

U. S. NUCLEAR REGULATORY COMMISSION

REGION V

Report Nos. 50-206/92-24, 50-361/92-24, and 50-362/92-24
License Nos. DPR-13, NPF-10, and NPF-15
Licensee: Southern California Edison Company (SCE)
Irvine Operations Center
23 Parker Street
Irvine, California 92718
Facility Name: San Onofre Nuclear Generating Station (SONGS), Units 1, 2,
and 3
Inspection at: San Onofre Site, San Diego County, California

Inspection Conducted: October 19 - 23, 1992

Inspectors: Arthur D. McQueen 11/17/92
A. D. McQueen, Emergency Preparedness Analyst Date Signed
Robert J. Pate / for 11/20/92
H. D. Chaney, Health Physics Inspector Date Signed
John Russell 11/18/92
J. Russell, Licensing Examiner Date Signed

C. W. Caldwell, Senior Resident Inspector, San Onofre
D. M. Barss, Emergency Preparedness Specialist, NRR/PEPB

Approved by: Robert J. Pate 11/20/92
Robert J. Pate, Chief Date Signed
Safeguards, Emergency Preparedness, and
Non-Power Reactor Branch

SUMMARY:

Areas Inspected: Announced inspection to examine the following portions of the licensee's emergency preparedness program: followup on Open Items identified during previous emergency preparedness inspections and to observe the 1992 annual emergency preparedness exercise and associated critiques. During this inspection, Inspection Procedures 82301, 92700 and 92701 were used.

Results: In the areas inspected, the licensee's emergency preparedness program appeared adequate to protect the public health and safety. The licensee was found to be in compliance with NRC requirements within the areas examined during this inspection. Three items were identified for future routine inspection followup. A former exercise weakness (91-27-01) from the 1991 emergency preparedness exercise remains a concern and is described in Section 9 of the report.

DETAILS

1. Persons Contacted

Licensee Personnel

C. Anderson, Supervisor, Emergency Planning (EP)
K. Bellis, Manager, Nuclear Affairs and Emergency Planning (NA&EP)
M. Brooks, Health Physics (HP) Engineer
B. Culverhouse, Emergency Planning Specialist
K. Fowler, Engineering Aide
R. Garcia, Emergency Planning Engineer
G. Hammond, Supervisor, Onsite Nuclear Licensing (ONL)
J. Jamerson, ONL
H. Morgan, Vice President and Site Manager
J. Wallace, NA&EP
R. Warnock, Superintendent, HP Support
H. Wood, Quality Assurance (QA) Engineer
M. Zenker, Lead Engineer, Emergency Planning
W. Zintl, Manager, Site Emergency Preparedness (SEP)

NRC Personnel

D. Barss, Emergency Preparedness Specialist, NRR/PEPB, NRC
C. Caldwell, Senior Resident Inspector, NRC
D. Chaney, Health Physics Inspector, NRC
A. McQueen, Emergency Preparedness Analyst, NRC
J. Russell, Licensing Examiner, NRC

The inspectors also contacted other members of the licensee's emergency preparedness, health physics, operations, administrative, and other technical staff during the course of the inspection.

A list of individuals present at the NRC exit interview on October 23, 1992, is at Attachment 1 hereto.

2. Action on Previous Inspection Findings (MC 92701)

(Closed) Followup Item (91-12-02) Verification of Augmentation Time to be performed with 1992 Exercise

The licensee had not performed an augmentation time verification during an annual exercise since 1985. During a previous routine inspection, the licensee indicated that the time verification would be performed with the 1992 exercise. It was observed during this exercise that the Operations Support Center (OSC) was activated within 18 minutes; the Technical Support Center (TSC) within 56 minutes; and the Emergency Operations Facility (EOF) within 54 minutes. This item is closed.

