ACCELERATED DISTRIBUTION DEMONSTRATION SYSTEM

REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

ACCESSION NBR:8808170124 DOC.DATE: 88/07/29 NOTARIZED: NO DOCKET #
FACIL:STN-50-528 Palo Verde Nuclear Station, Unit 1, Arizona Publi 05000528
STN-50-529 Palo Verde Nuclear Station, Unit 2, Arizona Publi 05000529
STN-50-530 Palo Verde Nuclear Station, Unit 3, Arizona Publi 05000530
AUTH.NAME AUTHOR AFFILIATION
LEWIS,C.A. Arizona Nuclear Power Project (formerly Arizona Public Serv
ROWLAND,J.W. Arizona Nuclear Power Project (formerly Arizona Public Serv
STERLING,E.C. Arizona Nuclear Power Project (formerly Arizona Public Serv
RECIP.NAME RECIPIENT AFFILIATION
SHRIVER,T.D. Arizona Nuclear Power Project (formerly Arizona Public Serv

SUBJECT: Part 21 rept re potential design problem concerning Potter & Brumfield supplied electrical relays.

DISTRIBUTION CODE: IE19D COPIES RECEIVED:LTR 1 ENCL 1 SIZE: 13
TITLE: Part 21 Rept (50 DKT)

NOTES:Standardized plant. 05000528
Standardized plant. 05000529
Standardized plant. 05000530

	RECIPIENT ID CODE/NAME	COPIES LTTR	COPIES ENCL	RECIPIENT ID CODE/NAME	COPIES LTTR	COPIES ENCL
	PD5 LA	1	0	PD5 PD	1	1
	LICITRA,E	1	1	DAVIS,M	1	1
INTERNAL:	AEOD/DOA	1	1	AEOD/DSP/TPAB	1	1
	ARM TECH ADV	1	1	NRR CRUTCHFIELD	1	1
	NRR VARGA,S	1	1	NRR/DEST/ADE 8H	1	1
	NRR/DEST/ADS 7E	1	1	NRR/DLPQ/QAB 10	1	1
	NRR/DOEA/EAB 11	1	1	NRR/DOEA/GCB 11	1	1
	NRR/DRIS/VIB 9D	1	1	NUDOCS-ABSTRACT	1	1
	REG FILE 01	1	1	RES/DSIR DEPY	1	1
	RES/DSIR/EIB	1	1	RGN1	1	1
	RGN2	1	1	RGN3	1	1
	RGN4	1	1	RGN5	1	1
EXTERNAL:	INPO RECORD CTR	1	1	LPDR	1	1
	NRC PDR	1	1	NSIC SILVER,E	1	1
NOTES:		1	1			

TOTAL NUMBER OF COPIES REQUIRED: LTTR 29 ENCL 28

RIDS/ADDS

RIDS/ADDS

JUL 29 '88 14:36 PVNGS ADMIN

POTENTIAL PART 21-FOR INFORMATION

2 OF 12 P.2

PV403-004B (11-84)
4190-800124 (PK/250)

Arizona Nuclear Power Project

ID#: 167-02607-JWR/CAL

DATE: July 29, 1988

TO: T. D. Shriver
Sta.# 6148
Ext. 2521

Prepared by:
Signature
Name/Ext./Sta. C. A. Lewis/4064/7010

Reviewed By:
Signature John H. Hesser Jr.
Name/Ext./Sta. J. W. Rowland/4059/7010

Approved by:
Signature Richard Badsgard for
Name/Ext./Sta. E. C. Sterling/4176/7034

File: 88-006-216

SUBJECT: Interim Reportability Evaluation Report (RER) 88-14, Rev. 0

Reference: A) 102-00836-TDS/DAJ, Dated June 27, 1988, RER 88-14

This memo transmits Engineering's interim evaluation of the subject RER, in response to your request, Reference (A). As noted on the attached RER, we recommend that this issue be considered reportable under requirements of 10CFR21. In addition, please note the inspection plan items that will be needed to complete the transportability assessment and that this may affect the scope of our final corrective actions. Our tentative schedule for issuance of the final RER is September 15, 1988, contingent on timely approval and resolution of all the inspection plan items.

