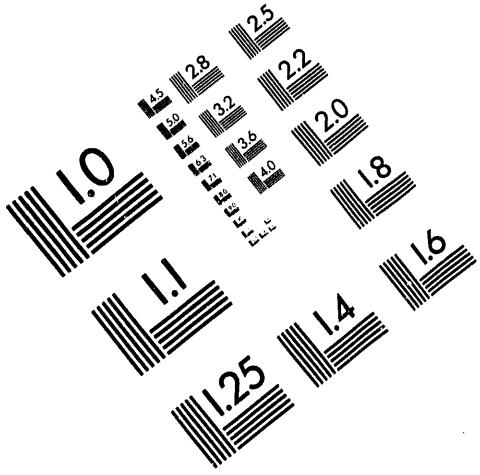
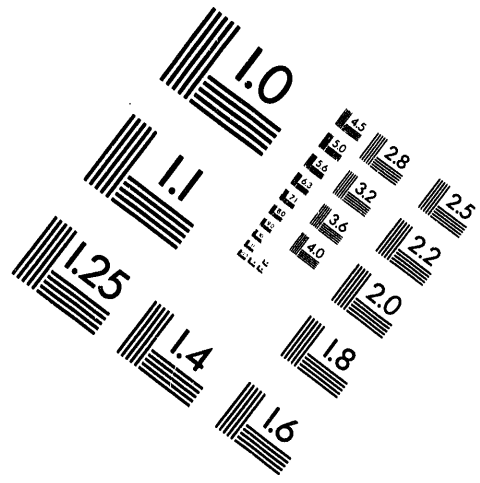
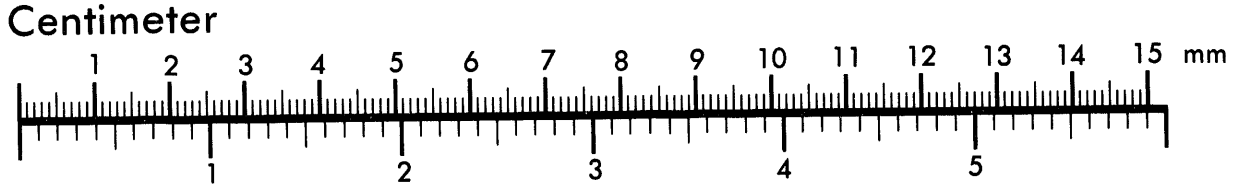
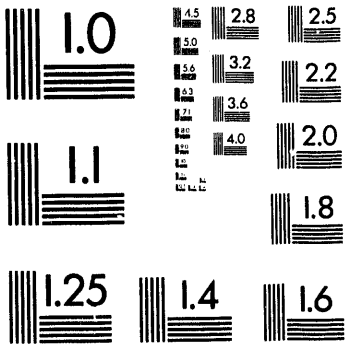
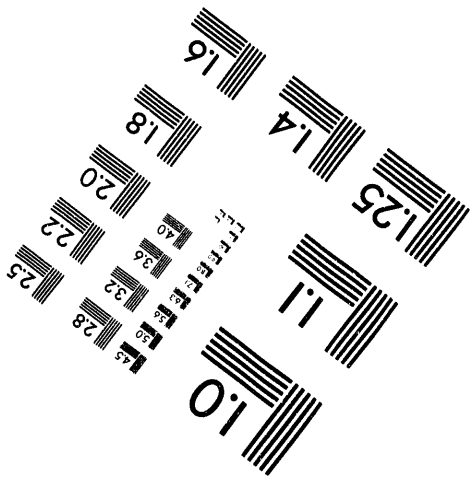


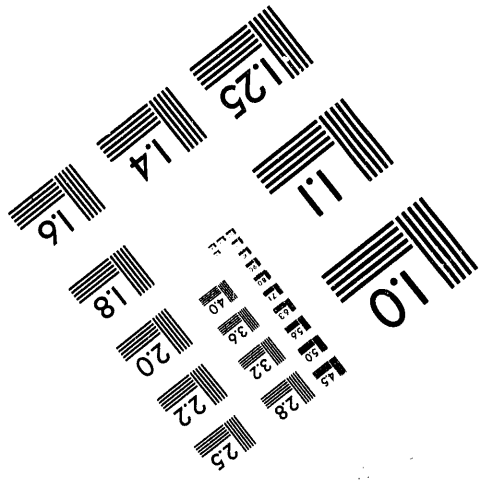
Association for Information and Image Management
1100 Wayne Avenue, Suite 1100
Silver Spring, Maryland 20910
301/587-8202











