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SCHWENCER,A. Licensing Branch 2

SUBJECT: Forwards summary of addl event demonstrating stratification on w/o reactor water cleanup backflow in horizontal piping downstream of vertical pipe runs & in other portions of reactor feedwater piping.

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January 9, 1985
G02-85-011

Docket No. 50-397

Director of Nuclear Reactor Regulation
Attention: Mr. A. Schwencer, Chief
Licensing Branch No. 2
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Schwencer:

Subject: NUCLEAR PLANT NO. 2
FEEDWATER PIPING THERMAL DEFLECTION
EVENT - OCTOBER 16, 1984

Reference: Letter, G02-84-541, G. C. Sorensen (SS) to A. Schwencer (NRC), "Feedwater Piping Thermal Deflection Events; Final Report", dated October 16, 1984

The referenced letter provided a report on several feedwater piping thermal deflection events at WNP-2 and stated that Reactor Water Cleanup (RWCU) backflow contributed towards the thermal gradients encountered. The attached report summarizes an additional event that demonstrates that stratification can occur without RWCU backflow, that stratification can additionally occur in other portions of reactor feedwater piping beyond that identified in the referenced report, and that stratification can occur in horizontal piping downstream of vertical pipe runs.

This summary is provided for information only; no further reports are anticipated. Should you have any questions, please contact Mr. P. L. Powell, Manager, WNP-2 Licensing.

Very truly yours,

G C Sorensen

G. C. Sorensen, Manager
Regulatory Programs

PLP/tmh
Attachment

cc: R Auluck - NRC
WS Chin - BPA
J Crews - NRC RV
JB Martin - NRC RV
AD Toth - NRC Site
E Weiss - NRC

A001
1/1

ATTACHMENT

RFW PIPE DEFLECTION DATA, OCTOBER 1, 1984 EVENT

In summary, data from this event shows:

- o Temperature stratification occurring in the RFW piping after reactor scram, though manual actions had been taken to prevent RWCU backflow;
- o Temperature stratification occurring in RFW piping upstream of the cross-tied 24" piping loop through which RWCU backflow circulated during the first major pipe deflection event in August, 1984;
- o Temperature stratification occurring (to a lesser degree) in RFW piping located in the WNP-2 Reactor Building main steam tunnel. This portion of piping is connected to RFW piping in the Turbine Building by 22' vertical pipe risers.

The significance of this data is that it demonstrated temperature stratification occurs without RWCU backflow; stratification must be considered in additional portions of RFW piping; and that stratification will also occur in horizontal piping downstream of vertical pipe runs.

There was an expectation that vertical piping would induce downstream mixing since density differences would not preclude cross-sectional mixing in the vertical riser. Upon entry to the downstream horizontal pipe run, however, the colder water from the vertical riser again flows preferentially along the bottom of the pipe, resulting again in a top-to-bottom temperature gradient. This temperature gradient is one half the magnitude ($\sim 100^{o}F$) of that which occurs in the Turbine Building horizontal pipe runs ($\sim 200^{o}F$). Deflection induced in the main steam tunnel pipe run is complimentary (the same direction) to the RFW piping in the Turbine Building, resulting in lower pipe stress at both locations when compared to pipe bowing occurring in the Turbine Building only.

Sequence:

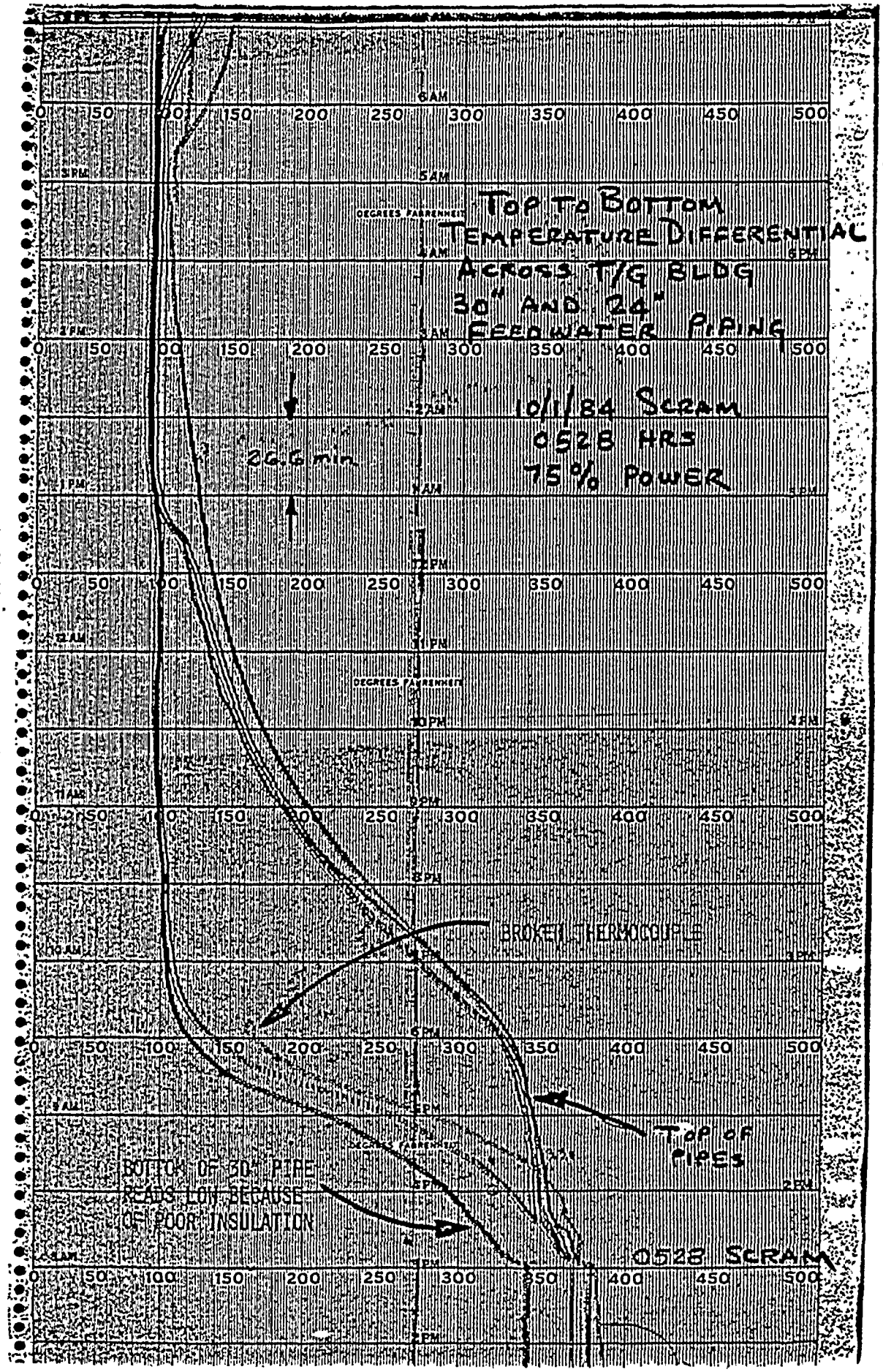
- o Reactor initial power 75%
- o Reactor scram @ 0528 hours, 10/01/84
- o Feedwater supply to RPV maintained
- o RWCU immediately transferred to condenser to preclude backflow of higher temperature water into RFW piping
- o Feedwater supply from condensate dropped rapidly to $100^{o}F$