If you have any questions or comments, please contact Chuck Lewis at extension 4064.

ECS/CAL/jle
Attachment

cc: D. A. Johnson
M. S. Coppock
B. J. Albert
J. H. Hesser
J. B. Hebison
S. K. Waters
R. M. Butler
J. E. Allen
J. R. LoCicero (ISEG)
J. M. Allen (U-I)
W. E. Ide (U-II)
O. J. Zeringue (U-III)

IE-19
1/1

3-of-12

ANPP	REPORTABILITY EVALUATION 10CFR21	RER No. 88-14 Rev. No. 0 Page No. 1 of 10

Unit	Q Class	Seismic Cat.	Reference Documents
1,2,3	Q	I	See References (p. 10)

Evaluation of Condition

I. DESCRIPTION OF DEFICIENCY

A. Evaluation

Numerous sub-group relay failures have occurred in the Combustion Engineering (CE) supplied, NSSS engineered safety features actuation system (ESFAS) cabinets as documented in the Reference (A) through (G) root cause failure (RCF) engineering evaluation reports (EER). These rotary relays are required to function properly in order to affect a safe plant shutdown following design basis events by actuating the associated logic and output devices (safe shutdown equipment). The following is a summary of the occurrences during approximately the last 2 years in the NSSS ESFAS cabinets discovered during safety systen actuations or during surveillance testing:

RELAY MODEL #	RELAY #	FUNCTION	UNIT #	TRAIN	W.O.
MDR-7032	K111	CSAS	1	B	229195
MDR-7032	K111	CSAS	1	B	251353
MDR-7032	K101	SIAS	2	B	268270
MDR-7032	K113	AFAS-1	2	A	151845
MDR-7034	K206	CIAS	2	B	209045
MDR-7032	K413	AFAS-2	2	B	191617
MDR-7034	K405	RAS	2	B	293046
MDR-7032	K110	SIAS	2	B	228496
MDR-7032	K312	RAS	3	A	250044
MDR-7034	K101	SIAS	3	B	283325
MDR-7032	K111	CSAS	3	B	267430
MDR-7032	K110	SIAS	3	A	263084
MDR-7033	K213	CIAS	3	A	262957
MDR-7032	K110	SIAS	3	B	245442
MDR-7032	K111	CSAS	3	A	294062
MDR-136-1	KXXX	AFAS	X	X	XXXXXX

Condition Identified By: EED (References A thru I)	Prepared By:	Date

Final Evaluation Reportable	[X] Yes [ ] No	Final Evaluation Reportability Concurrence	[X] Yes [ ] No
Richard Badgand for ECS Engr Manager	7-29-88 Date	[signature] OSAE Manager	7/29/88 Date

notified Resident Polich 7/29/88 [signature]
notified NRC region V John Burdoin 7/29/88 @ 10:30am [signature]