(Closed) Followup Item (91-22-01) Followup Licensee Training of Emergency Response Staff-Effectiveness

During a previous routine EP inspection, the inspector reviewed the computer based training program required to maintain annual emergency

response requalification. The training essentially consisted of a computer challenge test which certifies that the person has the knowledge which meets the minimum NRC requirements. The inspector reviewed the findings from the annual exercises in 1990 and 1991. The exercises appeared challenging to plant and emergency response personnel and appeared effective in helping the licensee train the staff. The inspector noted that the licensee had taken corrective actions in this area, including tabletop drills to improve personnel performance. The inspectors concluded that based on licensee performance during this exercise, this item could be closed.

(Closed) Followup Item (91-27-01) Health Physics Exercise Weaknesses

During the 1991 annual emergency exercise, an inspector observing activities in the Operations Support Center (OSC) documented weaknesses in health physics response activities during the exercise. Specifically, seven observations for improvement were documented. This item was reviewed during this exercise at the OSC. Several specific items found deficient in the 1991 exercise had apparently been corrected; however, new health physics response shortcomings were also noted. This item will be closed as an exercise weakness. A new item is being opened as an inspection followup item (IFI) under a new IFI number (see Section 9 below).

3. Exercise Planning (responsibility, scenario/objectives development, control of scenario)

The licensee's Emergency Preparedness (EP) staff has the overall responsibility for developing, conducting and evaluating the annual emergency preparedness exercise. The EP staff developed the scenario with the assistance of other SCE organizations possessing appropriate expertise (e.g., reactor operations, health physics, maintenance, etc.,) In an effort to maintain strict security over the exercise scenario, individuals who had been involved in scenario development were not participants in the exercise. The objectives were developed in concert with the offsite agencies. NRC Region V was provided an opportunity to comment on the proposed scenario and objectives. The exercise document included objectives and guidelines, exercise scenario, and necessary messages and data. Advance copies of the exercise document were provided to the NRC evaluators and other persons having a specific need. The players did not have access to the exercise document or information on scenario events. This exercise is intended to meet the requirements of IV.F 3 of Appendix E to 10 CFR Part 50.

4. Exercise Scenario

The exercise objectives and scenario were evaluated by the NRC and considered appropriate as a method to demonstrate Southern California Edison Company's (SCE) capabilities to respond to an emergency in accordance with their Emergency Plan and implementing procedures. The exercise scenario started with an event classified as an alert and ultimately escalated to a General Emergency (GE) classification. The

licensee management critique scenario summary appeared to effectively describe the events associated with this emergency exercise. A copy of that summary is at Attachment 2 hereto.

5. Federal Observers

Five NRC inspectors evaluated the licensee's response to the scenario. Inspectors were stationed in the (simulator) CR, TSC, OSC, and in the EOF. The inspector in the OSC also accompanied repair/monitoring teams.

6. Exercise Observations (82301)

The following observations, (Sections 7 through 10 below) as appropriate, are intended to be suggestions for improving the emergency preparedness program. An exercise weakness is a finding identified as needing corrective action in accordance with 10 CFR 50, Appendix E, Paragraph IV.F.5. All exercise times and other times indicated in this report are Pacific Daylight Time (PDT) a.m.

7. Control Room/Simulator

The following aspects of CR operations were observed during the exercise: detection and classification of emergency events, notification, frequent use of emergency procedures, and innovative attempts to mitigate the accident.

The inspector observed the actions of the control room staff during the EP exercise conducted in the early morning of Wednesday, October 21, 1992. The inspector assessed the performance of the staff as they implemented procedures, analyzed plant conditions, classified the event, and communicated with other organizations. The inspector also observed the critiques conducted after the exercise by drill participants and licensee staff.

The event began with a loss of control room annunciators. The annunciators were restored just prior to a steam generator tube rupture and a loss of one train of class 1E 4.16 KV power. The reactor was manually tripped. One vital 125 VDC bus was faulted causing an isolation of feed and steam for both steam generators. Auxiliary feedwater was lost. The atmospheric dump valve on the intact steam generator was faulted closed, forcing the crew to utilize the ruptured steam generator for plant cool down. The event terminated with restoration of 125 VDC power. The scenario was conducted in the licensee's plant referenced simulator. The control room staff consisted of an operating crew with operators common to both units 2 and 3 included.

