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Regulatory File

Commonwealth Edison Company

ONE FIRST NATIONAL PLAZA ★ CHICAGO, ILLINOIS

Address Reply to:
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December 3, 1971

Dr. Peter A. Morris, Director
Division of Reactor Licensing
U.S. Atomic Energy Commission
Washington, D.C. 20545

Subject: Additional Information concerning isolation of the primary system on reactor vessel high water level - Dresden Units 2 and 3

Dear Dr. Morris:

During the second fuel replacement outage on Dresden Unit 2, a high water level trip signal was added to the isolation circuitry. This high water level trip was active only in the refuel and startup/hot standby modes. This change was reviewed and approved by the Station and Nuclear Review Boards and was determined not to be an unreviewed safety question. The modification was reported in the Dresden Units 2 and 3 Semi-Annual Report covering the period of January to June 1971.

Based on the information in the Semi-Annual Report, members of your staff requested additional information on this subject. In addition, this matter was the subject of a letter dated October 28, 1971 from Region III Compliance who considered the installation of this trip to be in non-compliance with AEC requirements. We responded to the Region III letter by our letter of November 19, 1971.

The attached report indicates that should the pressure regulator fail during reactor startup, the stresses imposed on the vessel are not great enough to cause a significant change in the usage factor. We, therefore, conclude that this is not a safety consideration and that installation of the high reactor water level isolation to mitigate the consequences of failure of the pressure regulator is not a modification requiring your authorization.

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Should you have any questions concerning the attached report, please let us know.

In addition to three signed originals, 19 copies of this report are also submitted.

Very truly yours,

Wayne L. Stiede

Wayne L. Stiede
Nuclear Licensing Administrator

SUBSCRIBED and SWORN to before me this 3rd day of December, 1971.

Patricia A. Nelson

Notary Public

cc: Mr. Boyce H. Grier
Region III Compliance

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HIGH WATER LEVEL ISOLATION

Received w/Ltr Dated 12-3-71

A high water level isolation in the startup/hot standby position of the reactor mode switch has been installed in the Dresden and Quad-Cities reactors as an operational device. Installation of this device was reported in the Dresden Units 2 and 3 Semi-Annual Report covering the period January through June of 1971. This circuitry was installed because of recent experience in other boiling water reactor plants which indicated that an inadvertent failure of the pressure regulator could occur which can cause the bypass valves to open fully. This action would cause depressurization of the reactor.

The AEC Division of Compliance Region III and the Division of Reactor Licensing have requested an analysis be submitted to them concerning the safety aspects of the event and the design change which has been provided. The following report is intended to meet this request. The attached curves represent the reactor pressure, temperature, and the actual water level transients that would result from a vessel blowdown through the bypass system due to a pressure regulator failure assuming the high water level isolation system was not installed.

ANALYSIS

If the reactor is operating in a condition such that the mode switch is in the run mode and there is a pressure regulator failure resulting in full opening of the turbine bypass valves, the reactor pressure vessel would begin to depressurize. However, in approximately 20 seconds the main steam line isolation valves (MSIV) would automatically close because of a low pressure (850 psig) main steam line isolation trip which would terminate the depressurization. For the startup/hot standby position of the reactor mode switch, low pressure main steam line isolation trip would not be in effect since it is bypassed by the mode switch. To mitigate the consequences of a vessel blowdown caused by a pressure regulator failure when the reactor is operating with the mode switch in the startup/hot standby position, the high level isolation trip was installed. This report shows however that the stresses imposed on the vessel and the fatigue usage factor are not of safety significance. Should the pressure regulator fail while the reactor is operating with the mode switch in the startup/hot standby, the reactor pressure will start to drop and consequently the water level would swell causing a high water level trip which would result in the MSIV's closing. This sequence of events would take place in approximately 10-20 seconds.

