NON-PUBLIC?: N
ACCESSION #: 9103260438
LICENSEE EVENT REPORT (LER)

FACILITY NAME: HOPE CREEK GENERATING STATION PAGE: 1 OF 6

DOCKET NUMBER: 05000354

TITLE: REACTOR SCRAM - RELAY MALFUNCTION RESULTS IN STARTUP LEVEL
CONTROL VALVE FAILING CLOSED AND SUBSEQUENT LOW WATER LEVEL SCRAM
DURING PLANT STARTUP
EVENT DATE: 02/19/91 LER #: 91-005-00 REPORT DATE: 03/21/91

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 024

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

LICENSEE CONTACT FOR THIS LER:
NAME: Richard Cowles, Senior Staff TELEPHONE: (609) 393-3431
Engineer - Technical

COMPONENT FAILURE DESCRIPTION:
CAUSE: B SYSTEM: JB COMPONENT: RLY MANUFACTURER: A348
REPORTABLE NPRDS: Y

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

On 2/19/91 at 1010, while in the process of power ascension during restart following the stations third refueling outage, a reactor scram on low reactor pressure vessel (RPV) level occurred. Prior to the scram, the Nuclear Control Operator (NCO, RO licensed) controlling the reactor feedwater (RFW) system was in the process of swapping RFW control from startup level control (single element) to master level control (three element). When RFW was placed in master level control, the NCO experienced difficulty in maintaining normal vessel level (+35"), and swapped back to startup level control. A relay failure in the control circuit associated with one of the two startup level control valves (the RFW system utilizes one 3" and one 12" valve for system startup) resulted

in the 12" startup level control valve driving closed during the swap. Feedwater flow through the 3" valve was not sufficient to compensate for the loss of flow through the 12" valve, and the reactor scrammed on low RPV level (+12.5"). Subsequent investigation determined that the primary cause of this event was a relay failure in the circuit controlling the 12" startup level control valve. Immediate corrective actions included relay replacement and reviewing feedwater system startup procedures for possible enhancements with respect to the RPV level transient normally experienced during the transition from single element to three element RFW control. Longer term corrective actions include reviewing operating characteristics of the feedwater system during startup evolutions to determine if hardware enhancements are necessary and reviewing the preventive maintenance program for non-safety related solid state relays.

END OF ABSTRACT

PLANT AND SYSTEM IDENTIFICATION

General Electric - Boiling Water Reactor (BWR/4)
Reactor Feedwater System (EIIS Designation: SJ)
Reactor Protection System (EIIS Designation: JC)
Reactor Feedwater Control (EIIS Designation: JB)

IDENTIFICATION OF OCCURRENCE

Reactor Scram - Relay Malfunction Results in Startup Level Control Valve Failing Closed and Subsequent Low Water Level Scram During Plant Startup

Event Date: 02/19/91
Event Time: 1010
This LER was initiated by Incident Report No. 91-033

CONDITIONS PRIOR TO OCCURRENCE

Plant in OPERATIONAL CONDITION 1 (Power Operation), Reactor Power 24%, Unit Load 180MWe. Reactor startup in progress following third refueling outage (RFO3).

DESCRIPTION OF OCCURRENCE

During the morning of 2/19/91, startup of the plant was in progress following completion of RFO3, with reactor power at 24% (thermal power), and reactor vessel level at +35". The Nuclear Control Operator (NCO) assigned to reactor feedwater (RFW) control / vessel level monitoring was

controlling vessel level with the "B" Reactor Feed Pump (RFP) via the 3" and 12" Startup Level Control valves (SLCV) (AELV-1754 and AELV-1785, respectively, common to all three RFPs).

At approximately 10:10, the NCO attempted to shift vessel level control from the SLCVs to the RFW master level controller (MLC). After nulling the startup level controller (SULC) and MLC feed signals, the NCO placed the "B" RFP flow control in "auto".

At this point, level began gradually decreasing. When level reached +30" (level 4 annunciator received), and showed no indication of turning due to the sluggish response of the "B" RFP to a speed increase demand, the NCO recognized the level drop as an abnormal response. The NCO informed the Senior Nuclear Shift Supervisor (SNSS, SRO licensed) that he was, in accordance with his training and RFW procedures, placing the RFW system back on the SULC. Reactor vessel level continued dropping from 28" at a more rapid pace when level control was shifted back to the SULC, because the RFW 12" startup level control valve drove closed.

DESCRIPTION OF OCCURRENCE, CONT'D

A full reactor scram on reactor vessel low level (+12.5", level 3) occurred at 10:10:31 (about 30 seconds after event initiation).

Plant response to the transient was normal, with no significant deviations being noted. Reactor vessel level bottomed out prior to the level 2 (-38") Emergency Core Cooling Systems actuation setpoint, and was restored to normal level (+35") utilizing the "A" RFP via the 3" SLCV. Following stabilization of plant parameters, a four hour non-emergency report was made per 10CFR50.72.

APPARENT CAUSE OF OCCURRENCE

1. Post-scram investigation concluded that the initiating cause of the event was the failure of a relay controlling the position of the RFW 12" startup level control valve.