Prior to the exercise, the inspector reviewed the facility Emergency Operating Instructions (EOIs) in order to anticipate operator actions. The inspector noted that these EOIs did not consider instrument inaccuracies that could result from adverse containment conditions (harsh containment). The inspectors identified a concern regarding the

effective use of these EOIs for accidents resulting from breaks inside containment. No consideration of instrument errors, for harsh containment conditions, was included in the EOIs in the areas of setpoints for plant protective systems, nor in the acceptance criteria of safety function status checks. The Combustion Engineering (CE) Owners Group guidance for harsh containments, CEN-152, stated that these values for instrument inaccuracies should be considered in the EOIs. Conversations with licensee staff revealed that this concern was first raised during an EOP inspection conducted by the NRC in January of 1988. During the current inspection, the inspectors were informed the licensee was conducting a study of instrument inaccuracies in harsh containment conditions. The licensee was reminded of the guidance in NUREG-0899, "Guidelines for the Preparation of EOPs," which provides that the need for calculations should be minimized in the EOPs. This was because calculations increase the possibility of operator error and because of the time that they take. This item is considered an inspection followup item (50-361/92-24-01). Closure of this item requires consideration of instrument inaccuracies, while in harsh containment, in the EOIs.

The inspector observed the performance of the operating crew during the event. The inspector concluded the crew satisfactorily implemented all procedures in effect, including the EOIs and the emergency plan. The inspector concluded the crew effectively mitigated the casualty to the extent allowed by facility controllers.

The inspector observed one area of minor concern. In certain instances, communications needed to be prompted and information was not responded to. This was particularly evident during communications between the control room supervisor and board operators. This lack of proper communication was contradictory to facility procedure S023-0-44, "Professional Operator Development and Evaluation Program," which required repeat back of information for common understanding. This lack of communication was evidenced during certain crew briefings conducted by shift management. These misunderstandings were corrected during the conduct of the brief. The facility addressed the area of communications during the critique conducted after the scenario.

Overall, the inspector concluded the control room personnel adequately implemented procedures, interpreted control room indications, classified the event, and mitigated the event.

8. Technical Support Center (TSC)

The following aspects of TSC operations were observed: activation, accident assessment/classification, notification, and interactions between the various emergency response facilities. The following represent the NRC inspector's observations in the TSC.

- a. On three occasions it was noted that people were eating and/or drinking in the TSC while no eating, drinking, or smoking was allowed. In one instance, another player told an individual that no eating or drinking was allowed. This item was also identified

by licensee controllers.

- b. At 7:05, an action plan was implemented to swap out the breaker for auxiliary feedwater pump P504 since it had tripped on overcurrent. That did not appear to be a logical approach, since it would be of higher probability that the breaker tripped on an actual high current condition rather than a spurious trip. As such, it took until 8:07 to swap out the breaker only to have it trip again on high amperage. Thus, more than an hour was wasted on this number one priority task which was of no use. This item was also identified by the licensee.
- c. It was observed that on a couple of occasions a controller would ask a question of an individual that would inadvertently prompt them to perform an assessment of the situation, leading to some additional action. For example, a controller asked a phone talker a question on the status of the ability to restore the main feedwater and main steam isolation valves after 120 VDC bus 2D1 had been reenergized. The response was overheard by the Station Emergency Director, which reminded him to pursue opening main steam isolation valve HV-8205. Care should be taken by controllers in future drills and exercises, to insure they do not prompt players through questions or comments.

All in all, the inspector felt performance in the TSC was good. At first, the technical team did not appear to provide much support, but they were doing much better input and assessment after 5:25.

There was a great deal of thinking ahead as to potential challenges that could come up during the event. Thus, the Station Emergency Director had people thinking about compensatory actions fairly early into the event.

Players did relatively well in working through the Critical Functions Monitoring System (CFMS) failure. They could not rely on the status board, but it appeared that the communications from the simulator were helpful in overcoming this difficulty.