1 of 1

HW-7-3392

Cover Sheet for a Hanford Historical Document Released for Public Availability

Released 1994

**Prepared for the U.S. Department of Energy
under Contract DE-AC06-76RLO 1830**

**Pacific Northwest Laboratory
Operated for the U.S. Department of Energy
by Battelle Memorial Institute**

Battelle

DISCLAIMER

#1 - R. M. Evans
#2 - R. M. Evans
#3 - Area Engineer
#4 - Area Engineer
#5 - Area Engineer
#6 - Area Engineer
Attn.: Patent Group
#7 - N. Hilberry
#8 - N. Hilberry
#9 - N. Hilberry
#10 - D.A. Miller - T.N. Stapleton - 700 Area File
#11 - M. H. Smith
#12 - W. C. Kay
#13 - 300 Area File
#14 - Pink Copy
#15 - Yellow Copy
#16 - W. E. Jordan
#17 - C. P. Kidder—700 File
#18 - C. N. Gross

[redacted]

February 8, 1946

100 AREAS
January 29 through February 4

Physics

B Pile

B Pile has operated 25 MW below rated power level without interruption during the past week. The rate of gain of reactivity has been 1.5 ih/day. This has brought the excess reactivity held by rods to 40 inhours.

Shim rod calibrations in the withdrawal order used in B have been obtained from the rod position data after the start-up on January 21. The shim rod strengths were obtained by adding the normal excess reactivity to the calculated change in xenon poison. These poison values cannot be calculated accurately for the conditions under which the production distribution is thus disturbed by the horizontal rods and this limits the accuracy of such a calibration. These calibrations are used primarily for start-up predictions and they have adequate precision for this purpose. There is evidence for approximately 10% reduction in total shim rod effectiveness due to the shadowing by the permanent poison.

The north portion of B Retention Basin has been out of service this week. Its water level when nearly full dropped 24 in./day. This basin was pumped down so that its water level was the same as that in the flume separating the two basins. The basin level dropped 12 in./day under these conditions, indicating that the major leaks are not to the flume. It is planned to empty the basin and wash the sludge into the inlet of the south portion in order to inspect the bottom.

D Pile

D Pile was shut down on January 29. During the shutdown, 103 tubes of irradiated metal were discharged; in addition 2 tubes of bismuth were removed. The effective length of the shutdown was about 15 hours.

During operation after the shutdown it was necessary to reduce the level 10 MW below the regular operating level on two occasions to meet graphite temperature restrictions. The first of these intervals at reduced power lasted about 2-1/2 hours and the second about 2 hours. In both cases two or more horizontal rods were being used in intermediate positions causing the heat distribution to be shifted to the far side of the pile.

The pile reached equilibrium operating conditions on February 2 with 56 inhours of excess reactivity held by A Rod. It is not yet possible to make a reliable estimate of the reactivity loss associated with the discharge of January 29, but the above figure represents a loss of 4 inhours from the 60 inhours held at the time of the shutdown.

During periods of equilibrium operation the following tube temperature data were obtained.

Av. hottest ten tubes in 0.240-inch zone	39.8°C
Av. inlet water temperature	5.8
Av. temperature rise in ten hottest tubes	34.0

The degree of flattening realized in this pile is indicated by the fact that 90% of the tubes in the central orifice zone have at least 85% of the maximum temperature rise in this zone; all of the tubes in the central zone have at least 80% of the maximum rise in this zone.

F Pile

F Pile was run steadily throughout the week at 25 MW below rated level. There were no scrams or shutdowns.

