TENNESSEE VALLEY AUTHORITY

6N 38A Lookout Place
October 23, 1989

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Gentlemen:

TENNESSEE VALLEY AUTHORITY - SEQUOYAH NUCLEAR PLANT UNIT 2 - DOCKET NO. 50-328 - FACILITY OPERATING LICENSE DPR-79 - LICENSEE EVENT REPORT (LER) 50-328/89011, REVISION 1

The enclosed LER revision provides further details of an event wherein two radiation monitors were inoperable because of inadequate source check performance. This event was originally reported in accordance with 10 CFR 50.73, paragraph a.2.i.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

J. R. Bynum, Vice President
Nuclear Power Production

Enclosure
cc (Enclosure):
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NRC FORM 366 (6-89)

U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

APPROVED OMB NO. 3150-0104
EXPIRES: 4/30/92

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Sequoyah Nuclear Plant, Unit 2	0 5 0 0 0 3 2 8	1 OF 0 8

TITLE (4)

RE-90-119 radiation monitors inoperable because of inadequate source check performance.

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 5 0 0 0
0 8	2 3	8 9	8 9	—	0 1 1	—	0 1	1 0	2 3	8 9		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)	1 0 0	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)	XX 50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	
		20.405(a)(1)(iv)	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
	AREA CODE
C. A. Hipp, Compliance Licensing Engineer	6 1 5 8 4 3 - 7 7 6 6

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 LER is being revised to provide further details of the event.

On August 23, 1989, with Units 1 and 2 in Mode 1 at 100 percent power, 2,235 pounds per square inch gauge, 578 degrees Fahrenheit, it was discovered that a technical specification (TS) surveillance requirement (SR) to source check the radioactive gaseous effluent monitors on the condenser vacuum pump exhaust was not being fully met. A source check is defined in the SQN TS as a qualitative assessment of channel response when the channel sensor is exposed to a radioactive source. The subject monitors use a light-emitting diode (LED) light source to source check all components except the scintillation crystal. Additionally, the source check method used for other gaseous effluent radiation monitors that expose a second, nonprocess scintillation crystal to a radioactive source during source checking has been investigated and determined to be adequate. The root cause of this event has been attributed to a previous lack of emphasis on recognition of the literal requirements of the TS definition of source check. As interim corrective action, the two monitors with LEDs were source checked with a radioactive source to demonstrate their operability. The surveillance instruction has been revised to require a radioactive source to be used for source checking these two monitors. The TS changes specified in Generic Letter 89-01 will remove the effluent specifications from the TS and place them in the Offsite Dose Calculation Manual.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Sequoyah Nuclear Plant, Unit 2	0 5 0 0 0 3 2 8	8 9	— 0 1 1	— 0 1	0 2 OF 0 8

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

DESCRIPTION OF EVENT

This LER is being revised to provide further details of the event.

On August 23, 1989, with Units 1 and 2 in Mode 1, at 100 percent power, 2,235 pounds per square inch gauge, 578 degrees Fahrenheit, it was discovered, as the result of a technical specification (TS) review conducted at Watts Bar Nuclear Plant comparing installed equipment with TS requirements, that a SQN surveillance requirement (SR) was not being fully met. SR 4.3.3.10 requires, in part, a monthly source check on Radioactive Gaseous Effluent Monitors (EIIS Code IL) 1-RE-90-119 and 2-RE-90-119, which monitor the condenser vacuum pump exhaust on Units 1 and 2, respectively. A source check is defined in TS, Section 1.32, as a qualitative assessment of channel response when the channel sensor is exposed to a radioactive source. The radiation monitors listed in TS 3.3.3.10 all use a radioactive source for performing source checks with the exception of the two RE-90-119 monitors, which use a light-emitting diode (LED) light source to simulate a radioactive source. The LED light source is supplied by the monitor's manufacturer and is discussed in the associated vendor manual. The LED light source checks the electronic circuits in the monitor but does not check the scintillator. However, if the scintillator were to fail, a "downscale failure" would annunciate in the main control room (MCR). Sections of TS other than Section 3.3.3.10 were investigated to ensure other source check SRs were being met. The monitors requiring a source check by TS 3.3.3.9 use a radioactive source, and the monitors listed in TSs 3.3.2, 3.3.3.1, and 3.3.3.7 do not require source check performance. Thus, LED usage is limited to the two RE-90-119 monitors. The shift operations supervisor was notified of the event on August 25, 1989, and the action statements of Limiting Condition for Operation (LCO) 3.3.3.10 were entered at 1743 on Unit 2 because Monitor 2-RE-90-99 was also out of service. The LCO was not entered on Unit 1 because Monitor 1-RE-90-99 was in service, and LCO 3.3.3.10 requires a minimum of one operable monitor channel on the condenser vacuum pump exhaust. Subsequently, instrument mechanics used a radioactive source to source check Monitor 2-RE-90-119 on August 26, 1989, and the action statements of LCO 3.3.3.10 were exited at 1008. Instrument mechanics also used a radioactive source to source check Monitor 1-RE-90-119 on August 28, 1989.

