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U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO. 3150-0104 EXPIRES: 8/31/88

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### DESCRIPTION OF EVENT

NRC Form 366% .

On April 1, 1989, at 0246 EST, with unit 1 in mode 1 (100-percent power, 2235 psig and 578 degrees F) and unit 2 in mode 5 (0-percent power, 350 psig, and 180 degrees F), power was removed from a vital instrument board resulting in a containment ventilation isolation (CVI) signal (EIIS Code JM) and the momentary loss of residual heat removal (RHR) (EIIS Code BP) flow.

On April 1, 1989, at 0150 EST, Operations personnel noted an unusual odor adjacent to the 120V AC Class IE vital inverter 2-IV (EIIS Code EF). Initial investigation found a capacitor smoking, and the unit 1 senior reactor operator (SRO) was immediately notified of the situation. The situation was evaluated by Operations personnel in the main control room (MCR), and the SRO was directed to transfer the power supply for the 120V AC vital instrument power board 2-IV (EIIS Code EF) from the inverter (normal power supply) to the alternate/maintenance power supply in accordance with System Operating Instruction (SOI)-250, "Low Voltage AC/DC Electrical Systems." The alternate power supply for board 2-IV is 120V AC instrument power distribution panel 2B (EIIS Code EE). When attempting the transfer, the SRO discovered the inverter output frequency would not sychronize with the distribution toard 2B output frequency by the absence of a 'sync' light on vital board 2-IV. The AC input breaker to the inverter was opened, however, supplies would still not sychronize. The situation was discussed with Electrical Maintenance (EM) who recommended that the inverter be deenergized due to its condition and then reenergize the 120V AC vital instrument board 2-IV from the distribution panel 2B. Board 2-IV supplies power to various instrumentation process racks, therefore, Abnormal Operating Instruction (AOI)-25.8, "Loss of 120V AC Vital Instrument Power Board 2-IV," was reviewed for any potential effects on the operation of the unit. The AOI lists the major loads supplied by the board, however, the operators did not have adequate time, due to the deteriorating condition of the inverter, to determine all equipment that would be effected if the board was removed from service.

At 0246 EST, the inverter AC output breaker was opened to perform the transfer which resulted in a loss of power to board 2-IV. While attempting to deenergize the inverter, popping sounds from inside the inverter were heard and a significant amount of smoke began emitting from the inverter. Immediately, the DC power source supplying the inverter was removed. A fire alarm was called in to the MCR in anticipation of a fire with the possibility of polychlorinated biphenyls (PCB) filled capacitors. Subsequently, it was confirmed a PCB filled capacitor was not involved. At this point, the unit 1 SRO began steps to energize board 2-IV from panel 2B.

The shift operations supervisor (SOS) responded to the fire alarm by notifying Fire Operations and Nuclear Security. As a result of the loss of board 2-IV, unit 2 referenced AOI-25.8 and AOI-30, "Plant Fires." During the review of the MCR boards for loss of equipment, it was discovered that a CVI had occurred, and RHR suction valve 2-FCV-74-2 had closed which isolated RHR flow.

NRC Form 366A, (9-8.)	LICENSEE EVENT REPOR	E EVENT REPORT (LER) TEXT CONTINUATION				U.S. NUCLEAR REGULATORY COMMISSION APPROVED OMB NO 3150-0104			
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Unit 2 was operating with RHR train A in service prior to the event. Immediately, RHR train 2A pump was secured, and AOI-14, "Loss of RHR Shutdown Cooling," was referenced. A loss of reactor coolant system (RCS) (EIIS Code AB) normal letdown via the chemical and volume control system (CVCS) (EIIS Code CB) also occurred at the time of the event. The loss of board 2-IV also resulted in the deenergizing of a time delay drop-out (TDDO) type relay associated with the circuitry of radiation monitor (EIIS Code IL) (RM)-90-112. RM-90-106 and RM-90-112 are the containment lower and upper compartment air monitors, respectively. This deenergization simulated a high radiation signal from RM-90-112, causing a CVI to be actuated. At 0256 EST, vital board 2-IV was energized from distribution panel 2B. This allowed 2-FCV-74-2 to be opened, and RHR train A pump was started, reestablishing RHR flow for unit 2. At 0300 EST, RM-90-106 and 90-112 were returned to service and at 0323 EST, CVCS letdown was returned to service.

#### CAUSE OF EVENT

Sequoyah, Unit 2 TEXT (# more space is required, use additional NRC Form 366A's) (17)

> The root cause of this event was the inability to manually transfer the power supply for vital instrument board 2-IV from the normal supply to the alternate/maintenance supply without momentarily losing power to the board. This transfer could not be completed because the vital inverter output frequency would not sychronize with the alternate supply frequency. The distribution panel output breaker for the synchronization signal to the vital inverter is normally open to prevent system disturbancies on the distribution panel affecting solid state protection system (SSPS) channels.

> Vital instrument board 2-IV also supplies power to a plug mold which is the power supply for circuitry of RM-9C-112. The deenergization of this circuitry simulated a high radiation signal from RM-9O-112 via the deenergization of a TDDO type relay. This relay had been previously installed to prevent a CVI actuation from spurious voltage signal spikes. A high radiation signal from either RM-90-106 or RM-90-112 will cause the SSP3 (EIIS Code JG) to generate a train "A" and train "B" CVI actuation.

