NON-PUBLIC?: N
ACCESSION #: 9207090003
LICENSEE EVENT REPORT (LER)

FACILITY NAME: BIG ROCK POINT PLANT PAGE: 1 OF 6

DOCKET NUMBER: 05000155

TITLE: REACTOR SCRAM DUE TO INITIAL PRESSURE REGULATORY FAILURE
EVENT DATE: 06/03/92 LER #: 92-010-00 REPORT DATE: 07/02/92

OTHER FACILITIES INVOLVED: N/A DOCKET NO: 05000

OPERATING MODE: N POWER LEVEL: 077

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

LICENSEE CONTACT FOR THIS LER:
NAME: MICHAEL D BOURASSA, SENIOR TELEPHONE: (616) 547-6537
TECHNOLOGIST

COMPONENT FAILURE DESCRIPTION:
CAUSE: B SYSTEM: SB COMPONENT: BLL MANUFACTURER: G080
B SB FCV G080
REPORTABLE NPRDS: N
N

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

On June 3, 1992 plant operations were normal. At 0533, the reactor scrammed on high flux due to a sudden spike in reactor pressure from 1335 psig to 1360 psig. All control rods inserted fully and no other engineered safeguards equipment was challenged, however contrary to design, the turbine did not trip and the Generator Output Breaker did not open.

The root cause of the reactor scram has been determined to be an IPR bellows failure due to a weld defect combined with normal operating mechanical, cyclic stresses.

Hand Trip Solenoid Binding is the most likely root cause of the failure

of the turbine to trip.

The facility was returned to operation on June 7, 1992. The IPR bellows was replaced with a spare, and the H
nd Trip Solenoid was disassembled,
inspected and tested successfully before re-installation. Long term evaluations will be performed to address upgrading the current IPR and Hand Trip Solenoid designs.

0C0692-0009-BL01

END OF ABSTRACT

TEXT PAGE 1 OF 6

DISCUSSION OF EVENT

On June 3, 1992 plant operations were normal. At 0533, the reactor (RCT) scrammed on high flux due to a sudden spike in reactor pressure to 1360 psig. All three Wide Range Monitor channels (MON) tripped. (Reactor pressure did not reach the high pressure trip setpoint of 1380 psig.)

The operators performed the post scram actions in accordance with Off Normal Procedure 2.31, Reactor Scrams. Approximately one minute after the scram, the No. 1 Control Room Operator (CO) opened the generator output breaker when he discovered that it had not automatically opened in response to the scram. He then observed that the turbine had not tripped and inserted a turbine trip signal via the trip push button in the control room. This action failed to trip the turbine, therefore he dispatched an AO to the front standard of the turbine with instructions to manually trip the turbine. In the time it took the AO to go to the turbine, the CO#1 also attempted to phase trip the unit by jumpering the 287 relay. However, this action was also unsuccessful and at 0537, the AO succeeded in tripping the turbine at the front standard using the Hand Trip level. (Note: the AO did not check the position of the hand trip solenoid (HTS) before or after the manual trip.)

At 0537, the No. 2 Reactor Feed Pump (P) was secured. An AO was dispatched to check the regulator (RC) controls for CV-4136 (FCV) to insure that it had operated automatically. (The closure of CV-4136 is directly related to maintaining condenser (COND) vacuum.) The AO backed down the regulator but did not detect any air flow from the solenoid valve (FSV) that ports air from CV-4136's operator. (Subsequent investigation indicated that CV-4136 did close when the turbine tripped and the stop valve closed, as designed.) At about the same time, or shortly thereafter, the second feed pump was secured and the cooldown

rate was slowed. (The operators noted that the cooldown rate during the first hour of the event was 75 degrees F/hour.)

With the cooldown rate well under control, the facility proceeded to the cold shutdown condition.

NOTE: When the operators were verifying full control rod insertion, three drives (D3, F4 and D6) suffered a temporary loss of position indication (ZI) because of overtravel. In accordance with System Operating Procedure 38, the safety system (JE) was reset and position indication returned. The control rods were verified fully inserted.

