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N-REACTOR DEPARTMENT

MONTHLY REPORT -- SEPTEMBER 1963

Compiled by N-Reactor Department

October 7, 1963 - Richland, Washington

Work performed under Contract No. AT(45-1)-1350 between the Atomic Energy Commission and General Electric Company.

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GENERAL SUMMARY

N REACTOR FUELS

Production

Input at the extrusion press of 229 billets, or 44 tons, consisted primarily of outer billets providing the same tonnage as previous month, but with 36 fewer extrusions. Delays in obtaining 15 mil steel shoes resulted in a considerable decrease below previous month of finished production to Final Storage. However, acceptable tooling for these parts was put into production in mid-September and the backlog of material awaiting these shoes will be reduced and the completed assemblies transferred to Final Storage during October. A current evaluation of the first load status indicates that 365 outer and 210 inner extrusions are required to complete the first reactor charge. Based on these data, the total input requirement for the first load has been increased from 640 to 700 tons. Status of first load at the end of September shows Shop input 84 per cent complete, autoclave 77 per cent complete, and 56 per cent transferred or awaiting transfer to Final Storage. First load yield to date is 54.3 per cent compared with previous month yield of 53.6 per cent. On September 16, the Final Assembly area completed locking and sizing of the first 50 per cent of the first load.

Quality Control

A proposal has been made regarding disposition of the approximately 2200 outer pieces held due to out-of-control conditions at the locking clip welder. The proposal recommends that these assemblies be accepted for reactor charging if they pass the autoradiographic test of the locking clip weld plus the normal criteria for acceptability. An additional 840 pieces welded at a different time are currently under evaluation and a recommendation as to the disposition of these pieces will be made during October.

Engineering

Revision 3 of the specification for uranium metal billets for NPR fuel elements and revision 1 of chemical specifications for uranium metal billets for NPR fuel elements have been transmitted by RLOO-AEC to the uranium feed sites. These documents establish an impurity limit of 35 ppm maximum of phosphorus.

Unbonded extrusions continue to be a major production and yield problem. The specific causes of unbonding have not yet been determined. Several tests are currently under way and metallurgical examination of bonded and unbonded samples has been stepped up to provide additional data.

The engineering manpower that has been assigned to the charging machine testing (about five man months during September) has seriously affected other important programs, such as braze improvement, bonding studies, and product evaluation.

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RESEARCH & ENGINEERING

It has been determined during the preparation of Technical Pases for individual process tube operating limits that the enthalpy removed in the center hole of the present tube-in-tube fuel element is the item limiting maximum tube power. A program has therefore been initiated to acquire precise measurement of the temperature distribution in the coolant channels during the low power demonstration phase of operation.

Analysis of the data from pressure drop and plugging experiments with the NPR-PCE Facility in 189-D Laboratory has been completed and a report is being prepared.

Irradiation testing of prototypic "first load" fuel element assemblies for N Reactor is continuing in KER-3 and KER-4 Loops. A third charge reached an exposure of 1030 MWD/T and a fourth charge reached 667 MWD/T September 15, 1963. Both tests have experienced standard operating conditions.

Irradiation of prototype Li-Al target elements with N Inner Enriched (NIE-1) elements for heaters continues in KER Loop No. 2 as part of the program for determining the technical feasibility of incremental tritium production in N Reactor. A duplicate test was discharged from KER-1 at a gas volume ratio (GVR) of 8 in August. Goal exposure for the KER-2 test is a GVR of 20-25. The expected discharge date is January 1.

A report summarizing the methods which have been investigated for the detection of hydride in the zircaloy tubes has been completed.

The results of noise analysis studies show that there is no need for the procurement of special equipment. The use of detectors incorporated in the N Reactor for other purposes, HL analogue computers, and the analysis techniques used in other Hanford reactors will provide adequate noise analysis information.

Process Standards required for fuel loading are about 75 per cent complete.

(1-HW-78671, Special Production Study - N-Reactor Department, by R. L. Dickeman, dated August 16, 1963.

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Hazards evaluations associated with start-up physics tests have been completed and a report is being issued.

As of September 21, 1963, 60 per cent of the procedures for operational test program had been prepared and 7 per cent of the tests had been completed.

N REACTOR PROJECT

A design review of the fog spray system has provided a basis for establishing operational test requirements and has verified the adequacy of the diesel fog spray pumps operating singly.

A report has been issued containing a comprehensive set of calculated values for N Reactor control system capacities derived from measured values obtained under experimental conditions.

The effect of plugged steam generator tubes on N Reactor power levels has been analyzed and the means of compensating therefor have been evaluated.

The confinement system design criteria have been revised to reflect the current design approach which has been presented to reactor safety and hazards review groups.

Continued fuel charging testing has revealed widely varying values of fuel element support strength and has produced correspondingly erratic results in terms of the circumstances causing support deformation. Recommendations have been made for initial charging procedures, and existing magazines are being modified to incorporate the eccentric tapered adapter to limit the amount of support deformation.

Field current testing of all tubes in steam generator unit 4A revealed that 64.5 per cent of the tubes contain serious intergranular corrosion defects; this unit is to be retubed. Rerolling of tubes in unit 3B has been completed as a preparatory step in the sleeve type repair of tube mouth cracking. Material for sleeving has not yet been delivered. Further progress in the repair of unit 3B is dependent on test results with prototypic joints and delivery of production sleeving material.

Custody of the Process Tube Flow System was made September 10 and the Power Calculator System on September 20, 1963.

A tube failure on the boiler occurred September 18 during a high level run test. Test was curtailed. Foster-Wheeler representatives visited the site September 23 to discuss the boiler performance. They stated that errors in design were causing the numerous tube failures and failure to meet performance specifications. They proposed design modifications to be performed during the week of October 14, 1963.

Preliminary flushing work prior to chemical cleaning of the Secondary System has been completed. Chemical cleaning operation is scheduled to start October 1 and be completed October 3, 1963.

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N REACTOR PLANT

The boiler was shut down on September 18 when a roof tube ruptured during a test run at 500,000 pounds per hour steaming rate. This failure was similar to the previous roof tube failure in July, 1963, and points up some design deficiencies in the boiler. Foster-Wheeler representatives inspected the boiler on September 20 and have limited boiler output to 300,000 pounds per hour until design changes can be made to correct the present deficiencies which prevent the boiler from achieving its rated output.

Fabrication difficulties were encountered on the fuel spacer dummy order. Problems were resolved by a vendor visit. Test quantities have been received. The vendor states he will still meet the required delivery date for bulk quantities.

Mechanical maintenance effort in connection with equipment conditioning and repair for operational test performance has required the addition of a second crew somewhat earlier than anticipated.

Transfer of operational spare parts, operational spares, and tools from Kaiser is under way.

PERSONNEL STATISTICS

Number of employees as of August 31, 1963 602
Number of employees as of September 30, 1963 611

	<u>Exempt</u>	<u>Nonexempt</u>	<u>Total</u>
General	2	2	4
Finance	15	8	23
N Reactor Fuels	54	122	176
Research & Engineering	49	9	58
N Reactor Plant	63	170	233
N Reactor Project	<u>91</u>	<u>26</u>	<u>117</u>
TOTAL	<u>274</u>	<u>337</u>	<u>611</u>

Employment

	<u>Exempt</u>	<u>Nonexempt</u>	<u>Total</u>
Additions	9	14	23
Reductions	<u>7</u>	<u>7</u>	<u>14</u>
Net Additions	<u>2</u>	<u>7</u>	<u>9</u>

SAFETY & SECURITY

Days without a disabling injury	304
Hours worked without a lost disabling injury	862 823
Medical treatment injuries (September)	29

There was 1 security violation in the Department during September, 1963.

