DECLASSIFIED

RECORD CENTER FILE

ITW-22886 ✓

COPY 1 OF 1, SERIES-MA

This document consists
of 23 pages. Copy No. 50
of 52 copies. Series A

Plus one restricted attachment
Plus one restricted attachment

Classification Cancelled and Changed To

DECLASSIFIED

By Authority of CG-PR-2
R.M. Iken 3-16-92
By PM Eick 6-21-94
Verified By J.W. Wells 6-21-94

TECHNICAL ACTIVITIES REPORT

HEAT, WATER, AND MECHANICAL STUDIES

by

W. K. Alexander
Pile Engineering Branch
Pile Technology Unit

December 1, 1951

RESTRICTED DATA

~~The information defined in the Atomic Energy Act of 1946, its transmittal or the disclosure of its contents in any manner to an unauthorized person is prohibited.~~

NUCLEONICS DIVISION
RICHLAND, WASHINGTON

Due to film deterioration,
portions of this document
may be illegible.

WARNING - PRELIMINARY REPORT

THIS REPORT CONTAINS INFORMATION OF
A PRELIMINARY NATURE AND IS PREPARED
PRIMARILY FOR THE USE OF HANFORD WORKS
TECHNICAL SECTIONS PERSONNEL. THIS RE-
PORT IS SUBJECT TO REVISION ON FURTHER
CHECKING OR COLLECTION OF ADDITIONAL DATA.

RECEIVED

JUN 18 1956

300 AREA
CLASSIFIED FILES

DECLASSIFIED

MASTER

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED 975

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, make any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

COPYDISTRIBUTION

1. C. H. Greaser
2. R. H. Bouten
3. V. K. J. Cs
4. G. E. McCullough - W. R. Lewis - J. A. Ayres
5. E. P. Lee - J. H. Warren - J. L. Harp
6. R. C. Moham - H. T. Jolls
7. C. W. Batsford
8. S. L. Nelson
9. J. T. Becker
10. I. G. Clough
11. D. S. Lewis
12. E. J. Fili
13. F. F. Gast - V. J. Ozeroff - A. B. Carson
14. P. H. Reinker
15. F. E. Kruesi
16. D. E. Davenport
17. E. R. Montgomery
18. F. L. Dickman - E. C. W. C.
19. H. L. Henry
20. J. C. L. Chatten
21. K. F. Zuh - L. A. K. Krbacher
22. I. Ward - J. T. Kattner
23. H. L. Mars - W. L. Schallert
24. L. E. Turner
25. C. J. Wick
26. R. J. Schier - E. L. Eschbach
27. L. P. Bupp
28. E. L. Reed - C. A. R. y
29. H. J. White
30. C. H. Goldtherpe - P. M. Jackson
31. J. C. W. C. - R. E. Johnson - W. J. Morris
32. H. Harty - R. C. Livingston - J. M. Roberts
33. R. E. Schilsen - G. E. Wade
34. E. G. Desskoy - C. D. Emmons
35. M. W. Carban
36. H. H. Greenfield - M. Altman
37. R. C. Vanderwater - C. Warren
38. K. G. Tyda - D. E. Lays
39. R. Neidner - R. F. Recht
40. R. M. Fryer
41. R. V. Andrews - J. D. Fogelquist - G. S. Fujika
42. J. M. Atwood - R. H. Purcell
43. M. I. Miller - W. C. A. Woods
44. M. Lewis - S. Goldsmith
45. J. K. Alexander
46. D & C Files
47. - 48. Extra (2)
49. Pink Copy
50. Yellow Copy
51. 300 File
52. 700 File

DECLASSIFIED

DECLASSIFIED

-3-

HM-22886

CONTENTS

HEAT STUDIES ②

OUT MERIC TIME-DELAY RELAY FOR PANELLIT SYSTEM ALARM	5
INDUCTION HEATING OF SLUGS	5
ELECTRIC RESISTANCE HEATING OF SLUGS	5
INSTALLATION OF A THERMOCOUPLE SLUG	6
SLUG STRESSES	6
MEASUREMENT OF HEAT-TRANSFER COEFFICIENTS FOR SLUG BENTS	6
EFFECT OF TUBE LENGTH AND ANNULUS ON TUBE POWER	6
PRESSURE DROP FILM STUDIES	7
FULL-SCALE MACK-UP	7
FLUX TESTS	8
FLUX TUBE ENLIGHTENMENT OF BENT AND F PILES	8
ELECTRIC FILM STUDIES	8
ELECTRIC FILM DESIGN	9
C FILM WITHIN THERMAL INSULATING LAYER	9
STRESS AND STRESSES IN BENT CIRCULAR AND THERMAL SHIELDS	9
"UCON" - WATER MIXTURES FOR SLUG LUBRICATION	9
CRACKING OF FUTURE PILES	10
SHIELDING OF NEW PILES	10
TECHNOLOGICAL SYSTEM HEAT EXCHANGERS	10

WATER STUDIES

100-D FILM LIBRARY	11
FILM FORMATION TEST APPARATUS	11
CALCULATION CHEMICAL PURGE FOR FILM REMOVAL	11
CAN DIFFERENCE TEST	12
PT-105-150-P - THE EFFECTS OF IN-PILE CONDITIONS ON DRI-FILM CONTINUES APPLIED TO SLUG SURFACES	12
FILM LIBRARY TECHNOLOGICAL STUDIES	12
SLUG JACKET ABRASION AT HIGH FLOW RATES	12
PT-105-453-P - SODIUM DICHLORATE ELIMINATION TESTS	13
TECHNOLOGICAL STUDIES	14
PT-105-473-P - THE USE OF ALUMINUM SULFATE FOR PROCESS WATER CALCULATION	14
ACTIVATED SILICA ADDITION	14
100-H SILICA ADDITION EQUIPMENT DESIGN	15
HIGH TEMPERATURE CORROSION	15
PT-105-407-P - PILE TEST OF MAGNESIUM FILAMENT DUMMIES	16
FLUX TUBE CORROSION SURVEY	16
WEIGHED TUBE CORROSION APPARATUS	16
CORROSIVE EFFECTS OF HEAVY METAL IONS ON ALUMINUM	16
ELECTROGRAPHIC DETECTION OF CORROSION FROM PILES	17
INDUCTION HEATING FACILITY	17
FILTY TUBE MACK-UP	17

DECLASSIFIED

CONTENTS
(Cont'd)