At 0710, the CO#2 turned the hood sprays on at the front standard and noticed that the HTS coil (CL) continuity light (IL) was out. This would indicate that the HTS was in the tripped position. This was the first time the HTS was checked following the reactor scram. Shortly thereafter, other operations and maintenance personnel checked the HTS and confirmed it to be in the tripped position with the level up and the light out. It is not known whether the HTS tripped immediately in response to the reactor scram, or whether it tripped after the stop valve closed.

Prior to the event, reactor power was approximately 60 MWe (186 MWt), which is approximately 77% of rated (240 MWt) power. During the previous evening on June 2, 1992, the operations crew had pulled three notches between the hours of 1622 and 1819 to increase reactor power. The Initial Pressure Regulatory (IPR) (RG) responded normally to the power change by opening the admission valves (FCV), allowing the turbine load to follow the increase in system power. Later on between 2000 and 2400 several additional IPR adjustments were made (on the order of a few psig, not associated with the notch pulls earlier) by the operating shift. At about 0235 and 0355 on June 3, 1992, additional IPR adjustments were made to offset an indicated increase in reactor pressure. At 0457, CO#1 made the following log entry:

"Reactor pressure indicator (PI) PI-IA05 seems to be creeping up - bumped IPR to lower twice. (Responds good at turbine front.) Verified reactor pressure at Control Rod Drive (AA) upper accumulator (ACC) room using PI-425 (PI) (reads 1332). PI-IA05 reads 1336 psig - Maintenance Order submitted. Appears to be same problem logged at 5/21/92 (NOTE: Instrument and Control exercised PI-IA05 potentiometer (FD)) IPR drain (DRN) warm but not hot."

These symptoms and associated actions were indicative of bellows degradation and have been incorporated into our bellows monitoring plan discussed later in Item A of our "Actions to Prevent Recurrence".

CAUSE OF THE EVENT

Root Cause Investigation

A. Reactor Scram

On June 3, 1992, the IPR was disassembled and a crack was discovered in the bellows (BLL). This bellows is supplied by General Electric (G080), and is unique to Big Rock. On June 4, 1992 the failed bellows and a spare bellows (for comparison) was sent to a company lab for examination. The failed bellows was radiographed and then sectioned to allow examination under the scanning electron microscope (SEM). SEM examination disclosed a lack of fusion at a weld root. The crack originated at a point where lack of fusion was.approximately 65% of through wall. Crack propagation was attributed to fatigue caused by normal cycling of the bellows during operation. The SEM exam did not detect the presence of chlorides and IGSCC is not suspected as a contributor to crack initiation.

A comparison of radiographs taken of the failed bellows and the spare bellows was also performed. Due to configuration, interpretation of the radiographs was noted as being difficult. However, from a qualitative perspective, the lab did note that the welds on the spare bellows were of a better overall quality. This spare was installed in the place of the failed bellows.

Therefore, the root cause of the reactor scram has been determined to be an IPR bellows failure due to a lack-of-fusion weld defect combined with

CAUSE OF THE EVENT (Continued)

normal operating mechanical, cyclic stresses. Two scrams, one on August 11, 1976 and the other on August 22, 1989 were also attributed to IPR failure.

B. Turbine Trip Failure

Hand Trip Solenoid binding is the most likely root cause. It appears that the HTS received at least two valid trip signals and the solenoid (SOL) was energized. The HTS apparently bound up mechanically. This prevented the solenoid from unlatching the spring loaded trip mechanism and dumping control oil from the trip header. Upon manually tripping the unit from the front standard, control oil pressure was dumped from the trip header. This combined with the vibration associated with the stop valve closure and turbine coastdown probably caused or allowed the HTS to trip. This conclusion is based on the following:

- Although the HTS was found to be tripped approximately 11/2 hours after the reactor scram, no immediate verification of its function was made at the front standard by the AO prior to tripping the turbine.

- The turbine electrical circuitry was tested and found to be functional.