Briefings by the TSC Emergency Coordinator to TSC personnel were informative. However, they were somewhat sporadic at times, with the time between briefings varying from 5 to 45 minutes.

9. Operational Support Center (OSC)

The following aspects of OSC operations were observed: activation of the facility, functional capabilities, and the disposition of various in-plant repair/monitoring teams. An NRC inspector observed activities conducted by the OSC and selectively accompanied maintenance and response field teams dispatched from the OSC location.

The inspector observed and evaluated the OSC staff as they performed

tasks in response to the exercise. These tasks included activation of the OSC, assembly of needed personnel, assignment of priorities, repair team selection and assembly, radiological control planning, team briefings, protective action decision making, periodic notifications of the OSC staff, documentation of activities, communications, and interfacing of intracompany emergency response groups. No prestaging was evident, other than that required for scenario development.

The inspector noted that the OSC was activated in less than 30 minutes and in accordance with licensee Emergency Plan Implementing Procedures SO123-VIII-30.3, 40.1, and 80. Frequent OSC staff briefings were made during the drill; however, several announcements overrode those being made by the Control Room. The OSC staff was generally proactive in their assessments and anticipation of further OSC actions, such as:

- The dispatching of radiation monitoring personnel (HP Technicians-HPTs) to provide support for operations personnel already inplant.
- Envisioning jurisdictional disputes over access to the Unit 2 AFW Pump Building while the radiography source was in an unshielded condition.

Getting the OSC operational was very well organized. Dedicated radiation protection equipment and radiation monitoring instruments were effectively deployed. Radiation monitoring instruments were properly response checked prior to issuance to field teams. The problems noted during the 1992 EP Exercise concerning response checking of the high range probe of the high range gamma exposure rate monitoring instruments (Teletectors) prior to issuance were resolved by use of either the licensee's high activity sources in the instrument calibration laboratory or by comparison of infield readings (greater than 1 roentgen per hour, R/hr) of the Teletector to readings of another instrument that had been properly response checked. Periodic habitability radiological surveys were accomplished as required.

Dispatched teams were very well briefed and controlled. All teams, except for one, appear to be well equipped for accomplishing their assigned tasks.

The inspector noted that Control Room announcements were hard to hear in several areas of the OSC envelope and could not be heard at all in some rooms adjacent to the OSC used for team briefings.

One repair team was accompanied by the inspector due to its involvement in activities requiring entry into ultra high radiation fields (1,000 R per hour or more) and performing tasks to mitigate plant damage or radioactive releases to the environment. This team (No. 19) had to access the Auxiliary Feed Water Pump Building (AFW Building) which had an unshieldable radiography source exposed that created dose rates of 1,000 R/hr at 6 inches from the source. Planning for tasks within the building assumed workers would not get within 2 feet of the source (64.5

R/hr). The task to be accomplished within the AFW Building was to establish the valve line for returning the steam turbine powered AFW pump (P140) to service. Approximately 4 valves near the radiography source had to be positioned. The radiography source was located directly on top of the discharge piping of the pump. Approximately 2 hours were spent in planning for the AFW Building entry. The inspector noted that senior HP engineers and operational HP supervisors were involved in the planning, and even though they were planning for success the extremely conservative radiation exposure controls and limits placed on the repair team would have only led to failure. The inspector noted the following shortcomings in the licensee's planning and execution of this repair task:

- Limiting operators and HPTs to 2.5 and 0.5 rem whole body exposures, respectively. These controls limited one of the three operators to less than 2 minute of work and prevented the HPTs from entering the AFW Building with the operators and monitoring their performance.
- Establishing stay times for the operators (one at a time entering the AFW Building to position selected valves) when they were outfitted with state of the art alarming/digital readout dosimeters.
- Not taking advantage of Unit 3's AFW Building as a mockup for operator familiarization with valve locations and determining worker body positions for dosimeter placement.
- Not anticipating need for valve manipulating tools or keys to unlock valve hand wheels.
- HPTs remained outside of the AFW building even though radiation exposure rates just inside the entrance were less than 0.5 R/hr.
- Unknown to the HPTs, two of the three operators became detached from the team on the way to the AFW Building. The operators separated from the team for several minutes to obtain work gloves. No determination of the dose rates to be encountered by the operators on their quest to find gloves was made prior to their leaving the team.
- The use of multiple whole body and extremity dosimeters were rejected during task planning.
- Of the two operators used at the AFW Building, one (a senior operator) could not find one of the valves and bent directly over the radiography source twice looking for it. Getting within 6 inches of the source would have surely depleted the operator's remaining dose, causing the dosimeter to alarm. This would have required the backup operator (less experienced) to enter the building and find the valve and position it.

