UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
101 MARIETTA STREET, N.W.
ATLANTA, GEORGIA 30323

SEP 15 1987

Report Nos.: 50-327/87-49 and 50-328/87-49

Licensee: Tennessee Valley Authority
6N38 A Lookout Place
1101 Market Street
Chattanooga, TN 37402-2801

Docket Nos.: 50-327 and 50-328 License Nos.: DPR-77 and DPR-79

Facility Name: Sequoyah

Inspection Conducted: August 4-6, 1987

Inspectors: E. D. Testa for 8/18/87
W. M. Sartor Date Signed

E. D. Testa for 8/18/87
A. Gooden Date Signed

E. D. Testa 8/18/87
E. D. Testa Date Signed

Accompanying Personnel: B. B. Desai
C. D. Perny
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Approved by: T. R. Decker 8/18/87
T. R. Decker, Section Chief Date Signed
Division of Radiation Safety and Safeguards

SUMMARY

Scope: This routine, announced inspection involved the observation of an emergency exercise at the Sequoyah Nuclear Plant that included partial participation by a Region II Site Team. The NRC Inspection Team was comprised of six (6) inspectors from the Region II Office and one NRC contractor. The NRC Site Team (Reactor Safety oriented) consisted of 17 individuals from the Region II Office. This off-hours exercise was initiated at 6:30 p.m. on August 5, and terminated at approximately 3 a.m. on August 6.

Results: No violations or deviations were identified. The licensee's onsite emergency response actions for this exercise were adequate to provide protective measures for the health and safety of the public.

REPORT DETAILS

1. Persons Contacted

Licensee Employees

*H. L. Abercrombie, Site Director
*L. M. Nobles, Plant Manager
*T. H. Youngblood, Sequoyah REP Manager
*B. K. Marks, Manager, Emergency Preparedness Branch
*L. T. McEathern, Electrical Maintenance Engineer
*R. Y. Pierce, Mechanical Maintenance Engineer
*T. Noble, Sequoyah Project Management Staff
*D. Wall, Emergency Preparedness Branch
*N. S. Catron, Emergency Preparedness Branch
*J. Espy, Reactor Engineer
*R. J. Kitts, Division of Nuclear Services
*T. E. Adkins, Division of Nuclear Services
*K. K. King, Division of Nuclear Services
*A. M. Qualls, Assistant Plant Manager
*G. B. Kirk, Compliance Licensing Manager

Other licensee employees contacted included engineers, technicians, operators, mechanics, public safety members and office personnel.

NRC Resident Inspectors
K. Jenison
D. Poertner
M. Branch

*Attended exit interview

2. Exit Interview

The inspection scope and findings were summarized on August 6, 1987, with those persons indicated in Paragraph 1 above. The inspectors described the areas inspected and discussed in detail the inspection findings listed below. No dissenting comments were received from the licensee. The licensee did not identify as proprietary any of the material provided to or reviewed by the inspectors during this inspection.

3. Licensee Action on Previous Enforcement Matters

This subject was not addressed in the inspection.

4. Exercise Scenario (82301)

The scenario for the emergency exercise was reviewed to determine that provisions had been made to test the integrated capability and a major portion of the basic elements existing within the licensee's Emergency

Plan and organization as required by 10 CFR 50.47(b)(14), 10 CFR 50, Appendix E, Paragraph IV.F and specific criteria in NUREG-0654, Section II.N.

The scenario was reviewed in advance of the scheduled exercise date and was discussed with licensee representatives. The scenario developed for this exercise was challenging and adequate to exercise the onsite emergency organizations consistent with the licensee's scope and objectives. The scenario also provided sufficient information to the State and local government agencies for their participation in the exercise.

Exercise control was considered adequate in all areas. Controller instructions and the licensee's pre-exercise meetings provided for a well coordinated exercise.

No violations or deviations were identified.

5. Assignment of Responsibility (82301)

This area was observed to determine that primary responsibilities for emergency response by the licensee have been specifically established, and that adequate staff was available to respond to an emergency as required by 10 CFR 50.47(b)(1), 10 CFR 50, Appendix E, Paragraph IV.A, and specific criteria in NUREG-0654, Sections II.A and II.B.

The inspectors verified that the licensee made specific assignments to the emergency organization. The inspectors observed the activation, staffing, and operation of the emergency organization in the Control Room, the Technical Support Center (TSC), the Operations Support Center (OSC), and the Central Emergency Command Center (CECC). At each of these centers, the assigned responsibilities of emergency staff personnel appeared to be consistent with the licensee's Emergency Plan.

No violations or deviations were identified.

6. Onsite Emergency Organization (82301)

The licensee's onsite emergency organization was observed to determine that the responsibilities for emergency response were unambiguously defined, that adequate staffing was provided to insure initial facility accident response in key functional areas at all times, and that the interfaces were specified as required by 10 CFR 50.47(b)(2), 10 CFR 50, Appendix E, Paragraph IV.A, and specific criteria in NUREG-0654, Section II.B.

a. Control Room - A supplemental Control Room shift had been designated for the exercise. The Control Room player shift responded quickly in classifying the simulated emergency conditions. The on-duty Shift Engineer assumed the duties of Site Emergency Director promptly upon the initiation of the

simulated emergency, and directed the response until relieved by the Plant Manager. The Control Room shift appeared knowledgeable of their emergency duties and promptly referred to their emergency procedures.