SUGGESTION PLAN PARTICIPATION

	<u>September</u>	<u>Year-to-Date</u>
Number of eligible employees	339	264
Number of suggestions received	39	266
Number of suggestions acted upon	27	199
Number of suggestions adopted	13	84
Net annual savings	\$2 018	\$20 327
Amount of awards	\$ 295	\$ 2 985
Per cent of awards to savings	14.6	14.7
Average amount of awards	\$ 22.69	\$ 35.54

PATENT SUMMARY - SEPTEMBER, 1963

All persons engaged in work that might reasonably be expected to result in inventions, or discoveries, advise that, to the best of their knowledge and belief, no inventions or discoveries were made in the course of their work during September. Such persons further advise that, for the period therein covered by this report, notebook records, if any, kept in the course of their work have been examined for possible inventions or discoveries.

STAFF

General Manager
 Manager, Employee Relations
 Manager, Finance
 Manager, N Reactor Fuels
 Manager, N Reactor Plant
 Manager, N Reactor Project
 Manager, Research & Engineering

R. L. Dickeman
 C. O. Steinnagel
 J. Milne
 L. M. Loeb
 W. M. Mathis
 J. S. McMahon
 M. C. Leverett

R L Dickeman

General Manager
 N-Reactor Department

RL Dickeman:skd

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N-REACTOR FUELS OPERATION
SEPTEMBER 1963

I. PRODUCTION STATISTICS

	<u>Current Month</u>		<u>Last Month</u>	<u>First Load</u>		
	<u>Scheduled</u>	<u>Actual</u>		<u>Schd.</u>	<u>Tons</u>	<u>Per Cent</u>
	<u>Tons</u>	<u>Tons</u>	<u>Actual</u>	<u>Tons</u>	<u>To Date</u>	<u>Complete</u>
<u>Shop Input</u>						
Inners	18.0	10.2	21.1			
Outers	32.1	33.9	25.5			
Total	50.1	44.1*	46.6	700	590.8	84.5
<u>Shop Output</u>						
<u>Autoclaves</u>						
Inners	17.5	18.5	18.9			
Outers	35.0	32.9**	31.8			
Total	52.5	51.4	50.7	420	324.4	77.2
<u>Assemblies</u>						
Awaiting Shoes	x	x	x		17.9	x
Awaiting Certi- fication or Transfer	x	x	x		48.9	x
Finished Prod.		22.1	93.7		140.5	x
Total	x	x	x	372	207.3	55.6

Throughput by Stations

<u>Station</u>	<u>Inners</u>	<u>Outers</u>	<u>Total</u>	<u>In-Process</u>	<u>Defective</u>
				<u>Inventory</u>	<u>Rate</u>

Extrusions (billets)	71	158	229	85	11.0%
Cut-up First	1235	1898	3133	17	----
Cut-up rework	102	24	126	856	----
Chem. Milling (ends)	1002	4980	5982	463	.2
Braze (ends)	251	5633	5884	276	5.0
Heat Treat	63	2925	2988	35	.6
Straightening	0	18	18	6	.1
End Test (ends)	0	6070	6070	0	4.3
Vacu-blast	0	3234	3234	98	----
Welding (ends)	110	5833	5943	37	----
Clad and bond test	53	3111	3164	50	15.4
Support weld	2104	2438	4542	105	1.1
Autoclave***	2922	2804	5727	603	----
Final Inspection	2246	2589	4835	14,142	3.2

* 3.7 ton were peel test rejects.

** 1.1 ton - normal.

*** Includes production performed on 9/28/63.

4 Includes 90 normal.

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Other Statistics

	<u>Inners</u>	<u>Outers</u>	<u>Total</u>
Rework storage			
Support fabrication	17,980	19,045	37,025
Locking clip fab.		4,745	4,745
Special Extrusions			28
 Tubes Scrapped			
Engineering, N-RD	18	62	80 1703 lbs.
Materials, IPD	63	86	149 2632 lbs.
 Oxide Burned	27 batches		1875.39 lbs.

Shop YieldCurrent Month

First Run	79.9	56.7	60.2
Estimated Rework	<u>6.4</u>	<u>8.0</u>	<u>7.6</u>
Total	86.3	64.6	67.8

Previous Month

First Run	82.8	66.5	72.1
Estimated Rework	<u>6.4</u>	<u>11.0</u>	<u>9.4</u>
Total	89.2	77.5	81.5

First Load to Date

First Run	x	x	x
Estimated Rework	<u>x</u>	<u>x</u>	<u>x</u>
Total	63.0	50.2	54.3

II. SHOP OPERATIONSA. Production

Extrusion press input consisted of 229 billets or 44.1 tons. The majority of the extrusions were outer billets which provided essentially the same tonnage as previous month, but 36 fewer extrusions. Twenty-eight additional extrusions were made for Engineering which included eight zirconium and six uranium primary extrusions.

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Finished assemblies to Final Storage of 22 tons was considerably below forecast as a result of delays in obtaining 15 mil steel shoes. Acceptable tooling for these parts was put into production in mid-September and the backlog of material awaiting thick shoes will be reduced and the completed assemblies transferred to Final Storage during October.

Currently, 365 outer and 210 inner extrusions are required to complete the first reactor charge. Based on these data, the total input requirement for the first load has been increased from 640 to 700 tons, of which 590.8 tons, or 84.5 per cent, have been extruded to date.

B. Plant Problems and Incidents

The air exhaust problems that have kept the oxide burner inoperative for a significant amount of time during the last two months have been completely resolved with the discovery of a badly plugged wire filter in the exhaust system. The filter was thoroughly cleaned and the air exhaust system then functioned normally. Operating procedures are being revised to incorporate periodic checks of this part of the equipment.

Bearing replacement in the cut-off saw has continued to result in excessive down-time. An Engineering evaluation is under way to correct this problem.

The 7-1/2 inch liner shorted out on September 19, 1963, and had to be removed from service. The short resulted from graphite around the terminals causing the busses to short out to the heat shield. Shielded asbestos, packed around the elements would have considerably reduced the damage. All liners are now being repaired in this manner.

The flexible portion of No. 6 autoclave blowdown line leaked steam during blowdown as a result of a cracked silver-soldered joint. Similar fittings on all autoclaves have been visually inspected and new lines are being procured which are designed to meet service needs.

On September 18, 1963, a fire occurred, following an extrusion, in the exhaust system at the end of the runout table. This system provides exhaust for the engineering cut-off saw and is used to exhaust smoke from the end of the extrusion. A spark from the extrusion is the probable cause of the fire. The fire was contained within the exhaust unit and there was a very minor spread of contamination which was easily cleaned. Total damage was under \$30.00.

C. Plant Improvements and Achievements

On September 16, 1963, the Final Assembly Area completed locking and sizing of the first 50 per cent of the first load.

New throughput records were established in one eight-hour shift at copper removal, squaring lathe (ends), chem mill (ends), and preweld etch.

On The September run of NIT extrusions, a different cutting pattern was used. Instead of 17 24-inch elements, there are now 15 24-inch and three 18-inch elements. This was accomplished by utilizing an additional six inches of the extrusion. To date, no problems have been exhibited in clad thickness.

