UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT
WASHINGTON, D.C. 20555

May 29, 1979

IE Information Notice No. 79-13

INDICATION OF LOW WATER LEVEL IN THE OYSTER CREEK REACTOR

Summary

A loss of feedwater transient at the Oyster Creek facility on May 2, 1979, resulted in a significant reduction in water inventory within the reactor core shroud area as measured by one set of water level instruments (triple low level), while the remaining level instruments, sensing from the reactor annulus area indicated water levels above any protective feature setpoint (Figure 1). The water level within the core shroud area was reduced below the "triple low level" setpoint of 4-feet, 8-inches above the top of the fuel.

Subsequent analysis by the licensee has determined that the minimum collapsed water level (solid, without steam voids) over the top of the fuel was 1 to 1-1/2 feet.

Coolant sample analyses and offgas release rates do not indicate any fuel damage occurred.

General

Oyster Creek is a non-jet pump BWR with licensed power of 1930 MWt. The plant was first made critical May 3, 1969.

Status Before Transient

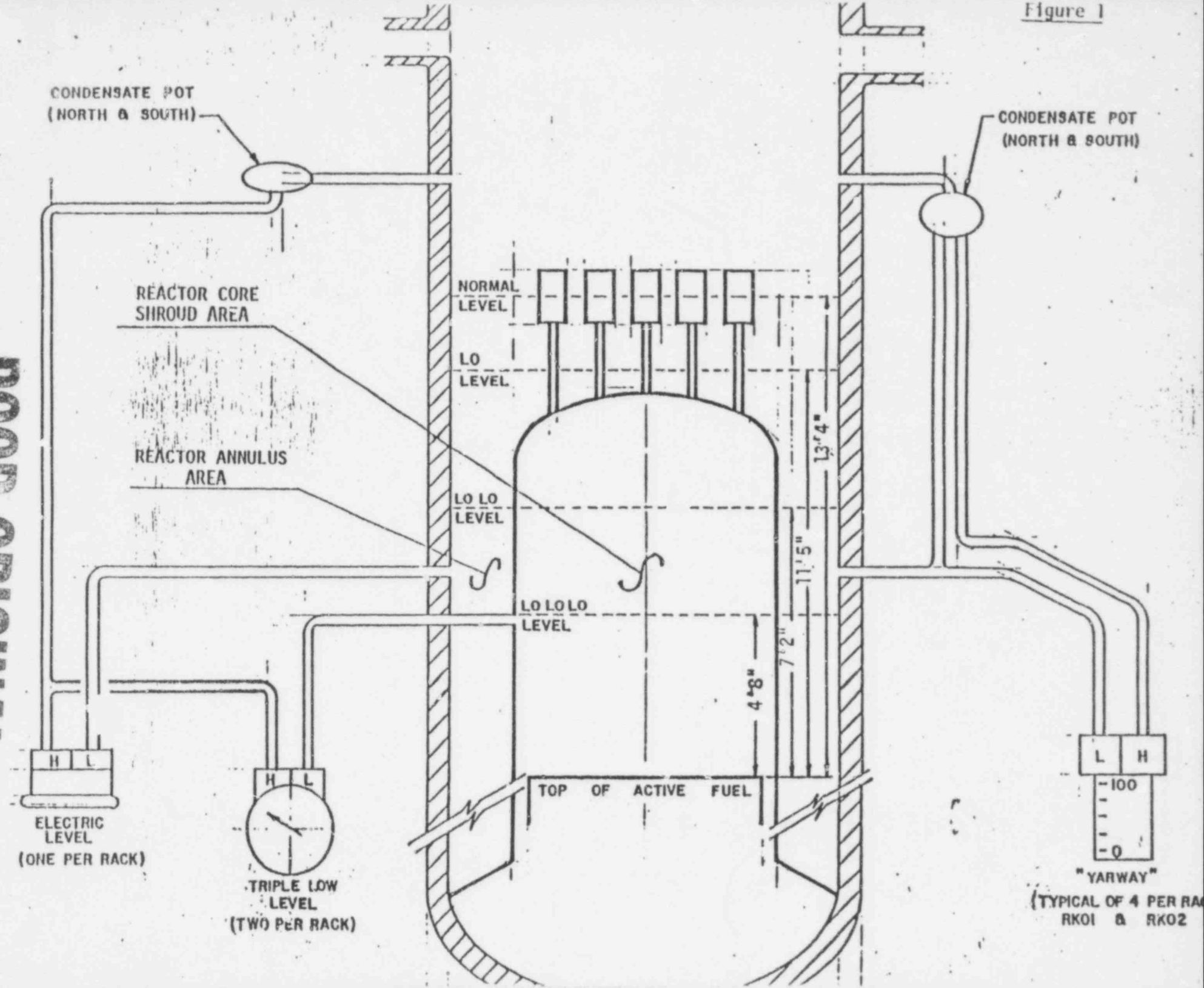
Operating at near full power with the main parameters at levels as follows:

1895 MWt power level
79" Yarway (13'4" over top of fuel) reactor water level
1020 psig reactor pressure
7.1×10^6 #/hr feedflow
14.8×10^4 gpm recirculation flow rate (4 pumps)
12 psid core Δp

Equipment Out of Service (OOS)

"D" recirc pump OOS due to seal cooler problem
"B" startup transformer OOS for inspection of associated 4160v cabling

Figure 1



Initiating Event

The initiating event was a false pressure spike on the reactor high pressure scram switches. This pressure spike was caused by an instrument technician who was performing Technical Specification required surveillance testing on isolation condenser pressure switches.

Sequence of Events

The most significant events following the reactor scram are listed in Table 1, with the time in seconds following the scram. A discussion of these events is provided for further information.

Thirteen seconds after the reactor scram on a false high reactor pressure signal, the turbine tripped at 25% low load setpoint. The turbine trip initiated a transfer of power from the auxiliary transformers to the startup transformers (Figure 2). Because one startup transformer (SB) was out of service, two feedpumps and two condensate pumps on that 4160v bus (1B) lost power (pumps 1B and 1C). The third feedpump (1A) tripped due to low suction pressure resulting from the feedwater transient. An immediate attempt to restart 1A was unsuccessful because of failure of an auxiliary oil pump to start. The oil pump is interlocked in the feedpump start sequence.

Initially, water inventory was decreasing due to steam flow through the turbine bypass valves to the main condenser. This loss together with the void collapse associated with decreased feedwater temperature and the subsequent loss of feed flow, resulted in a rapid reactor water level reduction to the low water level alarm setpoint of 11-feet, 5-inches above the top of the fuel at 13.6 seconds. At 25 seconds, an emergency diesel generator (DG-2) had automatically fast-started following the power loss to bus 1D and picked up emergency loads as designed. This loading included the second control rod drive (CRD) pump which with the other CRD pump (powered through the retained startup transformer) provided the only coolant makeup during this time. The operator manually initiated a main steam line isolation valve (MSIV) closure at about 43 seconds into the transient to conserve water inventory. The minimum indicated water level in the annulus area was 9-feet, 8-inches above the top of the fuel (the low low setpoint is 7-feet, 2-inches above the top of the fuel). After closure of the MSIV the isolation condenser was condensing steam from the core and returning the condensate to the reactor annulus (downcomer) region through connection to a recirculation loop pump suction line (Figure 3). Reactor water level began to increase shortly after MSIV closure.

Subsequently, at 76 seconds, an isolation condenser was manually placed in service for core decay heat removal. At approximately this time the discharge valves in "A" and "E" recirculation loops were closed in accordance with a Standing Order which was in effect at that time to prevent inadvertent isolation condenser isolation due to forced flow from operating recirculation pumps being

SEQUENCE OF EVENTS

TIME (SEC.)	EVENT
0	REACTOR SCRAM/RECIRC. PUMP TRIP
13	TURBINE TRIP/LOSS OF FEEDWATER/CONDENSATE PUMPS
13.6	LOW WATER LEVEL SCRAM POINT
16.8	#2 RPS MOTOR GEN. SET TRIP
31	#2 DIESEL GENERATOR BREAKER CLOSED/2ND CRD PUMP STARTED
43	MSIV CLOSED*
76	B ISO. CONDENSER PLACED IN SERVICE*
90	LOW WATER LEVEL ALARM CLEARED
172	LOW LOW LOW WATER LEVEL TRIP POINT
186	RECIRC. LOOP DISCHARGE VALVES NOTED CLOSED
1922	C RECIRC. PUMP STARTED THEN TRIPPED*
2208	FEEDWATER PUMP STARTED*
2340	RECIRC. PUMP STARTED/LOW LOW LOW WATER LEVEL ALARM CLEARED
2700	RPS #2 RESTARTED/SCRAM RESET*
3600	STARTUP TRANSFORMER SB RETURNED TO SERVICE