MECHANICAL DEVELOPMENT STUDIES

SPHINCTER SEAL TEST -----	18
BALL COLLISION TEST -----	18
HEAT FLUX MONITORING BY TELEVISION -----	18
HORIZONTAL I.D. CONVERSION STUDY - PRESENT FILES -----	18
P-13 LEAK VALVE -----	18
CHEMICAL SLUG STRIPPER -----	18
TEMPERATURE MONITORING OF TUBE OUTLETS - STUDY -----	18
SLUG WEIGHT MEASUREMENT -----	19
BY-PRODUCT RECOVERY - STUDY -----	19
SLUG DAMAGE - CHARGING (IN-PILE) -----	19
SLUG DAMAGE DUE TO CHARGING -----	19
PROCESS TUBE REPLACEMENT -----	19
CROSSHEAD IMPROVEMENT -----	19
HEAT EXCHANGER TEST FACILITY -----	19
ADDITIONS TO FACILITIES AT 189-D TEST LABORATORY -----	20
189-D TEST LABORATORY OPERATION -----	20
CRACK IN ALUMINUM PROCESS TUBES; TEST #8 -----	20
PRESSURIZED "C" AND "D" MACHINES; TEST #29 -----	20
HEAVY AGGREGATE CONCRETE P.U.; TEST #34 -----	21
UNPRESSURIZED CHARGING MACHINE; TEST #39 -----	21
"C" LING PROCESS TUBE; TEST #44 -----	21
CRACK IN ZIRCONIUM TUBES; TEST #46 -----	21
FLAPPER NOZZLE ASSEMBLY; TEST #50 -----	21
DEFLECTION TESTS OF SINGLE GUN BARREL ASSEMBLY; TEST #51 -----	21
FABRICATION OF ENLARGED, REPLACEMENT FIGHT/ILS -----	22
PIGTAIL FLEXURE; TEST #54 -----	22
HORIZONTAL HOT GLAND SEAL; TEST #64 -----	22
HORIZONTAL HOT MACH-UP; TEST #65 -----	22
FUNCTIONAL TEST OF C FILE - VS LIDS AND BALL 3X SYSTEM; TEST #67 -----	23
STRAINER PRESSURE DROP AND STRENGTH DETERMINATION; TEST #69 -----	23
DEQUENCY OF DISCHARGE TIP-OFF (HIGHER FLOWS); TEST #71 -----	23

DECLASSIFIED

HEAT STRESS - M. W. Corbin

-5-

H'-22886

AUTOMATIC TIME-DELAY RELAY FOR PANELLIT SYSTEM ALARM - W. F. Gilbert

Installation of a Microflex mechanical time-delay relay was completed at B Pile on November 5, 1951, as authorized by PT-105-502-E. Satisfactory Panellit alarm test data were obtained for a period of 15 days, using a 10 second time delay. A daily graphic record was maintained of the number of Panellit alarms and of the number of completed 10 second delay periods. A total of 96 Panellit alarms were recorded, 4 of which may have been due to Panellit pressure fluctuations, and the remainder due to routine Panellit testing. Except during routine Panellit alarm checking, no completed 10 second time-delay periods were recorded. This indicated that the 10 second delay period would probably be sufficient to eliminate pile shutdowns caused by momentary water pressure fluctuations if the automatic shutdown circuit were utilized.

The test will be continued with the Microflex relay using a two second time delay period.

INDUCTION HEATING OF SLUGS - F. Neidner

Further work has been done in preparation for heating slugs to approximate pile temperatures by induction heating. The purpose of the heating would be to study slug stresses.

The calculations for and the design of a new induction heater coil have been completed. Fabrication of the coil will be started soon. The coil will be of the multi-layer type, consisting of 75 turns of 1/4 inch copper tubing, and will have a length of approximately 4 inches. The inside and outside diameters of the coil are 2 inches and 4-3/4 inches, respectively. An unsuccessful attempt was made to purchase tubing with a square cross-section and with a wall thickness of .060 inch. Consequently, round tubing with .049 inch wall thickness was purchased for the coil and the possibility of reforming it into a square shape is being considered. This coil was designed for a power of 50 KW at a frequency of 3000 CPS. The water tube for containing the test slug inside of the coil, and the housing for the coil, will be fabricated of phenolic plastic. Accommodations for thermocouple leads will be included.

ELECTRIC RESISTANCE HEATING OF SLUGS - F. Neidner

Investigations and calculations were continued for the heating of slugs by electrical resistance. The number and magnitude of problems involved appears to be quite large.

Information from a similar test conducted at Oak Ridge will be used to determine the problems and conditions which may apply to this test.

The latest calculations indicate that a current of approximately 22,000 amperes will be necessary to reach a slug axial temperature of 500° C instead of the previously reported 30,000 amperes. The current density to reach high axial temperatures must be drawn from an AC source, due to the expense and unavailability of suitable DC equipment. However, equipment to produce 15,000 amperes of direct current is available now in the 189-F Building. This DC power supply will probably provide an axial temperature of 300° C, thereby permitting slug studies simulating present pile conditions. Useful data may be obtained from this DC power source and it will probably make possible a comparison of DC and AC power for the electrical resistance method of slug heating.

DECLASSIFIED

DECLASSIFIED

-6-

RI-22886

Electrical contact resistances will be critical in this test. Due to extremely high current densities expected, failure might readily occur from the resistance of an imperfect contact. Preliminary tests are now underway to determine the most feasible methods of making these various electrical contacts.

INSTALLATION OF A THERMOCOUPLE SLUG • W. D. Gilbert

Plans are being made to install a thermocouple slug in one of the piles to replace the one which failed in March, 1951. Data will be obtained to aid in the calculation of axial slug temperatures, effect of irradiation on the thermal conductivity of uranium, heat generation by the slug after shutdown, and the effect of film on slug temperatures.

SLUG STRESSES • I. E. Arns

The slug stress calculations have been completed as reported last month. A document on these calculations is being prepared.

MEASUREMENT OF HEAT-TRANSFER COEFFICIENTS FOR SLUG BONDS • I. E. Arns

Various types of uranium-aluminum bonds are being made by the Metallurgy Group. Tests for the measurement of heat-transfer coefficients are being considered to determine whether the bonds may be used from a heat-transfer view. Preliminary calculations for the design of the apparatus have been made. This work will be continued.

EFFECT OF TUBE LENGTH AND ANNULUS ON TUBE PERFORMANCE - F. G. Vanderwater and H. H. Greenfield

A preliminary investigation was made of the effect on pile performance of increasing the active metal length and the annulus cross-sectional area of the process tube. The calculations and data will be reported in document RI-22799. Three process tube annulus sizes and two active metal lengths were considered in the study. A summary of the results follows.