The revision on the beta heat treatment conveyor in the 333 Building, whereby the No. 2 automatic safety lock cylinder was removed and a manual locking device installed, has decreased the downtime and the mechanical maintenance by an estimated 50 per cent. The malfunction of the automatic locking cylinder had in the past failed at least once a month, causing approximately four hours downtime and four hours maintenance repair time for two craftsmen, plus the time lost in the rerun of several fuel elements.

Decontamination work was essentially completed on the pad adjacent to the oxide burner. This pad has not been usable for the past several weeks because of loose oxide which had been spread during a fire in one of the barrels. The final phase of this problem will be the removal of contaminated earth and gravel from the edge of the pad which is expected to be completed during October.

III. QUALITY CONTROL OPERATION

A proposal was made on disposition of 2200 outer pieces held due to out-of-control conditions at the locking clip welder.

In effect, the proposal states that the material welded at the locking clip welders prior to November 29, 1962, be accepted for reactor charging if it passes the autoradiographic test of the locking clip weld plus normal criteria for acceptability. A recommendation for disposition of approximately 840 pieces welded between November 29, 1962 and January 9, 1963 will be made upon the conclusion of the autoradiographic filming of the locking clip welds on that material. This group of material includes Autoclave failure No. 1, welded on January 4, 1963, and Autoclave failure No. 2, welded on January 9, 1963.

IV. ENGINEERING OPERATION

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Uranium Specifications

Revision 3 of HW-67575, "Specifications for Uranium Metal Billets for NPR Fuel Elements," and Revision 1 of HW-76155, "Chemical Specifications for Uranium Metal Billets for NPR Fuel Elements," have been transmitted by RLOO-AEC to the uranium feed sites. These documents have been reviewed by the feed sites and the phosphorus impurity limit of 35 ppm maximum accepted as of September 1, 1963.

Large Diameter Ingot Study

Ten NOT billets fabricated from 13-inch diameter ingots were coextruded and evaluated for inner clad thickness variation. These coextrusions were compared with ten control coextrusions fabricated from 11-inch diameter ingots. Clad thickness variation was not improved. Although the results were not conclusive due to the small sample size and unforeseen processing variables, they do indicate that a simple change in casting geometry will not provide a radically improved billet. Additional tests are under way on the 13-inch diameter ingot material with casting geometry changes incorporated to improve both heat treatment and extrusion working on the ID surfaces.

Uranium Alloys

Coextrusions made from "high silicon" (150-420 ppm) alloy billets have been evaluated. Initial results show improvement in clad thickness variation, both from heat treated and non-heat treated billets. Primary extrusion of six ingots of high silicon (74-238 ppm) material has been completed to provide additional stock for further testing.

Primary Extrusion Tests

Primary extrusion tests, aimed at reduction of clad thickness variation by improved working during primary extrusion, were completed by Bridgeport Brass Company, Ashtabula, Ohio. Variables tested include ram speed, die-cone angle, and mandrel temperature. These extrusions are being shipped to Hanford for evaluation.

Zircaloy Strip Fabrication

Six lots of Zircaloy strip have been produced by Turk's Head rolling. All lots passed the bend test. An order has been placed for 200 pounds of strip produced by this process.

Bonding Studies

Unbonded extrusions continue to be a major production and yield problem. The specific cause(s) for unbonding have not yet been determined. Several tests are under way to assist in isolating the basic problem(s). These tests include: 1) outgassing of components during billet preheat; 2) evaluation of absorbed films developed during billet cleaning; 3) surface porosity; 4) inert gas pressure billet designs; and 5) billet preheat temperature evaluation. Metallurgical examination of bonded and unbonded samples has been stepped up to provide additional data.

Rewelding

Fuel recovery by rewelding has been initiated on production material using Pilot Plant equipment. Operating personnel are currently being trained on the equipment and processes.

Supports

Charge machine testing continued at a high level during the month. Test results have led to the following conclusions: 1) support strength has greater variability than originally anticipated; 2) a strength difference exists between autoclaved and non-autoclaved supports; 3) a modified magazine design will reduce charging damage; 4) fuels charged into empty tubes will not sustain unacceptable support damage; and 5) support damage is greatest to one particular support location (left front).

The manpower (about five man months during September) required to support this test program has seriously affected other important programs, i.e., braze improvement, bonding studies, and product evaluation.

Support testing was accelerated to establish the limits of support variability to be expected in current production and in the first load. This data is nearly complete and will be formally reported during October.

Gas Pressure Bonding

Six NOT and six NIT specimens each of Zr-3 and Zr-2 closure rings without seal or closure welds were autoclaved in 400°C - 725°F steam for 72 hours. There was no evidence of corrosion and no failures. The Zr-3 specimens were pressure bonded at 46,000 psi 650°C - 1202°F and the Zr-2 at 46,000 psi, 950°C - 1382°F, both ten minutes at temperature.

Support Welding

Destructive testing of outer support welds after autoclaving has shown a potential problem with weld strength. Several welds have failed at unexpectedly low shear force. Further evaluation is under way. The testing program will include tensile-shear testing and metallographic examination for structure and hydride distribution before and after autoclaving.

CAF-954

The revised project proposal requesting withdrawal of CAF-954 was approved by the General Electric Company and sent to RLOO-AEC.

V. TESTING METHODS OPERATIONUltrasonic Tests on Billets

A probe utilizing the new critical angle ultrasonic technique was designed and constructed to fit the bore of N-fuel billets. Tests made during the development of the technique indicated that it may be possible to evaluate both grain size and orientation effects simultaneously. The technique is based on a boundary wave type of ultrasound propagation where at a critical angle sound appears to be transmitted through the surface layers of the test media.

Braze Station Operation

Equipment has been assembled and a jig is being built to make X-ray fluorescence measurements for braze contamination. A constant potential X-ray unit has been borrowed from the Chemical Processing Department and the necessary electronic instrumentation assembled. Provision is being made to scan both the inside and outside braze layer on one end simultaneously; both the inner and outer fuel element components will be accommodated. Construction and assembly of the equipment should be completed early in October, with production tests possible by mid-October.

Irradiated Fuels Tester - UT-10

An irradiated outer tube accidentally dropped in ten feet of water was tested for cracking. No core flaws were detected; the fuel was from a group which had not been irradiated to full goal exposure. Mapping of cracks in other fuels has been successfully demonstrated using techniques similar to that used for mapping the clad thickness on the production testers.

Hot Die Sized Fuel Element Tester - UE-3

Work on the tester manual continued. The operating procedures were developed and written up for all eddy current portions of the tester. The procedure for the bond testers are nearly complete. The parts lists are being compiled and check prints have been issued on all ten of the circuit diagrams.

Routine Tester Operation

A reorganization within Production Fuels of IPD creating a group in electronic testers under Quality Engineering and the transfer of a Testing Methods Operation engineer to head up the group, was effective September 1, 1963. Liaison engineering support will be provided as requested; a current example is standards preparation work.

Irradiated Fuels Tester - UT-11

Two-hundred and forty irradiated AlSi fuel elements (out of a group of 400) were tested and mapped. Ten were found to have evidence of unbonding; three of the ten had unbonding as large or larger than a 313 Building reject standard. It is expected that one or two of the fuels with the largest flaws will be destructively examined at the Radiometallurgy facility for correlation with bond testing results.

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N-REACTOR FUELS OPERATION
SEPTEMBER 1963

VISITORS

<u>Name</u>	<u>Company</u>	<u>Contact</u>	<u>Date</u>	<u>Purpose</u>
WJ Farrell PE Tade	Sciaky Bros, Inc. Chicago, Illinois	TB Correy	9/24	Consult on welding power supply.
P Thome'	French AEC Saclay, France	TB Correy	9/27	Civilian applications.