An inspector noted that the TSC call list was implemented with player assistance. Specifically, a TSC organization member (who was pre-positioned for the exercise) assisted the Operations Clerk with initiating the computer programmed TSC call list when directed by the Shift Engineer following the Alert classification. The Operations Clerk had indicated knowledge of the back-up system (i.e. the clerk making telephonic notifications to key personnel on the TSC call list). The TSC call list was implemented timely; however, this may have been as a result of the player's assistance.

The need for additional training of the Operations Clerks in using the recently implemented computer directed TSC call list was identified as an exercise weakness at the exit briefing (50-327/87-49-01, 50-328/87-49-01).

b. Technical Support Center - The TSC was declared activated approximately 1 hour and 5 minutes after the Alert classification; however, most members were present and performing emergency functions prior to the formal declaration. TSC personnel performed well during the exercise; good role-playing and professional attitudes were displayed at all times. The Site Emergency Director (SED) was clearly in command and provided frequent briefings to the staff as well as maintained an acceptable noise level. Status boards were not completed in sufficient detail to determine significant events and equipment status. However, the SED compensated for this by later writing a list of problem areas and ongoing repairs. Although the list was not prioritized it appeared that repairs were properly managed by the TSC.

c. Operations Support Center (OSC) - The OSC was promptly staffed as defined in IP-7, "Activation and Operation of the Operations Support Center." The inspector noted that the initial repair teams were delayed because the radios required for communicating with OSC teams were not readily available. This was identified as an inspector follow-up item (50-327/87-49-02, 50-328/87-49-02). It was also noted that the repair team which was deployed to seal door A62 did not appear to be fully briefed and equipped prior to dispatch. As a result, final repair preparations were made in a 700 mR/hr area (simulated). The need to fully brief and prepare OSC teams prior to dispatch was identified as an inspector follow-up item (50-327/87-49-03, 50-328/87-49-03).

d. Central Emergency Control Center - The licensee promptly

established its offsite emergency organization at its CECC in Chattanooga, TN. The CECC appeared to be adequately staffed and equipped to direct and coordinate the overall TVA response to the emergency condition and perform assigned functions such as offsite radiological monitoring and dose assessment, public information, State and local government coordination, and plant assessment. The licensee's critique identified the need to improve the initial briefing/reception of the NRC Site Team upon its arrival. An inspector also noted that the positioning of the CECC status boards resulted in their partial obstruction by personnel standing in the vicinity of boards.

No violations or deviations were identified

7. Emergency Response Support and Resources (82301)

This area was observed to determine that arrangements for requesting and effectively using assistance resources had been made and that other organizations capable of augmenting the planned response were identified as required by 10 CFR 50.47(b)(3), 10 CFR 50, Appendix E, Paragraph IV.A, and specific criteria in NUREG-0654, Section II.C.

The licensee's Radiological Emergency Plan provides for emergency response support. The scope of this exercise did not include offsite fire or medical support to the Sequoyah Nuclear Plant.

No violations or deviations were identified.

8. Emergency Classification System (82301)

This area was observed to determine that a standard emergency classification and action level was in use by the nuclear facility licensee as required by 10 CFR 50.47(b)(4), 10 CFR 50, Appendix E, Paragraph IV.C, and specific criteria in NUREG-0654, Section II.D.

An inspector observed that the emergency classification system was in effect as stated in the Radiological Emergency Plan and the implementing procedures. The system appeared to be adequate for the classification of the simulated accident.

No violations or deviations were identified.

9. Notification Methods and Procedures (82301)

This area was observed to determine that procedures had been established for notification by the licensee of State and local response organizations and emergency personnel, and that the content of initial and followup messages to response organizations had been established; and means to provide early notification to the populace within the plume exposure pathway have been established as required by 10CFR 50.47(b)(5), 10 CFR 50, Appendix E, Paragraph IV.D, and specific criteria in NUREG-0654, Section

II.E.

An inspector observed that notification methods and procedures had been established and were used to provide information concerning the simulated emergency conditions to Federal, State, and local response organizations.

No violations or deviations were identified.

10. Emergency Communications (82301)

This area was observed to determine that provisions existed for prompt communications among the principal response organization and emergency personnel as required by 10 CFR 50.47(b)(6), 10 CFR 50, Appendix E, Paragraph IV.E, and specific criteria in NUREG-0654, Section II.F.

Communications among the licensee's emergency response facilities and between the licensee's emergency response organization and offsite authorities were adequate with the exception of the initial lack of radio support to the OSC repair teams as previously reported.

11. Public Education and Information (82301)

This area was observed to determine that information concerning the simulated emergency had been made available for dissemination to the public as required by 10 CFR 50.47(b)(7), 10 CFR 50, Appendix E, Paragraph IV.D, and specific criteria in NUREG-0654, Section II.G.

