HW--28076

DE93 002068

[redacted]

This document consists of 7 pages. Copy No. 22 of 25 copies. Series A.

COPY 1 OF 1, [redacted]

1. JM Atwood
2. JA Ayres
3. RW Benoliel
4. CW Botsford
5. RO Brugge
6. LP Bupp
7. JJ Cadwell
8. MW Carbon - RG Vanderwater
9. EA Eschbach
10. S Goldsmith
11. OH Greager - WK Woods
12. AB Greninger
13. CN Gross
14. TW Hauff
15. HL Henry
16. PC Jerman
17. EP Lee
18. M Lewis
19. AR Maguire - KT Perkins
20. JE Maider
21. GE McCullough - WL Schalliol
22. RE McGrath
23. RO Mehann
24. ET O'Sullivan
25. PH Reicker - AB Carson
26. RB Richards
27. RA Rohrbacher - WE Foust
28. HG Spencer
29. AEC-HOO - Attn: DG Sturges
30. JH Warren - SL Nelson
31. 300 Files
32. 700 Files
33. Yellow Copy

[redacted]

[redacted]

PRODUCTION TEST NUMBER 105-519-E,
RAISING PERMISSIBLE OUTLET WATER TEMPERATURES
OF SELECTED TUBES AT C PILE

OBJECTIVE

The objective of this production test is to simulate with a few tubes operation of the old piles with small water annulus at power levels in the range of 800 - 950 MW.

This is to be accomplished by installing process tubes, of the size used in the B, D, DR, F, and H Piles, in the experimental area of C Pile as defined in PT-105-533-A, Supplement A(1). These tubes will be located so that power rates of 595 - 675 kw/tube will be encountered. They will be cooled by water flowing at about 30 gpm and being heated through temperature rises of 75 to 85 C, leading to outlet water temperatures in the range of 95 to 105 C when the river water temperature this summer is 20 C. By locating these tubes low in the pile to increase to about 123 C the temperature at which boiling is encountered in the rear crossheader, the range of panellit trip settings need be reduced only to about 45 lbs/sq.in. to detect changes in water flow prior to encountering boiling.

BASIS AND JUSTIFICATION

Increased production can be obtained in several different ways, but the lowest cost method is through the use of higher exit water temperatures. Production gains that could be obtained would amount to approximately 6 per cent per pile for every 5 C increase in outlet water temperature in the range of 90 C to 105 C. If, as a result of data obtained from this test, it will be possible to operate the piles at 105 C exit water temperature, this would result in an 18 per cent increase in power levels.

The present corrosion limit established with Ferrifloc dichromate-free water now prevents operating at exit water temperatures above 90 C. The cooling water at C Pile, alum treated water containing 2 ppm dichromate, has been found to give lower corrosion rates. Therefore, higher exit water temperatures appear to be justified at those piles using this type of water.

There are two methods whereby prototype in-pile data on corrosion of aluminum jacketed slugs can be obtained at temperatures higher than now authorized. One method is to operate a complete pile on a production test at a higher exit water temperature. While this method will give the desired data, the risk is present of damaging a great number of slugs and process tubes should unforeseen complications result from higher temperatures. In order to minimize this risk, a full pile test should be run in a stepwise manner by raising the outlet water temperature a small increment at a time.

The second method is to operate only a few tubes in a pile at increased temperatures in a region of correspondingly high flux. This type of test permits the evaluation of many outlet temperatures simultaneously, in the same period of time that a full pile test would permit the evaluation of only one temperature. The desired data could be obtained from a relatively few tubes, and the risk of damaging a pile during the test is practically eliminated.

(1) Brugge, R. O., "PT-105-533-A, Supplement A, Local Controlled Increases in C Pile Tube Powers", HW-27540, March 27, 1953.

The estimated shutdown time of thirty-six hours required to replace process tubes would result in a loss of 1,350 MWD of production at present C Pile power level. If only 6 per cent, one-third of the possible 18 per cent production gain, can be realized at each of the five other piles as a result of this test, then this loss in production can be recovered in 7-1/2 days of operating time at the higher power levels made possible by this test.

SCHEDULE

Start: This test is to start on the first shutdown after approval of the test authorization.

Duration: This test will continue until the desired data are obtained--approximately eight months.

Area: 100-C.

Priority: Extra shutdown time is warranted in view of the gains in production that may be experienced as a result of the data obtained form this test.

COSTS

Cost Code: xxxx-5270-253.14.

Reactivity: A small reactivity gain will be experienced as a result of the smaller annulus, but this value is negligible.

Plant Utilities and Maintenance: Approximately 180 man hours of which 130 will be required during shutdown.

Shutdown Time: Eighteen hours during first shutdown after approval of this test to remove nine C type process tubes and install nine H type process tubes will be required. Special charging and pick-up of dicharged metal will be required on subsequent shutdowns. This is estimated as 1/2 hour per tube. An additional eighteen hours will be required to replace the H type tubes with C type tubes.

Elevator Time: Same as above.