ANPP

REPORTABILITY EVALUATION

10CFR21

CONTINUATION SHEET

RER No. 88-14

Rev. No. 0

Page No. 6 of 10

SYSTEM	RELAY #	MODEL #	FUNCTION
NSSS ESFAS	K213	MDR-7033	CIAS
NSSS ESFAS	K212	MDR-7034	CIAS
NSSS ESFAS	K210	MDR-7034	CIAS
NSSS ESFAS	K209	MDR-7034	CIAS
NSSS ESFAS	K208	MDR-7034	CIAS
NSSS ESFAS	K201	MDR-7034	CIAS
NSSS ESFAS	K202	MDR-7034	CIAS
NSSS ESFAS	K101	MDR-7034	SIAS
NSSS ESFAS	K102	MDR-7033	SIAS
NSSS ESFAS	K103	MDR-7033	SIAS
NSSS ESFAS	K108	MDR-7033	SIAS
NSSS ESFAS	K109	MDR-7032	SIAS
NSSS ESFAS	K110	MDR-7032	SIAS
NSSS ESFAS	K301	MDR-7034	SIAS
NSSS ESFAS	K302	MDR-7034	SIAS
NSSS ESFAS	K308	MDR-7034	SIAS
NSSS ESFAS	K311	MDR-7033	SIAS
NSSS ESFAS	K401	MDR-7034	SIAS
NSSS ESFAS	K403	MDR-7034	SIAS
NSSS ESFAS	K408	MDR-7034	SIAS
NSSS ESFAS	K409	MDR-7034	SIAS
NSSS ESFAS	K410	MDR-7034	SIAS
NSSS ESFAS	K412	MDR-7034	SIAS
NSSS ESFAS	K304	MDR-7034	CSAS
NSSS ESFAS	K111	MDR-7032	CSAS
NSSS ESFAS	K114	MDR-7032	CSAS

Total NSSS ESFAS = 51 per cabinet
(There is a cabinet in each of the two trains per unit)

SYSTEM	RELAY #	MODEL #	FUNCTION
BOP ESFAS	K201	MDR-167-1	CPIAS
BOP ESFAS	K202	MDR-167-1	LOP/LS
BOP ESFAS	K203	MDR-167-1	LOP/LS
BOP ESFAS	K204	MDR-172-1	LOP/LS
BOP ESFAS	K205	MDR-172-1	LOP/LS
BOP ESFAS	K206	MDR-172-1	CRVIAS
BOP ESFAS	K207	MDR-172-1	CREFAS
BOP ESFAS	K208	MDR-172-1	SPARE
BOP ESFAS	K209	MDR-172-1	SPARE
BOP ESFAS	K221	MDR-136-1	LS
BOP ESFAS	K222	MDR-136-1	LS

	REPORTABILITY EVALUATION	RER No. 88-14
ANPP	10CFR21	Rev. No. 0
	CONTINUATION SHEET	Page No. 7 of 10

SYSTEM	RELAY #	MODEL #	FUNCTION
BOP ESFAS	K223	MDR-136-1	LS
BOP ESFAS	K225	MDR-136-1	LS
BOP ESFAS	K226	MDR-136-1	LS
BOP ESFAS	K227	MDR-136-1	LS
BOP ESFAS	K231	MDR-136-1	LS
BOP ESFAS	K232	MDR-136-1	LS
BOP ESFAS	K233	MDR-136-1	LS
BOP ESFAS	K234	MDR-136-1	LS
BOP ESFAS	K235	MDR-136-1	LS
BOP ESFAS	K236	MDR-136-1	LS
BOP ESFAS	K125	MDR-136-1	LS
BOP ESFAS	K126	MDR-136-1	LS
BOP ESFAS	K127	MDR-136-1	LS
BOP ESFAS	K128	MDR-136-1	LS
BOP ESFAS	K124	MDR-136-1	DGSS
BOP ESFAS	K123	MDR-136-1	CRVIAS
BOP ESFAS	K112	MDR-136-1	FBEVAS
BOP ESFAS	K121	MDR-136-1	FBEVAS
BOP ESFAS	K122	MDR-136-1	CREFAS

Total BOP ESFAS - 30 per cabinet
(There is a cabinet in each of the two trains per unit)

SYSTEM	RELAY #	MODEL #	FUNCTION
RTSG	52Z	MDR-5053	Aux. Relay
RTSG	Isol.	MDR-4094	Isol. Relay

Total RTSG - 2 per breaker cabinet
(There are 4 breaker cabinets per unit)

List of Acronyms

AFAS-1 - auxiliary feedwater actuation signal for Steam Generator #2
AFAS-2 - auxiliary feedwater actuation signal for Steam Generator #2
MSIS - main steam isolation signal
RAS - recirculation actuation signal
CIAS - containment isolation actuation signal
SIAS - safety injection actuation signal