Due to the failure to ensure workers knew exactly where the valves were located, using extremely conservative dose limits, and not using multiple dosimeters; the licensee would have, more than likely, failed to accomplish the mission in one try and one operator would have received a significant amount of unmonitored exposure and would have also exceeded the licensee's administrative dose limits (not the 25 REM allowed under emergency conditions).

The inspector further noted that EIPs S0123-VIII-10, "Emergency Coordinator Duties," S0123-VIII-10.1, "Station Emergency Director Duties," S0123-VIII-40.1, "OSC Health Physics Coordinator Duties," S0123-VIII-80, "Emergency Group Leader Duties," and other EIPs, limit the Rapid Deployment Teams from the OSC to 0.3 R per person for performing the following:

- Plant-saving actions,
- Lifesaving actions,
- Protection of the public health and safety, and
- Restoration of critical plant functions.

The 0.3 R per person limit is extremely restrictive considering the nationally recognized limits of 25 R or higher per person for plant and life saving activities respectively. The inspector further noted that the licensee frequently evaluates personnel exposure extensions to the potential for exceeding 10 CFR Part 20 exposure limits, when the NRC has previously established (NUREG-0654 FEMA-REP-1, Revision 1) that emergency worker exposure limits should follow the guidance provided by the Environmental Protection Agency's (EPA) Emergency Worker and Lifesaving Activity Protective Actions Guides (EPA Documents 520/1-75/001 or more current, with the new Revision to 10 CFR Part 20, EPA 520/1-75-001-A).

Furthermore, the inspector noted the following at the licensee's OSC Controllers critique after the drill:

- The controllers failed to note that the two operators left the AFW pump team during their travel to the AFW Building.
- The controller failed to note that one operator could not find one of the valves, wandered around looking for it, and bending over the radiography source twice.
- The controllers failed to note that the operators body position during the valve line up and location of his dosimeters did not ensure monitoring of the significant exposure being received by his right hip/thigh area from the radiography source. However, a possible overexposure (the 2.5 rem assigned limit) was alluded to at the Corporate debriefing on the drill.

- The controllers did not address problems with Control Room announcements.

Some minor findings not observed by the inspector were identified by the licensee's controllers.

The inspector concluded that the OSC staff responded satisfactorily in their tasks and in accordance with their EP implementing procedures. However, the inspector felt that the above noted observations concerning extremely conservative radiological exposure controls could have prevented the licensee from implementing timely and effective plant saving and release mitigating actions. The above noted concerns are considered Inspection Followup Items (50-361/92-24-02).

10. Emergency Operations Facility (EOF)

a. Initial Notification of Offsite Agencies

The inspector observed the initial notification of offsite agencies by the Shift Communicator. Notifications to state, local and federal (NRC) agencies were completed within 15 minutes of the declaration of the Alert. The shift communicator effectively used established procedures and communication equipment. Information was presented in a clear and concise manner.

b. Emergency Operations Facility

The inspector observed the following activities at the EOF: activation, coordination with state and local agencies, accident assessment, dose projection, notification to state and local agencies, and formulation of protective action recommendations (PARs).

- (1) The EOF was activated 54 minutes after declaration of an Alert. The activation was orderly and effectively implemented. Procedural guidance was utilized and personnel appeared knowledgeable in their duties and responsibilities.
- (2) Offsite dose assessments were initiated shortly after the EOF was activated. Initial assessments were based on "what if" assumptions considering existing plant conditions. As plant conditions changed additional assessments were conducted as appropriate.
- (3) PARs were developed following established procedural guidance and in consideration of existing plant conditions as well as previously implemented offsite protective actions. Discussions were held between the licensee and offsite officials to ensure the bases and logic for PARs were understood.