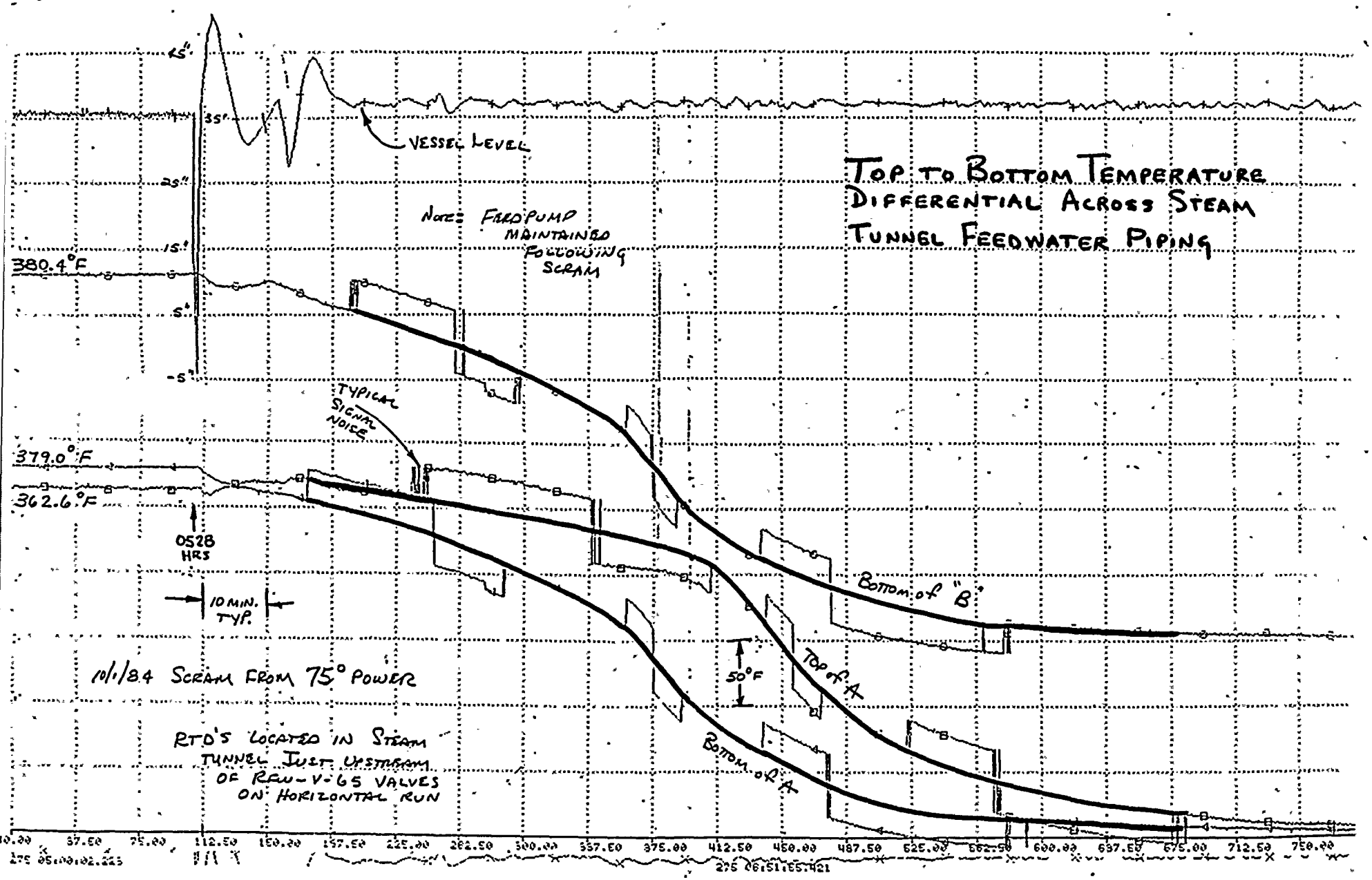
- o 0645 hours, 200°F top-to-bottom temperature gradient measured in Turbine Building RFW piping
- o 0650 hours, maximum vertical displacement recorded at RFW-114 in the Turbine Building
- o 0650 hours, 100°F top-to-bottom temperature gradient measured in main steam tunnel RFW piping