DESCRIPTIVE DETAILS

During the first shutdown at C Pile after approval of this test authorization, nine tubes in the experimental area as defined in PT-105-533-A, Supplement A(1), will be discharged and the tubes replaced with nine H type process tubes. Three of the nine tubes will operate at an outlet water temperature of 95 C, three at 100 C, and three at 105 C. The 0.318 inch orifice will be replaced with orifices of appropriate size to give the desired outlet water temperatures at a flow rate of approximately 30 gpm. It will be necessary to reduce the range of panellit trip settings on these tubes to 45 lbs/sq. in. to guard against boiling.

(1) Loc. Cit.

[redacted]

The rear face thermocouples of these tubes will be connected to a temperature recorder located in the control room.

The nine tubes will be charged with numbered, weighed, and measured four inch uranium pieces. A standard rear dummy pattern will be used. Weight loss and dimensional changes will be determined on the discharged slugs by post-exposure weighings and measurements. Visual examination will be made of the discharged slugs to determine if any localized attack has taken place.

One tube operating at each of the three temperatures will be discharged after receiving 400 MWD/T exposure. If data obtained from these tubes show corrosion is not excessive, the slugs remaining in the tubes under this test will be irradiated to their full exposure.

The tubes discharged after 400 MWD/T exposure will be reloaded with weighed and numbered pieces as in the previous loading. Of those tubes that are allowed to reach 600 MWD/T exposure, one at each of the three temperatures will be reloaded with weighed and numbered pieces. The remaining tubes will be removed from the pile for examination and replaced with C type process tubes. When the second charges of weighed slugs in the old type tubes are discharged the tubes will be removed from the pile and replaced with C type process tubes.

If the allowable power output per tube at C Pile is changed then the necessary changes of orifice sizes, panellit gauge ranges and trip settings will be made of the tubes used in this test, or the slugs in the tubes will be discharged at the first shutdown prior to or immediately after the power change.

SPECIAL INSTRUCTIONS

Hazards

The ruptured slug rate may increase at the higher operating temperatures of the nine tubes used in this test; however, this increase is not expected to be inordinate. Predicted neutron leakage due to the enlarged gap between the process tube and gunbarrel will not create a hazardous condition.

SPECIAL EQUIPMENT

A temperature recorder to be furnished by Technical personnel will be located in the control room to monitor temperatures of the tubes used in this test.

Nine process tubes of the size used in B, D, DR, F, and H Piles will be provided. The special front nozzle orifices needed for these tubes will be supplied.

Weighed, measured, and numbered, four inch uranium slugs will be supplied.

SPECIAL ADJUSTMENT

The adjustments to the panellit gauge ranges and trip settings as specified by Heat Transfer Sub-Unit will be made by Manufacturing personnel.

DATA DESIRED

1. Temperature data will be taken continuously with the temperature recorder supplied for this purpose.

2. Flow rates will be calculated from daily panellit readings which are routinely recorded.

3. Exposure data will be obtained from Production Scheduling.

4. A record of weights, dimensions, and visual inspection will be kept by Pile Fuels personnel.

RESPONSIBILITY

Reactor Section

The Reactor Section will be responsible for all scheduling, charge and discharge operations, the operational safety and production continuity of the pile, and for the collection of data on the tubes operating under this production test. Requested operational data will be forwarded to the Technical Section.

Technical Section

M. Lewis and S. Goldsmith, Pile Coolant Studies Sub-Unit, will be responsible for the technical aspects of pile irradiation, analysis of all data, and issuance of the final report. R. A. Rohrbacher, Fuel Examination Sub-Unit will be responsible for examinations and measurements of the slugs used in this test.

Stanley Goldsmith
PILE TECHNOLOGY SUB-SECTION
ENGINEERING DEPARTMENT

S Goldsmith:mc

APPENDIX

LIMITS

The following is a list of limits that may be affected by this test:

1. Corrosion - This is the limit to be exceeded by operating three tubes at 95 C, three tubes at 100 C, and three tubes at 105 C outlet water temperatures. Pile power level will not be limited by this test unless the outlet water temperature of any tube in the test exceeds 110 C.

2. Graphite Temperature - This test is to be conducted in the experimental area covered by PT-105-533-A, Supplement A, where a 430 C graphite temperature is authorized. The increase in graphite temperature because of the smaller tube in the graphite channel will not be significant.

3. End Cap Temperatures - The limit imposed by end cap temperatures will be exceeded if necessary.

4. Slug Core Temperatures - The slug core temperatures will be well below the temperature authorized.

5. Tube Powers - The tube powers will not be changed by this test.

6. Boiling - The panellit trip settings will prevent exceeding this limit.

APPROVALS

R. B. Richards
Manager, Pile Technology Sub-Section
Engineering Department

J. H. Warren
Production Superintendent, Operations Sub-Section
Reactor Section

R. O. Mehann
Superintendent, Process Sub-Section
Reactor Section

E. P. Lee
Manager, Reactor Section

O. H. Greager
Manager, Technology
Engineering Department

C. N. Gross
Manager, Manufacturing Department

Date of issue June 10, 1953

S Goldsmith:mc

DATE
FILMED
12/18/92