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COINCIDENT STRESS AND PRESSURE DATA
OBTAINED FROM PT-278-A AND PT-301-I

References: HW-60864, "R Reactor Bulk Temperature Program," SS Jones, October 15, 1959 ().

Letter by RL Loundagin to OE Adams, "Design Test No. 1053, Strain Gage Readings of 105-DR Effluent Piping Taken in Conjunction With PT-278-A and PT-301-I," April 19, 1960.

Report by Radiographic Testing Operation, Hanford Laboratories Operation F-87-A Supp., March 15, 1960.

Personal communication with OE Adams, SS Jones, JL Benson and JM Manuel; May 16-26, 1960.

INTRODUCTION

This document presents experimental data obtained during a series of tests which were completed at 105-D and DR Reactors in February and March, 1960. No analysis of the data is included in this document. The tests were:

<u>Date</u>	<u>PT Number</u>	<u>Conditions</u>
2-22-60	PT-301-I, II	Reactor cold, full flow, BPA power failure*
2-23/24-60	PT-278-A, III B	1170 MW, full flow, BPA power failure*
3-9-60	PT-278-A, II	1190 MW, full flow, poison push causing bulk surge and scram

*Simulated

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The data consists of coincident stresses and pressures at times of peak stress occurrences during the tests. The pressure and strain measurements were taken at positions on the rear face effluent piping system and the downcomer. All data are for 105-DR Reactor.

R. L. Scott, of Radiographic Testing Operation, Hanford Laboratories Operation, and R. L. Loundagin, of Materials Development Operation, Facilities Engineering Operation, installed the strain gages and obtained strain measurements. The strain measurements were reduced to apparent or principle stresses by graphical solution.

The pressure gages and recording instrumentation were installed and operated by Hal Copeland of Industrial Engineering, Facilities Engineering Operation. The pressure recording charts were read and corrected by J. M. Manuel of Reactor Engineering, Research and Engineering Operation.

DR Reactor operating conditions at times of high stress conditions were obtained by the Reactor Engineer, Jack Benson.

Sketches showing the location of all strain gages and pressure taps are included. Not all pressure and strain gages were recorded during this set of tests.

J. P. Hawley, Reactor Engineering
Process and Reactor Development
IRRADIATION PROCESSING DEPARTMENT

O. E. Adams, Reactor Engineering
Process and Reactor Development
IRRADIATION PROCESSING DEPARTMENT

S. S. Jones, Reactor Engineering
Process and Reactor Development
IRRADIATION PROCESSING DEPARTMENT

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TABLE I

PT-301-I, II - 105-DR - 2/22/60
SUMMARY OF TEST RESULTS

Date-Time	TORP (Psi)	Flow (GPM) (1000)	ti (°C)	to (°C)	Power (MW)	Pres. Gage	Pressure in psi			Strain Gage	Apparent Stress* or Principle Stresses		Angle From Pipe Axis
						No.	Median	Max.	Min.	No.	σ (Psi)	σ_2	
2-22-60 05:41 pm	472	71.8	5.4	6.4	0	AP-1	9.0	11.2	5.5	AS-1	5,364	-287	4.5°
						AP-2	4.0	4.6	3.0	AS-2	2,682	798	35°
						BP-1	-6.2	-5.5	-8.0	AS-3B	290*		60°
						BP-2	-4.2	-3.4	-5.4	AS-4	6,122	2,982	80°
						BP-3	-3.0	-1.8	-4.0		$\pm$ 696	$\pm$ 0	
						BP-4	-0.1	-0.1	-0.1	BS-1	3,088	1,408	32.2°
						CP-1	4.5	7.0	2.0	BS-2	829	41	58°
						CP-2	-0.1	-0.1	-0.15	BS-3A	72.5*		90°
						DP-1	3.7	7.7	-0.3	BS-3B	72.5*		30°
						FP-1	3.9	5.4	2.4	CS-2	290*		---
						KP-1	9.8	10.0	9.6	CS-3	-145*		---
						LP-1	21.9	22.1	21.7				
						MP-1	14.1	14.2	14.0				

Stresses all dropped sharply after the pumps were tripped out. Therefore, no other times were examined.

