REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

ACCESSION NBR:8208200225 DOC.DATE: 82/08/16 NOTARIZED: NO DOCKET #
FACIL:50-361 San Onofre Nuclear Station, Unit 2, Southern Californ 05000361
50-362 San Onofre Nuclear Station, Unit 3, Southern Californ 05000362
AUTH.NAME AUTHOR AFFILIATION
BASKIN,K.P. Southern California Edison Co.
RECIP.NAME RECIPIENT AFFILIATION
MIRAGLIA,F. Licensing Branch 3

SUBJECT: Requests NRC reconsider position & formally respond to util 820723 Amend Application 8 to License NPF-10 requesting extension of surveillance internal for ESF actuation sys subgroup relays to 18-month interval.Justification encl.

DISTRIBUTION CODE: A001S COPIES RECEIVED:LTR 1 ENCL 1 SIZE: 12
TITLE: OR Submittal: General Distribution

NOTES:J Hanchett 1cy PDR Documents. ELD Chandler 1cy. NRR Scaletti 1cy. 05000361
J Hanchett 1cy PDR Documents. ELD Chandler 1cy. NRR Scaletti 1cy. 05000362

	RECIPIENT ID CODE/NAME		COPIES LTTR	COPIES ENCL	RECIPIENT ID CODE/NAME		COPIES LTTR	COPIES ENCL
	LIC BR #3 BC	01	7	7				
INTERNAL:	ELD/HDS2		1	0	NRR/DHFS DEPY	08	1	1
	NRR/DL DIR		1	1	NRR/DL/ORAB		1	0
	NRR/DSI/RAB		1	1	REG FILE	04	1	1
	RGN5		1	1				
EXTERNAL:	ACRS	09	10	10	LPDR	03	1	1
	NRC PDR	02	1	1	NSIC	05	1	1
	NTIS		1	1				
NOTES:			3	3				

TOTAL NUMBER OF COPIES REQUIRED: LTTR 31 ENCL 29

Southern California Edison Company

P. O. BOX 800
2244 WALNUT GROVE AVENUE
ROSEMEAD. CALIFORNIA 91770

K. P. BASKIN
MANAGER OF NUCLEAR ENGINEERING,
SAFETY, AND LICENSING

TELEPHONE
(213) 572-1401

August 16, 1982

Director, Office of Nuclear Reactor Regulation
Attention: Mr. Frank Miraglia, Branch Chief
Licensing Branch No. 3
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Gentlemen:

Subject: Docket Nos. 50-361 and 50-362
San Onofre Nuclear Generating Station
Units 2 and 3

SCE's letter of July 23, 1982 forwarded Amendment Application No. 8 to Operating License No. NPF-10 for San Onofre Nuclear Generating Station, Unit 2. Amendment Application No. 8 consisted of Proposed Change NPF-10-4 to the Appendix A Technical Specifications of Operating License No. NPF-10 and requested an extension of the surveillance interval for the Engineered Safety Feature Actuation System (ESFAS) subgroup relays from the present six-month interval, as shown in Table 4.3-2 of the Technical Specifications to an 18-month (refueling) interval.

The Proposed Change provided specific relay design considerations in conjunction with reliability data and operating history from other Combustion Engineering (CE) NSSS plants to justify the proposed testing interval of 18 months for the ESFAS subgroup relays.

Specifically, the proposed change provided information which demonstrated that:

1. The physical and design characteristics of the Potter-Brumfeld rotary relays used for the ESFAS actuation relays support an 18 month surveillance interval.

2. System availability, based on a reliability analysis was not significantly affected by increasing the surveillance interval to 18 months.

3. CE plants with ESF actuation systems similar or identifical to San Onofre Units 2 and 3 conducted surveillances at 18 month intervals and that there was no evidence of problems or relay failures associated with the 18 month surveillance interval.