For an increase in the active metal length:

1. The maximum permissible tube power based on boiling considerations would decrease slightly.
2. The tube power for a given surface temperature and for a fixed header pressure would decrease slightly for the standard and C Pile process tube annulus sizes.
3. The tube power for a given surface temperature would increase slightly for a process tube annulus 50 per cent greater than the standard process tube annulus size.
5. Uranium utilization would decrease rapidly.
6. The tube power would increase for a given specific slug power.

For an increase in the annulus size:

1. The maximum permissible tube power based on boiling considerations would increase rapidly.
2. The tube power for a given surface temperature would increase rapidly.
3. Water utilization would decrease slightly.
4. Uranium utilization would increase rapidly.

DECLASSIFIED

DECLASSIFIED

-7-

H-22886

5. The specific slug power for the maximum permissible tube power based on boiling considerations would increase rapidly.

Water utilization was expressed as a ratio of maximum allowable power level, based on boiling considerations, to quantity of water required.

Uranium utilization was expressed as a ratio of maximum allowable power level, based on boiling considerations, to length of active charge.

PFSSURE DROP FILM STUDIES - H. H. Greenfield

In the past, calculations of slug surface temperatures may have indicated values too low due to minimizing the heat transfer effect of film buildup on the slugs. Early flow laboratory work, documents 3-1844 and 3-2203, indicated that the film had a conductivity similar to water. This was based in part on the fact that the film was considered to be composed of about 95 per cent water. In later work, HW-10588, it was reported that the effect of film buildup was about 0.1 of that reported earlier.

Calculations based on corrosion data and theoretical considerations of the effect of film buildup indicate that the early flow laboratory results might be more realistic. Because of the importance of knowing the effect of film buildup on the slug jacket surface temperature, a series of tests are being planned. These will make use of the short-tube heat transfer mock-up and flow laboratory facilities at D Area. It is planned to simulate pile operating conditions and to determine the effect of film formation on the slug surface temperature.

FULL SCALE MOCK-UP - F. F. Fecht and K. G. Toyoda

C Pile Process Tube Test

A test on the uniform heater tube was attempted on the full-scale mock-up to determine the circumferential temperature distribution of the heater tube using a C Pile process tube with plastic ribs. Near the 550 KW power level, bending and buckling of the process tube was observed. The bending and buckling action was found to be the result of ribs being washed down stream due to failure of the glue joints holding the plastic ribs to the heater wall. Standard C Pile process tubes, now being electrically insulated, will eliminate the use of plastic ribs; tests will be resumed when the tubes are ready.

Aluminum Cosine Heater Tube

An aluminum, variable-wall-thickness heater tube was designed to approximate the cosine power distribution of the piles. A sample section of the heater tube has been fabricated. A check on dimensional accuracy of the sample shows maximum deviation of 0.003 inch from calculated external dimensions.

The 0.003 inch deviation corresponds to approximately 4 per cent error in temperature and in power dissipation from calculated design data.

Steam at 200° C was passed through the sample section to determine whether high temperatures will cause warping due to internal stresses incurred during fabrication. No warping was observed for this section. Slight

DECLASSIFIED

DECLASSIFIED

-8-

W-22886

internal diameter changes after heating seem to be present, although the evidence is not entirely conclusive. When the heater tube is made, each section will be annealed to minimize the possibility of warping due to internal stresses.

Nickel Cosine Heater

Calculations for a variable-wall-thickness, nickel heater tube have been completed. The nickel heater tube was designed so that the full-scale mock-up can be operated at temperatures exceeding the melting point of aluminum. It is anticipated that fabrication of nickel heater tube will begin when the aluminum cosine heater tube is completed.

Internal Diameter Measuring Probe

A new probe for accurately measuring internal diameters of heater tubes is being made. Measuring range of the new probe will be 1.200 to 1.400 inches.

FLOW TESTS - L. E. Foster

Additional flow tube tests were made to obtain pressure drop data on various nozzle, pigtail, and process tube sections. The data have been compiled and will be issued in a report.

The report will contain curves of pressure drop versus water flow for a complete process tube assembly. It will also include curves of pressure drop versus flow for various components of a process tube assembly, including the following parts: front crossheader fittings, pigtails, front nozzles, orifices, uranium loading, solid dummy loading, perforated dummy loading, and the rear nozzle. The differences in nozzles and crossheader fittings from pile to pile was considered.

FRONT TO REAR ENRICHMENT OF B, D AND F PILES - M. Altman

Work on this problem is being continued. The following aspects are being examined in detail.

1. Effect of enrichment on the shield temperatures.
2. Determination of optimum pile gas composition for use with the enrichment.
3. Effect of enrichment on far and near side graphite temperatures due to increased heat generation.

As a first step in this direction, an attempt is being made to correlate graphite conductivities in the old piles. Difficulties are being encountered here due to the uncertainty of temperature measurements and the uncertain physical configuration of the pile graphite. An additional difficulty is the uncertain flux distribution in the piles.

ELECTRICAL ANALOG STUDIES - M. Altman and S. F. Fields

In connection with the problem of enriching the old piles, use is being made of the existing electrical analogue to prepare temperature maps under various conditions.

DECLASSIFIED

DECLASSIFIED

-9-

HJ-22886

Temperature maps are being made up to show the influence of varying graphite conductivities, gaps between tube and filler blocks, pile gas composition, etc. It is planned to publish these results as part of a comprehensive document on enrichment which is being prepared by the Theoretical Physics Branch, and the Graphite, and Heat Transfer Programs of Pile Engineering Branch.

ELECTRICAL ANALOG DESIGN - L. E. Foster

The specifications and drawings of a new electrical analog for the study of steady state heat transfer problems were sent to five vendors for bidding on November 26, 1951. At present it appears that a commercial vendor could supply an electrical analog having greater utility than one built in our own shops. After the bids have been returned to the Purchasing Section, a decision will be made on securing the analog.

C PILE BOTTOM THERMAL INSULATING LAYER - M. Altman

In order to summarize the work done on this problem, a document HJ-22618 (M. Altman to W. F. Lewis - C Pile Bottom Thermal Insulating Layer) was issued.

In this document it is pointed out that the installation of the cast iron shield might result in the following:

1. A reduction of graphite expansion around the inlet zone of a tube such as C173 by as much as 50 per cent. This would be the result of an increase in temperatures in tube and filler blocks.
2. A reduction of graphite expansion around the center of this tube by as much as 90 per cent.

It was estimated, conservatively, that relatively good contact between the legs of the insulator and the cast iron shield on which they rest must be insured. Should a gap of more than 0.005 inch separate the two, then excessive temperatures might result at power levels of 1200 MW with radial enrichment.

A copy of the report was inserted into the minutes of the C Pile Working Committee.