* By Operator Action

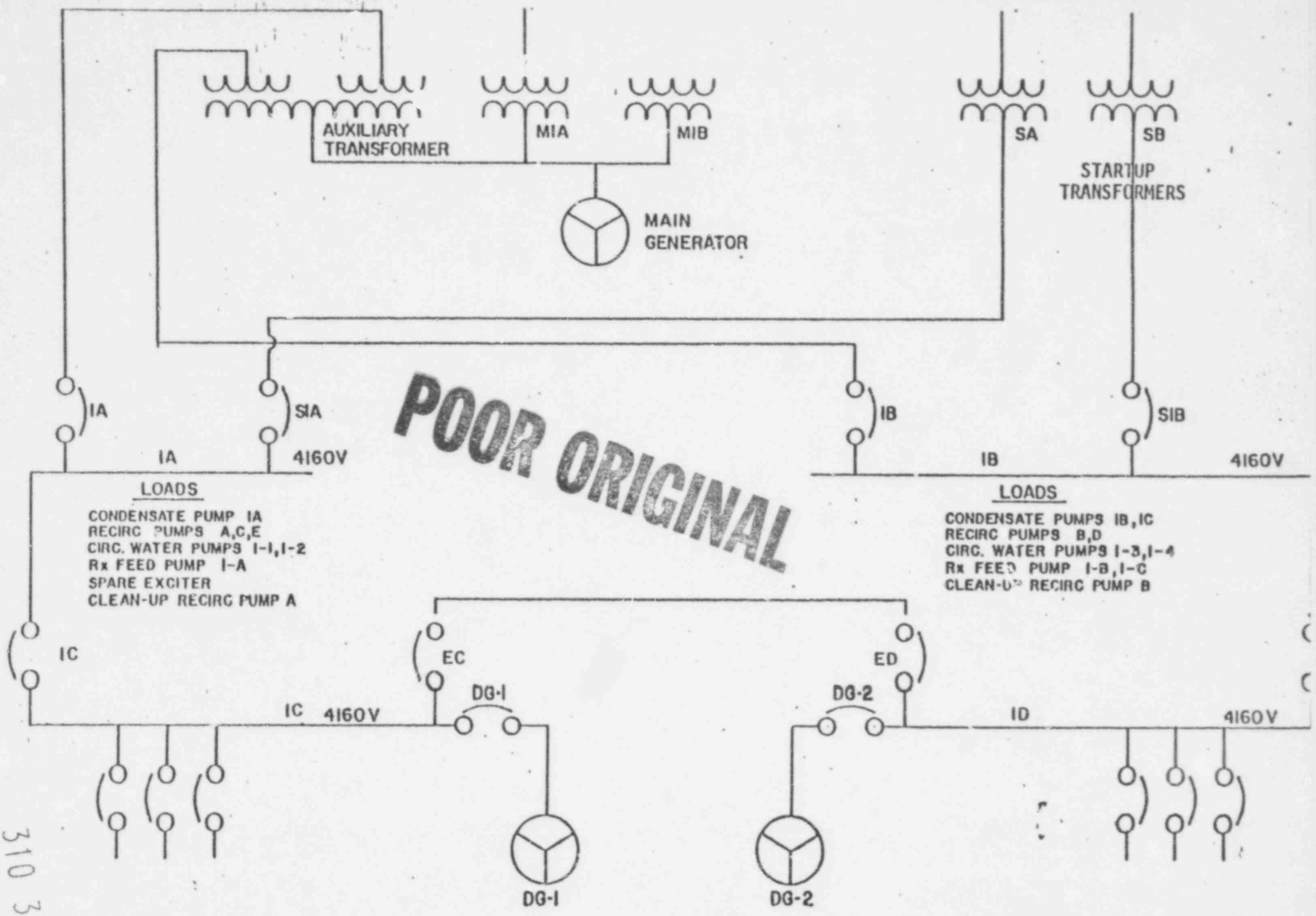