NOTE: The frequency of stress fluctuations during all tests was measured and is available.
Contact O. E. Adams, Jr., or J. P. Hawley if this information is desired.

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TABLE II

PT-278-A, III B - 105-DR - 2/23-24/60
SUMMARY OF TEST RESULTS

Date-Time	TORP (Psi)	Flow (GPM) 1000	ti (°C)	to (°C)	Power (MW)	Pres. Gage No.	Pressure in psi			Strain Gage No.	Apparent Stress* or Principle Stresses		Angle From Pipe Axis
							Median	Max.	Min.		σ_1 (psi)	σ_2	
2-23-60 08:30 pm	75	24.8	6.2	7.7	0	AP-1	4.7	5.0	4.4	AS-1B	870*		60°
						AP-2	3.6	3.8	3.5	AS-1C	725*		60°
						BP-1	—	—	—	AS-2	1,073	-57	17°
						BP-2	0.1	0.1	0.1	AS-3B	1,522*		60°
						BP-3	-0.05	.05	-0.1	BS-3A	-435*		90°
						BP-4	0	+.05	-.05	BS-3B	-435*		30°
						CP-2	-0.25	0	-0.5	CS-2	72.5*		—
						DP-1	1.2	3.9	-1.8	CS-3	-145*		—
						FP-1	1.6	3.4	-0.1	BS-1	1,418	758	35.5°
						KP-1	4.2	4.3	4.2				
						LP-1	11.1	11.4	10.9				
						MP-1	7.0	6.9	7.1				
2-23-60 09:14:30 pm	478	70.6	5.1	6.0	0	AP-1	7.7	10	5	AS-1B	362*		60°
						AP-2	1.8	2.5	1	AS-1C	-218*		60°
						BP-1	-5.6	-4.4	-6.9	AS-2	332	-3,088	1°
						BP-2	-4.0	-2.9	-4.5	AS-3B	-1,653*		60°
						BP-3	-2.75	-1.6	-3.7	AS-4	5,833	2,633	87°
						BP-4	-0.4	-0.2	-0.5		+ 1,007	+ 717	
						CP-2	-0.15	-0.1	-0.2	BS-1	1,089	653	60°
						DP-1	3.7	10.7	-2.3	BS-2	554	84	54°
						FP-1	3.2	5.9	1.4		+ 87	+ 0	
						KP-1	8.1	8.6	7.8	BS-3A	-580*		90°
						LP-1	20.2	20.5	20.0	BS-3B	-580*		30°
						MP-1	13.2	13.7	12.7	CS-2	218*		—
										CS-3	-362*		—
2-24-60 00:34 am	508	75.8	5.0	42.5	700	BP-1	-6.2	-5.4	-7.7	AS-1B	1,653*		60°
						BP-2	-4.4	-2.9	-5.4	AS-1C	725*		60°
						BP-3	-2.6	-1.8	-4.0	AS-2	1,492	-188	23°
						CP-2	-0.1	-0.05	-0.15	AS-3B	-435*		60°
						DP-1	4.7	9.9	-0.3	AS-4	15,920	6,240	83.5°
						FP-1	3.7	5.9	1.9		+1,590	+1,190	
						KP-1	9.4	9.6	9.2	BS-1	698	318	9.8°
						LP-1	21.7	21.9	21.4	BS-2	-2,474	-3,674	10°
										+ 130	+ 0		
										CS-2	1,232*		—

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TABLE II (Contd)