A001

Additionally, the proposed change indicated that the ESF subgroup relays are only a part of the overall ESF accident mitigation system whose function is achieved by a series of actuations from channel sensor inputs through equipment actuation and that the operability of the overall system is verified by combining results of the following:

1. Separate tests on individual actuated components (for example, by the routine Section XI testing of pumps and valves);

2. Channel checks and channel functional tests (for example, on setponts and actuation logic);

3. Channel calibrations and response time measurements (for example, on sensors or valve closing or opening); and

4. Tests that exercise individually or in combination with one of the above objectives, all the components not otherwise routinely tested in the ESF system.

SCE met with the NRC staff in Bethesda, Maryland on July 29, 1982, to discuss the proposed change in order to facilitate expeditious review and approval of the requested 18 month surveillance interval. During the meeting, the NRC indicated that because of the generic overtones associated with the proposed change, (i.e., operating CE plants perform a ESFAS subgroup actuation relay surveillance every 18 months and CE's position that Revision 3 of NUREG-0212, CE standard Technical Specifications, should reflect an 18 month surveillance interval for the ESFAS subgroup actuation relays) SCE's request would be referred to the Committee to Review Generic Requirements (CRGR).

During a subsequent telephone conversation between the NRC (E. Rossi, J. Rosenthal, B. Stevens) and SCE (F. Nandy), the NRC confirmed that SCE's request for extension of the surveillance interval for the ESFAS subgroup relay would be referred to the CRGR. The NRC also indicated that exemptions could potentially be obtained by SCE for the subset of ESFAS subgroup relays that could not be tested while the plant is at power, but that the remainder of the ESFAS subgroup relays would have to be tested every six months. The NRC further indicated that there was concern relative to the adequacy of the current six month surveillance interval and that a more frequent interval may be considered.

It is SCE's position that sufficient information was previously provided by SCE's letter of July 23, 1982 substantiating the acceptability of the requested 18 month surveillance interval. Enclosed for your information is a comparison of previously provided information with the provisions delineated in IEEE 338-1977 for "Change of Test Interval," which justifies extension of the surveillance interval from six month to 18 months.

SCE also contends that it is inappropriate for the NRC to arbitrarily assign a six month surveillance interval while the issue is under evaluation by the CRGR, considering that CE plants with similar or identical ESFAS relays are currently performing surveillance on an 18 month interval consistent with the requirements of their plant technical specifications. Additionally, SCE considers that results of the reliability analysis which shows that system unavailability is not significantly affected by the proposed 18 month surveillance interval (i.e., falls within the safety goal of the Standard Review Plan) do not justify the costs associated with plant shutdown every six months in order to perform surveillance of the ESFAS subgroup actuation relays.

Accordingly, SCE requests that the NRC staff reconsider their position and formally respond to SCE's July 23, 1982 requests in conjunction with the clarification provided by this letter for extension of the surveillance interval from 6 months to 18 months. SCE suggests that it is appropriate for the staff to approve the requested 18 month surveillance interval consistent with the justification provided by SCE and in consideration of the surveillance schedules for other CE plants with similar or identical ESFAS subgroup relays without impacting the activity of the CRGR.

If you have any questions or comments, please let me know.

Very truly yours,

K P Baskin

cc: F. Rosa, Branch Chief, Instrumentation and Control Systems Branch
H. Rood, Project Manager, Licensing Branch 3

ENCLOSURE

JUSTIFICATION FOR EXTENSION OF SURVEILLANCE INTERVAL
FOR SAN ONOFRE UNITS 2 AND 3
ENGINEERED SAFETY FEATURE ACTUATION SYSTEM (ESFAS)
SUBGROUP RELAYS

COMPARISON WITH PROVISIONS OF IEEE 338-1977

The change in test interval for the ESFAS subgroup actuation relays has been evaluated with consideration to the applicable provision of Section 6.5.2 "Change of Test Interval" of IEEE Std-338-1977, "IEEE Standard Criteria for the Periodic Testing of Nuclear Power Generating Station Safety Systems" (Reference 1). The results of the evaluation are as follows:

EQUIPMENT CHARACTERISTICS

San Onofre Units 2 and 3 use the Potter and Brumfeld rotary relays for the ESFAS subgroup actuation.