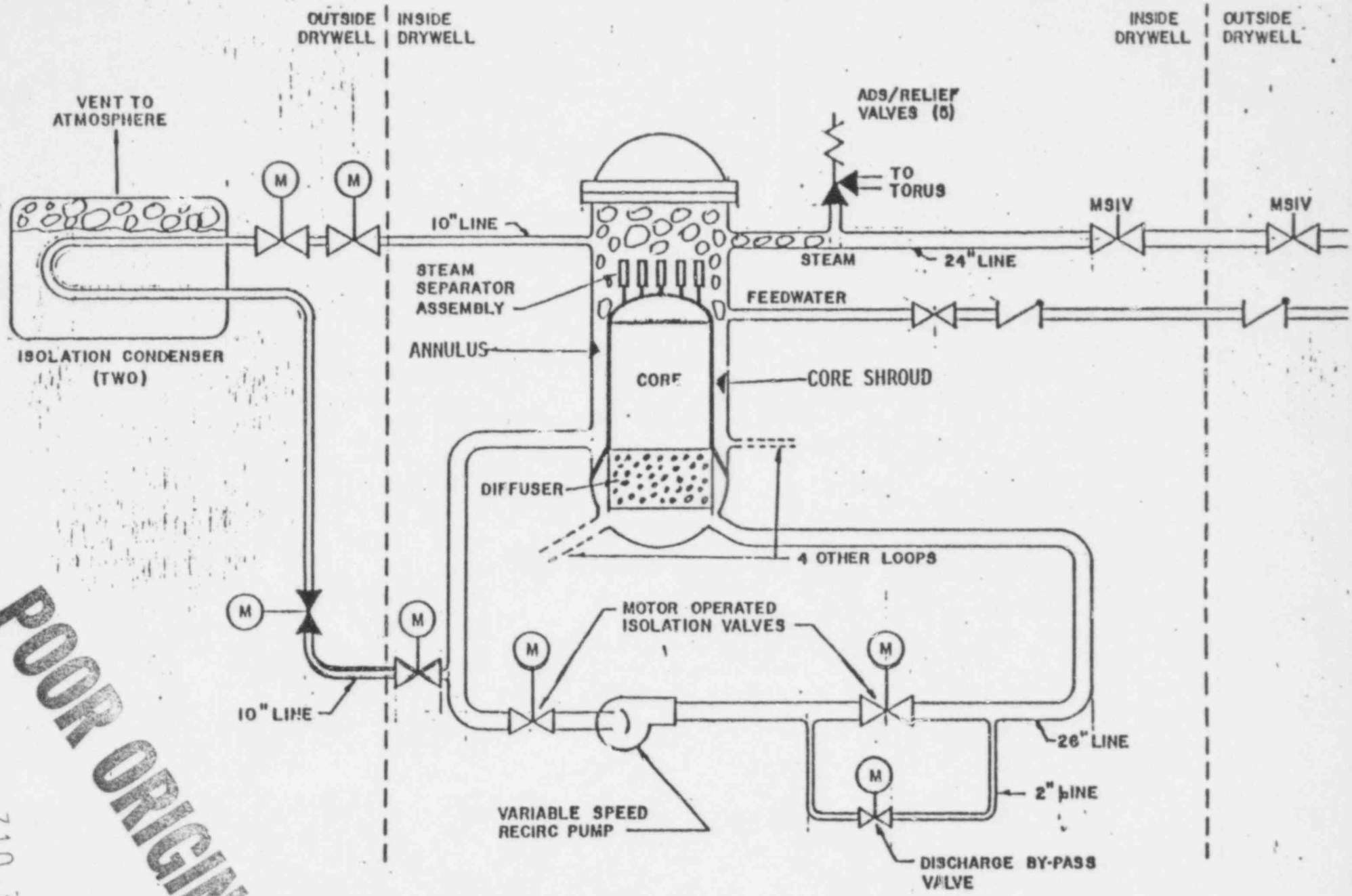