- (4) Notifications to offsite agencies were completed in a timely manner utilizing the established primary communications system. When, in accordance with scenario conditions, the primary communication system was unavailable, backup communications were implemented and local offsite agencies were contacted within required time limits. Notification to state authorities was accomplished shortly after completing notification to local agencies. The notification to the state was a few minutes beyond the established time requirement. In consideration of exercise conditions, this delayed notification was not considered to be an area of concern.

The inspector observed a discussion between a local agency liaison representative and the EOF Communicators which identified a problem with the way information was presented in backup communication methods. Wind direction was provided in compass bearings and speed in meters per second and not the sector format and miles per hour used in primary communication methods. This caused confusion at the local Emergency Operations Centers (EOCs) and the licensee was requested to report future information in the format offsite officials were familiar with. The licensee exercise players agreed to make these changes. No further communications were observed using the backup communication method so the inspector was unable to determine if these changes were made.

Event Notification Forms (ENFs) # 3 and 4 indicated there was not a need for protective action beyond the site boundary while at the same time recommending evacuation of the State Beach. This communication inconsistency could lead to confusion and should be resolved by the licensee.

The inconsistency noted with the communication of PARs on ENFs and problems concerning the reporting of meteorological information to offsite agencies with backup communication methods is considered an Inspection Followup Item. (50-361/92-24-03)

- (5) The status of protective actions implemented by offsite agencies was reported to the licensee through offsite liaison representatives. Licensee officials remained cognizant of the status of offsite protective action implementations.

c. Environmental Sampling

The inspector noted that the volume of soil and vegetation samples obtained by offsite agencies and delivered to the EOF for analysis were not obtained in standardized sampling units. The licensee should ensure that offsite agency sampling procedures and methods

are compatible with available analytical methods to ensure efficiency and enhance consistency and accuracy of results.

11. Licensee Critiques

A series of exercise critiques was conducted by the licensee upon completion of the exercise. First, a facility critique was conducted at each emergency response facility, with players and controllers, immediately following the exercise. Upon conclusion of these critiques, a controller critique was conducted to review the major items surfaced at the facility critiques. On October 22, 1992, a formal corporate critique was conducted at the site to cover significant exercise problems, strengths and observations. NRC inspectors observed the facility critiques immediately following the exercise and the formal corporate critique.

- Facility critiques immediately following the exercise termination appeared satisfactory and appropriate to exercise activities. Most of the shortcomings noticed by the NRC inspectors were also noted by the licensee and were discussed in critiques.
- The corporate exercise critique on October 22 also appeared satisfactory and appropriate to exercise activities.
- Several significant inspection observations concerning OSC activities were not identified by the licensee.

12. Exit Interview

An exit interview was held on August 21, 1992, to discuss the preliminary NRC findings. Attachment 1 to this report identifies the personnel who were present at this meeting. The licensee was informed that no violations of NRC requirements or new exercise weaknesses were identified during the inspection. Items discussed are summarized in Sections 2 and 7 through 10 of this report.

ATTACHMENTS:

- 1 - NRC Exit Interview Attendees
- 2 - Exercise Scenario Summary

ATTACHMENT 1

NRC EXIT INTERVIEW ATTENDEES

T. Adler, SCE	E. Goldin, SCE
C. Anderson, SCE	J. Habis, SCE
D. Barss, NRC	J. Hammond, SCE
K. Bellis, SCE	R. Krieger, SCE
D. Bennette, SCE	F. Liu, SCE
D. Breig, SCE	A. McQueen, NRC
M. Brooks, SCE	H. Morgan, SCE
G. Buzzelli, SCE	J. Reilly, SCE
C. Caldwell, NRC	D. Richards, SCE
D. Chaney, NRC	R. Rosenblum, SCE
R. Clark, SCE	J. Russell, NRC
K. Collins, SCE	G. Sanders, SCE
B. Culverhouse, SCE	J. Scott, SCE
J. Curran, SCE	M. Short, SCE
K. de Lancey, SCE	L. Simmons, SCE
B. Erickson, SDG&E	R. Waldo, SCE
M. Farr, SCE	J. Wallace, SCE
J. Fee, SCE	D. Warnock, SCE
K. Fowler, SCE	H. Wood, SCE
R. Garcia, SCE	M. Zenker, SCE
	W. Zintl, SCE

