NRC Form 366
(9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/88

LICENSEE EVENT REPORT (LER)

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Sequoyah, Unit 2	0 5 0 0 0 3 2 8	1 OF 0 7

TITLE (4)
Single Failure Criteria Not Being Considered Completely In The Initial System Design Results In Inoperability Of Both Trains Of Emergency Gas Treatment System (EGTS)

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES	DOCKET NUMBER(S)
0 8	0 2	8 8	8 8	— 0 3 2	— 0 1	1 0	1 4	8 8	Sequoyah Unit 1	0 5 0 0 0
										0 5 0 0 0

OPERATING MODE (9)	1	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
POWER LEVEL (10)	0 9 5	20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)
		20.405(a)(1)(i)	50.36(c)(1)	50.73(a)(2)(v)	73.71(c)
		20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	OTHER (Specify in Abstract below and in Text, NRC Form 366A)
		20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	
		20.405(a)(1)(iv) XX	50.73(a)(2)(ii)	50.73(a)(2)(viii)(B)	
		20.405(a)(1)(v)	50.73(a)(2)(iii)	50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
K. W. Fenn, Plant Operations Review Staff	AREA CODE 6 1 5 — 8 7 0 - 6 5 1 1

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	

SUPPLEMENTAL REPORT EXPECTED (14)

		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE)	XX NO				

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

This report is being revised to provide updated details on the long-term corrective action.

On August 2, 1988 with unit 2 in mode 1 and unit 1 in mode 5, both trains of the unit shared, Emergency Gas Treatment System (EGTS) were declared inoperable because of an incomplete system design. It was discovered during a design review of the system that a single failure occurrence causing the discharge modulating damper in the automatic train to fail open prior to initiation of the system or prior to arming of the swapover logic, could preclude the system from performing it's design function. With this single failure condition present, the initiation of EGTS operation on an accident signal could result in an unmodulated open path of annulus air discharged to the environment. Design calculations have shown that with this condition present the Site Boundary whole body gamma dose could exceed the 10 CFR 100.11 limits of 25 Rem. The cause of this condition is attributed to a design oversight in that this specific scenario was not anticipated in the initial design. Immediate corrective actions were to declare both trains inoperable until compensatory measures were incorporated into procedures to take manual control of the EGTS trains. Both trains of EGTS were returned to operable status at approximately 2245 EDT on August 2, 1988. Long-term corrective actions planned are to modify the present pressure switch logic to preclude any single failure occurrence on the discharge damper arrangement.

To prevent recurrence, present design procedures which were not in place during the initial design of EGTS, require encompassing plural reviews and established technical checkpoints to be evaluated on new design changes.

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TEXT (If more space is required, use additional NRC Form 366A's) (17)

DESCRIPTION OF EVENT

This report is being revised to provide updated details concerning the long-term corrective action.

At approximately 1815 EDT on August 2, 1988 with unit 2 in mode 1 (95 percent power, 2235 psig, 576 degrees F) and unit 1 in mode 5 (0 percent power, 0 psig, 112 degrees F), both trains of Emergency Gas Treatment System (EGTS) EIIS code BH) were declared inoperable because it was discovered that the system may not have met the plant design bases when assuming a single failure as required by 10 CFR 50 Appendix A. The EGTS is a common system serving both units 1 and 2. During a revision of an instrument accuracy calculation for EGTS pressure sensing instruments, design engineers were reviewing the operational logic of the EGTS - Air Cleanup Subsystem discharge modulating dampers, PCO-65-80 (Train A) and -82 (Train B). These dampers are in the EGTS - Air Cleanup Subsystem discharge ductwork to the Containment Shield Building exhaust stack. Redundant ductwork and dampers are provided for each unit (see sketch on attachment 1). These dampers are modulated by a differential pressure (DP) controller (PDIC-65-80, -82, respectively) to maintain the containment building annulus pressure below atmospheric (-0.5 inches water) during a Loss of Coolant Accident (LOCA). This function is accomplished by the EGTS fans taking suction from the annulus and regulating the discharge flow out the Shield Building exhaust stack (PCO-65-80,-82) or recirculating airflow back to the lower extremities of the annulus (PCO-65-88,-89). During normal plant operations, the annulus is maintained at approximately - 5.0 inches water by way of the annulus Vacuum Control fans. Upon initiation of the EGTS operation on a Phase A Containment Isolation, the normal line-up is for one train of the EGTS discharge ductwork to be in automatic operation and the other train to be in a standby state in which it can be put into operation in the event of a failure in the automatic train.