During the course of the investigation of this event, it was determined that the gaseous effluent radiation monitors listed below are source checked in accordance with surveillance requirements with a radioactive source as installed by their manufacturer. However, this radioactive source is exposed to a second scintillator, which is installed only for source checking and not exposed to the main scintillator utilized in the monitoring of the process effluent. Since the response of the process scintillator is, therefore, not checked by this method, the adequacy of the source check for these monitors relative to the intent of the TS was questioned. The monitors involved are:

1. 1-RE-90-99 - Unit 1, condenser vacuum pump exhaust monitor (intermediate range)
2. 2-RE-90-99 - Unit 2, condenser vacuum pump exhaust monitor (intermediate range)
3. 1-RE-90-100B - Unit 1, shield building vent monitor
4. 2-RE-90-100B - Unit 2, shield building vent monitor
5. 0-RE-90-101B - Auxiliary building vent monitor
6. 0-RE-90-118 - Waste disposal system gas effluent monitor
7. 0-RE-90-132B - Service building vent monitor

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Sequoyah Nuclear Plant, Unit 2	0 5 0 0 0 3 2 8	8 9	— 0 1 1	— 0 1	0 3 OF 0 8

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

DESCRIPTION OF EVENT (Continued)

As a result of further investigation, it has been concluded that both the second scintillator method and pulsed LED method of source checking are acceptable from the standpoint of technical adequacy and meet the intent of the source check surveillance. It has been further concluded that a source check performed by the second scintillator method is in compliance with the TS definition of source check, but a source check performed by the pulsed LED method is not. Therefore, the scope of the event reported in this LER is limited to the two RE-90-119 monitors that use the pulsed LED source check method. The bases for these conclusions are summarized below.

I. Technical Adequacy

A limited survey of other nuclear plants and of radiation monitor vendors determined that three methods of performing source checks on noble gas radiation monitors have been supplied by vendors and are in use in the industry.

Method 1 - A gamma source positioned or aligned to the detector to excite the main scintillator upon initiating a source check signal.

Method 2 - A second scintillator mounted on the detector light pipe that is excited by a radioactive source upon initiating a source check signal (see attached simplified sketch).

Method 3 - A pulsed LED positioned at the light pipe that is energized upon initiating a source check signal. The LED gives off light pulses that simulate the light emitted by a scintillator exposed to a radioactive source (see attached simplified sketch).

Twenty-two nuclear plants were contacted during this survey with the following results: 4 plants use Method 1; 18 plants use Method 2; and 3 plants use Method 3 (some plants use more than one method). SQN is roughly consistent with the industry average. Of the nine noble gas radiation monitors at SQN that require source checks by TS, seven use a second scintillator (Method 2) and two use a pulsed LED (Method 3).

In addition to the survey, an evaluation of SQN source check method adequacy was also performed. It was determined that source check Methods 2 and 3 do not degrade the qualitative assessment of the channel response and are therefore acceptable from the standpoint of technical adequacy. A brief summary of the evaluation follows.