Since San Onofre Unit 2 is in the initial startup phase, in lieu of plant specific equipment performance history, numerous relay suppliers in addition to Potter and Brumfeld were contacted to gather information on factors which could affect reliable operation of the relays and to relate these factors to the frequency of relay operation. Physical parameters of concern as they relate to the Potter and Brumfeld rotary relays are discussed as follows:

Coil - Discussions with relay manufacturers resulted in one concern: since the relays are operated as energized closed, the coil should be specifically designed for continuous operation. The coil is designed for continuous operation. Further investigation showed that the coil is designed for continuous operation, and is operated within its specifications. Therefore, it is concluded that the mode of coil operation does not warrant a frequent test interval.

Contact Gap - Contact gap requirements were researched to determine if contact welding due to arcing could occur. It was found that the establishment of the appropriate contact gap is a function of the applied load. With the maximum design load in the San Onofre Units 2 and 3 ESFAS application, the contact gap is approximately twice the required gap needed to extinguish an arc. Furthermore, the subgroup relay manufacturer has conducted a full load cycle test on a representative sample of relays to show that welding does not occur. Therefore, since the subgroup relay contact loads are within manufacturers specifications, the remote potential for welding due to arcing is not considered to warrant a frequent test interval.

Contact Material - Contact material was considered in order to identify the potential for problems associated with oxidation or corrosion. The concern is whether a prolonged test interval would cause an increase in contact degradation or resistance and thereby prevent proper circuit operation. Various relay manufacturers were consulted and in each case they stated that degradation would not be a significant factor when extending the test interval up to 18 months provided the contacts are 100% fine silver, and that the contact loads are not too small (i.e., less than 100 milliampers). In the San Onofre Units 2 and 3 subgroup relay designs, contact material is 100% fine silver and contact loads are on the order of one ampere. Therefore, contact material corrosion is not considered to warrant a frequent test interval.

Rotor Operation - The rotor operation in conjunction coil material outgasing was intially thought to be a limiting factor in determining a test interval and that increasing time between tests may reduce the relays' reliability. This concern was based on undocumented (and unsubstantiated) information regarding an aging test performed on a similar relay where response time increased beyond acceptable tolerances after the test. In discussions with the relay manufacturer they hypotesized that coil outgasing may have caused deposits to form on the relay/rotor bearing surfaces. Such deposits could impede rotor operation and increase relay response time. Increasing the test frequency may cause self cleaning of the bearing surfaces. Further investigation with the test facility revealed that the test temperatures used to accelerate aging were excessive and therefore the test was deemed invalid by the responsible organization. Furthermore, tests performed on the ESFAS subgroup relays at ANO-2 (which are identical to those used at San Onofre Units 2 and 3 in the same application) during their refueling outage showed that the rotor performs properly after an extended period of energization. Therefore the potential for degraded rotor operation is not considered to warrant a frequent test interval.

The design features of the Potter and Brumfeld relays are such that factors which could potentially affect relay operation relative to the frequency of relay operation are not considered to be a concern.

EQUIPMENT PERFORMANCE

Arkansas Nuclear One, Unit 2 (ANO-2) is a similar CE plant which employs the Potter and Brumfeld rotary relays as ESFAS subgroup actuation relays. Similar to San Onofre Units 2 and 3, ANO-2 utilizes 112 of these relays located in 2 cabinets, 56 relays per cabinet, in the main control room area. These relays are tested on a refueling outage interval consistent with the ANO-2 plant Technical Specifications.