TRIPS

TD Naylor RH Scanlon	Bridgeport Brass Ashtabula, Ohio National Lead of Ohio, Cincinnati, Ohio	JF Puterbaugh GK Stearns	9/23 & 9/24 9/25	Discuss uranium fabrication development plans.
HP Kraemer LM Loeb	Wah Chang, Albany, Oregon Harvey Aluminum Torrance, Calif. Torrance Brass Torrance, Calif. Bridgeport Brass Riverside, Calif.	S Yih G Moudry H Clark C Hoehne	9/23 9/24 9/25 9/26	Zircaloy cladding fabrication. " " Cu Sleeve Fabrication. Zircaloy cladding fabrication.
HP Kraemer	Custom Tube Paramount, Calif. Airline Welding & Engrg., Gardena, Calif.	M Wheeler M Castanzo	9/27 9/27	Zircaloy cladding fabrication. Cu-si sleeves
LM Loeb	APED, San Jose, California	RB Richards	9/27	Tour facilities.
DW Darsow	Wah Chang Albany, Oregon Oregon Met. Portland, Oregon Rem, Inc. Portland, Oregon	RA Graham DC Simmons CA Brown	9/16 & 9/17 9/16 9/18	Zr-2 extrusion component " " " "
RB Socky	London, England		9/9 to Attend Society for 9/13/63 Nondestructive Testing Meeting	
CN Jackson	Boeing Co. Seattle, Wash.	L Berryman	9/20 & 9/21	Discuss NDT and present paper at SNT meeting.

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ORGANIZATION AND PERSONNEL

	<u>8/31/63</u>	<u>9/30/63</u>
Exempt	58*	56*
Nonexempt	123**	121**
Total	<u>181</u>	<u>177</u>

Tech Grads Assigned to N-Reactor Fuels = 4

Terminations

<u>Name</u>	<u>From</u>	<u>To</u>	<u>Effective Date</u>
Nielsen, R (MTP)	Quality Control	Leave of Absence to attend college	9/27/63
Bosso, D (Nonexempt)	Quality Control	Returned to college	9/27/63
Carpenter, GB (Nonexempt)	N-Fuels Engrg.	To stay at home	9/6/63
Langford, LM (Nonexempt)	N-Fuels Engrg.	Retired	9/30/63

Transfers

Denton, CJ (Exempt)	Testing Methods	IPD - Prod. Fuels	9/1/63
Stewart, RB (Nonexempt)	CPD	N-Fuels Engineering	9/16/63
Mohr, RJ (Nonexempt)	Quality Control	IPD	9/2/63
True, MW (Nonexempt)	IPD	Quality Control	9/2/63
Uhlrich, RJ (Tech Grad)	Tech Grad Rot.	Support Services	9/1/63

INVENTIONS

All Engineering personnel engaged in work that might reasonably be expected to result in inventions or discoveries advise that to the best of their knowledge and belief, no inventions or discoveries were made in the course of their work during September, 1963. Such persons further advise that for the period therein covered by this report, notebook records, if any, kept in the course of their work have been examined for possible inventions or discoveries.

- * Includes two temporary upgrades to exempt from nonexempt rolls.
 ** Includes temporary employees.

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SIGNIFICANT REPORTS

<u>HW Number</u>	<u>Classification</u>	<u>Author</u>	<u>Date</u>	<u>Title</u>
None	Unclassified	P. Conrad	9/63	Deionized Water Operating Instructions
None	Unclassified	SG Forbes	9/63	The Locking Clip and Its Installation in "N" Outer Tubes
None	Unclassified	R. Thompson	9/63	Autoclave Instrument Calibration
HW-78713	Confidential	TB Correy	9/3/63	Survey of Possible Support Attachment Processes for N-Reactor Fuels
HW-78713 1	Confidential	TB Correy	9/4/63	Re: HW-78713, Survey of Possible Support Attach- ment Processes for N-Reactor Fuels
HW-78979 RD	Confidential	TB Correy	9/17/63	Closure Welds for a Proposed Aluminum Cladding Process

SECURITY VIOLATIONS

There were no security violations in the N-Reactor Fuels Operation during September. Total CYTD - 8.

Manager, N-Reactor Fuels

LM Loeb:mf

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RESEARCH AND ENGINEERING

1. ADVANCE TECHNOLOGY

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2. REACTOR ENGINEERING

Three sections of the Technical Bases applying to operation of the N-Reactor pressurizer have been prepared in draft and a fourth is under preparation. These Bases cover temperature-pressure relationships within the pressurizer vessel and temperature difference restrictions between the fluid in the pressurizer and the fluid in the primary cooling system.

The Technical Bases for establishing operating limits for the individual process tubes have been issued for comment. This effort has pointed out that the enthalpy use in the center hole of the present tube-in-tube fuel element is the item limiting maximum tube power. Work has therefore started to develop a program for more precise measurement of the temperature distribution in the coolant channels during the low power demonstration phase of operation.

The Technical Bases for the Circulating Raw Water System and the Primary Pumps are being prepared.

The three 105-N and the one 109-N fog spray nozzle types were tested in the 189-D Equipment Laboratory to obtain discharge characteristics for

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use in the analysis of the fog spray system currently being made by the Design Analysis Unit of Process Design. In addition to the supply pressure and discharge measurements obtained, photographs were taken of the spray patterns at 150 per cent, 100 per cent, 50 per cent, and about 15 per cent of design pressure. Final analysis of results will be made when the photographs become available. The following observations have been made, however:

- a. The largest of the 105-N fog spray nozzles produces a shower rather than "fog" and discharges a substantially larger flow quantity than that called for in the design.
- b. The two smaller 105-N nozzles are satisfactory from the standpoint of both discharge capacity and quality of "fog" produced. Both produce spray patterns that were virtually independent of supply pressure.
- c. The 109-N spray nozzle discharged a substantially greater flow quantity than that called for in the design but appeared to produce a satisfactory spray pattern at supply pressures somewhat less than design pressure.

Analysis of the data from pressure drop and plugging experiments with the NPR-PCE Facility in 189-D Laboratory has been completed and a report is being prepared.

Testing of the electrically-heated mockup of the downstream half of an N-Reactor tube-in-tube fuel column is progressing satisfactorily and on schedule. Current work involves measurement of pressure drop across the fuel column, downstream spacer charge and outlet connector over a range of equivalent tube powers, outlet pressures and flowrates.

3. REACTOR PHYSICS

Enough data has now been generated to complete the survey study of the use of single tube fuel elements in N-Reactor. Cases have been considered during the month in which the flow spacer-target tube was loaded with Li-Al alloy (for tritium production) or depleted uranium (for plutonium production). Additional calculations of some operating parameters, such as temperature coefficients of reactivity, for the latter cases still remain to be done.

Reactivity losses encountered upon loading one ninth of the N-Reactor process tubes with Np-237 target tubes containing ~ 35 gms Np-237 per foot are estimated to be ~ 5 per cent. Using this same supercell arrangement, in which eight regular fuel cells surround a target cell, it is estimated that an enrichment of 1.08 ± 0.02 per cent would be required to change η sufficiently to bring the reactivity of the supercell back to its normal value.

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The Pu production from the uranium fuel elements for this case is different from the initial N-Reactor uniform loading of .947% tube-in-tube fuel elements. From calculations of the conversion ratios for the two fuels of different enrichments and from adjusting the production for the loss in number of uranium tubes present, estimates were made of these production losses. The following table indicates the values obtained.