There have been further developments in the attempt to provide a more precise method for measuring power. Originally, measurements indicated that the temperature of the outlet water as indicated by the thermohm, by the mercury thermometer in A Sample Room, and by a resistance thermometer at the inlet to the retention basin was the same. More recent measurements have indicated that the temperature measured at the entrance to the retention basin was 0.1 °C hotter than the A Sample Room temperature. While this would be a significant difference if the two instruments were in good condition, the resistance thermometer, when withdrawn from the retention basin inlet, was in a considerably battered condition due to the turbulence of the water and its accuracy is questionable. A more serious difficulty has appeared, however. The thermohm had, in the past, indicated a power level about 2 MW lower than that calculated from the A Sample Room temperatures. This caused no particular concern since a maladjustment of the circuit could easily produce such a difference. However, when the rod configuration used to control the pile was recently changed in such a way as to shift the temperature distribution the difference between the two instruments quickly increased to 5 MW and remained there. Furthermore, measurements made during start-up periods, when many rods are in the pile, show differences as much as 15 MW between the two instruments. It thus appears that the old difficulty of incomplete mixing of the water may still be present. Further tests are planned calling for abrupt changes in rod configurations with other factors held as constant as possible.

The Bailey outlet temperature elements have been installed in A Sample Room and the outlet temperature indicated by these elements is in agreement with the mercury thermometer. The power level, as indicated by the Bailey Calculator circuit, is however 10 to 15 MW low. This is regarded as purely an instrument problem and the circuit is currently being overhauled.

Temperature maps have been quite satisfactory since the recent change in P-column strengths. They have exhibited one unusual feature, however, in that the hottest

tubes in the 0.240-inch orifice zone have been in the lower half of the unit while the hottest tubes in the other three orifice zones are in the upper right hand portion of the units. This may be due to the fact that the hottest tubes have been, for the most part, in the upper half of the unit throughout its history. The greater permanent reactivity gains in this region may be effective in producing a distortion of the distribution such as is observed. All tube temperatures are so far below current limits that no problem arises from this effect.

The total cold clean reactivity for the unit is 747 ih. The total gains for the week were 5 ih. This is slightly less than the 1 ih/day found before the last shutdown. Such a decrease in rate of gain is to be expected following a large push of high neutron effectiveness.

General

The annealing at 200 °C for 3 hours of a graphite sample which had elongated 0.52% during an exposure of 836 MW-days/C.T. in the test hole of the D Pile reduced the elongation to 0.48%. As previously reported, annealing in the Sykes experiment at temperatures up to 450 °C reduced the elongation to 0.41%.

A Sykes experiment on capsule graphite exposed 834 MW-days/C.T. in the D Pile gave 111 cal/gm, in comparison to 122 cal/gm previously observed in capsule graphite exposed 616 MW-days/C.T. This decrease in stored energy results from a further drop in the peak of the stored energy spectrum in the region of 200 °C annealing temperature; this effect was first noted on the capsule sample exposed 616 MW-days/C.T. and was interpreted as indication of a basic change in crystal structure.

Two casings of graphite samples cut transverse to the direction of extrusion were loaded into the test hole of the D Pile on January 29, to obtain further data on the rate of expansion.

Borescoping of the vertical and horizontal thimbles of the D and F Piles has confirmed the hypothesis that drastic corrosion occurs only in the presence of liquid water. Minor changes in the drain lines of the third safety system have been recommended to insure against accidental entry of water. To test thimbles for leaks and to insure that they will withstand the action of the third safety device, apparatus for pneumatic testing in situ is being developed.

Assay data on two complete tubes of bismuth have been received from the customer, and found to be in reasonably good agreement with the values predicted by the formula in current use. This formula was derived on the basis of earlier assays on partial tubes.

Water, Corrosion, and Engineering

Process Water Control and Pressure Drop Studies

The iron content in the process water averaged 0.015, 0.011 and 0.010 ppm at B, D and F Areas, respectively. The rates of pressure drop increase for those areas were 0.34, 0.50 and 0.16 lbs./(sq.in.)(day), respectively. The rate for F is appreciably higher than normally experienced at this area. Colloidal mobility measurements made on water from this area were lower than normal the first part of the week, which would favor film deposition, but they were normal or slightly higher the latter part

of the week. However, the rate of film formation was as high the latter part of the week as it was the first part. A possible explanation for this high rate is that the iron content of the process water at D was abnormally high around January 24, but it would hardly be expected that the effect of the iron on pressure drop would continue for this length of time.