	REPORTABILITY EVALUATION	RER No. 88-14
ANPP	10CFR21	Rev. No. 0
	CONTINUATION SHEET	Page No. 8 of 10

CSAS - containment spray actuation signal
CPIAS - containment purge isolation actuation signal
LOP/LS - loss of power/load shed
CRVIAS - control room isolation actuation signal
CREFAS - control room essential filtration actuation signal
DGSS - diesel generator start signal
RTSG - reactor trip switchgear

D. Safety Significant Assessment

The failure of any relay to properly rotate by spring tension upon being deenergized by a valid safety system actuation signal would prevent the associated valves, pump motors, etc. from operating as required for a safe plant shutdown. This relay failure mechanism as described in Section I, A. constitutes a defect of a basic component which could create a substantial safety hazard as defined in 10CFR Part 21, since the loss of multiple components in both train A and train B due to a common failure mechanism could occur.

II. ANALYSIS OF SAFETY IMPLICATIONS

This reportability evaluation has determined this problem to be reportable under 10CFR Part 21.

III. CORRECTIVE ACTION

The corrective actions which are more short term (approximately 6 months or less) are:

- Increase in testing frequency as specified in the justification for interim operation (JCO) for the model MDR-7032. This is supported by a reliability analysis performed by engineering.

- Complete the inspection plan outlined in Section I., C. to assess transportability and allow the vendors P&B and CE to complete their failure analysis reports.

ANPP	REPORTABILITY EVALUATION 10CFR21 CONTINUATION SHEET	RER No. 88-14 Rev. No. 0 Page No. 9 of 10

- P&B needs to finish their analysis of the relay samples and determine which relay design changes are necessary to isolate and prevent chlorides from the relay case and prevent offgasing of the coil coatings. To date this includes the following possible changes:

  1) Changing the wiring and coil insulation materials from PVC to other materials.

  2) Adding vents to the coil casing to prevent any future offgasing from plating out on coil internals. This would also tend to lower coil operating temperatures.

  3) Changing the coil varnish to an epoxy compound which is less susceptible to offgasing.

  4) Lubrication of the shaft and sleeve bearings to reduce rotational drag.

- CE needs to finish their assessment of ECO data, failure rate information and issue their report. This could result in:

  1) Changes in the power supplies (lower voltages).

  2) NSSS ESFAS cabinet component changes.

  3) Addition of forced air cooling.

The corrective action which is more long term (approximately 6 months or more) is to replace all relays which were subjected to higher than normal relay coil voltages or temperatures with the revised P&B relay design resulting from their analysis of the failure mechanisms. These relays are believed to have been aged due to excessive coil heat and are probably at the statistical end of their operating life.

ANPP	REPORTABILITY EVALUATION 10CFR21 CONTINUATION SHEET	RER No. 88-14 Rev. No. 0 Page No. ~~10~~ of ~~10~~

References

A) EER 88-SI-100, dated 5/23/88

B) EER 88-SA-007, dated 2/3/88

C) EER 88-SI-025, dated 2/3/88

D) EER 87-SA-356, dated 12/29/87

E) EER 88-SI-106, dated 5/28/88

F) EER 88-SA-010, dated 2/12/88

G) EER 87-SA-016, dated 5/28/88

H) Seal Report No. 4358, 'Examination of 4 Rotary Relays', dated 5/3/88

I) HI-REL Laboratories Report No. FR067130, dated 8/20/87

J) RER 88-14 Request 102-00836-TDS/DAJ, dated 6/24/88

K) NSSS ESFAS Aux. Relay Cabinets Tech. Manual N001-13.06-87

L) RTSG Tech. Manual N001-13.03-262

M) BOP ESFAS Tech Manual J104-81

	REPORTABILITY EVALUATION	RER No. 88-14
ANPP	10CFR21	Rev. No. 0
	CONTINUATION SHEET	Page No. 2 of 10

The MDR relay failures can be described as the failure of the relays to change position when they are de-energized. Normally, when the coils are de-energized, the rotor turns 30 degrees due to spring force. However, during the identified failures, the spring force was not able to return the rotor to its de-energized position. The relays were "sticking" in their energized position. This condition resulted in the relay contacts not properly changing states. The consequence of the relay failures is that the safety equipment was not actuated, as required.