<u>ENRICHMENT</u>	<u>REACTOR POWER</u>	<u>PRODUCTION LOSS</u>
1.08%	3550 MW	-16.2%
1.08%	4000 MW	- 5.6%

The reactor power of 3550 MW is that which would result with a tube power of 4000 KW with only 8/9 of the tubes operating as power producing tubes. To achieve a reactor power of 4000 MW, a tube power of about 4500 MW is needed.

The hazards work associated with startup physics tests is complete except for any unforeseen problems which might arise before startup. A report is in preparation.

The second set of lectures on ex-reactor nuclear safety and in-reactor heat generation were presented to prospective N-Reactor operators.

The planning for startup measurements of lattice parameters and spectral indices is proceeding on schedule. The irradiation during zero power physics tests of special N-Reactor fuel elements, containing experimental radioactivants, under high temperature (530 F) and high pressure (1400 lbs/in²) is a "first" in Hanford experimental reactor technology. The preparation of special fuel elements for this purpose, however, poses some problems in fabrication.

Two methods of fabricating the special elements are under consideration. The first method is essentially the conventional method of machining and drilling fuel wafers, loading them with radioactivants and subsequently assembling them in tubes of cladding. Separate cladding tubes are not available and would have to be specially fabricated.

In the second method production line fuel pieces would be drilled parallel to their axis from each end to a depth of approximately 3-1/2 inches. Maximum diameter drills would be used leaving only about 0.020 inches of fuel next to the cladding. These holes would be plugged with rods containing pins of the radioactivant materials. The holes for these rods will be drilled through the fuel piece end caps. This eliminates nearly all the unbonded surfaces inherent in method one and is expected to minimize final closure problems. Electron beam welding would be used for the final closure. This method precludes the use of sector foils that provide a backup measurement in method one.

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The choice between these two methods depends upon whether sufficient accuracy can be achieved in drilling the coaxial holes in the fuel in the second method. Work on drilling test holes is underway and appears promising. Drill runout on the initial hole was 0.006 inches.

Estimates have been obtained for production of tritium for the case in which highly enriched uranium is used to fuel the reactor. No significant amounts of plutonium are produced in this case. The current estimate is for tritium production in the range of 0.9 to 1.0 gm-equivalent/MWD. Further study is underway in an attempt to find more nearly optimized designs which will have a higher production rate.

The selection has been completed of the items of technical information to be included in the technical bases on speed of control and total control, and in some cases the technical data has already been generated.

4. CONTROLS, INSTRUMENTS AND SYSTEMS ANALYSIS

A status review meeting was held in early September among personnel of the N-Reactor Department and the Hanford Laboratories to review the progress of the process tube monitoring program and to point out the problems being encountered.

A complete probe for measuring inner diameter of NPR process tubes has been acquired from IPD. The probe is in operating condition and requires only slight modification to be incorporated in the over-all N-Reactor program.

A report summarizing the methods which have been investigated for the detection of hydride in the zircaloy tubes has been completed.

A preliminary specification for a radiation resistant closed circuit TV system for the process tube monitor has been written.

The noise analysis program is essentially completed with the exception of the issuance of the final reports. These reports will cover a survey of the open literature on reactor noise measurement techniques and on the application of noise techniques to the measurement of reactor parameters in large reactors. The results of the studies show that, in the case of a large reactor such as the N-Reactor, a large number of special detectors may be needed to measure the power spectral density of the reactor. It was also found that the application of rod oscillator techniques encompassed these same problems of requiring a large number of detectors.

It was found that there would be no need for special noise analysis equipment. The present equipment on the market are really special purpose analog computers, whose functions can be performed by the analog computers at the Hanford Laboratories, utilizing the techniques which have been used in the noise analysis of other Hanford reactors.

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The NPR fuel rupture monitor test program for Phase II of the tests at the KER-1 loop has been written. The performance of this test is dependent upon the operating schedule of the K-Reactor and the availability of space in the KER-1 Loop for the uranium corrosion sample.

Analog simulation of the primary pumps has been started and the development of the steam generator model is underway. The detailed analog programming of the heat dissipation utilized by Bailey Meter Company in their analog studies has been received and should prove quite valuable in the setting up of our analog model of the dissipation system.

The reactivity digital computer program designed to separate the total reactivity changes into the graphite effects and the water coolant effects is now being debugged. Some problems are being encountered in the inversion of a large matrix which must be resolved before the program is completed.

Technical Bases on nuclear instrumentation trip levels and the reactor bulk outlet temperature limits are out for comment. The recommendations from these bases have been transmitted orally to the Process Standards Unit.

Several additional methods of interface level detection in the heat exchangers are being considered with a float type device utilizing magnetically actuated reed switches appearing to be the most promising. A report has been started which will summarize the possible measurement methods and techniques which could be used for this application.

A detailed review is being made of the Bailey Meter Company schematic drawings for the primary and secondary coolant control systems. The drawings for the Modal control system have also been examined in detail and a number of small errors were found and have been called to the attention of the Architect-Engineer and other interested parties. The Modal control section of ATP-2420, "Heat Dissipation Plant Instrumentation System" has been written and the approved ATP has been issued.

The Controls, Instruments, and Systems Analysis Sub-section has been assisting Process Design in the preparation of maintenance standards for the fuel rupture monitor, seismoscope, power motion, and the gas systems.

During operational testing of the gas purge system the gas piping was over-pressurized, causing one of the rupture discs to burst. An analysis of the situation found that the delay time in the lengthy pneumatic system prevented the valves from operating properly to control the pressure adequately. Relocation of the pilot valves was recommended to remedy this situation.

Participation has continued on the Data System Task Force which is reviewing the Department's data processing needs. Assistance has been given BSDO personnel in the preparation of lists of reactor operating data which should be incorporated in the system master file.

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5. CHEMISTRY AND METALLURGY

Irradiation of two thermocoupled assemblies for study of crud deposition under N reactor water conditions but with use of ammonia for pH control continues in KER Loop #1. Five NIE-1 elements with unbonded end closures are included in the test charge as heater elements and also as part of an effort to determine whether the unbonded closure is suitable for use on the inner tube of N reactor fuel. Reactor operation has been intermittent during the month so the exposure to date has been very low.

Irradiation of prototype Li-Al target elements with NIE-1 elements for heaters continues in KER Loop #2 as part of the program for determining the technical feasibility of incremental tritium production in N-Reactor using Li-Al as the target alloy. A duplicate test was discharged from KER-1 at a gas volume ratio (GVR) of 8 in August. Goal exposure for the KER-2 test is a GVR of 20-25. The expected discharge date is January 1.

The duPont Company has observed a new phenomenon leading to volume instability of uranium under irradiation in the Mark VP fuel element which went into use in the Savannah River reactors nearly two years ago. Fuel volume increases up to 10 per cent have been observed and jagged macroscopic pores have been found in metal which has undergone significant volume increases. Cavitation and grain boundary tearing are two of the names that have been used to describe the phenomenon. It appears to occur in the temperature range 375-450 C so questions have frequently been raised as to whether it occurs in N fuel and if not, why not. Until this month the phenomenon had not been seen in N test elements and reasons given for this have included power level and system pressure differences. The specific power at Savannah River ranges up to 35 MW/T which is about twice the peak power at HAP0. The British claim they see the same thing at 3-5 MW/T so power level differences have not received a great deal of support. The system pressure at SRP is only about 200-300 psi and in the British reactors it is about 100 psi in contrast to 1600 psi in KER tests and 1350 psi expected in N-Reactor. System pressure therefore has been regarded as the difference.