Information was provided to the media and the public in advance of the exercise. The licensee promptly established its Joint Information Center (JIC) and provided a total of eight accurate and timely press releases that were properly coordinated. Good communications existed among Knoxville, the CECC, and the JIC. Excellent use of the satellite medium was made at both the State and licensee facilities.

No violations or deviations were identified.

12. Emergency Facilities and Equipment (82301)

This area was observed to determine that adequate emergency facilities and equipment to support an emergency response were provided and maintained as required by 10 CFR 50.47(b)(8), 10 CFR 50, Appendix E, Paragraph IV.E, and specific criteria in NUREG-0654, Section II.H.

The emergency response facilities were activated and promptly staffed during the exercise. The facilities appeared to be adequately equipped to support the emergency response with the exception of the radios for the OSC teams. Offsite radiological monitoring teams were dispatched by the licensee but were not observed by an NRC inspector during this exercise.

No violations or deviations were identified.

13. Accident Assessment (82301)

This area was observed to determine that adequate methods, systems, and equipment for assessing and monitoring actual or potential offsite consequences of a radiological emergency condition were in use as required by 10 CFR 50.47(b)(9), 10 CFR 50, Appendix E, Paragraph IV.B, and specific criteria in NUREG-0654, Section II.I.

The accident assessment program included both an engineering assessment of plant status and an assessment of radiological hazards to both onsite and offsite personnel resulting from the accident. Dose assessment activities were conducted by the CECC staff and coordinated with the State. During the exercise, the CECC plant assessment team functioned adequately in analyzing the plant status so as to make recommendations to the TSC and the CECC Plant Assessment Manager concerning mitigating actions to reduce damage to the plant equipment, to prevent release of radioactive materials, and to terminate the emergency conditions.

No violations or deviations were identified.

14. Protective Responses (82301)

This area was observed to determine that guidelines for protective actions during the emergency, consistent with Federal guidance, were developed and in place, and protective actions for emergency workers, including evacuation of nonessential personnel, were implemented promptly as required by 10 CFR 50.47(b)(10), and specific criteria in NUREG-0654, Section II.J.

An inspector verified that the licensee had and used emergency procedures for formulating protective action recommendations for offsite populations within the ten-mile EPZ. The licensee's protective action recommendations were consistent with the EPA and other criteria and notifications were made to the appropriate State and local authorities within the 15-minute criteria.

Protective actions for emergency workers onsite were initiated by an assembly to account for all personnel and provide for the simulated evacuation of non-essential persons if appropriate. An inspector noted that public safety members prevented OSC repair teams from moving to required locations to perform needed repairs during the assembly. This significant problem was identified by the licensee at the critique for followup action. The review of the licensee's actions taken to insure that repair teams dispatched to mitigate the casualty are not prohibited from moving to required locations during an assembly was identified as an inspector followup item (50-327/87-49-04, 50-328/87-49-04).

An inspector was positioned in the Alpine Village area to observe the notification of personnel in this work area. Observations included the inability to hear the site siren sounded for assembly and the lack of the plant's public address system remoted to this area. Public Safety

personnel responded to the area and provided workers with assembly instructions. However, some confusion was noted in that both alpha and numeric designators were used for the same assembly area. Only seven employees were in the area for this off-hours drill and were adequately accounted for. Although no deficiencies regarding the accountability of personnel were observed during the exercise, notification of an emergency and accountability for personnel in this area during normal working hours would be much more difficult.

No violations or deviations were identified.

15. Exercise Critique (82301)

The licensee's critique of the emergency exercise was observed to determine that deficiencies identified as a result of the exercise and weaknesses noted in the licensee's emergency response organizations were formally presented to licensee management for corrective actions as required by 10 CFR 50.47(b)(14), 10 CFR 50, Appendix E, Paragraph IV.E, and specific criteria in NUREG-0654, Section II.N.

An informal critique was held by the licensee immediately after termination of the exercise to permit players to provide comments. A formal critique of the emergency exercise was held on August 6, 1987, with exercise controllers, key exercise participants, licensee management, and NRC representatives. The licensee's critique was adequate for this exercise. Following the licensee critique, the NRC inspector provided preliminary findings observed during the exercise.

No violations or deviations were identified.

16. Inspector Followup (92701)

a. (Closed) Inspector Followup Item (IFI) 50-327, 328/86-64-01: Improper controller prompting of players. No controller prompting was observed.

b. (Closed) IFI 50-327, 328/86-64-02: Failure of the SED to be knowledgeable of changing conditions and direct assigned activities 10 minutes after assuming his duties. The SED maintained awareness of conditions at all times and had verified communications capability with the Control Room before moving to the TSC.

c. (Closed) IFI 50-327, 328/86-64-03: Failure to use public address (PA) system to inform site personnel of emergency conditions and to provide for timely staffing of the emergency response organization. Good use of the PA system was made in notifying personnel of the emergency and to initiate staffing of the emergency response facilities.

d. (Closed) IFI 50-327, 328/86-64-04: Failure to coordinate Control Room activities with the SED in the TSC. Control Room personnel kept

the SED apprised of all necessary activities.

e. (Closed) IFI 50-327, 328/86-64-05: Failure to provide for an alternate location which can provide HP support should high radiation levels prevent operation from the HP lab. Personnel were aware of an alternate location for HP support.

f. (Closed) IFI 50-327, 328/86-64-06: Failure of the CECC director to be aware of previously coordinated protective actions to be taken by the State. The CECC director was fully aware of the previously coordinated protective actions to be taken by the State.

g. (Closed) IFI 50-327, 328/86-64-07: Failure to provide an accurate report of the emergency class to the NRC. Accurate emergency classification reports were provided to the NRC.

h. (Closed) IFI 50-327, 328/86-64-08: Emergency Implementing Procedures (EIPS) for emergency classification did not adequately provide for transition to a higher level of classification. The EIPs were reviewed and provided for transition to higher levels of classification.