ANO-2 accumulated 27,048 hours of plant operating experience from its initial criticality to its first refueling outage. This corresponds to 3,029,376 relay hours of experience. A review of CE's Corrective Actions Data Base indicates that during this time period, ANO-2 experienced at least 25 automatic actuations of the Auxiliary Feedwater System and one actuation of the Safety Injection System. In each case, the associated subgroup actuation relays were challenged. There were no subgroup relay failures on these demands. ANO-2 tested all 112 subgroups during its refueling outage and had no failures.

CHANGES OF FAILURE RATE

Based on the above information, a failure rate can be calculated for the Potter-Brumfeld relays. Because there were no failures, the Poisson model was used to calculate the maximum likelihood estimator for the failure rate. (In essence, this model assumes 1 failure.) The calculated failure rate, λ_s, is 3.3×10^{-7}/hour. This value compares well with the industry failure rate data for relays in general which range from 10^{-7}/hour (References 9 and 10) to 10^{-6}/hour (Reference 2).

The relay failure rate calculated above can be used to calculate relay unavailability for various test intervals. The relay unavailability, U, is given by (Reference 12).

$$U = \frac{\lambda_s T}{2}$$

Where λ_s is the failure rate for the relays

and T is the length of the test interval.

Figure 1 shows the changes in individual relay unavailability that results from increasing the surveillance interval from 6 months to 18 months.

The most important impact of changing the relay test interval is the change in safety system unavailability, not the change in the unavailability of the individual relays. Because of system redundancies, this impact, as demonstrated below is much less than the impact on the unavailability of the indivdual relays.

In order to provide an evaluation of the impact of test intervals on ESFAS subgroup relay reliability and the resulting effects on safety system unavailability, fault tree analysis was used to quantify the impact of auxiliary relay test intervals on Auxiliary Feedwater System (AFWS) unavailability.

The first step of the evaluation included an assessment of the safety system challenge frequencies for the various ESF systems. The safety system challenging transients were extracted from Chapter 15 of San Onofre Units 2 and 3 Final Safety Analysis Report (Reference 3). The frequencies of

transient events were extracted from Reference 2. A review of the safety system actuation frequencies shows that the Auxiliary Feedwater System (AFWS) is challenged 2.17 times per year, which results in a more frequent actuation of the AFWS auxiliary relays than the relays found in the other ESF Systems. In addition, this safety system does not have a safety grade backup system to perform its intended safety function.

Given that the AFWS is the most frequently challenged safety system, it was considered that this system should be at least as reliable, or more reliable than other safety systems. The AFWS also has been assigned a well-defined safety goal of 10^{-4} to 10^{-5} (Standard Review Plan, Section 10.4.9). Therefore, an analysis of the AFWS was used to evaluate the effects of relay test interval.

A fault tree logic diagram for the San Onofre Units 2 and 3 AFWS was developed to the major component level with the actuation relays explicitly modelled for the appropriate components (pumps and control and isolation valves). The model was developed in this manner to more readily determine the impact of the auxiliary relay test interval on AFWS unavailability. Human error and common-cause failure were modelled in the fault tree. Common-cause failure was modelled using the Beta-factor approach (Reference 11). Most of the failure rate data was derived from Reference 2. Failure data for the remaining components was obtained from References 5, 6, 7 and 8. The fault tree was evaluated using the CE Reliability Evaluation Code (CEREC) which is based on the methodology of PREP and KITT (Reference 4).

The sensitivity of the AFWS unavailability with respect to the auxiliary relay test interval was evaluated as a function of the auxiliary relay failure rate and test interval. Auxiliary relay failure rates were obtained from the NREP Generic Data Base (Reference 2), industry failure data (References 9 and 10), and from ANO-2 operating history. The predicted failure rate based on Arkansas' history is 3.3×10^{-7}/hour. Industry failure data provides a failure rate of 10^{-7}/hour and the NREP Generic Data Base estimates of failure rate of 10^{-6}/hour.