The (Reference A through G) RCF EER's were supported in determination of the varnish offgas and corrosion failure mechanism for some of the above failed relays. ANPP sent four MDR-7032 rotary relays to Scanning Electron Analysis Laboratories, Inc. (SEAL) for examination. SEAL disassembled the relays for visual examination of the internals. For two of the relays, they observed large amounts of a brown/black powdery material in the magnet and coil areas. Some brown material was observed on the brass plates at the top of the coils. Additionally, there was evidence of shaft wear and metal chips in these samples. SEAL conducted Scanning Electron Microscope (SEM) examinations of the powdery contaminant, the metal chips, and the brown enamel (varnish) that coats the coil. SEAL concluded that the source of the contaminants was most probably the varnish applied to the winding of the coil. The contaminants caused the binding of the shaft and led to the observed shaft wear. SEAL did not find any evidence of corrosion on the shaft or brass bushings.

HI-REL Laboratories performed two analyses for ANPP. ANPP initially sent four failed MDR relays to HI-REL for their failure analysis. Two of the relays were model MDR-7032, one was a model MDR-7034, and one was a model MDR-136-1. HI-REL first performed electrical tests on the relays. For three of the relays, HI-REL verified that the relays would not move through the complete 30 degree arc upon de-energization. These relays were restricted to an arc of not more than 12 degrees. The fourth sample rotated through the full 30 degree arc. HI-REL then disassembled the relays and performed an internal visual inspection. The internal inspection revealed corrosion of the rotor, the dome shaped metal shield over the coils, and the upper and lower races. HI-REL attributed the rotational problems to this corrosion. Energy Dispersive Spectrum (EDS) analysis revealed extensive chlorine contamination on the brass races, the armature and the metal coil shield.

REPORTABILITY EVALUATION — RER No. 88-14

ANPP — 10CFR21 — Rev. No. 0

CONTINUATION SHEET — Page No. 3 of 10

The relay manufacturer, Potter & Brumfield (P&B), has assisted with a review of the application; temperatures, coil operating voltages, manufacturing process reviews in an attempt to isolate and correct the source of chlorides, cabinet air flow and frequency of relay operation. This is discussed further under corrective actions.

The cabinet designer (CE) has assisted by reviewing a series of engineering change orders (ECO) done in 1980 and 1981 that raised the operating voltage of the 4 power supplies (P/S) in each cabinet from 28 VDC to approximately 36 VDC. The specified P/S operating voltage for this ECO was 36.8 to 39.8 VDC (Reference K); thus raising the relay coil operating voltage substantially above the nominal 28 VDC coil rating. Coil voltages in Unit 2 measured on June 3, 1988 were between 29 to 32 VDC. This caused the relay coils to operate at an excessively high temperature and it is believed caused a higher rate of offgasing from the coil materials with a corresponding higher corrosion and failure rate.

This would tend to explain why the only Potter & Brunfield MDR series relay failures have been in the NSSS ESFAS cabinets. None have been noted for the reactor trip switchgear (RTSG) or balance of plant (BOP) ESFAS. However, additional information on these other cabinets is needed in order to ascertain if the same failure mechanisms previously discussed are present in those cabinets. This is discussed in more detail in the transportability section.