Attachment:
Exercise Objectives, Narrative
Summary, and Scenario Timeline

SEQUOYAH NUCLEAR PLANT RADIOLOGICAL EMERGENCY PLAN (REP) EXERCISE

GOALS AND OBJECTIVES

The 1987 Sequoyah Nuclear Plant (SQN) REP exercise will be a limited participation exercise requiring full participation by TVA, with limited participation by State and local emergency response agencies.

Exercise Goals

TVA's goals for the 1987 SQN exercise are as follows.

1. To allow plant and offsite personnel to test and demonstrate their response capability in accordance with the SQN REP and REP implementing procedures to protect plant personnel and the general public as appropriate.

2. To ensure that weaknesses observed in previous exercises have been corrected.

3. To identify emergency response capabilities that are in need of improvement or revision.

Exercise Objectives

General Objectives:

1. Demonstrate the ability to alert and mobilize TVA emergency response personnel and to activate TVA emergency centers in a timely manner. This exercise will be initiated between the hours of 6 p.m. and 12 p.m.

2. Demonstrate the adequacy, operability, and effective use of emergency communications equipment and the adequacy of the communications systems.

3. Demonstrate the ability of each emergency response facility manager to maintain command and control over all emergency response activities conducted from his facility throughout the exercise.

4. Demonstrate the primary functional responsibilities and/or problem-solving capabilities of emergency response personnel.

5. Demonstrate that timely and accurate information can be supplied to the State on a frequent basis.

6. Demonstrate that a timely and accurate flow of information can be maintained between the plant and the Central Emergency Control Center (CECC).

7. Demonstrate the ability to effectively generate protective action recommendations.

Specific Objectives:

A. Control Room Objectives

1. Demonstrate the ability of the Site Emergency Director (Shift Engineer) to classify an emergency condition and make required notifications in a timely manner.

2. Demonstrate the ability to formulate and implement initial onsite protective action measures for plant personnel.

3. Demonstrate the precise and clear transfer of responsibilities from the Control Room staff to the Technical Support Center (TSC) staff.

4. Demonstrate the ability of the Shift Engineer to periodically inform Control Room personnel of the status of the emergency situation and actions currently being planned by the TSC.

5. Demonstrate the ability of the Control Room personnel to maintain current knowledge of equipment and plant status and corrective actions taken through timely, detailed logkeeping.

6. Demonstrate the ability of the Control Room personnel to make a timely determination of the cause of an incident and perform mitigating actions to place the unit in a safe and stable condition through effective command and control.

B. TSC Objectives

1. Demonstrate the ability to alert and mobilize the TSC emergency response personnel and to activate the TSC in a timely manner.

2. Demonstrate that effective command and control occurs in the TSC.

3. Demonstrate the precise and clear transfer of responsibilities from the Control Room staff to the TSC staff.

4. Demonstrate the primary functional responsibilities and problem-solving capabilities of the TSC staff.

5. Demonstrate the ability of the TSC staff to support the Control Room staff's effort to identify the cause of the incident, mitigate the consequences of the incident, and place the unit in a safe and stable condition.

6. Demonstrate the proficiency of the Site Emergency Director in the TSC to classify an emergency condition based on current plant conditions.

7. Demonstrate the ability to formulate and implement onsite protective actions based on timely assessments of onsite radiological conditions.

8. Demonstrate the ability to perform timely assessments of onsite radiological conditions to support the formulation of protective action recommendations.

9. Demonstrate the timely updating of TSC status boards.

10. Demonstrate timely updating of each Operation Support Center (OSC) area and the Control Room, and the transfer of technical information to the CECC.

C. OSC Objectives

1. Demonstrate the ability to alert and mobilize the OSC emergency response personnel and to activate the OSC in a timely manner.

2. Demonstrate the ability of the OSC staff to initiate and coordinate activities in an efficient and timely manner through effective command and control.

3. Demonstrate the ability to direct and coordinate in-plant health physics (HP) surveys and to control the exposure of onsite emergency workers.

4. Demonstrate that OSC teams are thoroughly briefed on plant conditions and that adequate HP support is provided before being dispatched.

5. Demonstrate that adequate communications are maintained between OSC teams and the OSC.

6. Demonstrate that there is adequate communications and efficient transfer of information between the OSC areas and the TSC, HP laboratory, and Chemistry laboratory.