STRAINS AND STRESSES IN BIOLOGICAL AND THERMAL SHIELDS - C. Warren

An investigation is under way to attempt to isolate and define some of the shield stress problems likely to be encountered in raising power levels of the existing piles. Ascertainment of the effect of increasing power levels on distortion of shields due to thermal stresses will receive first consideration.

"UOON" - WATER MIXTURES FOR SLUG LUBRICATION - K. G. Toyoda

An investigation is being made to determine whether "Uoon 50-HB-660" - water mixtures could be used to reduce rib-slug frictional drop during

DECLASSIFIED

DECLASSIFIED

-10-

FI-22886

automatic slug charging and discharging operation. The problems which are encountered in the use of the mixtures from the heat transfer aspect follow:

1. Change in outlet fluid temperatures.
2. Change in slug surface temperatures.
3. Change in pressure drop.

The following design data were used as a basis for calculation:

1. Inlet water temperature - 70° F.
2. Flow rate = 24 gpm per tube.
3. Pile power - 55 MW.

Preliminary calculations indicate that 15 to 20 per cent "Ucon" solutions might be used without imposing great heat transfer problems. However, "Ucon" is reported to become insoluble in water at approximately 30° C. If this is the case, a 100 per cent "Ucon" layer may be formed on the hot slug surface and greatly increase slug surface temperature due to increased heat resistance of the film.

Accurate physical property data of "Ucon" - water mixtures are not available at present, but they are being secured. More definite conclusions on heat transfer effects of "Ucon" - water mixtures will be made when such data are available.

CORING OF FUTURE PILES - M. Altman

The desirability of coring future piles for 100 per cent helium is being investigated. The advantages and limitations are being examined, and it is anticipated that a document on this problem will be issued in the future. However, this problem is receiving a low priority at present.

SHIELDING OF NEW PILES - M. Altman

An investigation is being made of the heat transfer problems involved in the use of concrete shieldings. It is planned to determine the amount and type of cooling needed under a variety of operating conditions. No results have as yet been determined.

RECIRCULATION SYSTEM HEAT EXCHANGERS - D. E. Atos

A survey of the literature on heat exchangers for recirculation systems is being made to determine the approximate costs, the number of exchangers, the number of pumps, and the operating conditions for possible use with the piles. Data for the completion of this work are being collected.

M. V. Carbon
M. V. Carbon
PILE TECHNOLOGY UNIT

DECLASSIFIED

DECLASSIFIED

-11-

HM-22886

WATER STUDIES - R. M. Fryar

100-D FLOW LABORATORY - J. M. Atwood

Construction of the water quality experimental facilities was resumed on November 26, 1951. In view of the strong possibility that the project may run short of funds a second time, a list of uncompleted items and the order of their importance has been given to the responsible construction supervisor. It is hoped that enough of the laboratory can be completed to allow the initial experiments to be begun. No firm estimate of the completion date can be made.

Twenty-four hour operation of the high temperature corrosion apparatus and the raw and process water tests proceeded normally.

The old raw and process water quality tests were shut down for removal of test slugs. Weight measurements continued to show excessive film buildup with raw water. No appreciable difference in corrosion rates of slugs exposed to raw and process water has been found. Extremely low corrosion rates, on the order of 0.5 milligrams per square foot during a 12-week period, are being obtained.

FILM FORMATION TEST APPARATUS - P. V. Andrews

Construction of the film test apparatus is 95 per cent complete. It is estimated that it will be completed by December 1, 1951. Work has been started on installing the steam and water lines in the 100-D Flow Laboratory to supply the test apparatus. The instrument and control panel design is complete and construction of it is to be started the last week in November. As a result it is estimated that the apparatus will be ready for use by December 15, 1951.

The 2S and 72S aluminum plates to be used in further studies on this apparatus are scheduled for December delivery by Alcoa, and a definite date in December is to be obtained by Purchasing for actual delivery.

A preliminary schedule of experimental runs has been established for use of the apparatus and will be put into effect as rapidly as possible upon completion of construction and installation of the apparatus.

CALGON CHEMICAL PURGE FOR FILM REMOVAL - P. V. Andrews

Preliminary investigations on the use of Calgon as a chemical purge for film removal from aluminum tubes and slugs have been made. A few laboratory, beaker-type experiments have been made which show that a fresh film may partially be removed by a 1000 ppm heated Calgon solution. Little, if any, effect was noted on old, dried film. Consequently a series of experiments is being designed to inject Calgon solutions into a process tube in the 100-F Flow Laboratory to determine the possible value of Calgon as a chemical purge agent. It is anticipated that flow laboratory work will begin in December.

In addition to the above, discussions between the Water Quality Group and the Radiological Sciences Development Group were held to discuss the effects of phosphorus addition to pile effluent as regards effluent activity.

DECLASSIFIED

DECLASSIFIED

-12-

FI-22886

CAN DIFFERENCE TEST - N. F. Miller

Data which have been collected from the Can Difference Test indicate that there are no differences in the corrosion rates or the amounts of film buildup on Curry slugs canned in Alcoa, Scoville, or Victor 2S aluminum jackets.

The test was conducted using a 72S clad aluminum process tube with process water entering at an average temperature of 19° C and being heated by a 13 foot long steam jacket to an average outlet temperature of 82° C. Twenty-two slugs canned in Alcoa jackets, 22 slugs canned in Victor jackets, and 20 slugs canned in Scoville jackets were used in the test. The total effective operating time was four months. The slugs were so charged in the tube that slugs of each type were in contact with slugs of their own type as well as with the other two types. No indication of galvanic corrosion caused by contact of two slugs of different type was found.

Corrosion losses of all the three types of slugs were correlated with temperature by a plot of the reciprocal of the calculated absolute temperature of the bulk water against the log of the corrosion rate. This plot showed a straight line correlation between the two variables.

The log of the total film pick-up on each slug was plotted against the bulk water temperatures. This plot also showed a straight line correlation with the weight of film per slug doubling with every 16° C raise in bulk water temperature between the limits of 21° and 82° C.

A document is being prepared which presents the data more completely.

PT-105-150-P - THE EFFECTS OF IN-PILE CONDITIONS ON DPI-FILM COATINGS APPLIED TO SLUG SURFACES - N. F. Miller

No significant changes have been shown by the data taken on this production test during the past month.

FLOW LABORATORY RECIRCULATION STUDIES - N. F. Miller

Progress has been made during the past month in procuring and fabricating equipment to be used in the experimental recirculation system in the 105-F Flow Laboratory.

Installation of the pumps and piping will be commenced on November 24, 1951, and all installation should be completed in approximately two weeks.