SCENARIO SUMMARY

Attachment 2

The exercise began with Unit 2 operating at 100% power with Auxiliary feedwater pump 2P140 out of service for repair of suction piping and radiography in progress. The unit was also experiencing elevated reactor coolant system activity due to fuel clad defects.

At t=0330, the Unit 2 Control Room annunciator power supply breaker tripped due to a short circuit, resulting in a loss of all Control Room annunciators. The Shift Superintendent declared an ALERT per event code D2-3 at t=0335. Shift Communicators notified emergency response personnel by activating the automated recall system. Emergency response facilities were activated as follows:

OSC at t=0353
TSC at t=0431
HSC at t=0505

EOF at t=0429
ENC at t=0500

At t=0445, the radiography source in use at the auxiliary feedwater pump became jammed in the guide tube while being manipulated outside the camera resulting in local radiation levels which were reading approximately 3 R/hr 10 feet from the source. Appropriate radiological controls were established and the Radiation Safety Officer was contacted.

At t=0458 annunciator response personnel finished repairs at panel 2D5P4 and the annunciators were returned to service.

Two minutes later, at t=0500, a 65 gpm tube leak occurred on S/G 2E089 and an ALERT was declared per event code B2-1 at t=0512. A rapid plant shutdown was commenced in the Control Room Simulator.

At t=0519, operators manually tripped the reactor from 35% power. At t=0520, 1E 4kV bus 2A04 tripped due to a ground fault, resulting in inoperability of Train 'A' 4kV and 480V safety equipment including auxiliary feedwater pump 2P141. A SITE AREA EMERGENCY, B3-1, was declared at t=0525 when it was determined that the leak rate exceeded charging pump capacity. At t=0535, the leaking steam generator tube ruptured and SIAS was manually actuated at 0538. Non-Emergency Response Personnel within the Protected Area were directed to assemble.

At t=0645, 1E 125 VDC bus 2D1 deenergized due to a fault to ground in battery breaker 2D101. Loss of bus 2D1 caused the main feedwater isolation valves and main steam isolation valves to close. In response to the loss of main feedwater, operators started the remaining auxiliary feedwater pump 2P504 which operated for about a minute before it tripped on overcurrent due to a seized shaft. At this point, the unit was without main or auxiliary feedwater to the steam generators.

With the main steam isolation valves closed, Control Room personnel were directed by controllers to begin dumping steam via ADV 2HV8421 on the faulted steam generator at t=0703 resulting in a release of fission products to the environment. ADV 2HV8419 on the non-faulted steam generator was bound shut, although operators did not discover this fact until later in the exercise.

Because the loss of feedwater represented a challenge to the third fission product barrier (fuel clad) and a release path existed to the atmosphere, this steam generator tube rupture sequence met the criteria of a GENERAL EMERGENCY, B4-2, and the event was declared at t=0707.

Shortly after t=0800, Operators attempted to restore the cleared auxiliary feedwater pump 2P140. Because the radiography source had not been recovered, the pump was in a high radiation area (60 R/hour at the pump suction valve, MU468). The effort to approach the pump to valve it into service had to be coordinated with Health Physics, and required authorization for emergency exposure by the Station Emergency Director. When attempted, the suction valve did not open due to a bent stem.

Power to bus 2D1 was restored at t=0830. MSIV bypass 2HV8203 was opened at t=0841 to allow steaming the non-faulted S/G. At t=0845 Operators stopped steaming the faulted steam generator.

The exercise was terminated at t=0850.