The problems which prompted the ECO's for the NSSS ESFAS P/S were related to the relay pickup voltages. CE experienced difficulties with the hot pickup of some relays at San Onofre Nuclear Generating Station (SONGS). The specified values are:

	@ 25°C (77°F)	@ 40°C (104°F)	@ 55°C (131°F)
7032	L.T. 19V	L.T. 24V	L.T. 26V
7033	L.T. 18.6V	L.T. 24V	L.T. 26V
7034	L.T. 18.6V	L.T. 24V	L.T. 26V

(L.T. = Less Than)

ANPP	REPORTABILITY EVALUATION 10CFR21 CONTINUATION SHEET	RER No. 88-14 Rev. No. 0 Page No. 4 of 10

As can be seen, with the P/S at 28 VDC and allowing for auctioneering diode and cable losses of 5 to 6 volts, hot pickup would be a problem at 40 to 55°C. The solution chosen by CE was to raise the P/S voltage from 28 VDC to 36 VDC. This same solution was implemented on the PVNGS cabinets resulting in an even higher voltage at the relay coils due to a shorter run of cable, between the plant protection system (PPS) initiation relays and the NSSS ESFAS subgroup relays, than the cable lengths involved at SONGS. Recent relay coil measurements at SONGS indicate that the cable drops experienced there are at least 5 volts more than at PVNGS. This results in a correspondingly higher coil voltage at PVNGS for similar P/S voltages. . ..

B. Root Cause

The most likely root cause of this problem, from information available to date, is the lack of consideration given by the cabinet designers (CE) to the long term affects of excessive voltage applied to the relay coils (substantially higher than the 28 VDC coil rating) when implementing the ECO for higher power supply voltages and the failure to consider the potential differences (cable lengths) between plants when implementing the generic ECO.

C. Transportability

To address whether this failure mechanism and root cause is applicable to the other cabinets using these type relays the following list of MDR relay model numbers, system, relay number and function is presented. The inspection plan to assess transportability that has been drafted and presented to ANPP management separate from this RER is outlined below. All NSSS ESFAS relays listed are potentially affected by the offgasing and corrosion failure mechanisms since they have been subjected to excessive voltage as related to the root cause. The inspection plan calls for:

- Remove and inspect 1 BOP ESFAS relay and 1 RTSG relay with cabinet extremes for voltage and temperature.

- Measure RTSG relay coil voltages, surface temperatures and ambient temperatures.

7 of 12

	REPORTABILITY EVALUATION	RER No. 88-14
ANPP	10CFR21	Rev. No. 0
	CONTINUATION SHEET	Page No. 5 of 10

- In addition, the work order history for the NSSS ESFAS P/S needs to be reviewed to determine when P/S voltage adjustments may have been made.

- Additional temperature measurements in each bay of the NSSS ESFAS cabinets are needed.

The inspection plan has more detail for the above items. These additional items are needed to complete the transportability section and/or to support efforts by CE and P&B to clarify the failure mechanisms.

SYSTEM	RELAY #	MODEL #	FUNCTION
NSSS ESFAS	K402	MDR-7034	AFAS-1
NSSS ESFAS	K307	MDR-7033	AFAS-1
NSSS ESFAS	K113	MDR-7032	AFAS-1
NSSS ESFAS	K211	MDR-7034	AFAS-1
NSSS ESFAS	K413	MDR-7032	AFAS-2
NSSS ESFAS	K310	MDR-7034	AFAS-2
NSSS ESFAS	K112	MDR-7033	AFAS-2
NSSS ESFAS	K404	MDR-7034	MSIS
NSSS ESFAS	K406	MDR-7032	SPARE
NSSS ESFAS	K411	MDR-7034	MSIS
NSSS ESFAS	K313	MDR-7034	MSIS
NSSS ESFAS	K306	MDR-7034	MSIS
NSSS ESFAS	K305	MDR-7034	MSIS
NSSS ESFAS	K303	MDR-7034	MSIS
NSSS ESFAS	K107	MDR-7032	SPARE
NSSS ESFAS	K106	MDR-7032	SPARE
NSSS ESFAS	K105	MDR-7034	MSIS
NSSS ESFAS	K309	MDR-7034	RAS
NSSS ESFAS	K312	MDR-7032	RAS
NSSS ESFAS	K405	MDR-7034	RAS
NSSS ESFAS	K104	MDR-7034	RAS
NSSS ESFAS	K203	MDR-7034	CIAS
NSSS ESFAS	K204	MDR-7033	CIAS
NSSS ESFAS	K205	MDR-7034	CIAS
NSSS ESFAS	K206	MDR-7034	CIAS
NSSS ESFAS	K627	MDR-136-1	AFAS
NSSS ESFAS	K628	MDR-136-1	AFAS
NSSS ESFAS	K629	MDR-136-1	AFAS
NSSS ESFAS	K727	MDR-136-1	AFAS
NSSS ESFAS	K728	MDR-136-1	AFAS