Insufficient data was available to calculate a Beta-factor for the auxiliary relays. A review of CE's Corrective Actions data base revealed six events involving the failure of auxiliary relays at CE plants other than ANO-2, all of which were single failure events. For quantification of the fault tree, a Beta-factor of 10% was assumed.

Figure 2 depicts AFWS unavailability as a function of auxiliary relay failure rate for the current 6 month surveillance interval and the proposed 18 month surveillance interval. Three sources of relay failure rate data are plotted on the curves for reference. In each case, system unavailability is not significantly affected and still falls well within the safety goal of the Standard Review Plan.

CONCLUSION

The design features and operating history of the Potter and Brumfeld ESFAS subgroup relays in conjunction with the reliability analysis which shows that system unavailability is not signicantly affected by an increase in ESFAS subgroup relay surveillance interval, justify the proposed increase in the surveillance interval from 6 months to 18 months for the San Onofre Units 2 and 3 ESFAS subgroup actuation relays.

FRN:5249

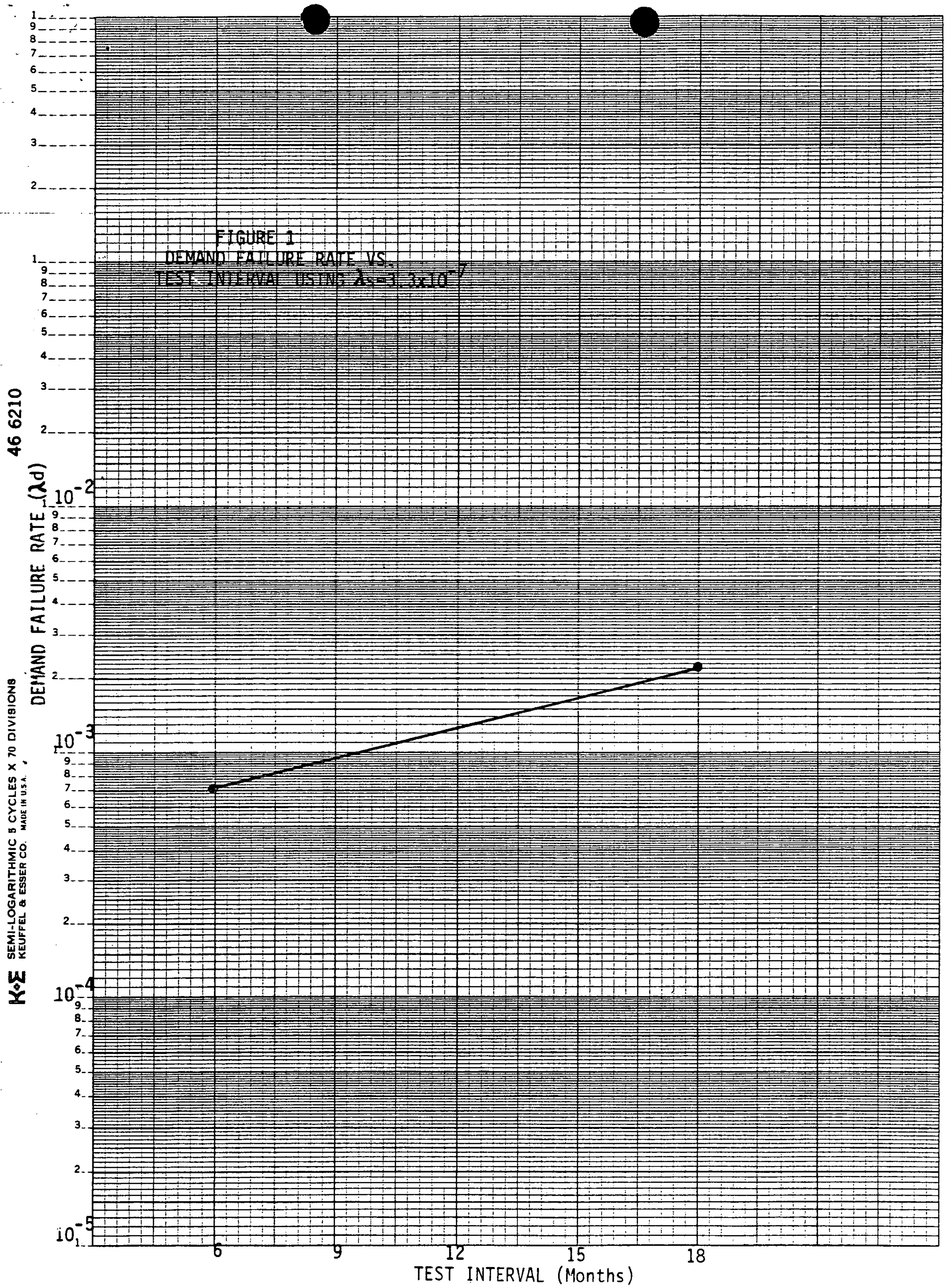

FIGURE 1
DEMAND FAILURE RATE VS.
TEST INTERVAL USING $\lambda_s = 3.3 \times 10^{-7}$
DEMAND FAILURE RATE (λd)
10^{-2}
10^{-3}
10^{-4}
10^{-5}
6
9
12
15
18
TEST INTERVAL (Months)
46 6210
K+E SEMI-LOGARITHMIC 5 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.

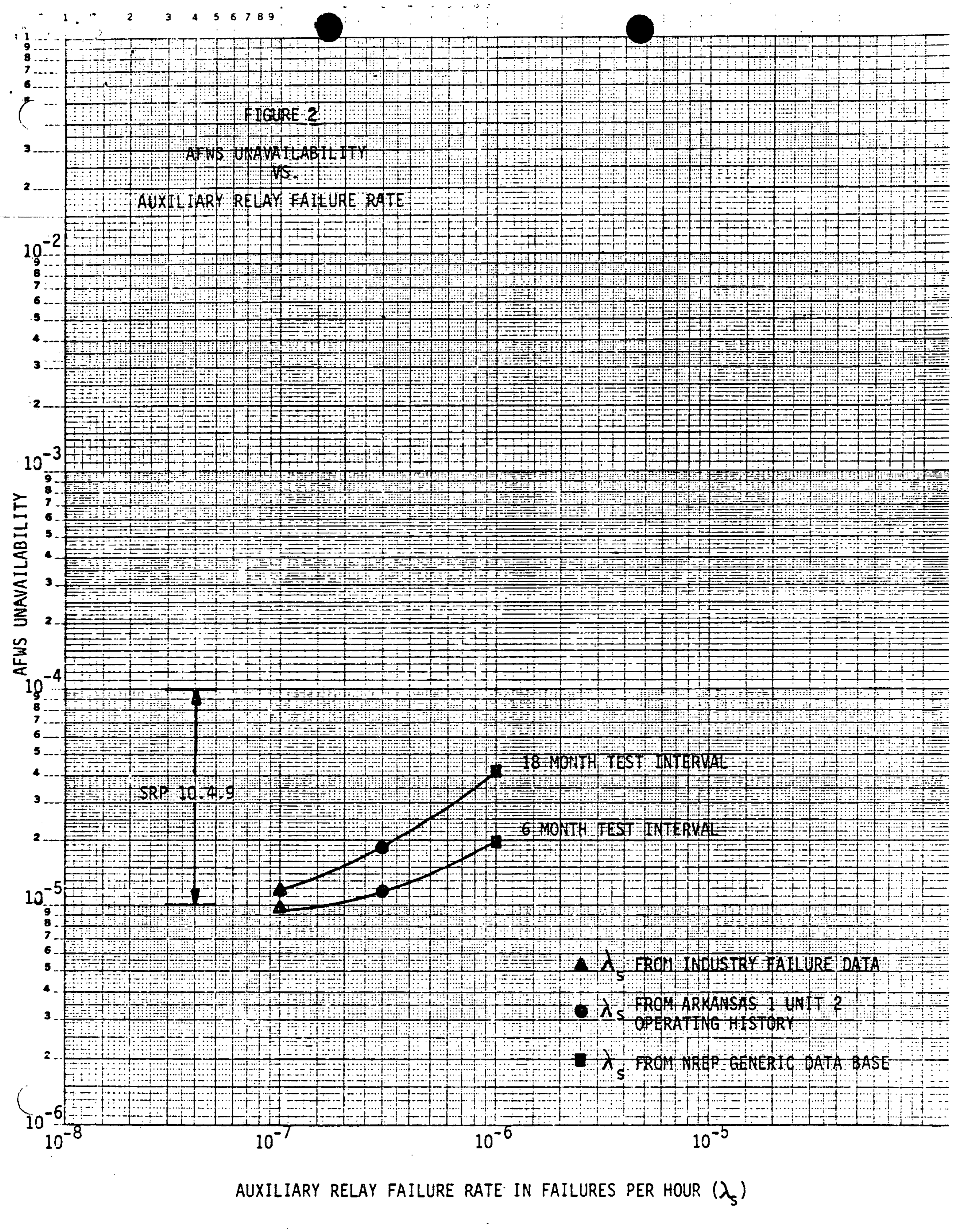
FIGURE 2
AFWS UNAVAILABILITY
VS.
AUXILIARY RELAY FAILURE RATE
AFWS UNAVAILABILITY
SRP 10.4.9
18 MONTH TEST INTERVAL
6 MONTH TEST INTERVAL
λs FROM INDUSTRY FAILURE DATA
λs FROM ARKANSAS 1 UNIT 2 OPERATING HISTORY
λs FROM NREP GENERIC DATA BASE
AUXILIARY RELAY FAILURE RATE IN FAILURES PER HOUR (λs)

