DECLASSIFIED

HW--11426

DE93 002063

RECEIVED

MAY 22 1956

300 AREA
CLASSIFIED FILES

- #1 - CN Gross
- 2, 3, 4 - AB Greninger
- 5 - FM Parker
- 6, 7 - FC Schlemmer
- 8 - WK MacCready - JE Maider
- 9 - EP Lee - JH Warren
- 10 - WW Windsheimer
- 11 - KP McCue
- 12 - PE Lowe
- 13 - Pink
- 14 - Yellow ←
- 15 - 700

Classification Cancelled (Change to
DECLASSIFIED)

By Authority of CG-PR 2

CA Bauman 1-14-92

By PM Eick 10-6-92
J.D. Wells 10-6-92

November 8, 1948

COPY 1 OF 1

RECORD CENT COPY

To: File

From: G. B. Carlton

START-UP OF 100-B PILE FOLLOWING 1569-B TUBE FAILURE

Introduction

Tube 1569-B ruptured on September 22, 1948 and was replaced. For details of this work, see Document HW-11425 (Ruptured Tube #1569-B; Carlton to File, 11-8-48). Between the time of failure and final isolation of this tube, considerable water escaped into the graphite packing. As a result, the unit start-up and subsequent operation was quite different from that usually followed. This report has been prepared to summarize the observations and activities related to this operation.

Summary

The ruptured tube was replaced and the unit start-up was effected about 10:00 P.M. on September 24, 1948.

The unit was operated at low levels until the effects could be evaluated, at which time the level was raised by small increments reaching nominal (275 MW) on October 6, 1948. During this period, the pile was shut down three times to readjust the permanent poison pattern to permit attainment of the nominal level.

The rate of water removal increased with the power level, reaching a maximum during the first week of sustained operation at 275 MW. After this time, the rate gradually fell off. By October 26, 1948, all reactivity previously absorbed by the water in the graphite had been recovered although approximately twice the normal amount of water was being removed from the circulating gas.

This condition continued until about November 6, 1948 when the rate of water removal returned to normal. A total of 520 gallons of water (over normal expectancy) was collected.

REPRODUCED FROM BEST
AVAILABLE COPY

MASTER DECLASSIFIED

DECLASSIFIED

100-11426

-2-

Discussion

The status of the unit just prior to start-up on September 24, 1948 was as follows:

- (a) Tube 1569-B had been replaced.
- (b) Tubes 1569 and 3169 contained SR-15.
- (c) Tubes 2374, 1579 and 3179 contained permanent poison.
- (d) Seventeen tubes contained B material.
- (e) Eight tubes were loaded with temporary poison.
- (f) The remaining 1974 tubes in the pile contained metal or dummies.
- (g) It was known that there was considerable water in the pile, probably in a pyramid shaped section with the apex at about the center of tube 1569.

In preparation for the start-up, a predicted critical was calculated assuming there was no water in the pile. By normal start-up procedure, this critical rod configuration was approached and, as expected, it was found that the pile was not reactive at this point. Additional rod was withdrawn in half rod increments until a critical configuration was found. From this determination it appeared that the water which had leaked into the graphite was equivalent to about 150 inhours of reactivity.

Following this critical determination, the operating level was raised until the graphite temperature at the fringe of the wet zone approached 100° C. It was determined that this condition could be established by operation at approximately 75 MW. This seemingly cautious approach to the problem was used because there was no precedent on which to base a program. It was recognized that the rapid evolution of water vapor could present unpredictable problems which might have serious consequences and for this reason the initial start-up and all subsequent changes were deliberately conservative.

The pile was operated at this level until September 26, 1948, at which time it was necessary to shut down and discharge the eight temporary "P" columns (see item e above). During the period of operation prior to this outage, temperature traverses had definitely established the wet zone in the pile. As expected, the affected area was roughly triangular in shape, the base including virtually the entire width of the pile at about row 06 and the apex located at tube 1569. The operation at 75 MW had not significantly reduced the size of the wet area although the amount of water removed averaged about 150 pints per 24 hours as compared to a normal expectancy of about 20 pints over the same period.

Following the temporary "P" column discharge of September 26, 1948, the pile operated at 75 MW for about 10 hours. On September 27, 1948, the level was increased to a nominal 100 MW. This increase was made after an evaluation of operation at 75 MW indicated that the possibility of the fringe graphite

DECLASSIFIED

DECLASSIFIED

HW-11426

-3-

temperature rising above 100°C was quite remote as long as the poisoning effect of the wet zone remained substantially unchanged. In view of the behavior of the water in the pile, it appeared that no sudden decrease in poisoning could be expected and that the return to normal operation would be largely dependent on the rate of water removal from the wet zone.