Though difficulty has been encountered in devising a method of recording the electrical conductivity of the water to be used, Instrument personnel in the Plant Engineering Unit are studying the possibility of modifying a potential recorder to perform this job. No other difficulties have arisen which might delay the completion of facility.

SLUG JACKET ABRASION AT HIGH FLOW RATES - N. F. Miller

The tube operating at 34 gpm was recharged shortly before the initiation of the alum coagulation test on October 10 and was discharged on November 21, 1951.

DECLASSIFIED

DECLASSIFIED

-13-

HI-22886

Summary of the weight changes during this test is presented below:

<u>N. of Slugs</u>	<u>Weight Loss in Grams</u>
0	-0.001
1	0.000
20	0.001
23	0.002
5	0.003

Inasmuch as the weighing is considered to be accurate to ± 0.002 grams and that a loss of 0.003 grams would be equivalent to a total abrasion and corrosion rate of less than 0.003 mils per month, it is felt that negligible abrasion has occurred during this operational period.

Although the slugs were not cleaned to remove film, data taken previously would indicate that less than .005 grams of film would be accumulated during the operating period which would not seriously change the results.

The tube will be recharged during the week of November 26, 1951.

PT-10-443-P - SODIUM DICHROMATE ELIMINATION TESTS - F. H. Purcell

- "Interim Report No. 2", HI-22370, covering the operating period between July 29, 1951, until October 5, 1951 was published at the beginning of the month. This report presents in detail the modifications and tests performed during this operating period.

The system performed satisfactorily during the month of November. The tubes were purged twice during this period, once at the beginning of H. Aro's scheduled outage on November 20, 1951 and again at the end of the shutdown. Data obtained during the purges were as follows:

Pressure - lbs./sq. in.

<u>Tube #</u>	<u>First Purge</u>		<u>Second Purge</u>	
	<u>Pre-Purge</u>	<u>Post-Purge</u>	<u>Pre-Purge</u>	<u>Post-Purge</u>
	<u>Crossheader</u>	<u>Panellet</u>	<u>Crossheader</u>	<u>Panellet</u>
2275	401	269	396	263
2376	401	278	396	268
2276*	403	281	404	275
2377*	403	278	405	272
			404	275

* Process Water Control Tubes

None of the strainers of the test system showed any signs of plugging during the first purge. Apparently, some of the purge particles coalesced during the second purge to partially plug one of the strainers. The test system was immediately shifted to filtered water and the strainer was flushed.

After a similar occurrence during the October purge, a suitable procedure was prepared concerning "during-operating" purges to prevent shutting down the pile in the event that a strainer starts to plug, this procedure was followed during the second purge this month.

DECLASSIFIED

Plots of the pressure drop across the filter have been prepared from the data collected from the test. Parts of the curves, where the crosshead pressures have remained almost constant, have been omitted. The decrease in this pressure drop for the experimental tubes has been the same as the pressure drop of the process water control tubes. This means that the filtration rates with and without sodium dichromate are apparently the same. However, the data involved in the comparison only covers a period of two months, and should not be used to draw any definite conclusions.

RECIRCULATION STUDIES - I. H. Purcell

The first draft of the report outlining the major problems of recirculation and the necessary experimental program to obtain the required answers has been completed. It is expected that this report will be published during the coming month.

PT-105-473-P - THE USE OF ALUMINUM SULFATE FOR PROCESS WATER COAGULATION - W. C. L. Woods

This test continued without incident through the month of November. Process tube pressure drops continued to show a decrease, and the effluent water activity at the 107 Retention Basin has remained at the lower values previously reported. These data are considered significant since the Filter has operated continuously for the period November 1 to 23; from November 19 on, the power level was maintained between 400 to 500 MW.

No explanation of the lower pressure drops has been obtained as yet. It is planned to obtain samples of the film from the slugs discharged at the next shutdown. The film will be analyzed and compared with analyses of film formed with ferrous sulfate coagulated water. It is hoped to obtain in this way some information on the nature of the film present on the slugs.

It has also been found possible to decrease the alum feed by half. This has resulted in a coagulating pH of 7.4 instead of the previous value of 7.1. The quality of the process water has not been affected by this operating change.

The following document was published this month: H-22636, "Interim Report No. 1, PT-105-473-P, The Use of Aluminum Sulfate for 100 Areas' Process Water Coagulation, Results of First Operational Period," W. C. L. Woods to File, November 10, 1951.

ACTIVATED SILICA ADDITION - W. C. L. Woods

The purpose of PT-105-473-P was to determine the effects of alum coagulated water on pile operating before using activated silica with alum. Because of the satisfactory results obtained with alum, a forthcoming production test in Filter will authorize the use of activated sodium silicate to determine the effects of the alum-activated silica coagulation process on filter plant operation, process water quality, and pile operation. The principal objective of this test will be to determine the maximum capacity of the present filter plant. The factors which will be investigated are: (1) flocculation and settling time, (2) filter rates with present filter bed media, and (3) filter rates with other filter media. Data on operations without activated silica addition will be

DECLASSIFIED

-15-

HM-22886

obtained to serve as a basis for comparison. It is expected that the capacity of the filter plant can be raised considerably by the use of activated silica. The results of plant experience elsewhere in the United States, and at Hanford Works has shown that increases from 25 to 50 per cent can be expected.

Project No. 611, authorizing the construction of experimental activated silica addition equipment in the 183-F Head House was started November 13. The material procurement for the project is 99 per cent completed, and installation of the necessary pumps and tanks has begun and should be completed by December 1. The present work schedule calls for completion of silica addition equipment by December 21, and the acid addition equipment by December 28.

100-H SILICA ADDITION EQUIPMENT DESIGN - J. M. Edwards

Equipment for the addition of activated silica as a coagulation aid with ferric sulfate was designed during the month. The facilities will be installed in 100-H Area utilizing the existing silicate equipment in the 190 Building. Acid and mixing, mixing and transfer equipment will be installed; activated silica from the existing mix tanks will be pumped through a new line from 190 to 183 Building and then metered into the raw water flumes.

The project proposal for the 100-F and 100-H facilities was prepared. Construction of the 100-H facilities will be commenced as soon as practicable in view of the immediate need for the 100-F facilities.

HIGH TEMPERATURE CORROSION - S. Goldsmith

- The facility in the 105-E Flow Laboratory to determine corrosion rates of aluminum at temperatures up to 150° C has been operating since October 15, 1951. Process tubes containing canned aluminum dunnies have been operating at 80° C, 99° C, 118° C, 135° C, and 150° C. Slugs are being removed at given intervals to determine corrosion rate versus temperature data and corrosion rate versus time data. Data obtained to date show the expected effect of temperature and time on corrosion rates. Adequate data are not available to give conclusive results, however, these data are expected within the coming month.

