NON-PUBLIC?: N
ACCESSION #: 9109050155
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Grand Gulf Nuclear Station - Unit 1 PAGE: 1 OF 5

DOCKET NUMBER: 05000416

TITLE: Reactor Scram Upon Load Shed of Balance of Plant Equipment
EVENT DATE: 07/28/91 LER #: 91-007-00 REPORT DATE: 08/27/91

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:
50.73(a)(2)(iv), Other

LICENSEE CONTACT FOR THIS LER:
NAME: Bruce A. Burke / Licensing Engineer TELEPHONE: (601) 437-6333

COMPONENT FAILURE DESCRIPTION:
CAUSE: SYSTEM: COMPONENT: MANUFACTURER:
REPORTABLE NPRDS:

SUPPLEMENTAL REPORT EXPECTED: No

ABSTRACT:

A load shed of balance of plant (BOP) equipment occurred while troubleshooting a Division 2 load shedding and sequencing (LSS) system trouble alarm. A reactor scram ensued. Investigation revealed that LSS panels had a logic coupling in that energizing the 15 volt converter without power from the 24 volt converter will cause a BOP load shed. This system response contradicts LSS system specification requirements. A vendor design error occurred and was not detected previously. Pre-operational testing had not detected the logic coupling and was a contributing factor. LSS panels were modified to preclude BOP load shed due to loss of the LSS panel 24 volt power converter. Analysis of the reactor scram and subsequent events determined that safety systems operated as designed. This report is being submitted to describe the ESF actuations pursuant to 10 CFR 50.73(a)(2)(iv) and plant Technical Specification 3.5.1 Action h.

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END OF ABSTRACT

A. Reportable Event

Actuation of the reactor protection system (RPS) JC! initiated an automatic reactor scram on July 28, 1991 at approximately 0131 hours as sensed by main turbine control valve (TCV) fast closure signals. The emergency core cooling system (ECCS) injected into the reactor via the high pressure core spray (HPCS) system BG! due to actuation of reactor water level trip signals JE!. Other engineered safety features (ESF) functioned as designed: actuation of containment isolation JM! and reactor water cleanup system isolation JM! occurred and standby gas treatment system BH! initiated during the reactor water level transient. This report is being submitted to describe the ESF actuations pursuant to 10 CFR 50.73(a)(2)(iv) and plant Technical Specification 3.5.1 Action h. Initial notification was made July 28, 1991 in accordance with 10 CFR 50.72(b)(1)(iv) and 50.72(b)(2)(ii).

B. Initial Conditions

The plant was in Operational Condition 1 at full power with reactor water at approximately 540 degrees F and 1032 psig. A load shed of balance of plant (BOP) equipment occurred while troubleshooting a Division 2 load shedding and sequencing (LSS) system EB! trouble alarm. A logic coupling was discovered in LSS system panel configurations while troubleshooting Division 2 LSS system. The vendor design error was a precursor to this reactor scram event.

C. Description of Occurrence

On July 20, 1991, Operations personnel received a trouble alarm for the Division 2 LSS panel. The LSS panel indicated a fault in the LSS automatic test (AT) function display. The AT mode was reset and the panel responded as normal. The Operations Department monthly functional surveillance was performed satisfactorily on the panel per procedure 06-OP-1R21-M-0002; the panel was eturned to service.

On July 21, 1991, Operations personnel again received a trouble alarm for this LSS panel. Five normally energized lights on the panel were reported as being off. Prior to troubleshooting the apparent power converter failure, the panel reset itself and

function appeared normal again. The panel 24 volt DC power converter was replaced. The LSS panel retested satisfactorily using the Operations surveillance procedure and was returned to service.

Further review with the manufacturer indicated that the panel's 15 volt DC converter could cause similar symptoms. The 15 volt converter was replaced on July 26, 1991. The LSS panel power system is supplied by the Division 2 125 volt DC battery EJ!.

On July 27, 1991, Operations received a trouble alarm for the same LSS panel. The panel indicated total failure of the panel's 15 and 24 volt power converters. Except for the incoming power supply available light, all of the panel lights and indications were out. The Division 2 diesel generator EK! and LSS system were declared inoperable.

Output of the 15 and 24 volt converters was confirmed to be zero. The panel was deenergized and output leads for each power converter were lifted. The panel was reenergized. The 15 volt power converter reset, but the 24 volt converter did not reset. The panel was deenergized again and the 24 volt converter was replaced. Upon verifying that the replacement 24 volt converter was good, leads for the 15 volt power converter were relanded. Output from the 24 volt converter was maintained open in order to facilitate troubleshooting. The LSS panel was reenergized and the BOP load shed occurred.

The BOP load shed tripped feeder breakers to BOP busses 11HD, 12HE, 13AD, and 14AE. The condensate SD! pumps, condensate booster SD! pumps, feedwater heater drain SN! pumps, circulating water KE! pumps, main turbine electro-hydraulic control (EHC) TG! pumps, reactor recirculation AD! pumps, service air LF! compressor, and instrument air LD! compressor tripped as a result of the load shed. Power to the RPS motor/generator set JC! was also lost upon the load shed and caused the main steam isolation valves (MSIVs) to close. The decrease in EHC pressure generated TCV fast closure signals in RPS and initiated an automatic scram.