Automatic operation of the discharge ductwork components involves the modulating dampers being controlled by the DP controller and the downstream isolation valves being open allowing discharge airflow to be directed out the Shield Building stack or recirculated back to the lower annulus. The redundant train in the standby state involves the modulating dampers being controlled by redundant DP instrumentation similar to the automatic train, but the downstream isolation valves are closed in order to isolate airflow via these paths. Bistable modules associated with the DP instrumentation are utilized to detect a failure in the operating train when annulus pressures exceed a deadband around the setpoint (-0.5 inches water). If a failure occurs, the intent of the design is for the bistable logic to cause the isolation valves in the operating train to close and the isolation valves in the standby train to open, hence transferring automatic control to the standby train. The bistable logic is comprised of four setpoints, two of which are used as arming signals (-4.0 and -0.7 inches water) and the other two setpoints (-0.2 and -1.2 inches water) comprise the deadband around setpoint of -0.5 inches water which if exceeded, is indicative of a failure. The arming bistables are such that once actuated, they are sealed into the logic unless manually reset by a local handswitch. The -4.0 inches water setpoint is armed during normal operation when the annulus DP is being controlled at -5.0 inches.

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The -0.7 inches water setpoint is armed when the EGTS operation is initiated and the annulus DP transients through the -0.7 inches water setpoint to the -0.5 inches water control point. Once the annulus DP is being controlled at -0.5 inches, a failure which causes the DP to exceed the deadband, will cause either the -0.2 or the -1.2 bistable to actuate and transfer automatic control to the standby train.

However, it was discovered that if a single failure occurred in the operating train at the time of a initiating accident or any point prior to the annulus DP reaching the -0.7 inches water arming setpoint, such that the modulating damper to the shield building stack failed open, the bistable logic would not allow automatic swapover to the standby train. If this failure occurred as described, the annulus DP would not reduce to the -0.5 inches water control point as designed, but would continue to discharge full flow (rated at 4000 CFM) out the shield building exhaust stack. With this condition present, preliminary results from Quality Information Release (QIR) NTBSQN8[illegible]222 indicate that the site boundary whole body gamma dose could exceed the 10 CFR 100.11 limits of 25 Rem. The results of this QIR show that because of this failure condition, the site boundary whole body gamma dose rate could possibly reach 27.3 Rem approximately two hours after initiation of a Loss of Coolant Accident (LOCA).

CAUSE OF EVENT

The cause of the condition described in this report is attributed to an oversight during the initial design phase of this system. The initial system design did consider single failure criteria and the logic was designed to preclude a single failure once the system operation is initiated and the annulus pressure reached the -0.7 inches water arming setpoint. However, because of a design oversight, the system logic did not include the necessary design to preclude a specific failure of the modulating damper in the open position prior to the initiation of the system on an accident condition or prior to the annulus pressure reaching the control point of the DP instrumentation. This specific scenario was not anticipated in the initial design process for EGTS.

ANALYSIS OF EVENT

This event is being reported in accordance with 10 CFR 50.73, paragraph a.2.ii, as a condition that resulted in the nuclear power plant being in a condition that is outside the design basis of the plant. A notification by phone was made to the Nuclear Regulatory Commission (NRC) within one hour from the time of discovery in accordance with 10 CFR 50.72, paragraph b.1.ii.

With the condition as described in this report, the EGTS system design created the potential of the plant exceeding the 10 CFR 100.11 site boundary whole body gamma dose limit of 25 Rem, approximately two hours after initiation of a LOCA.

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The design basis for the EGTS are (1) to keep the pressure in each Shield Building annulus below atmospheric at all times in which the integrity of that particular containment is required and (2) to reduce the concentration of radioactive nuclides in the annulus that is released to the environment during a LOCA, to levels sufficiently low to keep the site boundary dose rate below the 10 CFR 100.11 guidelines.