Early this summer it was learned that a test element (Zr clad U-2% Zr) irradiated by duPont in the VSWR at 1000 psi had been sectioned and cavitation observed. This upset the view that the high system pressure in N-Reactor would prevent the occurrence of cavitation. During this month, examination of the KSE-5 test elements began. This element was designed to fit KER-1 and KER-2 (2.1 inch ID process tubes) and to operate at metal temperatures up to 600 C for the purpose of developing a single tube fuel element for N-Reactor. Eight 12-inch test elements were irradiated to 1200 MWD/T in KER-2 during March - May 1963 under PT-544. A central element was sectioned this month and near one end several of the characteristic jagged pores were seen. In and of itself this may be a very minor observation. However, it does upset the view that N system pressure will prevent cavitation and some redirection of fuel development programs may be required should further cavitation be observed either in first load test elements or in advanced fuel test elements.

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Irradiation testing of prototypic "first load" fuel element assemblies for N-Reactor is continuing in KER-3 and KER-4. As of September 15, 1963, a third charge reached an exposure of 1030 MWD/T and a fourth charge reached 667 MWD/T. Both tests have incurred standard operating conditions.

6. PROCESS EVALUATION AND CONTROL

The Startup Test N-1, Physics Test, has been prepared and is being circulated for approval. Detailed procedures for the test are about 97 per cent completed in draft form.

Operating Safety Limits for Startup Test N-1 (physics testing) have been completed in draft form.

A list of systems required for cold and hot phases of the physics test (N-1) has been prepared.

Process Standards required for fuel loading are about 75 per cent complete.

Preparation of documentation for the Low Power Shakedown (Startup Test N-2 (OTP-0060)) is about 50 per cent complete and progressing.

Six system studies are under preparation, as follows:

- Zone Temperature Monitor
- Boiling Point Suppression System
- Seismoscope
- Intermediate Range Nuclear Instrumentation
- Compressed Air System
- Confinement System

On September 21, 1963, the status of the Operational Testing Program was as follows:

	<u>Completion</u>	
	<u>Scheduled</u>	<u>Actual</u>
Test Procedure Preparation	86%	60%
Tests Completed	23%	7%

A Temporary Process Nuclear Safety Specification, 2-63, Processing and Storage of 1.25% Enriched Uranium, has been completed and is circulating for approval.

SIGNIFICANT REPORTS ISSUED

HW-78671, "Special Product Study - N-Reactor," by R. L. Dickeman, August 16, 1963 (Secret).

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HW-78864, "A Program for Multi-Product Operation of the N-Reactor," by the staff of Research and Engineering, September 9, 1963, (Secret).

HW-78837, "N-Reactor Hazards Summary Report - Supplement No. 2," Edited by R. E. Trumble, September 4, 1963 (Secret).

TRIPS

<u>Name</u>	<u>Firm & Location</u>	<u>Date</u>	<u>Purpose</u>
G.H. Strong	Sola Company Chicago, Illinois	9/8-12	Discuss control equipment
G.W. Morrow	Chicago, Illinois Charlivoix, Michigan	9/9-11	ASA Committee N-3 liaison activities Discuss tests at Big Rock Point
D.L. Condotta	APED, San Jose, Calif. San Francisco, Calif.	9/25 9/26-27	Technical discussions. ANS Topical meeting.
P.F. Nichols	APED, San Jose, Calif. San Francisco, Calif.	9/25 9/26-27	Technical discussions. ANS Topical Meeting.
R.W. Benoliel	General Electric New York City	9/27-30	Interview

VISITORS

<u>Name</u>	<u>Firm & Location</u>	<u>Date</u>	<u>Purpose</u>
W. E. Tragert D. W. White	General Electric Schenectady, New York	9/18	Discuss fuel technology

PERSONNEL

Additions

<u>Name</u>	<u>From</u>	<u>To</u>	<u>Date</u>
R.A. Chitwood	IPD	Process Evaluation & Control	9/1/63
G.N. Danekas	New Hire	Reactor Engineering	9/9/63
F.D. Frisch	New Hire	Process Evaluation & Control	9/23/63

Removals

<u>Name</u>		<u>Date</u>
R. A. Baker	- Summer Professor	9/13/63
T. H. Nyman	- Summer Technician	9/20/63
F. D. Robbins	- Summer Professor	9/6/63

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SECURITY VIOLATIONS

None

INVENTIONS

All Research and Engineering personnel engaged in work that might reasonably be expected to result in inventions or discoveries advise that to the best of their knowledge and belief, no inventions or discoveries were made in the course of their work during September, 1963. Such persons further advise that for the period herein covered by this report, notebook records, if any, kept in the course of their work have been examined for possible inventions or discoveries.

M. C. Leverett

Manager
Research and Engineering

MC Leverett:LCC:mk

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N-REACTOR PROJECTPROCESS DESIGN OPERATIONProcess Research and Development

A design review of the fog spray system has been made to provide a basis for establishing operational test requirements; to verify adequacy of diesel pump fog spray capacity; and to recommend specific patterns for automatic fog spray operation. Because of the fact that the hydraulic resistances in the spray circuits are primarily in the nozzles, flow distribution can be concluded to be virtually independent of branch line resistances. Tests have shown that there is no sharp breakpoint in nozzle effectiveness at head pressures varying significantly below the design rating. If one nozzle in a circuit sprays, the rest will also spray, and reasonable spray patterns can be expected. The second point of the study has served to confirm that either one of the two diesel fog spray pumps operating singly will supply the necessary total flow and pressure head for miscellaneous reactor cooling services and required fog spray operation in 105-N and 109-N. Tentatively, certain specific fog spray stations in 105-N and 109-N have been selected for automatic operation in the event of a confinement signal. They will fully utilize the allocated fog spray flows and will produce spray patterns of maximum effectiveness for a variety of postulated incidents.

A study of the thermal stresses in the N-Reactor pressurizer has been completed and the results reported, including recommended operating procedures and limits. On the basis of borderline stresses in the 4-inch backup spray nozzle, a review of the design of this nozzle with the vendor has been suggested.

Charts and curves have been developed to aid in quickly calculating the heat transfer characteristics of cylindrical fuel elements with basic dimensions and thermal properties given. A report containing this information is in preparation.

A classified report has been issued containing a comprehensive set of values for N-Reactor control system capacities, based on calculations using the IBM 7090 program PACE. Measured values obtained under experimental conditions have been converted into usable reactor local control strengths for a variety of reactor conditions. In addition to predicting the strengths of the horizontal rod and ball safety systems, calculations were also performed for the isotope-producing rods.

An analysis has been made to determine the effect of plugged steam generator tubes on N-Reactor primary loop temperatures and power levels. On the basis of 50 per cent plugging of tubes in one steam generator, a power level reduction of approximately 1.5 per cent could be expected if the temperatures in the affected unit were allowed to increase without local flow correction. However, the resulting reactor outlet temperatures

would very likely be higher than allowable, because some of the reactor tubes involved could be hot channel tubes. If the temperatures were maintained at normal values by reducing the pump speed in the affected cell and if compensating flow increases in the other cells were assumed, the maximum power level reduction would then be approximately 3.1 per cent for a six-loop system and 4.3 per cent for a five-loop system. The actual reduction could be somewhat less depending upon actual hot channel factors.

Project CAI-816

Confinement System Design

The design criteria for the fission product confinement system have been revised for consistency with presentations made to reactor safety and hazards review groups. The control system has been modified to differentiate between steam release and fission product release over the full range of credible incidents. Gross gamma monitoring and radioactive particulate and halogen gas release sampling have been incorporated into the design of the confinement system steam vent monitoring. Corresponding changes in the working design are following.