7. Demonstrate the timely updating of OSC status boards.

D. Radiological Control and Chemistry Objectives

1. Demonstrate the ability to alert and mobilize HP personnel in a timely manner.

2. Demonstrate the ability of the HP staff to perform effective in-plant and site boundary surveys during radiological emergencies while following good HP and ALARA practices.

3. Demonstrate the ability to track changing radiological conditions through timely and detailed documentation of survey results.

4. Demonstrate timely and effective transfer of survey results from the HP laboratory to the TSC and OSC.

5. Demonstrate the ability to track and control the exposure of onsite emergency workers.

6. Demonstrate a timely and efficient activation of the plant environmental monitoring van and the establishment of adequate communications with the TSC and/or CECC.

7. Demonstrate the ability to obtain and analyze samples drawn from the in-plant normal or postaccident sampling systems and support plant radiation release calculations.

E. CECC Objectives

1. Demonstrate that the Operations Duty Specialist makes the initial notification to the State in a timely manner.

2. Demonstrate the ability to alert and mobilize the CECC emergency response personnel and to activate the CECC in a timely manner.

3. Demonstrate that the CECC Director makes a clear announcement when he determines the CECC operational, maintains effective command and control in the CECC, and provides periodic briefings to the CECC staff.

4. Demonstrate the ability to effectively call upon and utilize TVA corporate or outside support organizations and to obtain vendor and other outside resources if appropriate.

5. Demonstrate the precise and clear transfer of responsibilities from the TSC staff to the CECC staff.

6. Demonstrate the ability of the CECC staff to direct and coordinate the deployment of Radiological Monitoring Teams and coordinate TVA dose assessment activities with those conducted by the State.

7. Demonstrate the ability of the Dose Assessment Team to obtain, analyze, and use onsite and/or offsite radiological conditions and meteorological information to produce dose assessments to support formulating protective action recommendations and provide the recommendations to the CECC Director in a clear and timely manner.

8. Demonstrate the ability to inform, update, and coordinate with State Radiological Health personnel regarding meteorological and dose assessment information.

9. Demonstrate the ability to periodically inform and update Radiological Monitoring Control Center (RMCC) emergency response personnel regarding the status of the emergency conditions.

10. Demonstrate the ability of the CECC Plant Assessment Team to analyze current plant conditions, identify projected trends and potential consequences, and make protective action recommendations to the CECC Director using the Protective Action Guide (PAG) logic diagram.

11. Demonstrate the ability of the CECC to provide periodic updates of onsite status and provide protective action recommendations to the State in a clear and timely manner.

12. Demonstrate a timely and accurate flow of information between the TSC staff and the CECC assessment teams.

13. Demonstrate the ability of the Core Damage Assessment Team to generate source term information in a timely manner.

14. Demonstrate a timely and effective flow of information between CECC Radiological and Plant Assessment Teams.

15. Demonstrate the timely updating of CECC status boards.

16. Demonstrate that proper security is established for the CECC.

17. Demonstrate the ability to alert Federal and industrial emergency contacts as appropriate.

F. Environs Assessment Activities

1. Demonstrate the ability to coordinate Radiological Monitoring Teams from the RMCC in conjunction with the State. (Some participating personnel and radiological monitoring vans will be prestaged.)

2. Demonstrate the ability of the Radiological Monitoring Teams to efficiently and effectively utilize their procedures to perform dose rate surveys, collection and analysis of radiological samples, and other prescribed radiological monitoring activities.

3. Demonstrate the ability of the monitoring teams to follow contamination control procedures.

4. Demonstrate the ability to control the exposure of offsite emergency workers.

5. Demonstrate effective command and control of radiological monitoring activities from the plant, RMCC, and/or CECC as appropriate.

G. Public Information Objectives

1. Demonstrate the ability to effectively provide timely and accurate information to the public and coordinate periodic news media briefing with the State.

2. Demonstrate the ability to produce a news release from the CECC every two hours.

3. Demonstrate the ability to operate the Joint Information Center (JIC) and coordinate public information activities with other participating agencies. (Some personnel and equipment will be prestaged.)

H. Communications Objectives

1. Demonstrate the REP notification procedure throughout the notification chain, beginning at the SQN Control Room and extending to State and local authorities.

2. Demonstrate the adequacy of communications links between the plant and the CECC.

3. Demonstrate the adequacy of communications links between the CECC and the State Emergency Operations Center.

4. Demonstrate the adequacy of communications links between the CECC and the JIC.

5. Demonstrate the adequacy of communication links between the CECC the RMCC, and monitoring vans.

I. Exercise Conduct Objectives

1. Provide specific and measurable objectives for the exercise.

2. Continue improvements of controller and evaluator performance through an increased level of participation.

3. Demonstrate the ability to adequately perform postexercise critiques to determine any areas requiring additional capability improvement.