> Vital instrument board 2-IV also supplies power to several relay racks associated with SSPS, in particular relay rack 2-R-55. One of the relays on 2-R-55 (PB403BX) operates in conjunction with a pressure switch that monitors RCS pressure. The relay deenergizes when RCS pressure is greater than setpoint, resulting in 2-FCV-74-2 automatically closing. The loss of power to the vital instrument board simulated a high RCS pressure condition, allowing relay PB403BX to drop out. Consequently, the suction valve automatically closed, thereby isolating RHR flow. The RHR system at Sequoyah is designed with the two RCS suction valves in a series configuration.

The CVCS letdown isolation valve closed on loss of air when the nonessential air supply to containment was isolated when the solenoid valve for containment isolation valve 2-FCV-32-111 deenergized on loss of power to board 2-IV.

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LICENSEE EVENT	REPORT	(LER) TEXT	CONTINUATION
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U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO 3150-0104 EXPIRES: 8/31/88

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A contributing cause to this event was the failure to implement work request (WR)-B764099, which was written in July 1988 to identify a sychronization problem with vital inverters 2-III and 2-IV. The implementation of the WR had been attempted and rescheduled several times due to scheduling conflicts with SSPS channel calibration and surveillance testing.

Another contributing cause to this event was the unanticipated removal from service of vital inverter 2-IV because of blown large aluminum electrolytic type capacitors. Condition Adverse to Quality Report (CAQR)-SQP890222 was generated to address this issue. The capacitors are the original parts of the unit 2 inverter received in 1980.

# ANALYSIS OF EVENT

NRC Form 366A

This event is reported pursuant to 10 CFR 50.73, paragraph a.2.iv, as an engineered safety features (ESF) actuation and in accordance with paragraphs a.2.v (B) and a.2.vii (B) as a result of the loss of RHR capability.

Upon receipt of the CVI signal, all equipment functioned properly, as the supply and exhaust valves that allow air to pass in and out of containment for ventilation closed and RM sample valves closed. Since this was an inadvertent actuation of an ESF and no high radiation levels existed, there was no threat to plant personnel or to the general public.

Prompt operator action reestablished RHR flow within approximately 10 minutes of the initial isolation by opening 2-FCV-74-2 after power was reestablished to the vital board. There was no indicated change in RCS temperature during these 10 minutes. In the event the board could not have been returned to service, RHR flow could have been reestablished by an operator entering containment and, utilizing the valve handwheel, opening the valve manually.

#### CORRECTIVE ACTION

Operations personnel recovered from the incident in accordance with AOI-14, AOI-25.8, and AOI-30. Fire Operations and Nuclear Security were notified of the incident and the area was secured. To recover from the CVI, Operations personnel reopened the affected valves, restarted the RM pump, and reset the CVI signal.

As immediate corrective actions relevant to CAQR-SQP890222, large aluminum electrolytic capacitors were replaced in the unit 2 120V AC vital inverters. The sychronization for the unit 2 vital instrument board power supplies was confirmed during the capacitor replacement, eliminating the need to work WR-B764099. These type of capacitors were replaced in the unit 1 vital inverters in 1984, and Operations will perform by May 31, 1989, the appropriate portions of SOI-250 to verify the sychronization signal, necessary for inverter transfer, is present. The generic issue regarding failure of this type of capacitor is addressed in the CAQR.

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will be revised by June 30, 1989, to have sychronization verified between the inverter output frequency and the distribution board frequency after maintenance is performed involving replacement or adjustment of a oscillator or synchronization board in an inverter.

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The AOI-25 series will be evaluated by September 29, 1989, to determine if there is a need for a procedural enhancement as a result of this event.

# ADDITIONAL INFORMATION

Sequoyah, Unit 2

Vital inverters: Vendor - Solidstate Controls, Inc., Model No.SV12200/AC34R. Capacitor: Vendor - Computamite, Model No. 5400 microfarad, 200V DC, FAH7831-CDE812.

There has been one previously reported CVI resulting from a loss of power to a vital instrument board and one previously reported loss of RHR resulting from the closure of a RHR suction valve; SQR0-50-328/85004 and 50-327/82116, respectively.

### COMMITMENTS

- Maintenance Standard Practice (SQM)-66, "Post-Maintenance Testing," and Technical Instruction (TI)-76, "Electrical Maintenance Pre- And Post-Maintenance Testing," will be revised by June 30, 1989, to have sychronization verified between the inverter output frequency and the distribution board frequency after maintenance is performed involving replacement or adjustment of an oscillator or synchronization board in an inverter.
- 2. The AOI-25 series will be evaluated by September 29, 1989, to determine if there is a need for a procedural enhancement as a result of this event.
- Operations will perform by May 31, 1989, the appropriate portions of SOI-250 to verify the sychronization signal, necessary for inverter transfer, is present.

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# TENNESSEE VALLEY AUTHORITY

Sequoyah Nuclear Plant Post Office Box 2000 Soddy-Daisy, TN 37379

April 27, 1989

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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 - LICENSEE EVENT REPORT (LER) 328/89003

The enclosed licensee event report provides details concerning an engineered safety feature actuation and the momentary loss of residual heat removal when power was removed from a vital instrument power board. This event is reported in accordance with 10 CFR 50.73, paragraphs a.2.iv, a.2.v, and a.2.vii.

Very truly yours,

TENNESSEE VALLEY AUTHORITY

Plant Manager

Enclosure cc (Enclosure):

> J. Nelson Grace, Regional Administrator U. S. Nuclear Regulatory Commission Suite 2900 101 Marietta Street, NW Atlanta, Georgia 30323

Records Center Institute of Nuclear Power Operations Suite 1500 1100 Circle 75 Parkway Atlanta, Georgia 30339

NRC Inspector, Sequoyah Nuclear Plant