Support of Primary Piping in 109-N

Bergen Pipe Support Company has reviewed the design of the primary piping support system in 109-N, utilizing data made available from Electric Boat's computer analyses. As a result, Bergen has recommended corrective modifications which are now being carried out by Burns and Roe.

Charging Equipment

Continued use has been made of the mock-up charging test facility placed in operation at the 314 Laboratory on August 19, 1963, following the transfer of the charging machine to 105-N. Initially, the mock-up test facility consisted of 1) a 2.9-inch ID magazine at the charging end, with the tapered end of the magazine removed; 2) a prototypical eccentric tapered magazine adapter with a full polyethylene insert; and 3) a 2.7-inch ID magazine serving as the receiving tube. The first column of fuel that was charged through the above arrangement revealed no significant surface damage and no fuel element support deformation over 0.006 inch at a charging force of 1500 pounds. At that time it was felt that the magazine adapter had raised the threshold of charging force from 800 pounds to over 1500 pounds without resulting in appreciable fuel element support deformation. However, subsequent charging through the above arrangement revealed that support deformations over 0.006 inch could and did occur at a charging force of 1500 pounds because of widely varying values of fuel element support strength.

It was concluded that charging at 1500 pounds through a 2.9-inch magazine would not be practical. Therefore, the 2.7-inch ID magazine was moved from the receiving tube position to become the charging tube, and a process tube with a nozzle-to-tube step-up of 0.012 inch was installed in

the receiving tube position. Support deformations over 0.006 inch continued to result at a charging force of 1500 pounds. Next, the nozzle was removed and fuel was charged from the 2.7-inch ID magazine directly into the 2.7-inch ID process tube. Support deformations over 0.006 inch continued to result at a charging force of 1500 pounds.

Using the above arrangement, the charging force was reduced to 700 pounds, and the support deformation over 0.006 inch was limited to one support in four columns of fuel. Next, the 0.012-inch step-up nozzle was placed back into the mock-up, and two more charges were run at 700 pounds, resulting in a significant number of support deformations over 0.006 inch. With the 2.7-inch ID magazine removed, and a 2.9-inch ID magazine with eccentric tapered adapter substituted, support deformation over 0.006 inch continued to be evidenced at a charging force of 700 pounds.

Fuel element support measurements indicated that a static load of approximately 150 pounds would cause support deformations from 0.001 to 0.010 inch based on samples from three lots of randomly selected fuel. The following conclusions were reached upon completion of the foregoing testing:

1. The eccentric tapered adapter and special piston combination is an improvement over the concentric taper now part of the magazine.
2. Until a stronger support is developed, or existing supports strengthened, fuel should be charged into empty tubes only and should be aligned to ride evenly on four supports during the magazine loading operation.

Because of critical scheduling commitments which preclude further consideration at this time of alternate magazine concepts, it has been decided to modify the existing magazines to incorporate an eccentric tapered adapter with full polyethylene insert and special piston as replacement of the concentric tapered magazine end. In support of this, a polyethylene-to-steel mechanical connection has been successfully developed.

Development and Testing

Component Test Loop operation at 189-D was temporarily halted to permit installation of a new recirculation bypass line directly from the pump discharge to the top of the pressurizer. This will accelerate the hot testing of the RV-2 relief valves by permitting the pressurizer to be filled more rapidly following loop evacuation from relief valve tripping. Prototype testing of the RV-2 relief valve assembly will be resumed for evaluation of corrective changes recently made to relief valve components.

FIELD ENGINEERING OPERATIONConstruction105-N and 109-N Buildings

The custody of the following systems in the 105-N Building was transferred to General Electric during the past month; Process Tube Flow System, September 10th and Power Calculator System, September 20, 1963.

The initial balancing of the Zone IV H & V System in the 105-N Building was completed September 3d. Balancing of the Zone V System was completed September 23d. Balancing work has been started on the Zone II-III H & V System in the 105-N Building.

As of September 20th, installation of wire and cable in the 105-N and 109-N Buildings was estimated to be about 96 per cent complete. On the same date, termination of conductors was 91 per cent complete.

About 52 per cent of the Zone I and III electrical penetrations have now been sealed and tested.

The electrical work on the Irradiated Material Handling System has been completed with the exception of system testing.

All 1004 transducer channels of the Flow Monitor System have been put in operating-condition. Preliminary calibration checkout and load balancing is under way. Venturi Swagelok port reseating was started September 18, 1963.

Mechanical testing is continuing on the right side of the Fuel Rupture Monitor System. All V-2, V-4 and V-5 valves have been seat leak checked at 1825 psig. Seat adjustment on V-1 valves is starting. All valve stem assemblies have been replaced in left side racks and continuity and cleanliness tests have been started.

Installation of remote indicators is 90 per cent complete in the building Radiation Monitor System. Electrical and mechanical construction tests were started the third week in September.

Mechanical installation and construction testing has been completed on the shield cooling instrumentation.

Construction tests were started on September 23, 1963, on Rod Position Indication System.

The construction testing of the mechanical portion of the Emergency Water Instrumentation System has been completed.

117-N Building

Installation of all filter frames and roof insulation has been completed. Painting of the roof is complete.

1310-N Facility

Mechanical portions of this facility are essentially complete and in punch list phase. The painting subcontractor started work in September and is about 60 per cent complete.

181-N Building

The third rebuilt primary pump drive motor was shipped from Fairbanks Morse on September 20, 1963. The revisions on the Instrument Air System required for the system to function correctly have been completed.

163-N and 183-N Building

The 163-N Building was accepted on September 23d, with the Bumstead Woolford Contract as a construction exception item. Work is continuing by this company to complete testing of this facility.

1900-N Building

Project acceptance of the area piping system was made September 23, 1963.

1503-N Building

Project acceptance of the area underground electrical system was made September 23, 1963.

1300-N Emergency Dump Basin

The steel plate on the bottom and sides of the basin is 90 per cent in place while the outside walls are 80 per cent complete.

184-N Standby Power House

Following the tube failure of September 18th, Foster Wheelers' engineers and test personnel visited the site to review the boiler problem. In their opinion, the boiler will not meet performance specifications without major modifications in flow characteristics of both gasses and water.

A program of changes, including the changing of between 40 and 50 tubes, redesigning and rebuilding the refractory baffling and changing the baffling in the steam header, is designed to overcome poor circulation experienced in the present facility.

Until changes have been made the level of operation of the boiler is set at 300,000#hr by Foster Wheeler. The changes are scheduled to be made in a one week outage starting October 14, 1963.

Primary Piping

The entire portion of the primary loop has now been chemically flushed as well as 109 cells 1, 2, 4 and 5.

Primary Pump Number 1 was disassembled on Wednesday, September 18th to determine the cause of the bearing problems. It was discovered that the shaft and inboard bearing on the pump was badly scored and the breakdown bushing and sleeve were badly galled. The exact cause of the scoring and galling has not been determined. Spare replacement parts are being put in the pump now.

Complete punch lists have been transmitted to Kaiser Engineers for the remaining work on the 105-N Primary Loop and the 105 Service, Auxiliary and Drain piping.

The flushing portion of the 109 Secondary flushing and chemical cleaning procedure is complete. All sixteen of the dump condenser condensate pumps were successfully run simultaneously.

Pile Erection

Contractor Testing of horizontal rod assemblies on the right side has been completed and is now in progress on the left side. Oil leakage continues to be the primary problem.