Corrosion

Examination of the slugs discharged from four corrosion tubes at F on January 20 has been completed. These tubes, 2274, 2580, 3576 and 3586, had accumulated powers of 49.8, 53.9, 54.5 and 46.4 MW-days/tube, respectively. Twenty-one blistered slugs were found in Tube 2274, twenty in Tube 2580, three in Tube 3576 and three in Tube 3586. Only the seventeen downstream slugs in Tube 3586 were weighed prior to charging and it was only these slugs which were examined in this tube. The gravimetric data from the slugs from these tubes have not been calculated.

Examination of the slugs discharged from the four over-age tubes (1973, 1958, 1989 and 2585) at B on January 8 revealed no blistered slugs. Examination of the slugs discharged from the two over-age tubes at B on January 20 revealed no blistered slugs in Tube 1475 and three blistered slugs in Tube 1659.

Boroscope Inspections of Vertical and Horizontal Thimbles at D and F

A summary of conditions found in the vertical and selected horizontal aluminum thimbles at D and F during a recent inspection follows:

VERTICAL ROD THIMBLES - D PILE

Rod No.	Observed Condition			
	Below Rod Guide	Main Portion	Bottom of Wall	End Cap
10	clean except for scattered rust	clean with few rust specks	light brown film with irregular spots of scale	layer of rust
11	----------whole thimble was quite clean----------			good
12	clean	clean with some minor scratches	clean with slight pitting	good - some rust
13	----------whole thimble was quite clean----------			good
14	good, slight am't. loose scale	very good	no corrosion	good
15	fluffy scale	few occasional minor pits	quite good	some rust
16	good, some scattered rust	very clean, few scratches	very clean, a few rust specks	some rust
17	good, some rust	very clean	very clean, a few rust specks	some rust
18	slight scale	very good	very good	good
19	good	very good	very good	2 possible pits
20	slight scale	good except for a 10' rod scratch	good	good
21	end of guide corroded	good	good	good

[redacted]

[redacted]

VERTICAL ROD THIMBLES - D PILE (Cont.)

Rod No.	Observed Condition			
	Below Rod Guide	Main Portion	Bottom of Wall	End Cap*
22	slight scale	good, some scratches	slight etch & pits	slight scale
23	slight scale	very good	some old etch and small pits	
24	corr. prod. run down from between guide and thimble	good, some scratches	good	good
25	etched some	good	slight etch	some rust
26	good	slight etch some scratches	slight pitting	good
27	clean except for local spots of scale	very good	very good	some rust
28	6" of spongy scale slight etch under	good-some rust and scratch	good	some rust
29	good	very good	very good	good
30	some scale	very good	light film and scratch	very good
31	good	good	few pits	good
32	8" heavy scale	very good	good	very good
33	good	very good	very good	good
34	some scale and corrosion	good	good	some rust
35	very good	very good	very good	some rust
36	very good	very good	very good	some rust
37	slight scale	very good	very good	good-some pits & scale
38	very good	some old scratches	shallow pits	some rust

* When covered with rust, impossible to see surface condition.

HORIZONTAL THIMBLES - D PILE

"A" Rod - Fairly heavy abrasion of top kick-plate (4'6" long, starting from open end) with some pits just beyond kick-plate.
5' - some mottled scale
6' - scale disappeared
7' - some etch on top and corners
rest of thimble was very good
End cap - some slight pitting, otherwise good.

#2 Rod - Start of crystalline scale with coarse etch underneath at about 6', getting thicker at 7-8'.
9' - thin film
17' start of gouge on one side. A few dried barnacles.
20' good condition
34' some powdery scale and some scattered pits
End cap - some scale, possibly some pitting.

[redacted]

[redacted]

HORIZONTAL THIMBLES - D PILE (Cont.)

#9 Rod - A few slight pits and scratches on kick plate.
6'-6" some crystalline scale, coarse etch at graphite interface.
8' scale a bit heavier - not as bad as thimble #2
12' scale disappeared - scratch marks on both sides.
15' borescope could not be pushed in any further. End viewer showed no sharp break or bump in either thimble or graphite. Checked with mirror and light at open end and thimble appeared to be bowed upward from this 15' point
Rod could not be inserted beyond this point by hand but went all the way in under power.