DESCRIPTION OF EVENT (Continued)

Method 2 - Second Scintillator

The second scintillator method checks the plastic window, light pipe, photomultiplier tube, preamplifier, and subsequent signal processing circuitry. These components constitute the detector assembly that is considered to be the "channel sensor" as used in the TS definition of source check. Source checking these components without checking the main scintillator is technically adequate for channel response/sensor integrity because the scintillator is simply material that employs a natural phenomenon to change radioactivity to light and does not have a credible failure mechanism that would be detected by a source check. Should the scintillator become detached from the plastic window, the radiation monitor would initiate a main control room instrument malfunction alarm as a result of the downscale count rate failure circuitry. This downscale circuitry is required to be tested by TSs and is currently being tested monthly. In addition, the detector is checked quantitatively once every 18 months using a radioactive source adjacent to the main scintillator.

Method 3 - Pulsed LED

The use of light from LED to trigger the photomultiplier tube rather than the light induced by radioactivity passing through the scintillator is technically adequate by the same reasoning used for the second scintillator method. The two methods are functionally equivalent. American National Standards Institute (ANSI) N323-1978, Section 5.4, states that check sources should provide radiation of the same type or types as provided by those sources used in instrument calibration. However, check sources may provide radiation different from that used in calibration if: (1) The source instrument geometry is well understood and easily reproduced, or (2) the instrument response to this radiation is well understood and is not critically dependent on instrument adjustment. (For example, the use of a photon source to check instruments sensitive to beta radiation may be acceptable; the use of a photon source to check a detector utilizing BF3 response to neutrons is not acceptable.)

II. Intent of Source Check Surveillance

The intent of the source check is to provide a quick and simple indication that the radiation monitor is functioning. This check is performed frequently during the interval between calibration checks. Use of the source check mechanism installed by the monitor vendor (be it a built-in radioactive source exposed to the main scintillator or a second scintillator, or a pulsed LED light source) meets the intent of a quick and simple indication. When coupled with the observation that the monitor is measuring at least normal background radioactivity, a source check accomplished by any of the three methods listed above gives reasonable assurance that the monitor is functioning. The absence of any background radioactivity detection would result in an instrument malfunction alarm in the main control room.

DESCRIPTION OF EVENT (Continued)

Conversely, the source check intent of a quick and simple indication would not be achieved by the process required to expose the main scintillator to a radioactive source in the subject monitors at SQN. The heavy lead shield would have to be disassembled before the detector assembly could be removed. Removing the detector assembly requires bending and flexing of the high voltage and signal cables. Each time the detector cable assembly is removed, the risk of wire damage as a result of flexing would increase. Additionally, removing the detector assembly increases the probability of degrading the detector itself by subjecting the assembly to external factors such as: tearing the aluminum foil light shield in front of the detector; dropping or hitting the detector assembly, which could damage the photomultiplier tube; and separating the optical coupling between the light pipe and the photomultiplier tube. For these reasons, the process required to expose the main scintillator of the subject radiation monitors to a radioactive source for frequent source checking is considered to represent an increased threat to monitor reliability and is not considered consistent with the intent of the source check surveillance.

III. Compliance with TS

As stated previously, it has been concluded that a source check performed by the second scintillator method (Method 2) is in compliance with the TS definition of source check. The reasoning supporting this conclusion is that the detector assembly (made up of the main and secondary scintillators, plastic window, light pipe, photomultiplier tube, and preamplifier) is considered to be the channel sensor, and the detector assembly is exposed to a radioactive source during source checking as specified in the TS definition of source check. Therefore, no operation prohibited by TSs is considered to have occurred with respect to the dual scintillator radiation monitors, and these monitors are not included in the event addressed in the remainder of this LER. It should perhaps be noted that question of dual scintillator monitor compliance with the TS definition of source check would become moot when the TS changes specified in Generic Letter 89-01 addressing radioactive effluent TSs are implemented as discussed in the corrective action section for the monitors using the pulsed LED source check method.

As stated previously, it has also been concluded that a source check performed by the pulsed LED light source method (Method 3), while acceptable from the standpoint of technical adequacy, is not in literal compliance with the TS definition of source check because no radioactive source is used.

