



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

ENCLOSURE 1

SAFETY EVALUATION BY
THE OFFICE OF NUCLEAR REACTOR REGULATION
RELATED TO OPERATION OF
ZION NUCLEAR POWER STATION UNIT 1 AND 2
COMMONWEALTH EDISON COMPANY
DOCKET NOS: 50-295 AND 50-304

I. INTRODUCTION

On February 25, 1983, both of the scram circuit breakers at Unit 1 of the Salem Nuclear Power Plant (SNPP) failed to open upon an automatic reactor trip signal from the reactor protection system. This incident occurred during plant start-up and the reactor was tripped manually by the operator about 30 seconds after initiation of the automatic trip signal. Failure of the circuit breakers has been determined to be related to sticking of the under voltage trip attachment. On February 22, 1983, an automatic trip occurred during start-up of SNPP Unit 1 as a result of steam generator low-low level. In this case, the reactor was tripped manually by the operator almost coincidentally with the automatic trip. On February 28, 1983, the NRC Executive Director for Operations, directed the staff to investigate and report on the generic implications of these occurrences at the Salem Nuclear Power Plant. The results of this staff investigation are reported in NUREG-1000, "Generic Implications of the ATWS Events at the Salem Nuclear Power Plant." As a results of this investigation, the Commission requested (by Generic Letter 83-28 dated July 8, 1983) all licensees of operating reactors, applicants for an operating license, and holders of construction permits to respond to certain generic concerns. These concerns are categorized into the following four areas: (1) Post-Trip Review,

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(2) Equipment Classification and Vendor Interface, (3) Post-Maintenance Testing, and (4) Reactor Trip System Reliability Improvements.

The first action item, Post-Trip Review, consists of Action Item 1.1, "Program Description and Procedure" and Action Item 1.2, "Data and Information Capability." This evaluation addresses Action Item 1.2 only.

II. REVIEW GUIDELINES

The following review guidelines were developed after initial evaluation of the various utility responses to Item 1.2 of Generic Letter 83-28 and incorporate the best features of these submittals. Therefore, these review guidelines effectively represent a "good practices" approach to post-trip review. We have reviewed the licensee's response to Item 1.2 against these guidelines:

- A. 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 and progression of the events 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. Performance characteristics guidelines for SOE and time history recorders are as follows:

- 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 it can be determined if the time response is within acceptable limits based on FSAR Chapter 15 Accident Analyses. The recommended guidelines for the SOE time discrimination is approximately 100 milliseconds. If current SOE recorders do not have this time discrimination capability the licensee should show that the current time discrimination capability is sufficient for an adequate reconstruction of the course of the reactor trip and post-trip events. As a minimum this should include the ability to adequately reconstruct the transient and accident scenarios presented in Chapter 15 of the 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 should be able to reconstruct the course of the transient and accident sequences evaluated in the accident analysis of Chapter 15 of the FSAR. The recommended guideline for the sample interval is 10 seconds. If the time history equipment does not meet this guideline, the licensee should show that the time history capability is sufficient to accurately reconstruct the

transient and 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 safety-related equipment, each analog time history data recorder should be capable of updating and retaining information from approximately five minutes prior to the reactor trip until at least ten minutes after the trip.

- ° 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 Class IE.

- B. 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 and post-trip events can be reconstructed. The parameters monitored should provide sufficient information to determine the root cause of the unscheduled shutdown, the progression of the reactor trip, and the response of the plant parameters and protection and safety systems to the unscheduled shutdowns. 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 functions of these systems should be recorded for use in the post-trip review. The minimum parameters necessary to determine if the plant remained within its

safety limits are presented in Table 1. The parameter list was based on staff engineering judgment following a complete evaluation of utility submittals. If the SOE recorders and time history recorders do not monitor all of the parameters suggested in this table the licensee should justify the adequacy of existing monitored parameters to establish that the plant remained within the design conditions analyzed in Chapter 15 of the FSAR.

- C. The information gathered by the sequence of events and time history recorders should be stored in a manner that will allow for data retrieval and analysis. The data may be retained on hardcopy, (e.g., computer printout, strip chart record), or in an accessible memory, (e.g., 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.
- D. Data from all unscheduled shutdowns provides a valuable reference source for determination of the acceptability of the plant vital parameter and equipment response to subsequent unscheduled shutdowns. Information gathered during the post-trip review is to be retained for the life of the plant.