VERTICAL ROD THIMBLES - F PILE

Rod No.	Observed Condition: Below Rod Guide	Main Portion	Bottom of Wall	End Cap*
10	4" of white scale	some abrasion, few old pits	quite a bit white scale with rust	rust plug pcs., scale
11	some scale	few splotches of scale	fair am't scale	loose scale
12	some scale	good-a few scratches	good	good
13	white cryst. scale	lt. brown film	lt. brown film	some rust
14	white cryst. scale	lt. brown film	lt. brown film	some rust
15	some pits	some pits and scratches	light film and pits	some rust
16	some scale	good-some scratches	some old etch	some rust
17	very thin scale	good	good	some rust
18	light scale	some scratches	very light etch	some rust
19	some pitting	some pitting	light etch & pit	good
20	white rough scale	good-some scratches	good	some rust
21	some scale	light film	good	rust and scale
22	white scale	very good	very good	good
23	heavier scale	occasional pit	good	good
24	light scale	good	good	some rust
25	fluffy scale	good	good	some rust
26	medium scale	very good	thin film	some rust
27	light scale	very good	thin film	good
28	white scale	good	some scale	some rust
29	white scale	good	some scale	some pits and rust
30	thin cryst. scale	thin film	film thicker and darker	rust and scale
31	thin cryst. scale	thin film	film is darker	some rust
32	some scale	good	some scale	good
33	white rough scale	thin film	scale, some is flaked off	loose scale
34	some scale	good	some old etch	some rust
35	spongy scale	thin film	thin film	some rust
36	scale flaking	good	good	some rust
37	some scale	good-some scratches	old etch	some rust
38	some scale	good	good	some rust

* When covered with rust, impossible to see surface condition.

[redacted]

[redacted]

HORIZONTAL THIMBLES - F PILE

"A" Rod - At about 10' in fairly heavy abrasion was noted on the top and sides.
End cap - several small pits.

#2 Rod - Open end to 5' - some etch on top plate
6' (end of top plate) - a fairly heavy deposits of a damp appearing white crystalline matter. Where some of this material had flaked off, shallow pits were noted. Several small shiny drops of liquid were also seen.
8'6" - deposits had decreased to a light film
rest of thimble was food
End cap - very good

#6 Rod - Open end to 6' - good
rest of thimble was good
End cap - good

Graphite Expansion Problem

Results of tests in the F Flow Laboratory of the strain gage for measuring bowing of process tubes indicated that the stiffness of the borescope caused flexing of the unsupported tube and changed the local curvature during the course of a traverse. It is hoped that this effect will be less pronounced in process tubes. In order to improve precision the length of the gage has been increased three-fold (from 10 in. to 30 in.) and further studies on a flow laboratory tube are planned in which the traverse will be started from both inlet and outlet ends of the tube.

It may be necessary to abandon the strain gage method of measuring vertical displacements in favor of a method which uses a water column to determine the difference in elevation between any part of the tube and the end nozzles. Additional work on the strain gage method of measuring vertical displacements is being done in an attempt to predict its potential usefulness for measuring horizontal displacements.

Taking advantage of the fact that bowing of vertical thimbles is expected to involve displacements of less than one thimble diameter for quite some time, it is planned to study displacements in the mock-up thimble at B by exploring the tube with a plumb bob so arranged that an electrical circuit is closed when the bob touches the thimble walls.

Tests on small pieces of neoprene similar to that used on the gas seals indicate that the tear resistance may be very low. A 6-inch length of sheeting is being tested under conditions similar to those encountered at the pile. An increased strain of 5% of the initial width is being imposed daily.

Because of the strain being placed on the neoprene seal along the top of the pile by the expansion of the graphite and rising of the top shield, special attention has been focused on hazards incident to work on top of the pile. In order to have a warning of the slightest rupture of this seal the HN chamber is being moved from its present location near the stairway to the balcony; it will be placed on the far side railing near the center of the top of the pile. A warning signal is to be attached to call attention to abnormal readings.

W. E. Jordan

W. E. Jordan, Chief Supervisor
100-300 Technical

[redacted]

DATE
FILMED
9/30/94

END