FIGURE 2



sensed as a line break. This Standing Order was no longer appropriate since a plant modification had been made which tripped the recirculation pumps on any scram. The necessary procedure change had not been performed following the plant modification. The "D" loop discharge valve had been closed prior to the event since the associated pump was out of service. The "B" and "C" loop discharge valves were apparently closed in anticipation of restarting the recirculation pumps.

The reactor triple low water level (4-feet, 8-inches above the top of the fuel) setpoint was reached at 172 seconds into the transient. Shortly after this the "Events Recorder," which records the time certain events occur following a reactor trip, was turned off.

The triple low level in the core shroud area resulted from restriction of the isolation condenser return flow path to the core region due to closure of the recirculation pump discharge valves. With the recirculation pump discharge valves closed, the flow path back to the core shroud was via the 2-inch bypass lines around the discharge valves. The effect was to reduce the water level in the core shroud area and to increase the level in the reactor annulus area.

The core shroud area of the reactor was also receiving water from the CRD pumps.

Reactor pressure was controlled during the transient by intermittent manual operation of the two isolation condensers. Reactor pressure and reactor annulus water level variations with time are shown on Figure 4.

At 1922 seconds, a recirculation pump was started. It was manually tripped 90 seconds later because of a rapid decrease in the annulus level.

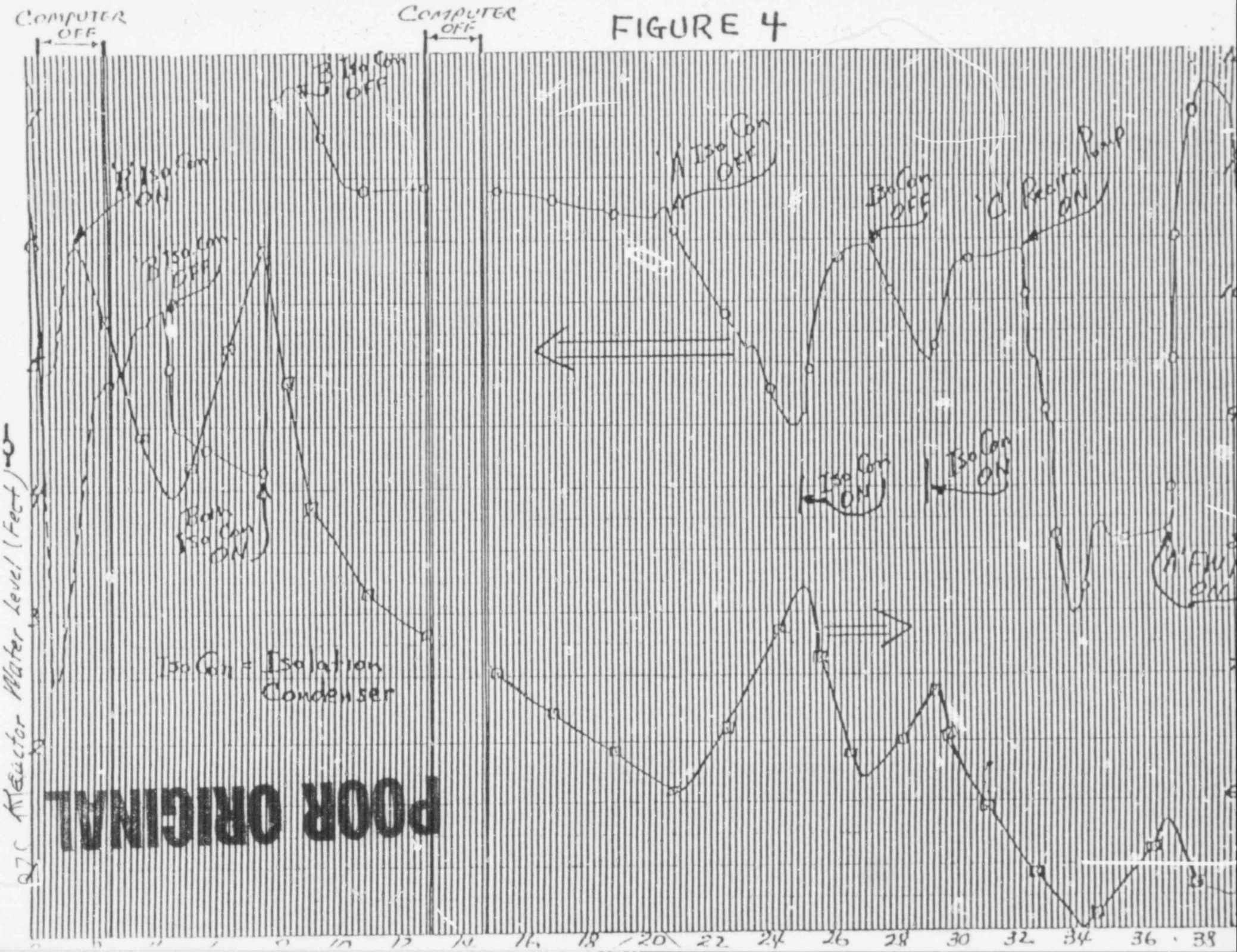
At 2208 seconds, a feed pump was started, following which at 2340 seconds, a primary recirculation pump and subsequently a reactor feedpump were operated for continued cooldown of the reactor.

From this time on, water level within the core shroud area was normal. The plant was brought to a cold shutdown condition to analyze the cause of the triple low level and to evaluate the possibility of fuel damage.

Conclusion

Review of the occurrence by the licensee and NRC established that although the water level in the core shroud area went below the triple low level setpoint, no fuel was uncovered and no fuel damage is expected to have occurred.

FIGURE 4



This Information Notice provides the details of a significant occurrence that is still under review by the NRC staff. If further NRC review indicates, an IE Circular or Bulletin may be issued to recommend or request specific licensee actions.

No written response is required. If you desire additional information regarding this matter, please contact the Director of the appropriate NRC Regional Office.

Enclosure:
List of Information Notices
Issued in 1979