	OL	III	W	FPI	08-14-80		Closed 2
Prairie Island 2	NSP	50-306	OL	III	W	FPI	08-14-80		Closed 2
Quad Cities 1	CECO	50-254	OL	III	GE	S&L	08-29-80		Closed 2
Quad Cities 2	CECO	50-265	OL	III	GE	S&L	08-29-80		Closed 2
Rancho Seco 1	SMUD	50-312	OL	V	B&W	Bech	08-27-80		Closed 2
River Bend 1	GSU	50-458	OL	IV	GE	S&W	08-28-80		Closed 2
Robinson 2	CP&L	50-261	OL	II	W	Ebas	08-26-80 09-30-80		Closed 2
Salem 1	PSE&G	50-272	OL	I	W	PSE&G	08-29-80		Closed 2
Salem 2	PSE&G	50-311	OL	I	W	PSE&G	08-29-80		Closed 2
San Onofre 1	SCE	50-206	OL	V	W	Bech	08-15-80		Closed 2
San Onofre 2	SCE	50-361	OL	V	C-E	Bech	08-25-80		Closed 2
San Onofre 3	SCE	50-362	OL	V	C-E	Bech	08-25-80		Closed 2
Seabrook 1	PSNH	50-443	CP	I	W	UE&C	08-27-80		Closed 2
Seabrook 2	PSNH	50-444	CP	I	W	UE&C	08-27-80		Closed 2

See notes on Page B-6.

TABLE B.1 (contd)

Facility	Utility	Docket	Facility Status	NRC Region	NSSS	AE	Utility Response Date	Inspection Report and Date	Closeout Status and Criterion
Sequoyah 1	TVA	50-327	OL	II	W	TVA	09-04-80		Closed 2
Sequoyah 2	TVA	50-328	OL	II	W	TVA	09-04-80		Closed 2
Shoreham	LILCO	50-322	LPTL	I	GE	S&W	10-08-80		Closed 2
South Texas 1	HL&P	50-498	LPTL	IV	W	Bech	08-26-80 08-12-83		Closed 2
South Texas 2	HL&P	50-499	CP	IV	W	Bech	08-26-80 08-12-83		Closed 2
St. Lucie 1	FPL	50-335	OL	II	C-E	Ebas	10-29-80	83-03(03-17-83)	Closed 4
St. Lucie 2	FPL	50-389	OL	II	C-E	Ebas	08-29-80		Closed 2
Summer 1	SCE&G	50-395	OL	II	W	Gilb	08-27-80 09-04-80		Closed 2
Surry 1	VEPCO	50-280	OL	II	W	S&W	08-27-80		Closed 2
Surry 2	VEPCO	50-281	OL	II	W	S&W	08-27-80		Closed 2
Susquehanna 1	PP&L	50-387	OL	I	GE	Bech	09-02-80		Closed 2
Susquehanna 2	PP&L	50-388	OL	I	GE	Bech	09-02-80		Closed 2
TMI 1	Met-Ed/GPUN	50-289	OL	I	B&W	Gilb	09-16-80		Closed 2
TMI 2	Met-Ed/GPUN	50-320	SDI	I	B&W	B&R	08-29-80		Closed 1
Trojan	PGE	50-344	OL	V	W	Bech	08-29-80		Closed 2
Turkey Point 3	FPL	50-250	OL	II	W	Bech	09-02-80		Closed 2
Turkey Point 4	FPL	50-251	OL	II	W	Bech	09-02-80		Closed 2
Vermont Yankee 1	VYNP	50-271	OL	I	GE	Ebas	08-22-80		Closed 2
Vogtle 1	GPC	50-424	OL	II	W	SS/Bech	09-02-80		Closed 2
Vogtle 2	GPC	50-425	CP	II	W	SS/Bech	09-02-80		Closed 2
WNP 1	WPPSS	50-460	CP	V	B&W	UE&C	09-05-80		Closed 2
WNP 2	WPPSS	50-397	OL	V	GE	B&R	08-28-80		Closed 2
WNP 3	WPPSS	50-508	CP	V	C-E	Ebas	09-05-80		Closed 2
Waterford 3	LP&L	50-382	OL	IV	C-E	Ebas	08-08-80		Closed 2

See notes on Page B-6.

TABLE B.1 (contd)

Facility	Utility	Docket	Facility Status	NRC Region	NSSS	AE	Utility Response Date	Inspection Report and Date	Closeout Status and Criterion
Watts Bar 1	TVA	50-390	CP	II	W	TVA	09-04-80		Closed 2
Watts Bar 2	TVA	50-391	CP	II	W	TVA	09-04-80		Closed 2
Wolf Creek 1	KG&E	50-482	OL	IV	W	Bech	08-29-80		Closed 2
Yankee-Rowe 1	YAECO	50-029	OL	I	W	S&W	08-29-80		Closed 2
Zion 1	CECO	50-295	OL	III	W	S&L	08-29-80		Closed 2
Zion 2	CECO	50-304	OL	III	W	S&L	08-29-80		Closed 2

Notes:

1. Facility status relates to the date of completion of this report, and is based on references 1 and 2 (see below).

2. The following abbreviations apply to facility status:
CP, construction permit; LPTL, low power testing license; OL, operating license;
SDI, shut down indefinitely or permanently.