- HTS or stop valve hydraulic relay (RLY) malfunction would prevent the turbine from tripping. The hydraulic relay may have hung up and prevented a trip, assuming the HTS functioned properly and dumped oil from the emergency trip header. However, the turbine did trip when the manual trip level was pulled at the front standard. This path requires the hydraulic relay to operate and it apparently did. Thus, this scenario requires that the hung up hydraulic relay would suddenly change state at the same time the AO pulled the trip level. This requires a fair amount of coincidence and is therefore deemed improbable.

C. Investigation

During plant cooldown with the steam jet air ejectors (EJR) in service, the HTS was reset with the turbine stop valve in the closed position, and successfully tripped twice from the control room using the turbine trip pushbutton. The HTS was then reset and the turbine stop valve opened. A turbine trip signal was inserted (pushbutton in the control room), the HTS tripped and the turbine stop valve closed. All attempts to repeat the turbine trip failure were unsuccessful. No binding or hesitancy on the part of the HTS was observed by operations and maintenance personnel.

CAUSE OF THE EVENT

The IPR was also examined while the plant was cooling down. The turbine inspector visually inspected the IPR and observed moisture coming from the weephole/telltale. Suspecting a bellows or gasket leak, the instrumentation and control personnel were directed to perform a pressure test, which confirmed the leak.

CORRECTIVE ACTIONS

A. The Hand Trip Solenoid was disassembled, inspected, and adjusted. Testing was completed on June 6, 1992. (Reference Maintenance Orders 92-TGS-0064 and 0068.)

B. The turbine was trip tested (with the reactor shutdown) using the manual pushbutton, jumpering the generator differential trip relay (287) and by the Reactor Protection System to confirm proper action of the HTS, turbine stop valve and CV-4136. Testing was completed June 6, 1992. (Reference New Operations procedure "Testing of Turbine Trip Functions".)

C. The HTS was trip tested (pushbutton on control room console) during subsequent plant startup on June 7, 1992, with the turbine at 3600 RPM. Verified
hat the turbine stop valve closed, turbine speed
decreased and white HTS coil monitoring light (LGT-9604) extinguished. (Reference control room log #352, page 76.)

ACTIONS TO PREVENT RECURRENCE

A. An IPR Bellows' monitoring plan was developed to detect leakage while the plant is on-line as a means of precluding similar trips. This plan includes temperature monitoring of the IPR sensing line and periodic inspection of the IPR telltale leak-off. Initiated June 6, 1992. (Reference OPS Memo #06-92.)

B. The feasibility of installing a new HTS system (updated version) or redundant HTS will be examined. Completion of the evaluation and recommendations is expected during the 1993 Refueling Outage.

C. Complete a study by the 1993 Refueling Outage that examines re-designing the IPR bellows versus replacing the IPR/turbine control system.

D. Perform an engineering evaluation to address the loss of control rod position indication when control rods travel past "00". Complete by the 1993 Refueling Outage.

0C0692-0009-BL01

SAFETY SIGNIFICANCE

The failure of the turbine to trip was minimized by the fact that the admission valves were closing in response to the failed IPR bellows. The turbine was not oversped, and the generator was not motorized due to the timely actions of the operators in recognizing that the 116 OCB had failed to open automatically. All control rods inserted fully, and no other Engineered Safety Feature equipment was needed for accident mitigation.

Consumers
Power William L Beckman
Plant Manager

POWERING
MICHIGAN'S PROGRESS

Big Rock Point Nuclear Plant, 10269 US-31 North, Charlevoix, MI 49720

July 2, 1992

Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

DOCKET 50-155 - LICENSE DPR-6 - BIG ROCK POINT PLANT -
LICENSEE EVENT REPORT 92-010: REACTOR SCRAM DUE TO INITIAL PRESSURE
REGULATOR (IPR) BELLOWS FAILURE

Licensee Event Report (LER) 92-010 (Reactor Scram Due To Initial Pressure Regulator (IPR) Bellows Failure), is attached. This event is reportable to the NRC per 10 CFR 50.73(a)(2)(iv).

William L Beckman

William L Beckman
Plant Manager

CC: Administrator, Region III,
USNRC NRC Resident Inspector - Big Rock Point

Attachment - LER

A CMS ENERGY COMPANY

*** END OF DOCUMENT ***