During the course of operation the 150° C tube became plugged with a film deposit, and only a very low flow could be maintained through this tube. It was noted that this film did not have the physical characteristics of the hydrous oxide film normally formed on slugs and tubes. The film formed in the 150° C tube resembled a boiler scale deposit. X-ray diffraction analysis of this deposit showed it to be made up largely of calcium carbonate. The tube was operated under a pressure which would keep the water from flashing to steam. A possible explanation for the formation of this deposit is that the bicarbonate-carbonate equilibrium in the water is shifted, which results in a higher carbonate concentration, and subsequent precipitation of calcium carbonate. A more complete analysis of the deposit is being made and results should give an indication as to the possible reason for such a deposit.

DECLASSIFIED

DECLASSIFIED

al6e

RP-22886

PT-105-407-P • PILE TEST OF MAGNESIUM FRONT DUMMIES - M. Lewis

Tube 388-H was tested under the production test of magnesium front dummies. This tube was discharged during September, but this was the first opportunity to examine the inlet eight feet. Pits were found only on top of the ribs. A yellow film was observed in place of the gray film that has been seen in magnesium dummy-loaded tubes. This film probably built up during the two months of operating without dummies. A few darkened areas that were covered by the film were noticed. No corrosion or corrosion products were seen besides the pits on the ribs.

FRONT TUBE CORROSION SURVEY - M. Lewis and S. Goldsmith

A document, "A Review of the Available Information on the Corrosion of the Inlet Portions of Pile Process Tubes", was written and is being published. An abstract follows:

The inlet portions of pile process tubes, which originally contained a pattern of aluminum dummy slugs, have been reported subject to pitting corrosion since the removal of the slugs. This corrosion is more severe than that found in the other portions of the tubes. The insertion of magnesium dummy slugs has been recommended to arrest this corrosion. A pile test of the effect of magnesium dummies is in progress and preliminary results are reported. Current-voltage relationships between magnesium and aluminum have been found to be satisfactory. A study of previously reported data on front tube corrosion has been made.

It is concluded that the overall corrosion of the tubes is low, but that pitting is occurring in the inlet portion. This pitting is not necessarily the result of removal of the front dummy pattern. Magnesium dummies, when tested, were found safe for the aluminum tubes, but no data were obtained as to their ability to protect the aluminum. The tubes are not considered to be in imminent danger of failure, and if a dummy pattern is inserted it will probably result in small production losses.

WEIGHED TUBE CORROSION APPARATUS - M. Lewis

Corrosion of the inlet portions of process tube under various conditions of flow rate and dummy charge is being studied in an apparatus of weighed tube sections. During calibration of the orifice flowmeters, difficulty with the pump caused a temporary shutdown. The difficulty has been corrected, and calibration is proceeding. Regular operation will begin immediately according to the plans presented in previous reports.

CORROSIVE EFFECTS OF HEAVY METAL IONS ON ALUMINUM - G. S. Fajicka

Samples of 2S and 72S aluminum were immersed in sample bottles containing trace amounts of heavy metal ions ranging in concentration from 0.005 to 0.100 ppm. Fifty-three sample bottles were placed in a 24 hour steady shake.

On November 16, a semi-monthly qualitative examination was made on the surfaces of the immersed aluminum strips to ascertain any visible changes

DECLASSIFIED

DECLASSIFIED

el7e

H. 22886

there. Some of the aluminum strips showed various amounts of surface attack which consisted of either pitting or salt-like deposits.

These strips in solutions containing silver, chromium, and copper ions showed evidence of some attack while these strips in solutions of lead and tin ions were relatively free from any visible change.

Both the 2S and 72S aluminum strips showed similar trends of surface change with the 72S samples showing a slightly greater degree of resistance to attack.

ELECTROGRAPHIC DETECTION OF CORROSION LOCAL POINTS - G. S. Fujioka

Trace amounts of metals on aluminum can contribute to the corrosion of the aluminum surface. By electrographic methods it is hoped that these traces can be detected.

A crude electrograph was assembled using readily available materials and some tests were conducted to determine the sensitivity of the electrographic technique for the detection of small quantities of copper.

A small piece of copper metal, the size of a pin head was embedded in the test material and it was found that a current of 20 milliamperes flowing for 20 seconds through the sample gave a sufficiently high amount of electrolytic oxidation of the copper metal to copper ions to give a good test with benzoinoxime test reagent.

Using a similar technique, a deposit of 20 micrograms of copper spread over an aluminum surface measuring 1/2 centimeter in diameter was detected. With further refinements in technique, smaller concentrations of copper may yield to detection by electrographic techniques.

INDUCTION HEATING FACILITY - J. D. Fogelquist

Construction of the Induction Heating Facility has been progressing on schedule. The unit is now 70 per cent complete and is expected to be completed by December 10, 1951.

All electrical wiring, except for safety interlocks, will be completed on November 28, 1951 and will be checked for correct installation at that time.

The initial Induction Heating Coil and process tubing to be used with this unit, are under construction in the shops and should be ready for installation by December 10, 1951. After the installation of these items, the unit will be tested and should be ready for use by December 14, 1951.

FIFTY TUBE MOCK-UP - J. D. Fogelquist

Construction of the Fifty Tube Mock-Up Laboratory ceased on November 2, 1951 due to the lack of delivery of rotameters.

Partial delivery of these items has now been filled, and the expected shipping date on the remaining rotameters is December 15, 1951.

Construction should resume one week after delivery of all the rotameters.

R. M. Fryer / W. K. A.
FILE TECHNOLOGY UNIT

DECLASSIFIED

DECLASSIFIED

-18-

HW-22886

MECHANICAL DEVELOPMENT STUDIES, - H. J. White

SPHINCTER SEAL TEST - P. M. Jackson

Temperature tests have been made on the seal by heating the rod and inserting it into the seal. It was found that temperatures up to 700° F had no observable effect upon either the seal or the lubricant, however the lubricant (Molykote) seemed to break down and fail at temperatures over 750° F.

Molykote has been checked to determine its activity under radiation and it is believed to be satisfactory for the type of service required on vertical safety rods. Drop time and wear resistance tests on VSR #20 are being scheduled for the next shutdown at D Unit.

BALL CORROSION TEST - P. M. Jackson

The nickel plated Boren steel balls being corrosion tested will be taken to the Metallurgy Section for inspection. A report of their findings will be issued in the near future.

REAR FACE MONITORING BY TELEVISION - H. Harty

The drafting portion of the design for a television installation at D Pile has been started. From this design a mock-up will be erected in the 189-D Building. Upon receipt of the television equipment, which will probably be ordered this month, the proposed installation will be tested.