The attached curves represent the reactor pressure (Figure 1), temperature (Figure 2), and actual water level (Figure 3) transients that would result from a vessel blowdown through the steam bypass system due to a pressure regulator failure if there were no high level isolation trip. The temperature of the steam and fluid in contact

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with the pressure vessel would be as shown by the upper solid line in Figure 2, except for the downcomer region around the jet pumps. If there is good mixing of the feedwater flow with the downcomer fluid the temperature in the downcomer would be as shown by the dotted line. If there is poor mixing in the downcomer (for instance, the recirculation pumps are off and the feedwater flow is entering slowly) the temperature of the fluid in contact with the vessel wall in the downcomer could approach the temperature of the feedwater as a lower limit.

The reactor pressure vessel blowdown temperature transient presented in Figure 2 was reviewed to determine its effect on the Dresden and Quad-Cities vessels should such a transient occur. The Vessel Report filed as part of the Dresden and Quad-Cities FSAR's includes an analysis of the stresses associated with one electromatic relief valve opening. The inadvertent opening of one of the electromatic relief valves results in the reactor water temperature dropping to 373°F in ten minutes. For the case of all bypass valves opening (without isolation) the reactor water temperature drops to 375°F in approximately six minutes. Therefore, an even more severe transient; namely, the loss of feedwater pumps with HPCI, was used in the review. This latter transient is not included in the Vessel Report for Dresden or Quad-Cities but was investigated in a separate, for information only, analysis of the Dresden Unit 2 vessel. It should be noted that the

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loss of feedwater pumps and actuation of the HPCI results in the reactor water temperature dropping to 300°F in four minutes. Thus, use of this transient for comparison purposes is conservative.

The component most strongly affected by the loss of feedwater pumps and actuation of the HPCI is the reactor pressure vessel support skirt. The range of the primary plus secondary stress intensities for the support skirt for conditions which are reported in the Vessel Report is 95,000 psi and with loss of feedwater pumps and HPCI actuation is 111,000 psi. Both of these values are greater than the $3S_m$ limit of 80,000 psi. It was, therefore, necessary to go to an elastic plastic analysis (as given in Code Case 1441) to show that these stress values are acceptable. The usage factors calculated by use of elastic plastic analysis is 0.44 for the transients analyzed in the Vessel Report and 0.55 when ten occurrences of loss of feedwater pumps and actuation of HPCI are assumed to occur along with the transients analyzed in the Vessel Report.

The ten occurrences of loss of feedwater pumps caused an increase in usage factor of U= 0.55-0.44=0.11/10 cycles or 0.011/cycle. Therefore, if 40 additional cycles occurred with all other transients remaining as specified for Dresden Unit 2, the total usage factor would be U=0.55 + 40x0.011=0.99.

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The conclusion to be reached is that because the loss of feedwater pump transient with actuation of HPCI is more severe than the blowdown transient associated with pressure regulator failure, the Dresden and Quad-Cities vessels could experience at least 40 of the pressure regulator blowdown transients without exceeding a usage factor of 1.0. However, to minimize even further the stresses on the vessel, the high water level isolation trip has been installed. It should be pointed out that a single failure in the pressure regulator and a procedural error could result in both the control and bypass valves opening with the reactor operating with the mode switch in the startup/hot standby position. This would result in an initial blowdown greater than analyzed in this report. However, the blowdown resulting from opening of both bypass and control valves would result in a water level swell and turbine trip on high water level in approximately three seconds. This action would result in closing of the stop valves leaving only blowdown through the bypass valves. The transient following stop valve closure is the same as analyzed here. It is concluded, therefore, that this transient and the one analyzed in this report are essentially the same.

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CONCLUSION

It is concluded that reactor safety would not be in question if the high water level isolation was not installed. The installation of this system was made for operational reasons and not safety. However, even if the high level isolation is not required as a safety system, we believe it should remain in the isolation circuitry to prevent uncontrolled vessel blowdowns. The electrical circuitry has been analyzed and it is concluded that the addition of the high water level trip circuitry will not prevent isolation circuitry from functioning should a protection signal occur which requires such isolation.