CAUSE OF EVENT

The root cause of this event has been attributed to a lack of emphasis on "literal compliance" with TSs during the initial evaluation of installed plant radiation monitors and development of Surveillance Instruction (SI) 3, "Daily, Weekly, and Monthly Logs," which controls source checks and radiation monitors.

A contributing cause is the nature of the radiation monitor check source design supplied by the manufacturer in the radiation monitor was equipped with an LED check source. Additionally, it is believed that the TS definition is overly restrictive (i.e., alternate methods have been developed that are technically equivalent)

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Sequoyah Nuclear Plant, Unit 2	0 5 0 0 0 3 2 8	8 9	— 0 1 1	— 0 1	0 6 OF 0 8

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

ANALYSIS OF EVENT

This event is being reported in accordance with 10 CFR 50.73, paragraph a.2.i, as an operation prohibited by TS in that the source checks to demonstrate the two RE-90-119 monitors operable were not consistent with the TS definition of source check. Although the "normal range" RE-90-119 monitors are backed up by "intermediate range" RE-90-99 monitors and LCO 3.3.3.10 requires a minimum of only one operable monitor channel on each unit's condenser vacuum pump exhaust, the event is reportable because, at the time of discovery, the 2-RE-90-99 monitor was out of service. In light of the RE-90-119 source check inadequacy, both the RE-90-99 and RE-90-119 monitors would likely have been considered inoperable at various time in the past, whenever the RE-90-99 monitors were out of service, such as for periodic calibration.

Continuous monitoring process and effluent radiological monitoring instrumentation is described in Section 11.4.2 of the Updated Final Safety Analysis Report (UFSAR); Section 11.4.2.2.2 of the UFSAR describes the RE-90-99 and RE-90-119 monitors specifically. These monitors continuously sample the condenser vacuum pump exhaust to monitor noble gas concentrations for indications of primary to secondary leakage and for evaluations of radioactivity released into the environment. The potential result of both the RE-90-99 and RE-90-119 monitors being inoperable would be a path for radiological release to the environment monitored for noble gas activity only by the "accident-range" Monitors RE-90-255, RE-90-256, and RE-90-404, also discussed in UFSAR, Section 11.4.2.2.2. However, the two RE-90-119 monitors were regularly source checked with an LED light source, as intended by the manufacturer, verifying the proper operation of all components except the scintillation crystal. Further, a failure of the scintillation crystal would have been annunciated in the MCR. Therefore, although the RE-90-119 monitors were technically inoperable, they were able to perform their design function and presented no risk to the health and safety of plant personnel or the general public.

CORRECTIVE ACTION

As interim corrective action, the RE-90-119 monitors were source checked with a radioactive source to demonstrate their operability. The action statements of LOC 3.3.3.10 were observed until operability of the two monitors was demonstrated. In addition, SI-3, the SI controlling source checks on radiation monitors, has been revised to require a radioactive source to be used for source checking the RE-90-119 monitors.

Corrective action to address the lack of emphasis on "literal compliance" with TSs during the initial evaluation of installed plant radiation monitors and development of SI-3 is not required because of improvements made to evaluation processes since initial plant licensing. Present site procedures, such as Nuclear Engineering Procedure 6.6, "10CFR50.59 Safety Evaluations," involving the installation of equipment require a thorough UFSAR and TS review prior to issuance of a design package. This process would identify discrepancies similar to those encountered in this event.

As long-term corrective action, SQN is in the process of preparing the TS changes specified in Generic Letter 89-01. These changes will move the effluent specifications from TSs to the Offsite Dose Calculation Manual, which will relieve the potential for TS noncompliance resulting from the use of the pulsed LED source check method.

FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Sequoyah Nuclear Plant, Unit 2	0 5 0 0 0 3 2 8	8 9	— 0 1 1	— 0 1	0 7 OF 0 8

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

ADDITIONAL INFORMATION

No previous events could be identified that reported a failure to perform source checks on radiation monitors.

COMMITMENTS

None.

