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SAIC-85/1523-6

REVIEW OF LICENSEE AND APPLICANT RESPONSES TO NRC GENERIC LETTER 83-28 (Required Actions Based on Generic Implications of Salem ATWS Events), Item 1.2 "POST-TRIP REVIEW: DATA AND INFORMATION CAPABILITIES" FOR JOSEPH M. FARLEY NUCLEAR PLANT, UNITS 1 AND 2 (50-348, 50-364)

Technical Evaluation Report

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FOREWORD

This report contains the technical evaluation of the Joseph M. Farley Nuclear Plant, Units 1 and 2 response to Generic Letter 83-28 (Required Actions Based on Generic Implications of Salem ATWS Events), Item 1.2 "Post Trip Review: Data and Information Capabilities."

For the purposes of this evaluation, the review criteria, presented in part 2 of this report, were divided into five separate categories. These are:

1. The parameters monitored by the sequence of events and the time history recorders,

2. The performance characteristics of the sequence of events recorders,

3. The performance characteristics of the time history recorders,

4. The data output format, and

5. The long-term data retention capability for post-trip review material.

All available responses to Generic Letter 83-28 were evaluated. The plant for which this report is applicable was found to have adequately responded to, and met, categories 2, 4 and 5.

The report describes the specific methods used to determine the categorization of the responses to Generic Letter 83-28. Since this evaluation report was intended to apply to more than one nuclear power plant specifics regarding how each plant met (or failed to meet) the [redacted] are not presented. Instead, the evaluation presents a categorization of the responses according to which categories of [redacted] are satisfied and which are not. The evaluations are based on specific criteria (Section 2) derived from the requirements as stated in the generic letter.

REVIEW CRITERIA

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INTRODUCTION

SAIC has reviewed the UTILITY'S submittal prepared in response to Generic Letter 83-28, item 1.2 "Post-Trip Review: Data and Information Capability". The submittal DATED NOVEMBER 4, 1983 contained sufficient information to determine that the data and information capabilities at this plant are acceptable in the following areas.

- The sequence-of-events recorder(s) performance characteristics.
- The output format of the recorded data.
- The long-term data retention, record keeping, capability.

However, the data and information capabilities, as described in the submittal, either fail to meet the review criteria or provide insufficient information to allow determination of the adequacy of the data and information capabilities in the following areas.

- The parameters monitored by both the sequence-of-events and time history recorders.
- The time history recorder(s) performance characteristics.

1. Background

On February 25, 1984, both of the scram circuit breakers at Unit 1 of the Salem Nuclear Power Plant failed to open upon an automatic reactor trip signal from the reactor protection system. This incident occurred during the plant startup and the reactor was tripped manually by the operator about 30 seconds after the initiation of the automatic trip signal. The failure of the circuit breakers has been determined to be related to the sticking of the under voltage trip attachment. Prior to this incident; on February 22, 1983; at Unit 1 of the Salem Nuclear Power Plant an automatic trip signal was generated based on steam generator low-low level during plant startup. In this case the reactor was tripped manually by the operator almost coincidentally with the automatic trip. At that time, because the utility did not have a requirement for the systematic evaluation of the reactor trip, no investigation was performed to determine whether the reactor was tripped automatically as expected or manually. The utilities' written procedures required only that the cause of the trip be determined and identified the responsible personnel that could authorize a restart if the cause of the trip is known. Following the second trip which clearly indicated the problem with the trip breakers, the question was raised on whether the circuit breakers had functioned properly during the earlier incident. The most useful source of information in this case, namely the sequence of events printout which would have indicated whether the reactor was tripped automatically or manually during the February 22 incident, was not retained after the incident. Thus, no judgment on the proper functioning of the trip system during the earlier incident could be made.

Following these incidents; on February 28, 1983; the NRC Executive Director for Operations (EDO), directed the staff to investigate and report on the generic implications of these occurrences at Unit 1 of the Salem Nuclear Power Plant. The results of the staff's inquiry into the generic implications of the Salem Unit incidents is reported in NUREG-1000, "Generic Implications of ATWS Events at the Salem Nuclear Power Plant." Based on the results of this study, a set of required actions were developed and included in Generic Letter 83-28 which was issued on July 8, 1983 and sent to all licensees of operating reactors, applicants for operating license, and construction permit holders. The required actions in this generic letter consist of four categories. These are: (1) Post-Trip Review, (2) Equipment

Classification and Vender Interface, (3) Post Maintenance Testing, and (4) Reactor Trip System Reliability Improvements.