Date-Time	TORP (Psi)	Flow (GPM) 1000	ti (°C)	to (°C)	Power (MW)	Pres. Gage No.	Pressure in psi			Strain Gage No.	Apparent Stress* or Principle Stresses		Angle From Pipe Axis
							Median	Max.	Min.		(psi)		
2-24-60 00:55 am	517	77.3	4.9	52.8	1170	BP-1	-6.3	-5.7	-7.4	AS-1B	3,045*		60°
						BP-2	-4.6	-3.4	-5.6	AS-1C	942*		60°
						BP-3	-2.7	-1.7	-3.6	AS-2	-2,708	-4,108	52.5°
						CP-2	-0.22	-0.15	-0.27	AS-3B	1,015*		60°
						DP-1	4.9	7.7	1.7	AS-4	17,867	8,987	89°
						FP-1	3.1	7.9	-0.5		+1,441	+ 995	
						KP-1	9.7	10.1	9.6	BS-1	1,520	1,380	30°
						LP-1	21.8	21.9	21.7	BS-2	-3,560	-6,360	9°
											+ 260	+ 0	
										BS-3A	4,712*		90°
										BS-3B	2,030*		30°
										CS-2	1,668*		---
										CS-3	- 725*		---
01:01:00 am 2-24-60 Trip Out	517	77.3	4.9	52.8	1170	BP-1	-6.3	-5.7	-7.4	AS-3B	3,190*		60°
						BP-2	-4.6	-3.4	-5.6	AS-4	17,354	8,834	89.5°
						BP-3	-2.7	-1.7	-3.6		+1,278	+ 838	
						CP-2	-0.22	-0.15	-0.27	BS-1	4,030	2,930	67.2°
						DP-1	4.9	7.7	1.7	BS-2	-6,145	-8,645	7.5°
						FP-1	3.1	7.9	-0.5		+ 206	+ 0	
						KP-1	9.7	10.1	9.6	CS-2	2,030*		---
						LP-1	21.8	21.9	21.7				
01:01:53 am 2-24-60 Post- Trip Out	~130	~35.0	4.9	~12.4	0	BP-1	-0.3	-0.1	-0.7	AS-1B	2,102*		60°
						BP-2	-0.7	-0.3	-1.2	AS-1C	1,522*		60°
						BP-3	-0.7	-0.4	-0.9	AS-2	6,975	4,915	19°
						CP-2	0.9	1.0	0.8	AS-3B	-725*		60°
						DP-1	-0.8	3.7	-4.8	AS-4	4,007	2,607	44°
						FP-1	1.3	5.7	-2.0	BS-1	344	90	15°
						KP-1	2.8	3.0	2.6	BS-2	-11,780	-13,220	17°
						LP-1	12.9	13.1	12.7	BS-3A	-580*		90°
										BS-3B	-435*		30°
										CS-2	652*		---
										CS-3	-798*		---

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TABLE III

PT-278-A, II - 105-DR - 3/9/60
SUMMARY OF TEST RESULTS

Date-Time	TORP (Psi)	Flow GPM 1000	ti (°C)	to (°C)	Power (MW)	Pres. Gage No.	Pressure in psi			Strain Gage No.	Apparent Stress* or Principle Stresses σ_1 (psi) σ_2		Angle From Pile Axis
							Median	Max.	Min.				
3-9-60 03:25 pm	503	78.1	6.4	69.1	1190	BP-1	-6.3	-6.0	-8.0	AS-1	1,525	-2,395	1.8°
						BP-2	-4.6	-3.6	-5.6	AS-2	5,118	4,018	21°
						BP-3	-2.1	-1.1	-3.1	AS-3B	-1,885*		60°
						CP-2	0.78	0.90	0.65	AS-4	17,514	11,834	89°
						DP-1	5.8	9.7	2.0		± 946	± 416	
						FP-1	2.5	5.9	-0.9	BS-1A	362*		0°
						KP-1	10.6	11.3	9.9	BS-1C	362*		60°
						LP-1	13.5	13.8	13.2	BS-2	-13,845	-19,445	34°
										BS-3A	-2,610*		90°
										BS-3B	-2,175*		30°
										CS-2	-580*		---
										CS-3	+435*		---
3-9-60 03:40:05 pm Posion Flush + 1:05 mm.	~460	~70.3	6.4	~13.9	0	BP-1	-6.3	-5.3	-9.0	AS-1	5,328	328	57°
						BP-2	-4.3	-3.0	-5.0	AS-2	11,040	6,940	26.7°
						BP-3	-2.5	-1.3	-4.0	AS-3B	-3,335*		60°
						CP-2	0.5	0.6	0.4	AS-4	7,236	4,596	48°
						DP-1	3.4	7.4	-0.8		± 1,421	± 841	
						FP-1	3.9	6.1	2.4	BS-1A	3,262*		0°
						KP-1	9.7	10.2	9.4	BS-1C	1,450*		60°
						LP-1	13.5	13.9	13.2	BS-2	-14,766	-17,566	81°
										± 116	± 0		
										-1,595*		---	

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FIGURE 2
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