3. For bulletin closeout criteria, see Page 3.

REFERENCES

1. United States Nuclear Regulatory Commission, Licensed Operating Reactors, Status Summary Report, Data as of 08-31-87, NUREG-0020, Volume 11, Number 09, September 1987.

2. United States Nuclear Regulatory Commission, Nuclear Power Plants, Construction Status Report, Data as of 06-30-82, NUREG-0030, Volume 6, Number 2, October 1982.

3. United States Nuclear Regulatory Commission, Code of Federal Regulations, Energy, Title 10, Chapter 1, January 1, 1987, cited as 10CFR 0.735-1.

APPENDIX C

Utility Manhours Expended on IEB 80-19

TABLE C.1

Facility	Review & Reporting	Corrective Action	Total	Closeout Status and Criterion
Beaver Valley 1	24	0	24	Closed 2
Beaver Valley 2	3	0	3	Closed 2
Bellefonte 1,2	10	0	10	Closed 2
Braidwood 1,2	4	0	4	Closed 2
Browns Ferry 1,2,3	7	0	7	Closed 2
Brunswick 1,2	8	0	8	Closed 2
Byron 1,2	4	0	4	Closed 2
Callaway 1	15	0	15	Closed 2
Catawba 1,2	38	0	38	Closed 2
Comanche Peak 1,2	12	0	12	Closed 2
Cook 1,2	25	0	25	Closed 2
Cooper Station	3	0	3	Closed 2
Crystal River 3	24	0	24	Closed 2
Diablo Canyon 1,2	40	0	40	Closed 2
Dresden 2,3	4	0	4	Closed 2
Duane Arnold	24	0	24	Closed 2
Fort St. Vrain	5	0	5	Closed 2
Ginna	1	0	1	Closed 2
Grand Gulf 1	20	0	20	Closed 2
Harris 1	40	0	40	Closed 2
Indian Point 3	4	0	4	Closed 2
Kewaunee	10	0	10	Closed 2
La Crosse	2.5	0	2.5	Closed 1
LaSalle 1,2	4	0	4	Closed 2
Limerick 1,2	80	0	80	Closed 2
Maine Yankee	32	*	32	Closed 3
McGuire 1,2	27	0	27	Closed 2
Millstone 2	8	40	48	Closed 3
Monticello	7	0	7	Closed 2
Oconee 1,2,3	60	0	60	Closed 2
Oyster Creek	12	0	12	Closed 2
Palisades	2.5	0	2.5	Closed 2
Palo Verde 1,2,3	5	0	5	Closed 2
Peach Bottom 2,3	16	0	16	Closed 2
Perry 1,2	3	0	3	Closed 2
Totals, this page:	584.0	40	624.0	

* Note: To be determined.

TABLE C.1 (contd)

Facility	Review & Reporting	Corrective Action	Total	Closeout Status and Criterion
Pilgrim 1	7	0	7	Closed 2
Quad Cities 1,2	4	0	4	Closed 2
Rancho Seco 1	8	0	8	Closed 2
Robinson 2	24	0	24	Closed 2
Salem 1,2	24	0	24	Closed 2
San Onofre 2,3	25	0	25	Closed 2
Sequoyah 1,2	10	0	10	Closed 2
Shoreham	8	0	8	Closed 2
South Texas 1,2	8	0	8	Closed 2
Summer 1	180	0	180	Closed 2
Susquehanna 1,2	20	0	20	Closed 2
TMI 1	27	0	27	Closed 2
Trojan	40	0	40	Closed 2
Turkey Point 3,4	4	0	4	Closed 2
Vermont Yankee	5	0	5	Closed 2
Vogtle 1,2	40	0	40	Closed 2
WNP 1,3	20	0	20	Closed 2
Watts Bar 1,2	10	0	10	Closed 2
Wolf Creek 1	15	0	15	Closed 2
Yankee-Rowe	5	0	5	Closed 2
Zion 1,2	4	0	4	Closed 2
Totals from previous page:	584.0	40	624.0	
Total hours reported:	1072.0	40	1112.0	

APPENDIX D

Abbreviations

AE	Architect Engineer
AEPSC	American Electric Power Services Corporation
Allis	Allis Chalmers Corporation
APCO	Alabama Power Company
AP&L	Arkansas Power and Light Company
APSCO	Arizona Public Service Company
ATWS	Anticipated Transient Without Scram
B&R	Burns & Roe
Bech	Bechtel Corporation
BECO	Boston Edison Company
BG&E	Baltimore Gas and Electric Company
B&W	Babcock & Wilcox Company
BWR	Boiling Water Reactor
C-E	Combustion Engineering Incorporated
CECO	Commonwealth Edison Company
CEI	Cleveland Electric Illuminating Company
CFR	Code of Federal Regulations
ConEd	Consolidated Edison Company of New York, Inc.
CP	Construction Permit
CPC	Consumers Power Company
CP&L	Carolina Power and Light Company
CR	Contractor Report
CYAPCO	Connecticut Yankee Atomic Power Company
DECO	Detroit Edison Company
DLC	Duquesne Light Company
DPC	Dairyland Power Cooperative
DUPCO	Duke Power Company
Ebas	Ebasco Services, Inc.
FPC	Florida Power Corporation
FPI	Fluor Pioneer, Inc.
FPL	Florida Power & Light Company
GA	General Atomics
GAO	Government Accounting Office
GE	General Electric Company
G&H	Gibbs & Hill, Inc.
Gilb	Gilbert Associates, Inc.