The first required action of the generic letter, Post-Trip Review, is the subject of this TER and consists of action item 1.1 "Program Description and Procedure" and action item 1.2 "Data and Information Capability." In the next section the review criteria used to assess the adequacy of the utilities' responses to the requirements of action item 1.2 will be discussed.

2. Review Criteria

The intent of the Post Trip Review requirements of Generic Letter 83-28 is to ensure that the licensee has adequate procedures and data and information sources to understand the cause and progression of a reactor trip. This understanding should go beyond a simple identification of the course of the event. It should include the capability to determine the root cause of the reactor trip and to determine whether safety limits have been exceeded and if so to what extent. Sufficient information about the reactor trip event should be available so that a decision on the acceptability of a reactor restart can be made.

The following are the review criteria developed for the requirements of Generic Letter 83-28, action item 1.2:

The equipment that provides the digital sequence of events (SOE) record and the analog time history records of an unscheduled shutdown should provide a reliable source of the necessary information to be used in the post trip review. Each plant variable which is necessary to determine the cause(s) and progression of the event(s) following a plant trip should be monitored by at least one recorder [such as a sequence-of-events recorder or a plant process computer for digital parameters; and strip charts, a plant process computer or analog recorder for analog (time history) variables]. Each device used to record an analog or digital plant variable should be described in sufficient detail so that a determination can be made as to whether the following performance characteristics are met:

- Each sequence-of-events recorder should be capable of detecting and recording the sequence of events with a sufficient time discrimination capability to ensure that the time responses associated with each monitored safety-related system can be ascertained, and that a determination can be made as to whether the time response is within acceptable limits based on FSAR Chapter 15 Accident Analyses. The recommended guideline for the SOE time discrimination is approximately 100 msec. If current SOE recorders do not have this time discrimination capability the licensee or applicant should show that the current time discrimination capability is sufficient for an adequate reconstruction of the course of the reactor trip. As a minimum this should include the ability to adequately reconstruct the accident scenarios presented in Chapter 15 of the plant FSAR.

- Each analog time history data recorder should have a sample interval small enough so that the incident can be accurately reconstructed following a reactor trip. As a minimum, the licensee or applicant should be able to reconstruct the course of the accident sequences evaluated in the accident analysis of the plant FSAR (Chapter 15). The recommended guideline for the sample interval is 10 sec. If the time history equipment does not meet this guideline, the licensee or applicant should show that the current time history capability is sufficient to accurately reconstruct the accident sequences presented in Chapter 15 of the FSAR.

- To support the post trip analysis of the cause of the trip and the proper functioning of involved safety related equipment, each analog time history data recorder should be capable of updating and retaining information from approximately five minutes prior to the trip until at least ten minutes after the trip.

- The information gathered by the sequence-of-events and time history data collectors should be stored in a manner that will allow for retrieval and analysis. The data may be retained in either hardcopy (computer printout, strip chart output, etc.) or in an accessible memory (magnetic disc or tape). This

information should be presented in a readable and meaningful format, taking into consideration good human factors practices (such as those outlined in NUREG-0700).

- All equipment used to record sequence of events and time history information should be powered from a reliable and non-interruptible power source. The power source used need not be safety related.

The sequence of events and time history recording equipment should monitor sufficient digital and analog parameters, respectively, to assure that the course of the reactor trip can be reconstructed. The parameters monitored should provide sufficient information to determine the root cause of the reactor trip, the progression of the reactor trip, and the response of the plant parameters and systems to the reactor trip. Specifically, all input parameters associated with reactor trips, safety injections and other safety-related systems as well as output parameters sufficient to record the proper functioning of these systems should be recorded for use in the post trip review. The parameters deemed necessary, as a minimum, to perform a post-trip review (ones that would determine if the plant remained within its design envelope) are presented on Tables 1.2-1 and 1.2-2. If the applicants' or licensees' SOE recorders and time history recorders do not monitor all of the parameters suggested in these tables the applicant or licensee should show that the existing set of monitored parameters are sufficient to establish that the plant remained within the design envelope for the appropriate accident conditions; such as those analyzed in Chapter 15 of the plant Safety Analysis Report.