The first design basis is accomplished by way of the two EGTS subsystems (Annulus Vacuum Control and Air Cleanup). The Annulus Vacuum Control Subsystem maintains the annulus at -5.0 inches water during normal operations in which containment integrity is required (modes 1-4). The annulus pressure is controlled by drawing air from the annulus and discharging to the Auxiliary Building Exhaust Duct System. The volume of air drawn from the annulus is controlled by DP instrumentation to maintain the pressure control point. This subsystem is shutdown and isolated during an accident condition. During a LOCA, the Air Cleanup Subsystem operation is initiated to maintain the annulus at a -0.5 inches water control point. The swapover from annulus Vacuum Control Subsystem to Air Cleanup Subsystem is initiated automatically upon receipt of a Phase A Containment Isolation signal and the common system is aligned to the accident unit. To accomplish the second design basis, during a LOCA the Air Cleanup Subsystem also removes radioactive airborne particulates and vapors in the annulus air by processing this air through a series of filters and adsorbers.

With the condition described, the first design basis of maintaining the annulus below atmospheric pressure would have still been accomplished. However, the second design basis of ensuring the site boundary dose rate limits are maintained below limits was not ensured by the system design. The same QIR as referenced earlier in this report also indicates that the 10 CFR 100.11 offsite whole body gamma dose limit for the low population zone would not be exceeded. The 10 CFR 100.11 low population zone whole body limit is 25 Rem and calculations show that assuming the equipment failure as described in this report, the actual dose would be approximately 4.4 Rem.

CORRECTIVE ACTION

Immediate corrective actions were to declare both trains of EGTS inoperable at 1815 EDT on August 2, 1988. The TS Limiting Condition for Operation (LCO) 3.6.1.8 requires both trains of EGTS to be operable in modes 1-4 and the action statement does not give provisions for both trains of EGTS being inoperable. Since unit 2 was in mode 1 at the time of this discovery, unit 2 complied with the action of LCO 3.0.3. Since unit 1 was in mode 5, no immediate action was required on unit 1.

Other immediate corrective actions initiated to reestablish the system to operable status were to establish compensatory measures which would ensure proper EGTS operation regardless of a single failure occurrence. This was accomplished by revising Emergency Instruction E-1, "Loss of Reactor or Secondary Coolant" and Function Restoration Guideline, FR.1, "Response To High Containment Pressure". These procedures were revised to perform operational actions to manually swapover to the standby train after 30 minutes only if the standby DP controller is producing full output.

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The standby DP controller producing full output would be indicative of a failure (i.e., (1) either the annulus pressure is actually continuing to produce a more negative pressure beyond the -0.5 inches water control point and the controller is trying the compensate by closing the modulating damper or (2) the standby controller has failed). When the control swapover occurs, it would not necessarily be known which train has experienced a failure.

Swapping to the standby train involves closing the automatic path isolation damper and opening the standby path isolation damper to allow pressure control via the standby train. If the failure had occurred in the the train which was initially in the automatic mode, then the annulus pressure would have actually been in a transient to a more negative pressure and swapping to the standby train would allow the annulus pressure to be controlled back to the -0.5 inches water control point by the standby controller arrangement. If the failure had occurred in the standby controller, then the annulus pressure would have already reached the -0.5 inches water control point under the control of the automatic train and swapping to the standby train would cause the annulus pressure to experience a transient to a more negative pressure through the failure indicating setpoint (-1.2 inches water). When the annulus pressure reached the -1.2 inches water setpoint, the system would automatically swap back to the initial operating train. These procedure changes were approved and the EGTS returned to operable status at approximately 2245 EDT on August 2, 1988. The LCO 3.0.3 action was exited on unit 2 when the EGTS was returned to service.

A generic review was also performed by reviewing the design logic of other similar two train systems (i.e., Auxiliary Building Gas Treatment, Control Room Emergency Ventilation System, and various Heating, Ventilating and Air Conditioning (HVAC) systems), to ensure no other similar design conditions existed. No other systems were found with a logic scheme resembling the EGTS swapover logic and no other conditions were found that would preclude proper systems operation upon a single failure occurrence.