2. Two factors contributed to the event:

a) The inherent response characteristics of the feedwater control system when transitioning from SULC to MLC at lower power levels

b) From past experience, the NCO expected the shift from SULC to

the MLC to cause a level transient resulting in an RPV level change of about five inches. This transient is induced by the addition of the steam flow, feed flow, and biasing signals when shifting RFW control from startup level control to three element control.

ANALYSIS OF OCCURRENCE

At the onset of the level control transition, the NCO observed the expected decrease to about 30" RPV level. When level did not appear to be turning, at 28" the NCO, thinking the MLC was responding sluggishly, placed the "B" RFP control back into manual and ran the SULC setpoint up to 50", and attempted to increase speed on the "B" RFP.

ANALYSIS OF OCCURRENCE CONT'D

Unknown to the NCO at the time, when he shifted "B" RFP from 11 auto" to "manual", a relay controlling the 12" SLCV malfunctioned (discovered during troubleshooting following the scram), and caused the 12" SLCV to drive closed. At this point, level began decreasing rapidly, and recovery was not possible, despite the fact that an attempt was made to bring the "A" RFP into service.

The closure of the 12" SLCV reduced feedwater flow below feedwater demand requirements. The 12" SLCV went shut due to the failure of the C32-K9 relay in the circuit which switches the output demand signal from the manual mode of SLCV control to automatic SLCV control.

When the K9 relay deenergizes, contact R1-T1 opens to remove power from the automatic control unit, and contact M1-R1 closes to supply power to the manual control unit. The control signal to the SLCVs swaps from the output of the automatic control unit to the output of the manual control unit. During this event, a failure of the K9 relay caused the 12" SLCV to drive closed.

The 3" SLCV remained open during the course of the level transient. It did not go closed, because the positioner is split range, and only controls on the bottom section of the control signal. The twelve inch SLCV also has a split range positioner that only controls in the middle and top sections of the control signal.

Additionally, industry operating experience relative to the make and model of relay in question (Agastat Series GP) was reviewed. It was determined that there is a significant body of industry operating

experience relative to these relays.

In summary, an NRC Information Notice (84-20) was initiated as a result of failure of these type relays at various plants in safety related systems. In response to 84-20, PSE&G replaced all Agastat Series GP relays and other type (EGP and FGP) Agastat relays in normally energized safety related applications in 1988.

ANALYSIS OF OCCURRENCE, CONT'D

It should be noted that 84-20 discussed relays failing to operate due to coil failures. The failure of the C32-K9 relay to properly function was not as a result of coil failure, but due to failure of a contact to properly make up.

Following this event, the Nuclear Training Department reviewed licensed oper
tor training with respect to feedwater control on startup of the plant. Operators are trained to return to startup level control (single element) if it is observed that the master level control is not functioning properly. The NCO involved in this event complied properly with his training and station procedures.

PREVIOUS OCCURRENCES

A review of past in-house operating experience determined that no prior similar events have occurred that would have served as a precursor to this event. However, as previously described, industry operating experience exists that relates to the initiating cause of this event (failure of the Agastat Series GP relay).

SAFETY SIGNIFICANCE

This event posed minimal safety significance, as a scram is an analyzed event, and all plant systems responded as expected. Additionally, the plant is bounded by the Updated Safety Analysis Report (USAR) for a loss of feedwater. All required Emergency Core Cooling Systems were available for service at the time of this occurrence, in the event that vessel level recovery via the normal RFW system was not available.

CORRECTIVE ACTIONS

1. The relay that failed was replaced in kind, and the failed relay was forwarded to the corporate laboratory for analysis of the relay

failure mechanism. Based on results of this analysis, a recurring task will be developed to address operability of similar relays.

2. Feedwater control procedures were reviewed for potential enhancements with regard to the vessel level variance during transition from SULC to MLC, and appropriate procedural changes were completed.

CORRECTIVE ACTIONS CONT'D

3. This report will be reviewed with all licensed operators by the Nuclear Training Department during the next licensed operator requalification cycle. As with past scrams and significant event transients, transient analysis recordings will be reviewed and the simulator tuned to model actual plant response.

4. All similar Agastat series GP relays in the feedwater control system were verified to be functioning properly.

5. An engineering evaluation of available vendor upgrade programs for the RFW system controls will be conducted.

Sincerely,

J. J. Hagan
General Manager
Hope Creek Operations

SORC Mtg. 91-035

PSEG
Public Service Electric and Gas Company P.O. Box 236
Hancocks Bridge, New Jersey 08038

Hope Creek Operations

March 21, 1991

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

Dear Sir:

HOPE CREEK GENERATING STATION
DOCKET NO. 50-354
UNIT NO. 1
LICENSEE EVENT REPORT 91-005-00

This Licensee Event Report is being submitted pursuant to the requirements of 10CFR50.73 (a)(2)(iv).

Sincerely,

J. J. Hagan
General Manager -
Hope Creek Operations

RBC/

Attachment
SORC Mtg. 91-035

C Distribution

The Energy People

*** END OF DOCUMENT ***