HORIZONTAL ROD CONVERSION STUDY - PRESENT PILES - J. M. Roberts

A preliminary report will be issued shortly outlining several plans for redesigning, converting, and modifying horizontal control rods and their related components. Several degrees of complexity and cost will be presented for further consideration.

P-13 REMOVAL - R. C. Lovington

The method of removing the P-13 Pressure Assembly as outlined in the Proposal Memorandum of September 27, 1951, has been approved. A Project Proposal is being written to cover the procurement and erection of the removal apparatus for testing, and the subsequent disassembly and storage of portions of the equipment until final use. A cost estimate is being prepared by the Design and Construction Services Unit.

CHEMICAL SLUG STRIPPER - R. C. Lovington

The fabrication and assembly of the chemical slug stripping apparatus is almost complete. Considerable delay of the final assembly has been experienced due to the failure of vendors to supply purchased material at the promised time.

TEMPERATURE MONITORING OF TUBE OUTLETS - STUDY - R. C. Lovington

This study of process tube temperature mapping is being continued. All of the available literature on instrument development for temperature mapping, such as the mercury jet switch and the Vernatherm power element, have been obtained and are being reviewed.

DECLASSIFIED

DECLASSIFIED

-19-

HW-22826

SLUG AIR WEIGHER - F. C. Lovington

The desired production rate for weighing slugs now exceeds the designed production rate for the present slug air weigher. Preliminary designs are being made of several possible alternate systems which might be used to provide increased production. An outline of each of these methods is being prepared and will be presented in the near future.

BY-PRODUCT POWER - STUDY - R. C. Lovington

Due to the urgency of more important work, little progress has been made in the investigation of by-product power recovery.

SLUG DAMAGE - CHARGING (IN-PILE) - C. H. Goldthorpe

A complete set of data has been gathered on nine of the original twelve charges to be made. The last three tests are scheduled to be made through a new process tube which is to be installed in the November 28, F Pile shutdown. A final report will be issued in December.

SLUG DAMAGE DUE TO CHARGING - L. A. Nelson

The test has been completed and the final report issued (HW-22600). No slug damage due to charging was detected. All of the charged slugs met the inspection requirements.

PROCESS TUBE REPLACEMENT - L. A. Nelson

The tube-puller winch was originally designed to exert a pull of 1000 pounds on the process tube, which was considered the maximum which could be applied safely. When this estimate was raised to 5000 pounds, the motor and gear reducer were tested and found to develop insufficient torque. The winch is being redesigned and new parts will be ordered.

CROSSHEADER IMPROVEMENT - L. A. Nelson

The possibility of allowing for process tube expansion and contraction by the deflection and movement of the crossheader appears feasible. The tentative design is awaiting prints and other information.

WATER COOLED TEST HOLE FACILITY - G. E. Wade

The preliminary design of the water cooled test hole facility has been discussed and approved by H. L. Henry of Pile Applications and L. P. Bupp of Pile Engineering. The revised design eliminates one of the seven outside tubes; that which contained the thermocouples. This permits spacing of the six remaining sample tubes so that a flare type joint combined with an "O" ring seal may be substituted for the welded joint, which in the past has proven unsatisfactory. Four smaller thermocouples tubes have been added to replace the tube removed. The new design also reduces the water in the facility by one third.

Drawings for the fabrication of the facility will be started at once. Also, drawings will be made for modifications necessary on the Gatling Gun as a result of the above alterations to the facility.

DECLASSIFIED

DECLASSIFIED

-20-

NY-22886

ADDITIONS TO FACILITIES AT 189-D TEST LABORATORY - W. J. Morris

Impending changes at the 189-D Building: increases in volume of activity and number of personnel, security closure, and consequent new routes of access and exit, necessitate improvements and additions.

Steps are already being taken by Plant Engineering to excess the bulk of the equipment which now occupies the 189-D Electrical Room. A space approximately 20' x 35' will thus be created which can be partitioned into two enclosures, and office for the custodian, and a combination lunch, change and calculation area, equipped with suitable tables, benches, and clothes lockers.

Construction of a wash room and toilet will be necessary as the present facilities, which have been "borrowed" from Operations personnel in the 185 Building, will be shut off from 189 by the security closure.

189-D TEST LABORATORY OPERATION - E. G. Dosskey

The Exponential Pile Group (P-12) and the front tube corrosion test now occupy the southwest and southeast ends, respectively, of the 189-D Building.

There has been no change, since the October report in the status of the 25-ton Whiting crane authorization.

Effective November 23, the 189-D Laboratory became an exclusion area.

CREEP IN ALUMINUM PROCESS TUBES; TEST #8 - C. D. Emmons

The final report on this test in in rough draft form.

PRESSURIZED "C" AND "D" MACHINES; TEST #29 - J. C. Wood

Several test runs were conducted using a "C" process tube to determine if it would be possible to back-seat an entire column of uranium slugs and dummies in the process tube. Results showed that, under carefully controlled conditions of charging, the slugs remained aligned in the process tube and it was possible to back-seat the entire slug column. This is not conclusive however, because of the limited number of successful runs. Due to the complication of controlling flow and pressure in the process tube during charging and discharging, other attempts were made to allow back-seating of the entire column. Slugs were charged one at a time at full pressure and discharged simultaneously, thus keeping the column nearly the same length to limit the distance which the slugs had to rifle down the tube. A run was made in which the upstream end of the process tube was filled with dummy perforated slugs, then charging and discharging conducted simultaneously, and at the end the extra dummy slugs were ejected. After both of the above methods of charging and discharging it was impossible to back-seat the new charge.

Removing the simulated graphite growth curve had no effect on the back-seating problems.

DECLASSIFIED

DECLASSIFIED

-21-

HW-22886

HEAVY AGGREGATE CONCRETE POUR; TEST #34 - C. D. Ewins

The report on this test has been written in rough draft form and is awaiting photographs which should be received shortly.

UNPRESSURIZED CHARGING MACHINE; TEST #39 - W. J. Morris

The new slug holding device consisting of two pistons porting from the present hydraulic system has been completed. The hydraulic pistons have been tested prior to installation. Final installation will be completed upon the arrival of the necessary valves and fittings.

A system to fill the Collins type seal has been added to the charging machine. Testing of the filling system will commence after the installation of the new slug holding device is complete.

Preliminary planning and estimating is now underway to combine the unpresurized charging machine with the pressurized discharging machine for further testing.

"R" RING PROCESS TUBE; TEST #44 - R. E. Johnson

A report consisting of a resume of available data has been prepared and circulated for approval.