To help prevent recurrence of this event and other conditions involving design which did not sufficiently anticipate problems in the initial design phase, engineering procedures have been implemented to ensure encompassing plural reviews are performed and established technical checkpoints are evaluated on all design changes. Nuclear Engineering Procedure (NEP)-5.2 "Review", was established in July, 1986 and Electrical Engineering Branch (EEB) Procedures Method (PM)-87-27, "Delegation of Signature Authority and Conduct of Specialist Reviews" was established in June, 1987 to implement these type of technical reviews.

As long-term corrective action to preclude the deficiency described in this report, the Sequoyah Electrical Engineering Branch (EEB) is evaluating a hardware modification to replace the existing pressure bistable arming logic. Initial design review indicates that this design change will involve replacing the existing pressure bistable arming signals (-4.0 and -0.7 inches water) with time delay circuitry, such that the standby train will be automatically armed after a predetermined time of operation. This time delay will ensure that upon initiation of the air cleanup system on an accident signal, there will be sufficient time to reduce the annulus DP to -0.5 inches water before arming the standby train.

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Once the standby train is armed, any deviation of the annulus DP outside the setpoint deadband (-0.2 and -1.2 inches water), which would be indicative of a failure in the operating train, would cause automatic swapover to the standby train. The design documentation for this modification will be issued by December 19, 1988 for unit 2 and February 16, 1989 for unit 1. The field implementation is anticipated to be complete on both units by March 24, 1989, as scheduled under Condition Adverse to Quality Report (CAQR) SQP880445.

ADDITIONAL INFORMATION

There have been no previous occurrences of any condition relating to inadequate design of the EGTS. There have been two previous occurrences of conditions affecting both trains of EGTS:

1. SQRO-50-327/87031 - relating to incomplete testing of the filter banks
2. SQRO-50-327/86033 - relating to a lack of seismic qualification of the charcoal filter trays.

There have been 18 previous occurrences relating to inadequate or incomplete system designs: SQRO-50-327/86057, 87001, 87003, 87020, 87028, 87033, 87039, 87044, 87045, 87049, 87066, 87072, 87073, 87077, 88004, 88020; SQRO-50-328/87003,88001

COMMITMENTS

1. Sequoyah Electrical Engineering Branch (EEB) will issue design documentation for modification of the EGTS pressure switches arming logic by December 19, 1988 for unit 2 and February 16, 1989 for unit 1.