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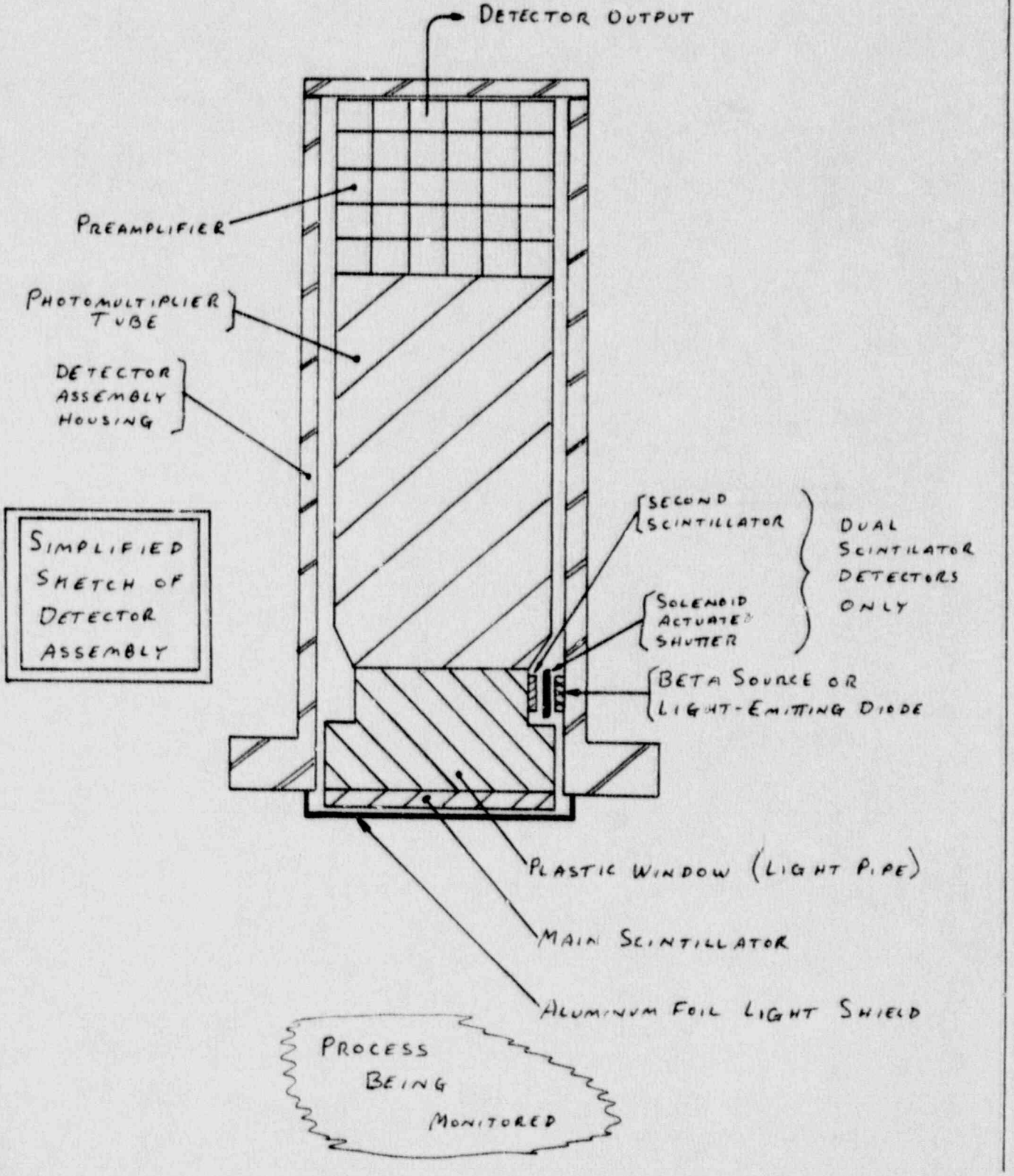
FACILITY NAME (1)	DOCKET NUMBER (2)	LER NUMBER (6)			PAGE (3)
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	
Sequoyah Nuclear Plant, Unit 2	0 5 0 0 0 3 2 8	8 9	— 0 1 1	— 0 1	0 8 OF 0 8

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



SIMPLIFIED SKETCH OF DETECTOR ASSEMBLY