S. Richards Cliff Clark:: For P21 file.

PRIORITY ATTENTION REQUIRED MORNING REPORT - REGION V JULY 29, 1988

LICENSEE/FACILITY	NOTIFICATION/SUBJECT
PALO VERDE UNIT 2 DN 50-529 REN N/A	TELEPHONE CALL FROM RESIDENT INSPECTOR/ FAULTY RELAYS

EVENT

ON JULY 28, THE LICENSEE PROVIDED A 10 CFR PART 21 REPORT ASSOCIATED WITH A POTENTIAL DESIGN PROBLEM RELATED TO POTTER BRUMFIELD SUPPLIED ELECTRICAL RELAYS USED IN THE BALANCE OF PLANT ENGINEERED SAFETY SYSTEM, NUCLEAR STEAM SUPPLY SYSTEM (NSSS), ENGINEERED SAFETY SYSTEM AND REACTOR TRIP SWITCH GEAR POSITION INDICATION. DURING THE PERFORMANCE OF SURVEILLANCE TESTING, THE LICENSEE NOTED INSTANCES WHERE THE RELAYS WOULD NOT OPERATE THE RELAY CONTACTS. PRELIMINARY EVALUATIONS INDICATED AN OFFGASSING PROBLEM FROM THE COIL VARNISH COATING WHICH CAUSED A PLATE OUT OF CHEMICAL CONTAMINANTS WHICH IMPEDE THE ROTATION OF THE ROTOR SUCH THAT THE CONTACTS DO NOT CHANGE STATE.

THE RELAYS MAY BE INSTALLED IN SOME OTHER PLANTS WHERE THE NSSS WAS PROVIDED BY COMBUSTION ENGINEERING.

CONTACT: W. WAGNER (FTS) 463-3731

EXECUTIVE SUMMARY

Potter & Brumfield (P&B) MDR series relays are used at PVNGS in several safety related applications. The relays are used as actuation relays in the NSSS and BOP Engineered Safety Features Actuation Systems and as indication relays in the Reactor Trip Switchgear System. The P&B relays are rotary relays. Most of the relays are normally energized. Upon de-energization, the relay rotor is moved through an arc of 30 degrees by spring action. This causes the relay contacts to change state.

At PVNGS, approximately 15 failures of the P&B relays have been experienced over the last two years. All of the failures have occurred with relays located in the NSSS ESFAS cabinets (auxiliary relay cabinets). The identified failure mode is that contaminants plate out and/or corrosion occurs on the internal surfaces of the relay's motor chamber. This prevents full rotor movement upon de-energization of the relay coil. Thus, the contacts do not properly change state and the associated safety equipment is not actuated.

ANPP's Engineering Department and Engineering Evaluations Department are in the process of developing design changes to eliminate the identified failure mechanism. In the interim, until the ultimate design solution can be implemented, increased relay exercising will be used to ensure that the appropriate level of relay reliability is maintained. This involves increasing the test frequency of the high risk relays (model MDR-7032). This interim corrective action will ensure that the health and safety of the public is adequately protected until the eventual design changes are implemented during future outages.