Information gathered during the post trip review is required input for future post trip reviews. Data from all unscheduled shutdowns provides a valuable reference source for the determination of the acceptability of the plant vital parameter and equipment response to future unscheduled shutdowns. It is therefore necessary that information gathered during all post trip reviews be maintained in an accessible manner for the life of the plant.

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Table 1.2-1. PWR Parameter List

SOE Recorder	Time History Recorder	Parameter / Signal
(1) x		Reactor Trip
(1) x		Safety Injection
x		Containment Isolation
(1) x		Turbine Trip
x		Control Rod Position
(1) x	x	Neutron Flux, Power
x	X	Containment Pressure
(2)		Containment Radiation
	x	Containment Sump Level
(1) x	x	Primary System Pressure
(1) x	x	Primary System Temperature
(1) x		Pressurizer Level
(1) x		Reactor Coolant Pump Status
(1) x	x	Primary System Flow
(3)		Safety Inj.; Flow, Pump/Valve Status
x		MSIV Position
x	x	Steam Generator Pressure
(1) x	x	Steam Generator Level
(1) x	x	Feedwater Flow
(1) x	x	Steam Flow
(3)		Auxiliary Feedwater System; Flow, Pump/Value Status
x		AC and DC System Status (Bus Voltage)
x		Diesel Generator Status (Start/Stop, On/Off)
x		PORV Position

(1): Trip parameters

(2): Parameter may be monitored by either an SOE or time history recorder.

(3): Acceptable recorder options are: (a) system flow recorded on an SOE recorder, (b) system flow recorded on a time history recorder, or (c) equipment status recorded on an SOE recorder.

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Table 1.2-2. BWR Parameter List

SOE Recorder	Time History Recorder	Parameter / Signal
x		Reactor Trip
x		Safety Injection
x		Containment Isolation
x		Turbine Trip
x		Control Rod Position
x (1)	x	Neutron Flux, Power
x (1)		Main Steam Radiation
(2)		Containment (Dry Well) Radiation
x (1)	x	Drywell Pressure (Containment Pressure)
(2)		Suppression Pool Temperature
x (1)	x	Primary System Pressure
x (1)	x	Primary System Level
x		MSIV Position
x (1)		Turbine Stop Valve/Control Valve Position
x		Turbine Bypass Valve Position
	x	Feedwater Flow
	x	Steam Flow
(3)		Recirculation; Flow, Pump Status
x (1)		Scram Discharge Level
x (1)		Condenser Vacuum
x		AC and DC System Status (Bus Voltage)
(3)(4)		Safety Injection; Flow, Pump/Valve Status
x		Diesel Generator Status (On/Off, Start/Stop)

(1): Trip parameters.

(2): Parameter may be recorded by either an SOE or time history recorder.

(3): Acceptable recorder options are: (a) system flow recorded on an SOE recorder, (b) system flow recorded on a time history recorder, or (c) equipment status recorded on an SOE recorder.

(4): Includes recording of parameters for all applicable systems from the following: HPCI, LPCI, LPCS, IC, RCIC.

3. Evaluation

The parameters identified in part 2 of this report as a part of the review criteria are those deemed necessary to perform an adequate post-trip review. The recording of these parameters on equipment that meets the guidelines of the review criteria will result in a source of information that can be used to determine the cause of the reactor trip and the plant response to the trip, including the responses of important plant systems. The parameters identified in this submittal as being recorded by the sequence of events and time history recorders do not correspond to the parameters specified in part 2 of this report.

The review criteria require that the equipment being used to record the sequence of events and time history data required for a post-trip review meet certain performance characteristics. These characteristics are intended to ensure that, if the proper parameters are recorded, the recording equipment will provide an adequate source of information for an effective post-trip review. The information provided in this submittal does not indicate that the time history equipment used would meet the intent of the performance criteria outlined in part 2 of this report. Information supplied in the submittal does indicate that the SOE equipment meets the performance criteria specified in part 2 of this report.

The data and information recorded for use in the post-trip review should be output in a format that allows for ease of identification and use of the data to meet the review criterion that calls for information in a readable and meaningful format. The information contained in this submittal indicates that this requirement is met.

The data and information used during a post-trip review should be retained as part of the plant files. This information could prove useful during future post-trip reviews. Therefore, one CRITERION is that information used during a post-trip review be maintained in an accessible manner for the life of the plant. The information contained within this submittal indicates that this criterion will be met.