III. EVALUATION AND CONCLUSION

By letter dated November 5, 1983, the Commonwealth Edison Company provided information regarding its post-trip review program data and information capabilities for Zion Station Units 1 and 2. We have evaluated the licensee's submittal against the review guidelines described in Section II. Deviations from the Guidelines of Section II were discussed with representatives of the licensee by telephone on August 29, 1985. A brief description of the licensee's responses and the staff's evaluation of the response against each of the review guidelines follows:

- A. The licensee has described the performance characteristics of the equipment used to record the sequence of events and time history data needed for post-trip review. Based on our review of the licensee's submittal, we find that the sequence of events recorder characteristics conform to the guidelines described in Section II A, and are acceptable. Our review determined that the time history recorder sampling rate is once per minute, which is significantly slower than the recommended sampling rate of once per 10 seconds. However, during our telephone conversation the licensee stated that a new trip log program to record time history data is being developed. Selected analog data will be sampled at 10-second intervals and will be recorded to ensure a 5-minute pre-trip and 10 minute post-trip record. Based on this information, we find that the time history recorder characteristics will conform to the guidelines described in Section II A, and will be acceptable. The

licensee should be requested to provide a documented description of the trip log program and a schedule for its implementation at Zion Station.

- B. The licensee has established and identified the parameters to be monitored and recorded for post-trip review. Based on our review and telephone conversation, we find that the parameters selected by the licensee do not conform to the guidelines described in Section II B. The licensee does not record all of the sequence of events and time history parameters recommended in Table I. No information has been provided to suggest that the existing set of monitored data will be adequate to support a post-trip review for the purpose of determining if the plant remained within the design envelop for the accident conditions analyzed in Chapter 15 of the plant FSAR.

We recommend that the following parameters be recorded by the licensee on the sequence of events recorder or the time history recorder:

- ° Containment Radiation. This parameter may be recorded either as a digital signal on the sequence of events recorder or as an analog value on the time history recorder. We are unable to determine that the current strip-chart recording of containment radiation is adequate to serve as a time-history record.
- ° Containment Isolation. We recommend that containment isolation status be monitored and recorded on the sequence of events recorder.

- ° Control Rod Position. We recommend that control rod position be recorded on the sequence of events recorder in order to establish the time of rod insertion in relation to the times of automatic and manual reactor trip signals.
- ° MSIV Position. We recommend that MSIV position be provided on the sequence of events recorder.
- ° PORV Position. We recommend that PORV position be provided on the sequence of events recorder.

C. During our telephone discussion, the licensee described the means for storage and retrieval of the information gathered by the sequence of events and time history recorders, and for the presentation of this information for post-trip review and analysis. The licensee stated that time, parameter name and any related set point information are provided. Based on our review of the licensee's submittals and this discussion, we find that this information will be presented in a readable and meaningful format, and that the storage, retrieval and presentation conform to the guidelines of Section II C.

D. Information provided by the licensee during our telephone conversation indicates that the data and information used during post-trip reviews

will be retained in an accessible manner for the life of the plant. Based on this information, we find that the licensee's program for data retention conforms to the guidelines of Section II D, and is acceptable.

Based on our review of the licensee's submittals and our telephone conversation with the licensee, we conclude that the licensee's post-trip review data and information capabilities for Zion Station Units 1 and 2 may be inadequate for diagnosing the causes of unscheduled reactor shutdowns and for ascertaining the proper functioning of safety-related equipment. We recommend that the licensee augment their current list of recorded parameters to include all of those described in Table I. Alternatively, the licensee should supplement their November 5, 1983 submittal with additional detail justifying the adequacy of those parameters selected for diagnosing an unscheduled reactor shutdown. We also recommend prompt installation of an updated time-history recorder to provide once-per-ten-second parameter sampling capability.

TABLE 1 PWR PARAMETER LIST

<u>SOE Recorder</u>	<u>Time History Recorder</u>	<u>Parameter/Signal</u>
(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 Pressure
(1) x	x	Steam Generator Level
(1) x	x	Feedwater Flow
(1) x	x	Steam Flow
(3)		Auxiliary Feedwater System: Flow, Pump/Valve Status

<u>SOE Recorder</u>	<u>Time History Recorder</u>	<u>Parameter/Signal</u>
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.