GPC	Georgia Power Company
GPUN	GPU Nuclear Corporation
GSU	Gulf States Utilities Company
GTE	GTE Sylvania, Inc.
HL&P	Houston Lighting and Power Company
IE	(See NRC/IE)
IEB	Inspection and Enforcement Bulletin (NRC)
IEEE	Institute of Electrical and Electronic Engineers
IELPCO	Iowa Electric Light and Power Company
IMECO	Indiana and Michigan Electric Company
IP	Illinois Power Company
IR	Inspection Report (NRC/Region)
JCP&L	Jersey Central Power and Light Company
KG&E	Kansas Gas and Electric Company
LER	Licensee Event Report
LILCO	Long Island Lighting Company
LP&L	Louisiana Power and Light Company
LPTL	Low Power Testing License
Met-Ed	Metropolitan Edison Company
MP&L	Mississippi Power and Light Company
MYAPCO	Maine Yankee Atomic Power Company
NIPSCO	Northern Indiana Public Service Company
NMP	Niagara Mohawk Power Company
NNECO	Northeast Nuclear Energy Company
NPPD	Nebraska Public Power District
NRC/IE	Nuclear Regulatory Commission/ Office of Inspection & Enforcement
NRR	Office of Nuclear Reactor Regulation (NRC)
NSP	Northern States Power Company
NSSS	Nuclear Steam System Supplier
NU	Northeast Utilities
OL	Operating License
OPPD	Omaha Public Power District
PASNY	Power Authority of the State of New York
PECO	Philadelphia Electric Company
PGE	Portland General Electric Company
PG&E	Pacific Gas and Electric Company
PP&L	Pennsylvania Power and Light Company
PSCC	Public Service Company of Colorado
PSE&G	Public Service Electric and Gas Company
PS&E	Pioneer Services and Engineering
PSI	Public Service Indiana
PSNH	Public Service Company of New Hampshire
PWR	Pressurized Water Reactor
R	Region (NRC)

RG&E	Rochester Gas and Electric Corporation
RPS	Reactor Protective System
S&L	Sargent & Lundy Engineers
S&W	Stone & Webster Engineering Corp.
SCE	Southern California Edison Company
SCE&G	South Carolina Electric and Gas Company
SDI	Shut Down Indefinitely or Permanently
SMUD	Sacramento Municipal Utility District
SNUPPS	Standardized Nuclear Unit Power Plant Systems
SS	Southern Services, Inc.
TECO	Toledo Edison Company
TMI	Three Mile Island
TUGCO	Texas Utilities Generating Company
TVA	Tennessee Valley Authority
UE	Union Electric Company
UE&C	United Engineers & Constructors
VEPCO	Virginia Electric and Power Company
VYNP	Vermont Yankee Nuclear Power Corporation
W	Westinghouse Electric Corporation
WEPCO	Wisconsin Electric Power Company
WNP	Washington Nuclear Project
WPPSS	Washington Public Power Supply System
WPS	Wisconsin Public Service Corporation
YAECO	Yankee Atomic Electric Company

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5. AUTHOR(S)
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12. SUPPLEMENTARY NOTES

13. ABSTRACT (200 words or less)

The NRC/IE issued IE Bulletin 80-19 initially on July 31, 1980, and issued Revision 1 of the bulletin on August 13, 1980. The bulletin was issued to all licensees and holders of construction permits of power reactors, because of numerous reports about single and multiple failures of C.P. Clare Model HG2-1011 mercury-wetted matrix relays in reactor protective systems. The concern based on those reports was that the build-up of coincident "failed-closed" failures of certain sets of relays could result in trip failures for off-normal events. Evaluation of utility responses and NRC/Region inspection reports shows that the bulletin can be closed out per specific criteria for 100% of the 123 power facilities with operating licenses or construction permits. In effect, all of the responses and inspection reports apply to Revision 1 of the bulletin. All except the three following facilities either do not have the subject relays in the reactor protective system, or have changed the relays to an acceptable type as a result of the bulletin. An inspection report closed the bulletin for Calvert Cliffs 1 & 2 based on licensee committments to replace the mercury-wetted relays with the dry-contact type. For St. Lucie 1, the licensee elected to continue to use the subject relays and presented acceptable justification.

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CLOSEOUT OF IE BULLETIN 80-19: FAILURES OF MERCURY-WETTED MATRIX RELAYS IN REACTOR PROTECTIVE SYSTEMS OF OPERATING NUCLEAR POWER PLANTS DESIGNED BY COMBUSTION ENGINEERING

APRIL 1988