With these points in mind, a general program was outlined to govern the operation of the pile until return to normal conditions could be effected. This program embodied the following points:

1. Stepwise increases in power level up to the rated (275 MW) power. This program would also include discharge of such temporary poison as was necessary to provide sufficient reactivity.
2. Close surveillance of H₂ gas circulating and drying equipment, including such operating changes as appeared desirable to permit operation of this system at maximum efficiency.

In accordance with step (1) above, the power level was raised to 125 MW on September 28, 1948; to 150 MW on September 29, and to 175 MW on September 30, 1948. Beyond this point, the program called for further increases in level to be made by 5 MW increments with a five hour waiting period between each rise to permit attainment of equilibrium graphite temperatures (3 - 4 hours) and evaluation of the effect of the change.

This program was followed and the nominal operating level of 275 MW was reached on October 6, 1948. During this period there were three shutdowns for the following reasons:

1. On September 30, 1948, a critical power grade Y condition necessitated a 16 hour outage.
2. On October 2, 1948, the pile was shut down for 2.5 hours to discharge permanent "P" columns 1579-B and 3179-B (see item c above).
3. On October 4, 1948, the pile was shut down for 2 hours to discharge the remaining permanent P column (2374-B) and two SR-15 tubes (1569-B and 3169-B) (see item b above).

Poison was discharged during outages (2) and (3) above to provide sufficient reactivity to permit attainment of 275 MW level.

Following each shutdown, the operating level was raised to 100 MW and then stepwise by increments (25 MW per 5 hours) to the highest previous level of operation. It was felt that these larger increments were justified in view of the fact that pile behavior up to the previous level had been established.

During the period October 6 to October 26, 1948, the pile was shut down twice (October 12 and October 19) for normal metal discharge. On both of these outages, reactivity gains, resulting from the removal of water from the

DECLASSIFIED

DECLASSIFIED

NO-11426

-4-

graphite, made it possible to reload virtually all of the SR and permanent P columns. A complete reactivity balance made on October 26, 1948 (after the unit had reached equilibrium from the October 19 outage) indicated that virtually all the reactivity lost to water had been recovered.

With regard to the water removal phase of the original plan, the following steps were taken:

1. All three driers were operated on the line throughout the period of excessive water recovery. Driers #1 and #2 were operated in the normal manner on automatic control while #3 was operated manually and cycled with #1.

A study was made of the desirability of altering drying and regeneration cycles to increase the efficiency of the drier system. It was found that the conservative method of pile operation did not vaporize water at a rate greater than that which the driers could handle on normal cycles. This fact was confirmed by examination of the inlet and outlet moisture analysis of the gas stream. In view of these facts, the cycles were not altered.

An effort was made to determine the effect of partially closing the division valve in the 115 gas loop to force more gas through the driers. Before any data was obtained on this change, it was decided to increase the gas flow by a more positive means (see below). Inasmuch as it did not seem desirable to operate at high flow with the division valve partially closed, this portion of the test was discontinued.

2. The gas flow was increased by a factor of 2.0 (2100 c.f.m. normal) by speeding up the cooler blower turbine. This action was taken on October 2, 1948, just prior to the first period of sustained operation at reasonably high levels, so the effect of the change was somewhat difficult to evaluate. The theoretical soundness of the idea, however, coupled with the fact that marked increases in amount of water removed were noted soon after the change was made, indicates that the gas flow change was probably beneficial.

The gas flow was returned to normal on November 6, 1948, at which time the rate of water removal had effectively returned to normal. By this time, 520 gallons of water had been removed from the driers. This is in addition to the amount expected from normal operation. Data covering the period of maximum water collection appear in the table attached.

DECLASSIFIED

DECLASSIFIED

HW-11426

-5-

<u>Date</u>	<u>Operating Level, MW</u>	<u>Water Collected, Pts.*</u>	<u>File Outage Remarks</u>
9-25-48	75	154	
9-26-48	75	162	4 hours
9-27-48	75-100	140	2.5 hours
9-28-48	100-125	146	
9-29-48	125-150	149	
9-30-48	150-175	95	10 hours
10-1-48	0-180	94	6.5 hours
10-2-48	185-195	131	2.5 hours
10-3-48	200-215	183	
10-4-48	215-225	150	2.3 hours
10-5-48	230-265	232	
10-6-48	265-275	281	
10-7-48	275	295	
10-8-48	275	225	
10-9-48	275	314	
10-10-48	275	210	2 hours
10-11-48	275	90	17.5 hours
10-12-48	275	159	
10-13-48	275	258	
10-14-48	275	199	
10-15-48	275	205	
10-16-48	275	155	
10-17-48	275	105	
10-18-48	275	97	1 hour
10-19-48	275	105	18.3 hours
10-20-48	275	79	

*Normal expectancy - 20 pints.

GBC:ges

DECLASSIFIED

**DATE
FILMED
12/18/92**