4. Conclusion

The information supplied in response to Generic Letter 83-28 indicates that the current post-trip review data and information capabilities are adequate in the following areas:

1. The recorded data is output in a readable and meaningful format.

2. The information recorded for the post-trip review is maintained in an accessible manner for the life of the plant.

3. The sequence of events recorders meet the minimum performance requirements.

The information supplied in response to Generic Letter 83-28 does not indicate that the post-trip review data and information capabilities are adequate in the following areas.

1. Based upon the information contained in the submittal, all of the parameters specified in part 2 of this report that should be recorded for use in a post-trip review are not recorded.

2. Time history recorders, as described in the submittal, do not meet the minimum performance characteristics.

It is possible that the current data and information capabilities at this nuclear power plant are adequate to meet the intent of these REVIEW CRITERIA, but were not completely described. Under these circumstances, the licensee should provide an updated, more complete, description to show in more detail the data and information capabilities at this nuclear power plant. If the information provided accurately represents all current data and information capabilties, then the licensee should either show that the data and information capabilities meet the intent of the criteria in part 2 of this report, or detail future modifications that would enable the licensee to meet the intent of the evaluation criteria.

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REFERENCES

NRC Generic Letter 83-28. "Letter to all licensees of operating reactors, applicants for operating license, and holders of construction permits regarding Required Actions Based on Generic Implications of Salem ATWS Events." July 8, 1983.

NUREG-1000, Generic Implications of ATWS Events at the Salem Nuclear Power Plant, April 1983.

Letter from F.L. Clayton, Jr., Alabama Power, to S.A. Varga, NRC, dated November 4, 1983, Accession Number 8311040080 in response to Generic Letter 83-28 of July 8, 1983, with attachment.

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SUPPORTING DOCUMENT FOR TELCON

J. M. Farley

1. Parameters recorded: **Unsatisfactory**

   See attached table for discrepancies.

2. SOE recorders performance characteristics: **Satisfactory**

   Plant process computer: time discrimination between events is 4ms and powered by non-interruptible power supply

3. Time history recorders performance characteristics: **Unsatisfactory**

   Plant process computer: sampling rate is from 2.5 sec to 1 sec intervals, non-interruptible power supply

   Time history duration is from 10 sec before to 10 sec after the trip for the 2.5 sec variables, and from 2 min before to 3 min after the trip for the 10 sec variables set.

4. Data output format: **Satisfactory**

   SOE data output includes time, parameter descriptor, change of state

   Analog data output includes time, parameter name and value

5. Data retention capability: **Satisfactory**

   Pertinent data are stored for the life of the plant.

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Required PWR Parameters for Post Trip Review
(circled parameters are not recorded)

SOE Recorder	Time History Recorder	Parameter / Signal
(0) x		Reactor Trip
(1) (x)		Safety Injection
(x)		Containment Isolation
(1) x		Turbine Trip
(x)		Control Rod Position
(1) x	x	Neutron Flux, Power
x	x	Containment Pressure
(2)		Containment Radiation
	(x)	Containment Sump Level
(1) (3)		Primary System Pressure (Vessel Pressure, Pressurizer Pressure)
(1) x	x	Primary System Temperature
(1) x		Pressurizer Level
(1) x		Reactor Coolant Pump Status
(1) (x)	x	Primary System Flow
(4)		Safety Inj.; Flow, Pump/Valve Status
(x)		MSIV Position
(x)	x	Steam Generator Pressure
(1) x	x	Steam Generator Level
(1) (x)	x	Feedwater Flow
(1) (x)	x	Steam Flow
(4)		Auxiliary Feedwater System; Flow, Pump/Value Status
x		AC and DC System Status
x		Diesel Generator Status
(x)		PORV Position

(1): Trip parameters; pressurizer or primary pressure is a trip parameter (depending on plant).
(2): Parameter may be monitored by either an SOE or time history recorder.
(3): Acceptable recorder options are: (a) reactor vessel pressure recorded on both an SOE and time history recorder, or (b) pressurizer pressure recorded or both an SOE and time history recorder.
(4): Acceptable recorder options are: (a) system flow recorded on an SOE recorder, (b) system flow recorded on a time history recorder, or (c) equipment status recorded on an SOE recorder.