CREEP IN ZIRCONIUM TUBES; TEST #46 - C. D. Ewins

Since the initial creep, which occurred during the first week of the test, there has been a change of 0.0006 inches in circumference in each tube. During the first month the gauge on the 600 psi tube indicated an increase of approximately 0.0020 inches in circumference, while the 400 psi tube showed 0.0010 inches change in circumference. Circumferential creep for the low pressure tube has thus totaled 0.0016 inches, and for the high pressure tube, 0.0026 inches.

There was no change during the last month.

FLAPPER NOZZLE ASSEMBLY; TEST #50 - F. E. Schilsen

Tests were made to determine the stability of pressure gauge readings in the flapper nozzle as affected by the flow orifices in the inlet adapter.

Using an inlet header pressure of 400 psig, tests were run with orifice sizes of 0.140, 0.200, and 0.285 inches; and with no orifice. The stability of the gauge reading was good. The gauge pointer vibrated a maximum of ± 5 psig from the apparent reading.

This concludes tests on the flapper nozzle assembly. The final report is now being written.

DEFLECTION TESTS OF SINGLE GUN BARREL ASSEMBLY; TEST #51 - R. E. Schilsen

The final report is being written and will probably be issued within the next month.

DECLASSIFIED

DECLASSIFIED

-22-

FI-22886

FABRICATION OF ENLARGED, REPLACEMENT PIGTAILS - R. E. Schilsen

No work was done on this project during the past month because of higher priority work.

PIGTAIL FLEXURE; TEST #54 - R. E. Schilsen

Tests were completed on the Atlantic Hase connector and the flapper nozzle pigtail.

Using a static internal pressure of 500 psig, the Atlantic Hase failed after being flexed $\pm 1/2$ inch for a total of 2730 cycles. The flapper nozzle pigtail failed after being flexed $\pm 3/4$ inch for a total of 2600 cycles.

This concludes all tests to date. Tests may be conducted on other pigtail designs in the future.

HORIZONTAL ROD GLAND SEAL; TEST #64 - R. E. Johnson

The graphite and "C" ring wear test was successfully completed after a short moving delay necessitated by the installation of the horizontal rod mock-up.

A new design employing a dense graphite gland, "C" rings, micarta wipers, and water lubrication has been derived from previous test results. Fabrication and partial testing have been completed. Results have been very satisfactory so far.

A rough draft report has been written on all the accomplishments to date.

HORIZONTAL ROD MOCK-UP; TEST #65 - R. E. Johnson

The graphite mock-up with provision for bowing to simulate growth has been completed except for final alignment. All prototype-supporting structures have been installed. The installation of the electrical system, the water heating equipment, and the prototype pieces remains to be done pending arrival of the appropriate equipment. Construction was estimated to be 24 per cent complete on November 11. To date, expenditures appear to be proportionate to the percentage complete.

Because of a ruptured thimble in #7 HCR at 105-B, #4 HCR (from which necessary control equipment is being taken) cannot be removed from operation. Consequently, continuation of the removal of the 105-B equipment will be pending repair of #7 HCR. With the acquisition of the 100-B equipment, the project has two drive units to its credit. A decision will be made soon as to who will get the new unit at 189-D or the older, contaminated one at 100-B. The older contaminated unit must carry a conditional RMU release which makes it less desirable to both parties.

The motor-generator set has a possible 14 to 20 week delay in delivery so that 105-C testing may have to be done by using the 100-B batteries as an expedient.

DECLASSIFIED

MECHANICAL VIBRATION TEST ASSIGNMENT SUMMARY

MONTHLY PROGRESS AS OF NOVEMBER 26, 1951

[illegible]

Process Tube Replacement	LA Nelson	Aug. 1950	X	X	2/3	3/5	1/2	1/2	1/2	1-1-52	55	1-1-52	26
Slug Damage-Charging (In-Pile)	CH Goldthorpe	May 1951	X	X	X	X	X	3/4		11-30-51	66	12-31-51	80
Final Test Ball 3K and VSR Systems	CH Goldthorpe	May 1951	X	X	3/4	1/2	1/8	1/4		3-15-52	35	3-15-52	40
Deformed Tube in Cored Graphite (9-Tube Mock-Up)	GE Wade	May 1951	X	X	X	X	X	X	6/7	11-15-51	99	11-20-51	100
Fabrication of Enlarged Replacement Pigtails	RE Schilson	May 1951	---	---	X	1/2				Uncertain	20	Uncertain	20
Strainer Δ p and Strength Determination	PM Jackson	June 1951	X	X	X	4/5	4/5	3/5		11-1-51	52	12-15-51	70
Effect of Process Tube Rib Spacing and Width	JC Wood	July 1951	X	X						11-15-51	15	1-15-52	15
Slug Damage-Charging (Flow Lab)	LA Nelson	Aug. 1951	X	X	X	X	X	X	X	10-31-51	91	10-31-51	100
P-13 Removal	RE Lovington	Aug. 1951	X	4/5	4/5					Uncertain	24	Uncertain	26
Cast Iron Modifications for Gasier Gun Barrel Replacement	GE Wade	Aug. 1951	X	X	X	X	X	X	6/7	10-31-51	97	11-30-51	97
Effect of Spinrotor Seal and Lubric. on VSR Drip Time	H Harty	Aug. 1951	X	X	X	4/5	3/5	1/2		11-15-51	59	1-1-52	64
Rear Face Monitoring by Television	H Harty	Aug. 1951	X	4/5	3/5					1-1-52	20	3-1-52	23
Chemical Slug Stripper (Assistance to Metallurgy)	RC Lovington	Sept. 1951	X	X	X	9/10	9/10			Uncertain	38	12-1-51	48
Horizontal Rod Conversion Study - Present Piles	JM Roberts	Oct. 1951								---	---	Uncertain	80
Adequacy of Discharge Tip-Off (Higher Flows)	JM Roberts	Oct. 1951	X	X	X	X	X	X	4/7	Uncertain	10	12-3-51	97
Water-Cooled Test Hole Facility	GE Wade	Oct. 1951	X	X	2/3					Uncertain	10	1-25-52	25
Temperature Monitoring of Tube Outlets - Study	RC Lovington	Oct. 1951								Uncertain	20	Uncertain	35
By-Product Power - Study	RC Lovington	Oct. 1951								Uncertain	25	Uncertain	10
Crossheader Improvement	LA Nelson	Oct. 1951	4/5	---						Uncertain	5	Uncertain	10
Improved Slug Air Weigher	RC Lovington	Nov. 1951	X							---	---	Uncertain	10

DECLASSIFIED