FIGURE 1 REACTOR PRESSURE

DRESDEN 2 & 3 AND QUAD CITIES 1 & 2 BYPASS FAILURE (40 % BYPASS) IN STARTUP/SHUTDOWN MODE WITH FEEDWATER FLOW

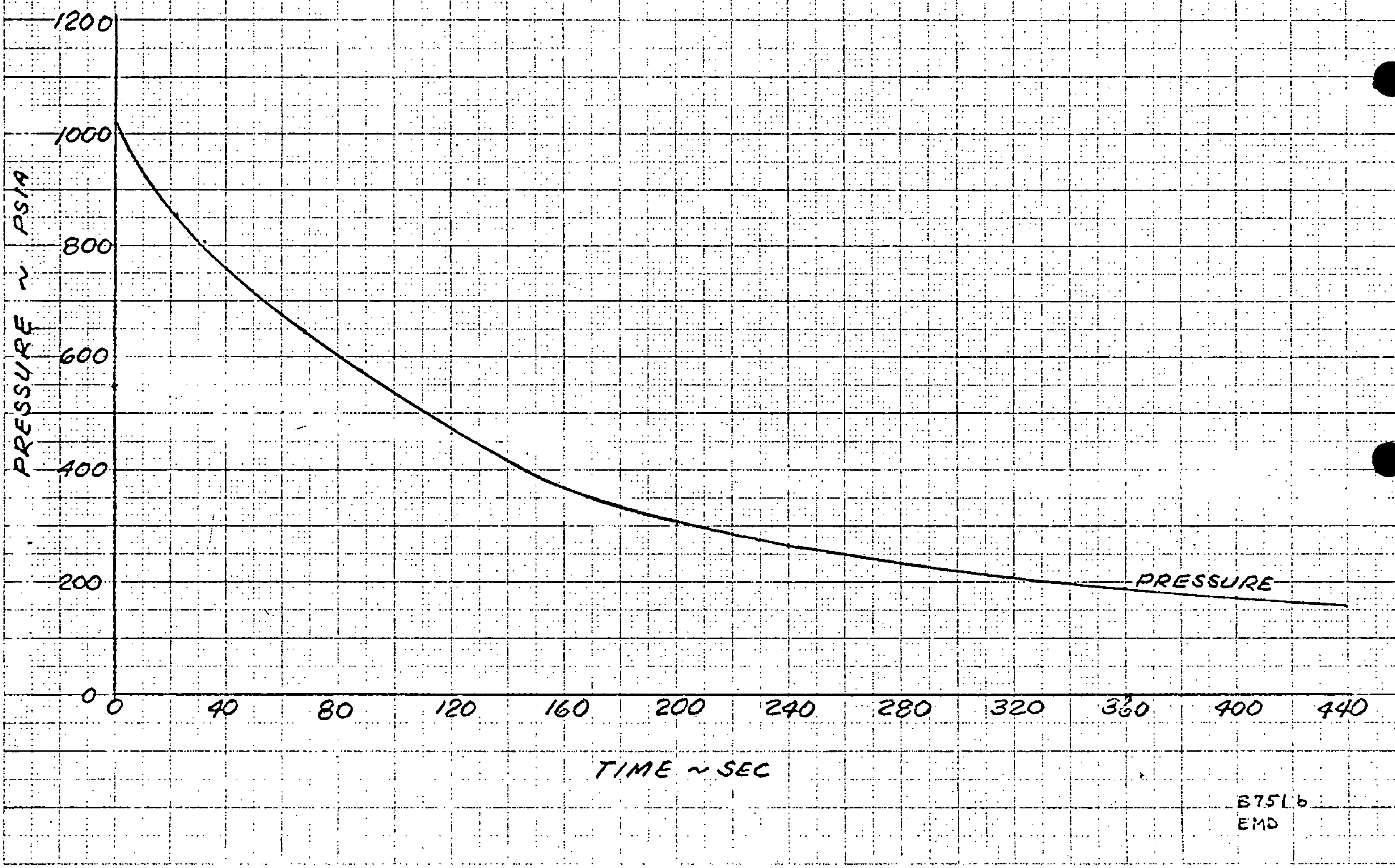

FIGURE 2 REACTOR TEMPERATURE