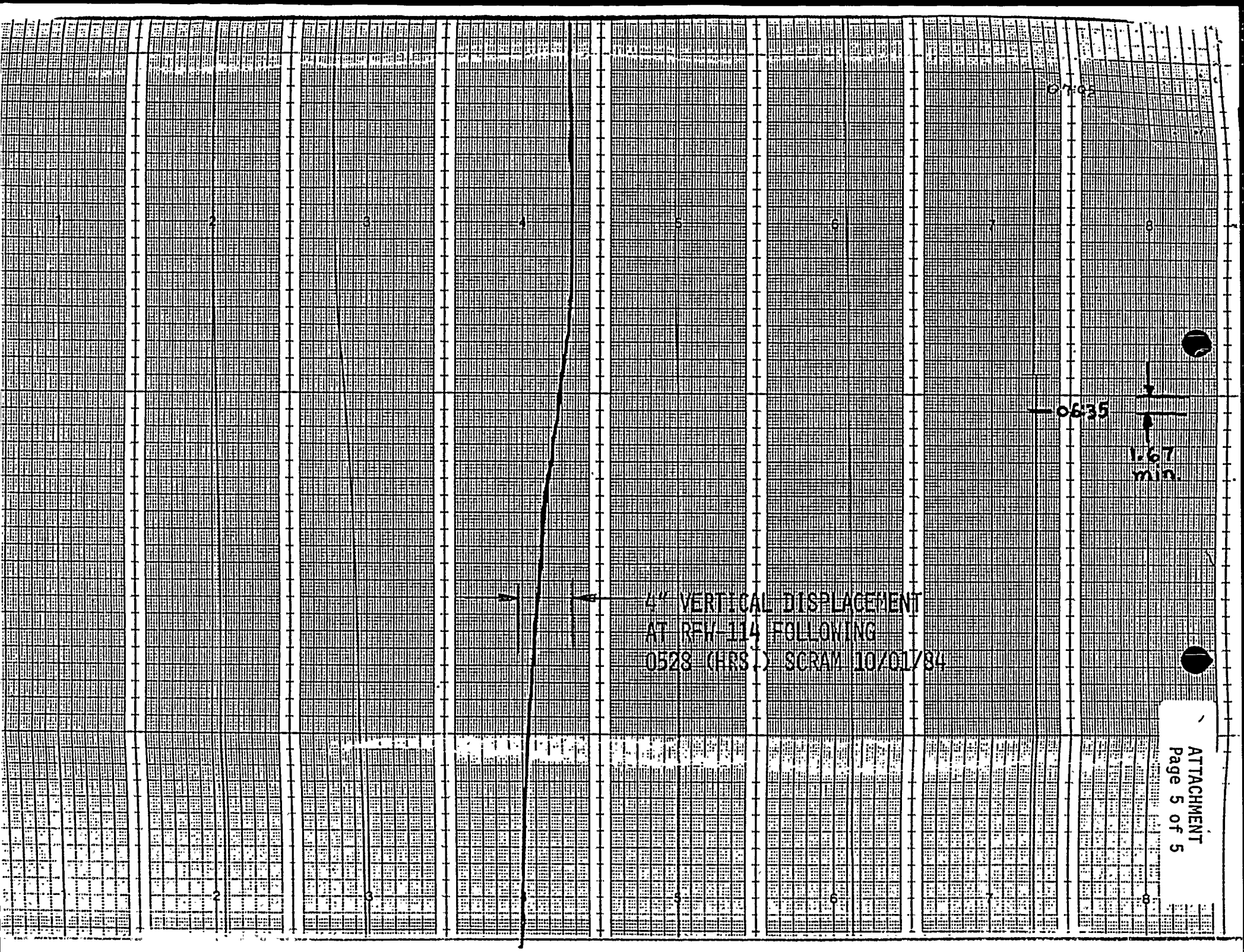
Reference: Design Engineering Report, WNP-2 Feedwater Piping Thermal Deflection Events, Washington Public Power Supply System Nuclear Plant No. 2, Richland, Washington

Note: Data in this attachment is supplementary to the above referenced report; knowledge of the content of the referenced report is required.

ANK
12/07/84


TOP TO BOTTOM
TEMPERATURE DIFFERENTIAL
ACROSS T/G BLDG
30" AND 24"
FEEDWATER PIPING
10/1/84 SCRAM
0528 HRS
75% POWER
26.6 min
BROKEN THERMOCOUPLES
TOP OF PIPES
BOTTOM OF 30" PIPE READS LOW BECAUSE OF POOR INSULATION
0528 SCRAM
DEGREES FAHRENHEIT
0
50
100
150
200
250
300
350
400
450
500


TOP TO BOTTOM TEMPERATURE DIFFERENTIAL ACROSS STEAM TUNNEL FEEDWATER PIPING
VESSEL LEVEL
NOTE: FWD PUMP MAINTAINED FOLLOWING SCRAM
380.4°F
379.0°F
362.6°F
TYPICAL SIGNAL NOISE
0528 HRS
10 MIN. TYP.
BOTTOM of "B"
TOP of A
BOTTOM of A
50°F
10/1/84 SCRAM FROM 75° POWER
RTD'S LOCATED IN STEAM TUNNEL JUST UPSTREAM OF RCU-V-65 VALVES ON HORIZONTAL RUN
45"
35"
25"
15"
5"
-5"
37.50
75.00
112.50
150.00
187.50
225.00
262.50
300.00
337.50
375.00
412.50
450.00
487.50
525.00
562.50
600.00
637.50
675.00
712.50
750.00



ATTACHMENT
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