The reactor feedwater pumps SJ! tripped on low suction pressure. Reactor vessel level decreased rapidly due to loss of feedwater flow. Reactor core isolation cooling (RCIC) pump BN! was manually initiated, but reactor level diminished to -41.6 inches wide range

(i.e., Level 2) before HPCS could be manually initiated.

ESF actuations upon this Level 2 condition included automatic initiation of standby gas treatment system and isolation of containment ventilation and reactor water cleanup systems. Both reactor recirculation pumps had tripped upon the BOP shed. The HPCS pump and Division 3 diesel generator (DG 13) EK! automatically started. HPCS injected condensate from the storage tank into the vessel for approximately five (5) minutes at 4000 gallons per minute. The RCIC injected approximately 4000 gallons of condensate into the vessel. Feedwater flow was reestablished to maintain vessel level.

Reactor pressure increased to a maximum of 1108 psig (1122 psia). Eleven (11) safety relief valves (SRVs) opened one time each to control reactor pressure.

D. Apparent Cause

The reactor scram was caused by a logic coupling in the Division 2 LSS system panel configuration. The logic coupling should not have existed per the system design specification. A vendor design error occurred and was not detected previously. Pre-operational testing had not detected the logic coupling and was a contributing factor.

E. Supplemental Corrective Action(s)

Investigation revealed that LSS panels had a logic coupling in that energizing the 15 volt converter without power output from the 24 volt converter will cause a BOP load shed. This system response contradicts LSS system specification requirements. Verification of this system response was performed by lifting the BOP load shed relay output leads and the ESF load shedding and sequencing relay coil leads and affixing an equivalent load. The load shedding response was confirmed by this test.

Division 1 and 2 LSS panels were modified so that the optical isolators are powered by the respective panel's 24 volt converter. The optical isolators separate the BOP load shed portion of the panel from Class 1E circuits. This modification will preclude BOP load shed actuation due to loss of the LSS panel 24 volt converter. The LSS circuitry was such that loss of the 15 volt converter would

not have caused a load shed. The modification does not change the response for a loss of the 15 volt converter.

A voltage spike apparently occurred in the 15 volt circuit during troubleshooting. It was suspected that degradation of integrated circuit (IC) chips in panel file cards had occurred. All panel cards containing IC chips were replaced. Troubleshooting continued, replacing cards as necessary to trace and eliminate LSS AT faults.

Thermography was also used to investigate any high temperature spots in the LSS panel card file. No card files indicated abnormal temperatures.

The Division 2 LSS AT continued to fault spuriously after the July 28, 1991 scram. However, such faults did not inhibit LSS system function as reported by the manufacturer. Investigation into the AT anomaly continued.

On August 15, 1991, an AT fault occurred which could not be reset. Two cards were replaced, the panel AT function was secured, and the panel was manually tested with the Operations surveillance procedure every twelve hours under a technical specification waiver of compliance. The two removed cards were tested in a test panel and one card was confirmed to be defective. The defect was determined to be a solder bridge which was shorting two pins on an IC chip. The LSS panel functioned properly after the solder bridge was removed. Based on the above findings, the Division 2 LSS panel was placed in automatic test mode on August 19 and no AT faults have been received to date.

The qualified service life of these converters is 11.1 years. Grand Gulf was unaware that spare LSS converters should be energized periodically in order to prevent degradation of internal electrolytic capacitors. Spares at Grand Gulf had not been energized on a periodic schedule. Controls will be implemented after receipt of the reworked spares. Future supplies affected will be controlled in the same manner.

DG 13 automatically started upon Level 2, but was run unloaded as the offsite power supply was available. Plant procedure requires that DG 13 be run at least partially loaded following a no-load run in order to remove a potential buildup of oil in the turbocharger.

The DG 13 manual synchronizing circuit was found to have a blown fuse when operators attempted to manually load DG 13 following the reactor transient. The blown fuse was replaced; no overcurrent condition existed. DG 13 was loaded in accordance with the station operating procedure. The manual synchronizing circuit does not affect the automatic loading of DG 13.

F. Safety Assessment

The reactor protection system responded to plant parameters as designed. Analysis of the reactor scram and subsequent events determined that safety systems operated as designed. HPCS initiated on low water level and injected as designed. Current usage factor for the HPCS nozzle is less than 0.70 as discussed in Technical Specification 3.5.1.h. Ten HPCS system actuation cycles have occurred with elevated reactor temperature including this event. The blown fuse in DG 13 manual synchronizing circuit did not affect the safety function of Division 3. The minimum water level indicated during this event was 105 inches above active fuel. The safety of the general public was not compromised by this event.

G. Additional Information

Energy Industry Identification System (EIIS) codes are identified in the text within brackets !.

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August 27, 1991 Vice President
Operations
Grand Gulf Nuclear Station

U.S. Nuclear Regulatory Commission
Mail Station P1-137
Washington, D.C. 20555

Attention: Document Control Desk

SUBJECT: Grand Gulf Nuclear Station
Unit 1

Docket No. 50-416
License No. NPF-29
Reactor Scram Upon Load Shed of Balance of Plant Equipment
LER 91-007

GNRO-91/00161

Gentlemen:

Attached is Licensee Event Report (LER) 91-007 which is a final report.

Yours truly,

WTC/BAB/cg

attachment
cc: Mr. D. C. Hintz (w/a)
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