DRESDEN 2 & 3 AND QUAD CITIES 1 & 2 BYPASS FAILURE (40 % BYPASS) IN STARTUP/SHUTDOWN MODE WITH FEEDWATER FLOW

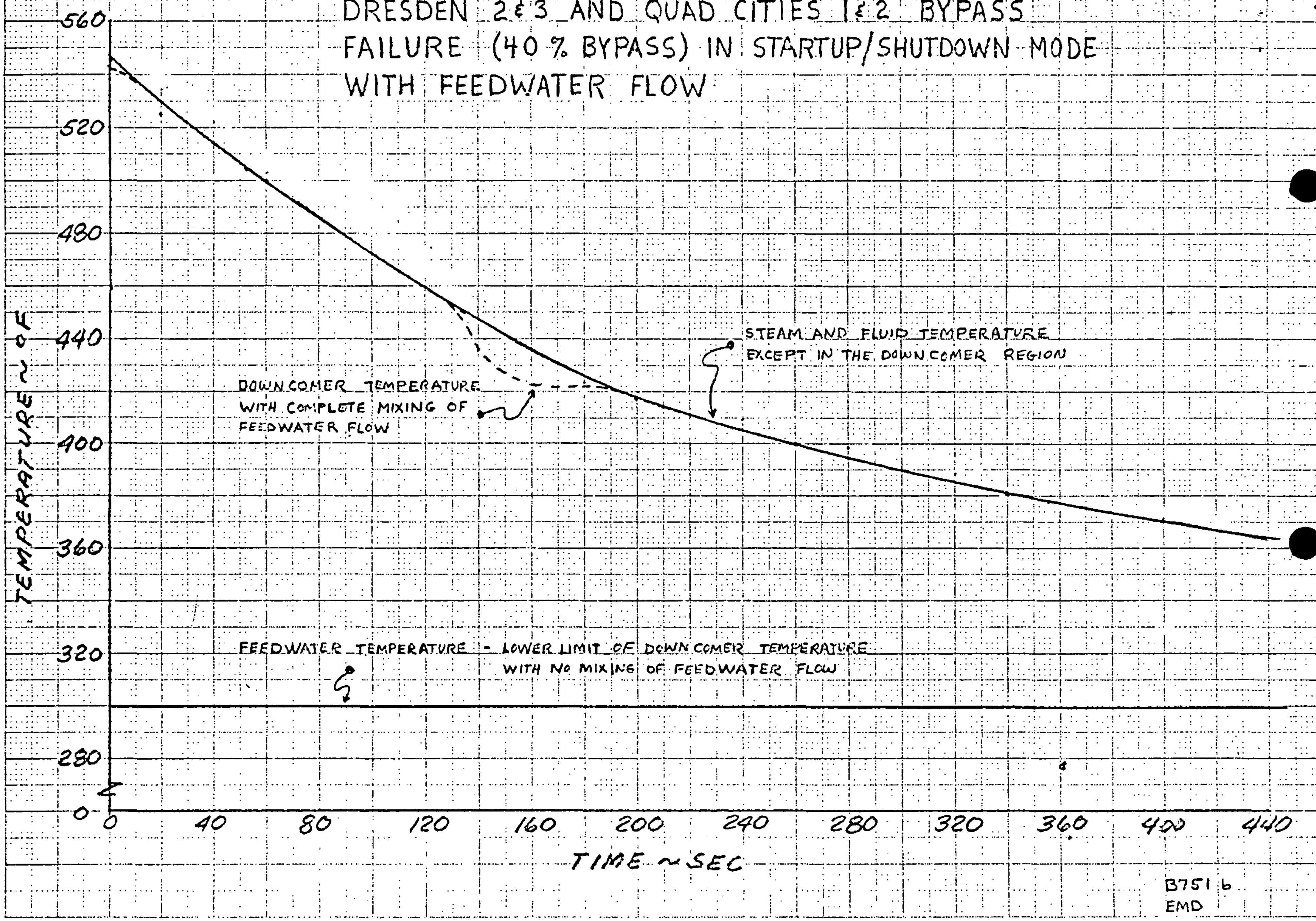

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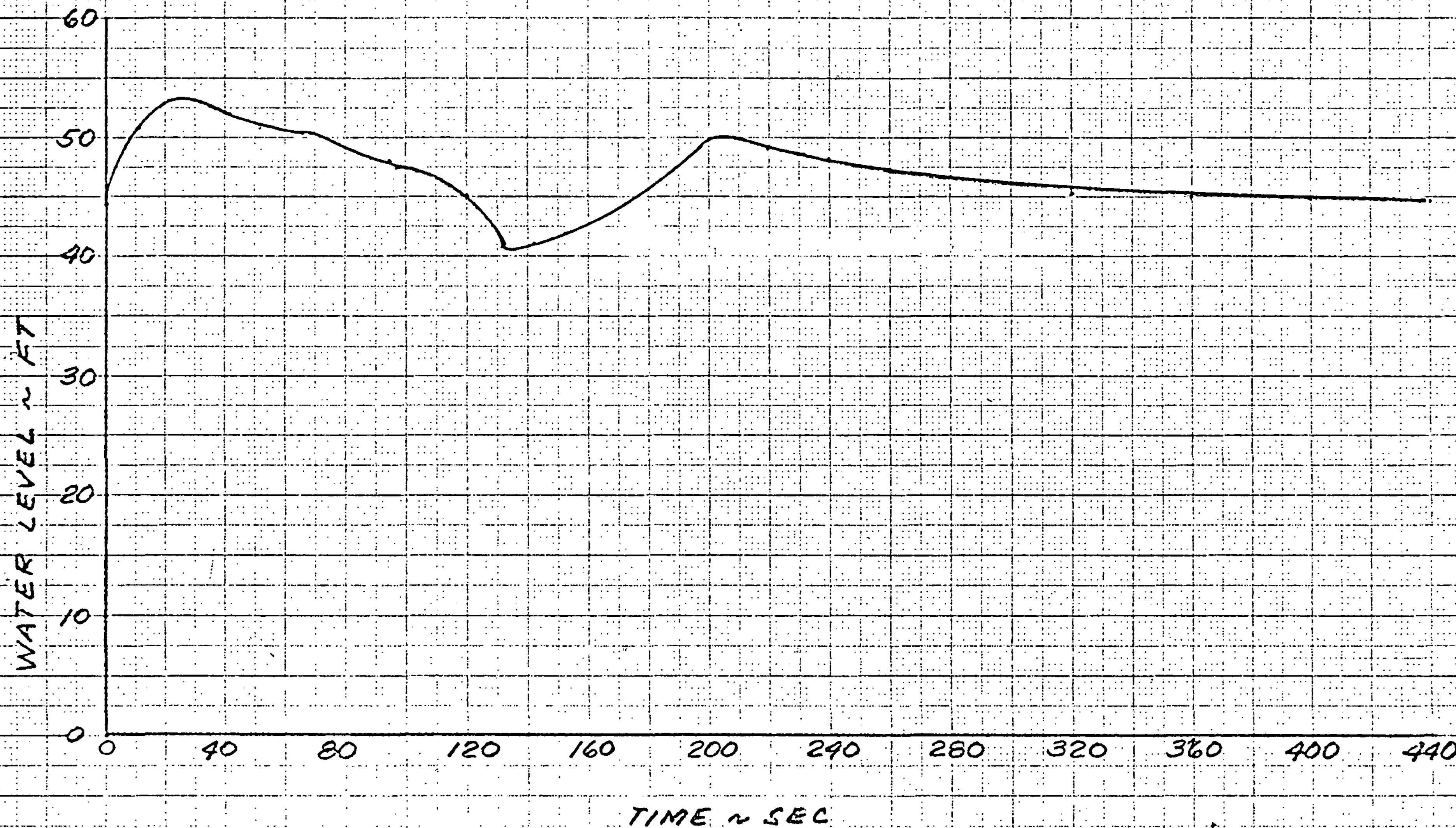
FIGURE 3 ACTUAL REACTOR WATER LEVEL

DRESDEN 2 & 3 AND QUAD CITIES 1 & 2 BYPASS FAILURE (40 % BYPASS) IN STARTUP/SHUTDOWN MODE WITH FEEDWATER FLOW



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