4. Participating personnel will know the date of the exercise but not its starting time or duration.

5. Provide training for new CECC personnel.

J. Credit will be taken for the following required REP drills.

1. Plant radiological monitoring drill.

2. Plant HP drill.

3. Radiochemistry drill.

4. CECC/State communications drill.

5. TSC/CECC communications drill.

6. Offsite environs monitoring drill.

7. CECC dose assessment drill.

NSC:RKQ
5-12-87
2474E

NARRATIVE SUMMARY

Unit 1 is at 100-percent power steady state on the 60th day of an extended run with the core near EOL. Several large fossil units are off-line resulting in low system voltage due to a high system load. The plant start bus voltages are at 6800 volts. U-1 containment is being purged due to high Noble Gas concentration. 1A-S Auxiliary Feedwater Pump (AFW) has been out of service and tagged for 20-hours to replace the pump inboard shaft bearing. The bearing had been running hot and was found to be slightly wiped. Investigation found a partial blockage in the oil supply line. This action has unit 1 in a 72-hour L.C.O. by T.S.3.7.1.2. Door A62 on elevation 690' between the auxiliary building and the penetration room has its latching mechanism broken and a bent hinge. The door has been removed and is in the shop for repairs. A fire watch has been established. The spent fuel pit heat exchangers are aligned to unit 1 Component Cooling System (CCS) in accordance with SOI-70.1 with both 1A-A and 1B-B CCS pumps running. C-S CCS pump is supplying Units 1 and 2 train "B" ECCS equipment. Spreader room penetration AB734A0311Q005 has been breached to pull a replacement cable, 1V1222A, in tray NN-A. RCS identified leakage from HCV-68-536 on RCS loop 3 hot leg and cold leg manifolds return line is .9 gpm. The leak rate has not changed since steady state full power operation was attained. Unit 2 is in Mode 5, main turbine work scheduled. Unit 2 has been shutdown for 72-hours and the RHRS is aligned in the shutdown cooling mode. 2B-B Component Cooling System (CCS) pump is tagged to replace the discharge valve flange. The flange was leaking through a cracked weld. The pump suction butterfly valve, 2-70-365A leaked by so badly the clearance was extended to include suction isolation valves FCV-70-78 and 39, and 2-HCV-70-531.

At time 00:00 a Reactor Coolant System (RCS) leak of 4 gpm occurs. Containment pocket sump level increase is alarmed. The unit enters a 4-hour LCO (TS-3/4.4.6.2) and a NOTIFICATION OF UNUSUAL EVENT may be declared by the Shift Engineer (SE). After about 15 minutes, the RCS leak has increased in size and an ALERT is declared when it has been determined the leak rate exceeds 50 gpm. Charging pumps are able to maintain pressurizer level but containment pressure is slowly increasing due to the RCS leak. Following unsuccessful attempts to identify and isolate the leak the operator begins turbine shutdown at 5%/minute. Reactor cooldown is started to cool and depressurize the RCS to minimize the Loss of Coolant Accident (LOCA). Containment purge dampers FCO-30-37 and 40 have been partially blocked open due to an obstruction across their seats. This is indicated on panel M-9 by the red open and green closed position lights for both dampers still being illuminated.

At approximately 1-1/2 hours into the scenario the 6.9 KV Shutdown Board 1A-A trips and locks out due to a fault on the normal feeder breaker 1718. This prevents 1A-A diesel generator from supplying power to the board and results in the loss of all 6.9 KV train "A" components. A SITE AREA EMERGENCY is declared due to fire or explosion compromising the function of required safety systems and/or loss of all control room alarms for > 15 minutes and plant transient in progress. Electrical maintenance projects ≃ 10 hours to repair and recover 1A-A Shutdown Board.

The RCS leak continues to increase. Charging pumps are still able to maintain pressurizer level but at a reduced RCS cooldown rate. Containment pressure continues to increase and results in phase A containment isolation and a Safety Injection (SI) signal at 1.54 psig.

The operator isolates Cold Leg Accumulators (CLA) and dumps the nitrogen into containment resulting in a phase B isolation. When the SI signal is initiated, 1B-B RHR pump fails to start and all idle ERCW pumps start. The ERCW pump start results in a pressure surge in the system causing a rupture of a bimetallic welded pipe reducer in the 1B main supply header on elevation 690' in the auxiliary building. ERCW is lost to 1B-B Centrifugal Charging Pump (CCP) and 1B-B SI pump room and oil coolers. Equipment in the immediate area is sprayed with raw water.

The LOCA continues to increase. If not turned off, the motor bearings on the train "B" CCP and SI pumps may begin to fail, because of a lack of cooling. All makeup water to the reactor, with the exception of the Positive Displacement Pump, is lost if these pumps fail.

The running CCP and SI pumps are stopped and locked out due to lack of cooling. A GENERAL EMERGENCY is declared due to LOCA in progress and degradation of ECCS.

The scenario further postulates that a gasket in the containment purge duct work ruptures in the elevation 690' penetration room. This vents containment to the room, and then through door A62 into the auxiliary building. A ground level release is detected and the Auxiliary Building is evacuated as all maintenance is stopped.

At no point in the scenario is the core uncovered. However, as the LOCA continues and due to the degraded condition of ECCS, fuel failure would result at some time in the future if cooling is not reestablished.

Radiation levels in containment and environmental radiation levels continue to increase. Containment pressure continues to slowly increase.