LIST OF REFERENCES

1. IEEE Std. 338-1977, IEEE Standard Criteria for the Periodic Testing of Nuclear Power Generating Station Safety Systems.

2. Generic Data Base for Data and Models Chapter of the National Reliability Evaluation Program (NREP) Guide, A. J. Oswald, et al., EGG-EA-5887, June, 1982.

3. Final Safety Analysis Report for the San Onofre Nuclear Generating Station Units 2 and 3.

4. PREP and KITT: Computer Codes for the Automatic Evaluation of A Fault Tree, W. E. Vesely and R. E. Narum, IN-1349 Mathematics and Computers, Reactor Technology TID-4500, Idaho Nuclear Corp.

5. NUREG-0635, "Generic Evaluation of Feedwater Transients and Small Break Loss of Coolant," NRC, January, 1980.

6. NUREG/CR-1363, "Data Summaries of Licensee Event Reports of Valves of U. S. Commercial Nuclear Power Plants," NRC, June, 1980.

7. WASH-1400 (NREG-75/014), "Reactor Saety Study, An Assessment of Accident Risks in U. S. Commercial Nuclear Power Plants," NRC, October, 1975.

8. NUREG/CR-1205, "Data Summaries of Licensee Event Reports of Pumps at U. S. Commercial Nuclear Power Plants," NRC, January, 1980.

9. IEEE Std. 500-1977, IEEE Guide to the Collection and Presentation of Electrical, Electronic, and Sensing Component Reliability for Nuclear Power Generating Stations.

10. AVCO, Reliability Engineering Data Series, Reliability Analysis Section, April, 1962.

11. NUREG/CR-2300, Vol. 1, Rev. 1, "PRA Procedures Guide," NRC, April, 1982.

12. IEEE Std. 352-1975, IEEE Guide for General Principles of Reliability Analysis of Nuclear Power Generating Station Protection Systems.

FRN:5249