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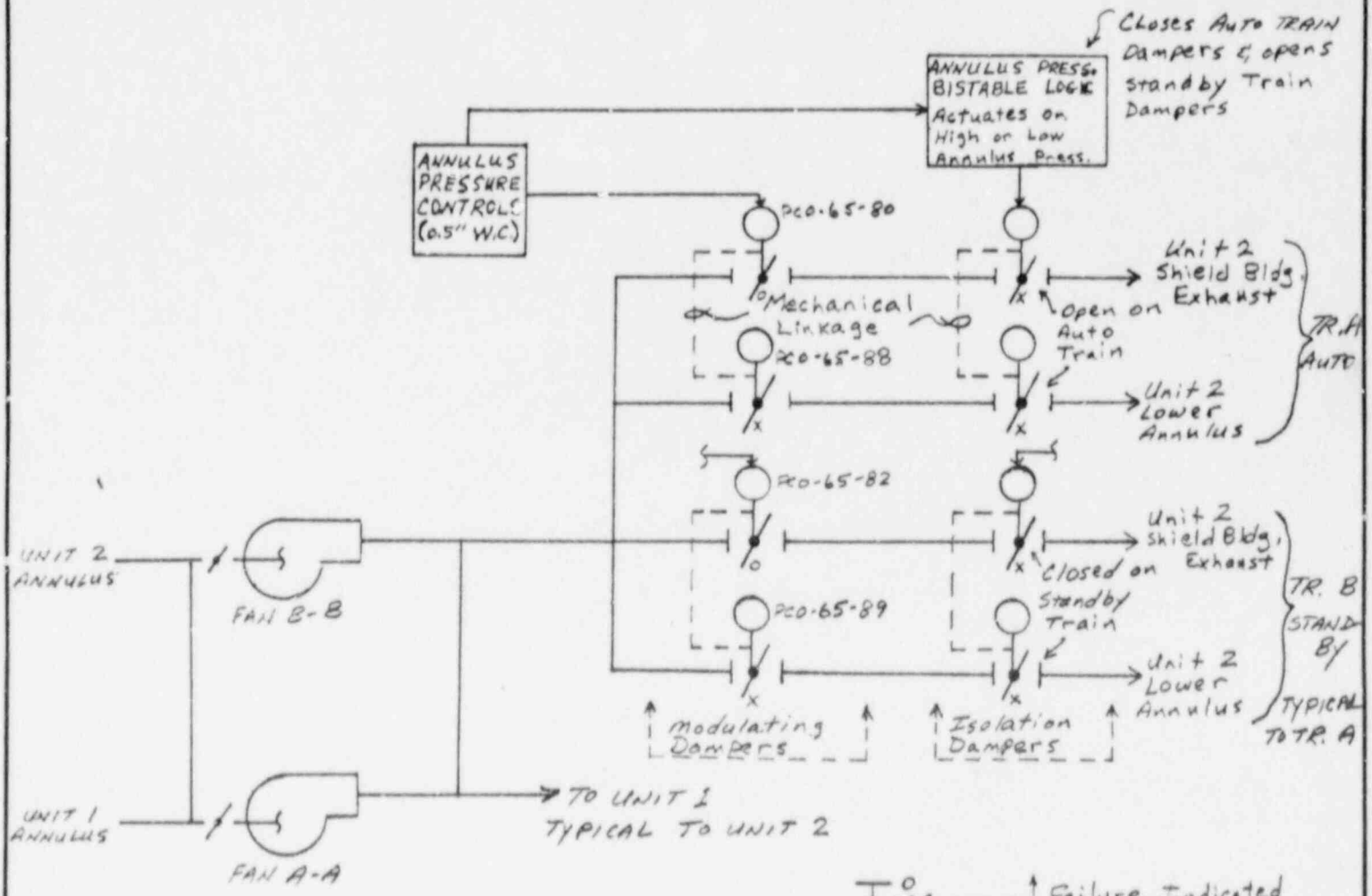

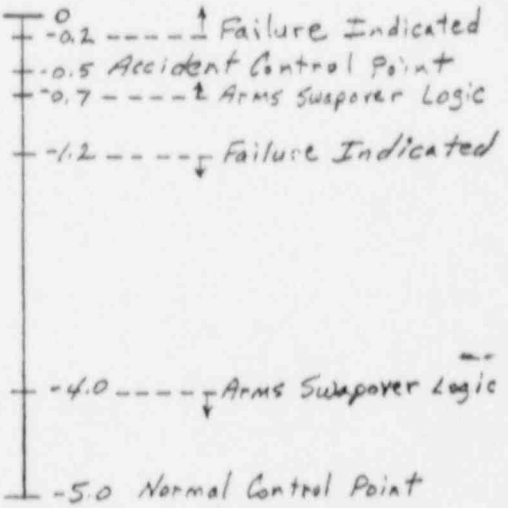

ATTACHMENT 1

EMERGENCY GAS TREATMENT SYSTEM (EGTS)

AIR CLEANUP SUBSYSTEM

BISTABLE LOGIC SETPOINTS

TENNESSEE VALLEY AUTHORITY
Sequoyah Nulcear Plant
Post Office Box 2000
Soddy-Daisy, Tennessee 37379

October 14, 1988

U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Gentlemen:

TENNESSEE VALLEY AUTHORITY - SEQUOYAH NUCLEAR PLANT UNIT 2 - DOCKET NO. 50-328 - FACILITY OPERATING LICENSE DPR-79 - REPORTABLE OCCURRENCE REPORT SQRO-50-328/88032 REVISION 1

The enclosed licensee event report is being revised to provide updated details concerning long-term corrective actions. This event was originally reported in accordance with 10 CFR 50.73, paragraph a.2.ii, on August 25, 1988.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

S. J. Smith
Plant Manager

Enclosure
cc (Enclosure):

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