Approximately 8 hours into the scenario, electrical maintenance is able to repair 1A-A 6.9 KV shutdown board sufficiently to reenergize it returning all train "A" ECCS equipment to operable status. This allows the operators to refill the RCS, place the RHRS in the shutdown cooling mode and reduce containment pressure.

The ruptured purge duct may be repaired sealing the containment breach. The exercise is terminated at this point.

NSC:TCB
2180E
Revised: 7-21-87

Sequoyah Nuclear Plant (SQN) Scenario Timeline

INITIAL CONDITIONS

- Unit 1 is at 100-percent power near End of Life (EOL); steady state power for last 60 days.
- Reactor coolant system (RCS) activity is 0.40 uci/gm Dose Equivalent I-131.
- The grid voltage is low due to several large coal fired plants being off-line. Start bus voltage is 6800 volts.
- The latching mechanism on door A62 is broken and a hinge was bent. The door has been removed and is in the shop for repairs. A breach permit has been issued and a fire watch has been established in accordance with PhySI-13.
- Containment is being purged due to high Noble Gas concentration of 10^{-3} uci/cc.
- 2B-B Component Cooling System (CCS) pump is tagged to replace a cracked discharge valve flange.
- The spent fuel pit heat exchanges are aligned to unit 1 and the C-S CCS pump is supplying train "B" ECCS equipment.
- Spreader room to auxiliary building penetration AB734A0311Q005 is breached to pull a replacement cable, 1V1222A, in tray NN-A.
- The unit is in hour 20 of a 72-hour Limiting Condition for Operation (LCO) due to 1AS auxiliary feed pump being out of service and tagged to replace the pump inboard shaft bearing. (T.S.3.7.1.2)
- 1-M-21 annunciator panel is being supplied by its alternate power supply from power rack A breaker 1 on panel 1-M-7. The 480V breaker in compartment 6C on 480V C&A ventilation board 1B1-B and breaker 208 on 125V vital battery board 1 are tagged to repair the inverter. Electrical maintenance expects to be finished and will release the clearance next shift.
- Reactor coolant system identified leakage is .9 gpm from valve HCV-68-536 in the RCS loop 3 hot leg and the cold leg manifolds return line. The leak rate has not changed since startup.
- Unit 2 has been shutdown 72 hours, is in main turbine outage, Mode 5, with the RHRS in the shutdown cooling mode.

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T = 00:00

A 4-gpm leak from the Reactor Coolant System (RCS) into containment begins. "Pocket Sump Level High" is alarmed and printed by the plant computer. RA-90-106C alarms, "Containment Building Lower Compt Air Monitoring," on panel M-12. AOI-6, "Small Reactor Coolant System Leak" and AOI-32, "Emergency Shutdown" is entered. A NOTIFICATION OF UNUSUAL EVENT may be declared. Surveillance Instruction 137.1 initiated.

T = 00:15

The RCS leak has increased to > 50 gpm as indicated by increased charging flow. Ice condenser equipment door open alarm is received on panel M-6. Lower compartment high radiation alarms are received. Charging flow has increased from 88 gpm to 150 gpm. An ALERT should be declared within 15 minutes by the Shift Engineer (SE) due to a primary system leak rate in excess of 50 gpm. The containment ventilation system isolates.

T = 00:20

An additional centrifugal charging pump (CCP) is placed in service. Lower compartment high moisture and temperature alarms are received on panel M-5.

T = 00:25

Chemical Volume Control System (CVCS) volume control tank makeup initiates. Containment pressure is ≃ .7 psig and pressurizer level is increasing with charging flow.

T = 00:30

Main turbine shutdown begins at ≃ 5-percent/minute after not being able to identify the leak, in accordance with AOI-32. Containment pressure is increasing.

T = 00:35

Containment pressure is ≃ .9 psig, and is still increasing but at a slower rate.

T = 00:40

"Reactor coolant loop Tref-Tauct hi-low" alarm on panel M-5 and "NIS power range upper detector high flux deviation or auto defeat" alarm on panel M-4 are received.

T = 00:50

Unit station service is transferred, the main turbine is tripped, and GOI-3B is entered, "Plant Shutdown from Hot standby to Cold Shutdown". RCS cooldown to cold shutdown at ≈ 50°F/hour is started using steam dumps. Although containment purge isolation has initiated, 2 containment purge dampers (FCO-30-37 and 40) are partially open because of an obstruction laying across the seats in the duct work. This is indicated by both the red open and green closed position lights for the dampers still being illuminated on panel M-9.

T = 01:00

Surveillance Instruction 38 "Shutdown Margin" is completed, manual insertion of control rods is complete with the control banks out five steps each and the shutdown banks fully withdrawn.

T = 01:15

Upper Head Injection (UHI) is isolated by procedure. "Pressurizer low pressure" and "Reactor coolant loops lo-lo T_{ave}" alarms are received on panel M-6.

T = 01:25

Reactor Coolant Pumps (RCP) 1 and 3 are removed from service by the operator.

T = 01:30

A loud noise is heard coming from shutdown board room A. 6.9 KV Shutdown Board 1A-A trips and is locked out on A-B phase differential over current on feeder breaker 1718. The unit ASE investigates and activates the fire alarm from shutdown board room A. AOI-30 is initiated. All train "A" 6.9 KV components are inoperable. Alarms received on panel M-2 include, "A 6.9 KV Shutdown BD Trip", "6900 V SD BD 1A-A Failure or Undervoltage", "480V SD BD 1A1-A (1A2-A) Failure or Undervoltage". The Site Emergency Director (SED) may declare a <u>SITE AREA EMERGENCY</u> based on fire or explosion damaging safe shutdown equipment and/or loss of all control room annunciators for greater than 15 minutes with a plant transient in progress.

T = 01:35

The Fire Brigade responds to the fire alarm and reports that breaker 1718 looks burned and they can smell hot metal and see smoke but no fire. The ASE cannot remove the breaker from its compartment.

T = 01:45

Electrical maintenance is dispatched to investigate and repair the board and breaker. The fire alarm is terminated.

T = 01:50

The main turbine is on the turning gear.

T = 02:00

The RCS leak increases and containment pressure continues to slowly increase. Power is restored to the control room annunciators.

T = 02:15

Safety Injection initiates on high containment pressure of 1.54 psig. RHR pump 1B-B does not start and indicates tripped on panel M-6. Emergency Instruction E-0 is entered. Electrical maintenance at breaker 1718 reports the breaker is welded into its compartment by the fault and has probably caused bus damage. They request a board clearance to disassemble the breaker compartment. Projected repair time is ≈ 10 hours. The RCS leak has continued to increase.

T = 02:20

Safety Injection is terminated and RCS cooldown and depressurization continues. The ASE reports a target on relay device 50 showing A phase overcurrent on RHR pump 1B-B breaker compartment 14. An electrical maintenance team will be dispatched by the OSC to investigate.

T = 2:30

The operators isolate cold leg accumulators 2 & 4 and dumps the nitrogen from 1 & 3 to containment.

T = 2:40

Containment phase B isolation and containment spray initiates on high containment pressure of 2.81 psig. RCP's 2 and 4 are tripped by the operators. Natural circulation is established and cooldown is continued using SG atmospheric relief valves.

T = 02:45

A crack has opened in the pipe reducer bimetallic weld in the 1B ERCW main supply header on elevation 690'. Water is spraying local equipment.

T = 03:00

The RCS leak continues to increase. The ERCW is isolated in accordance with AOI-13, Section B, part II. Due to lack of cooling water on the "B" train equipment the CCP and SI pumps are locked out until needed to prevent damage. A GENERAL EMERGENCY is declared due to a LOCA in progress beyond the capacity of makeup pumps and/or degradation of ECCS upon loss of ERCW. Plant cooldown, with atmospheric reliefs from SG's #3 and 4, continues at a rate within the capacity of the AFW system to maintain level in the SG's.

T = 3:05

The Positive Displacement (PD) Charging Pump is placed in service.

T = 03:15

CS pump 1B-B is stopped by the operator when containment pressure is less than 1.54 psig. The main feedwater isolation is manually reset.

T = 03:30

A rupture has occurred in the containment purge duct work gasket in the elevation 690' penetration room. This has breached containment allowing the containment atmosphere to vent to the auxiliary building through door A62. Auxiliary building ARM's, CAM's and ventilation monitors begin to alarm.

T = 03:50

A cold leg accumulator is realigned by the operator for makeup when needed.

T = 03:55

Containment Spray pump 1B-B is started by the operator due to increasing containment pressure.

T = 04:00

Assessment of plant conditions indicate that significant failed fuel will occur in several hours if makeup to the reactor cannot be reestablished.

T = 4:05

CS pump 1B-B is stopped by the operator.

T = 04:30

Electrical maintenance reports breaker 1718 compartment and bus damage is not as extensive as first feared but will still take several hours to repair.

T = 05:00

Radiation levels outside containment continue to increase.

T = 06:00

Maintenance teams continue working on shutdown board 1A-A repair. Containment pressure has stabilized as A cold leg accumulator is being used intermittently to maintain pressurizer level.

T = 07:00

Containment pressure begins to slowly increase again.

T = 07:10

"Condensate storage tank A level abnormal" alarm is received on panel M-15.

T = 07:20

CS pump 1B-B is started by the operator.

T = 07:40

The RWST level has decreased to ≈ 8%. The operator stops CS pump 1B-B and realigns its suction to the containment sump then restarts the pump although there is no ERCW supply to the containment spray heat exchanger.

T = 08:00

The 6.9 KV Shutdown Board 1A-A is repaired and reenergized. This returns "A" train ECCS equipment to operable status.

T = 08:05

CS pump 1B-B is stopped by the operators, the phase B isolation signal is reset, and RHR pump 1A-A is being aligned to the shutdown cooling mode.

T = 08:10

RHR pump 1A-A is returned to service and pumping in the shutdown cooling mode on hot leg #4.

T = 08:15

CCP 1A-A is returned to service and the PD pump is stopped.

T = 08:30

The pressurizer level has been returned to normal. RHRS has been placed in the shutdown cooling mode. Containment pressure is reduced and maintenance may repair the ruptured duct.

T = 09:00

The release from containment has been stopped.

- TERMINATE EXERCISE -

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