Vibration of the "W" Elevator platform on the down travel continues to delay the completion of testing on this unit. Other elevators have successfully completed preliminary runs and punch list work is proceeding. Temporary supports are being installed under the "W" elevator platform to position it for installation of the charging machine rails.

Voltage drop problems in the Ball 3X Instrumentation are delaying Operational Testing of this system, but other work on the system is proceeding satisfactorily with operational personnel familiarizing themselves with the system in preparation for the performance of the operational test.

NPR Testing Program

During the report period test requirements were issued for one test, two additional test procedures were issued for comment, one was issued as approved, actual testing of two systems was initiated and testing of two other systems was completed.

Over-all status of testing progress may be summarized as follows:

Total number of tests scheduled 39

Scoped	38
Issued for Comment	30
Issued as Approved	19
Tests Started	12
Tests Completed	6

	<u>Preparation</u>		<u>Performance</u>	
	<u>Scheduled</u>	<u>Actual</u>	<u>Scheduled*</u>	<u>Actual</u>
This Month	88.5%	62.0%	27.0%	8.4%
Last Month	78.0%	56.4%	12.0%	6.7%

*Scheduled performance based on latest official target schedule
 (SK-1-27854, dated 7/23/63).

Steam Generators

Eddy current examination of all tubes in unit 4A has been completed. The data indicated that 64.5 per cent of the tubes contained intergranular corrosion defects penetrating 50 per cent or more of the tube wall and that 55.5 per cent of the tubes have nominally 80 per cent or more wall penetration. Eight tubes were confirmed as having 100 per cent wall penetration by helium leak testing. Retubing of unit 4A is considered necessary.

All tubes in unit 3B have been rerolled in the tubesheet area and for an additional one-inch length starting 1/2 inch beyond the tubesheet, preparatory to a sleeve type repair. Milling a flat on the ends of each tube to permit more uniform welding of sleeves to the existing tube and tubesheet fillet weld has been started. Development and testing work related to the sleeve type repair indicate that the controlling variables of the joint design have been identified but not yet optimized. Combustion Engineering has selected Incoloy-800 as the sleeve material. However, the sleeve material is not yet available. Furtherance of repair work on unit 3B is dependent upon receipt of sleeving material and satisfactory results of Combustion Engineering tests on prototypic joints. General Electric has performed tests on 30 joints of various types and materials and has conducted analytical studies to permit meaningful evaluations of test results and procedures furnished for approval by Combustion Engineering.

The primary side of the eight steam generators in cells 1, 2, 4, and 5, and the primary loop piping in the pipe gallery and 105-N Building have been chemically cleaned by a recirculating flush of a trisodium phosphate solution. Cleaning of cell 3 steam generators will not be performed until unit 3B repairs are completed.

Hydrostatic testing of secondary system piping in the cells and the shell side of the steam generators has been started. Test water temperatures during hydrostatic testing are kept above the name plate minimum pressurization temperatures (115-139 F) to avoid the possibility of brittle fracture during test.

PROGRAM EVALUATIONDesign Status

Title I - 100 per cent complete.

Title II - 100 per cent complete.

Costs

On September 23, 1963, AEC issued Revision #6 to the Project Proposal requesting \$2,320,000 additional funds. On October 1, 1963, Directive AEC-142, Modification #12 authorizing a new total of \$190,320,000 was issued. The AEC's August 31, 1963 estimated cost at completion indicated a total of \$192,820,000 which includes a contingency of \$3,778.

Schedules

On February 1, 1963, RLOO-AEC issued Revision #5 to the Certified Construction Schedule. This schedule shows a construction completion of March 15, 1964.

It has now been mutually agreed that the 105 Reactor Building will be transferred to General Electric on October 15, 1963 and the 109 heat dissipation building on November 1, 1963.

The construction status as of October 1, 1963, based on Revision #5 to the AEC construction schedule dated February 1, 1963, is as follows:

	<u>Scheduled</u>	<u>Actual</u>
Temporary Construction	94	97
General Area Systems	97	99.5
105-N Reactor Building	96	99
109-N Heat Exchanger Building	95	96.3
163N-183N Water Treat. Facilities	100	99.8
181-N River Water Pump House	100	100
182-N High Lift Pump House	100	100
184-N Standby Power House	100	99.9
153-N Switchgear Building	100	100
NPR Project (CAI-816)	96	98

RESPONSIBILITY

There was no change of responsibility since last month's report.

ORGANIZATION AND PERSONNEL

	<u>8-31-63</u>	<u>9-30-63</u>
<u>Exempt</u>		
Permanent	93	93
Summer Professor	1	0
Tech. Grads.	2	2
<u>Nonexempt</u>	<u>26</u>	<u>25</u>
	122	120

Personnel Changes

<u>Name</u>	<u>From</u>	<u>To</u>	<u>Effective Date</u>
WJ Love (exempt)	N-Reactor Project	Terminate	9-1-63
RE Hubbard (exempt)	Leave of Absence	Field Engineering	9-5-63
RM Halleen (Summer Prof)	Process Design	Terminate	9-6-63
RB Stewart (nonexempt)	N-Reactor Project	N-Reactor Fuels	9-23-63
P Bott (nonexempt)	New Hire	N-Reactor Project	9-23-63
P Shepard (nonexempt)	N-Reactor Project	Contract & Accounting	9-30-63

SAFETY AND SECURITY

There were no disabling injuries reported during September; one security violation was reported.

INVENTIONS OR DISCOVERIES

All persons engaged in work that might reasonably be expected to result in inventions or discoveries advise that, to the best of their knowledge and belief, no inventions or discoveries were made in the course of their work during the period covered by this report. Such persons further advise that, for the period therein covered by this report, notebook records, if any, kept in the course of their work have been examined for possible inventions or discoveries.

TRIPS

<u>Name</u>	<u>Firm and Location</u>	<u>Date</u>	<u>Purpose</u>
Davis, HS	Stanford, Montana	9-3-63	Consultation with QROO personnel on heavy aggregates.
Richards, WA	Sola Chicago, Illinois	9-9-63	To discuss power supply for Bailey Meter.
	Bailey Meter Company Wickliffe, Ohio	9-11-63	NPR instrumentation.
	Burns and Roe, Inc. Hempstead, New York	9-12-63	To discuss Specification HWS-6648.
	Engelhard Newark, New Jersey	9-12-63	RTD problems.
Bainard, WD	Beckman Instrument Co. Fullerton, California	9-9 to 9-12-63	To review and approve vendor drawings.
Lenkersdorfer, HD	PORTCO Portland, Oregon	9-10 and 9-11-63	To discuss plastic extrusions and forming.
	East Side Tool & Die Portland, Oregon	9-11-63	To review Dummy order.
	Thompson Metal Fab. Portland, Oregon	9-11-63	To review Tipoff order.
Bainard, WD	Beckman Instrument Co. Fullerton, California	9-23 to 9-25-63	To review and approve vendor drawings.
Bailey, GF	American Nuclear Soc. San Francisco, Calif.	9-26 and 9-27-63	To attend ANS Topical Meeting.
Kratz, EM	General Electric Co. Schenectady, N. Y.	9-19 to 9-21	Senn generator failure and possible common points with NPR

VISITORS

Spalaris, CN	General Electric Co. San Jose, Calif.	9-9 & 9-10	Discuss Incoloy-800 properties with Combustion Engineering and General Electric
Smith, WR	General Electric Co. San Jose, Calif.	9-12 to 9-13	Discuss condition, repair methods and materials for 3B and 4A
Bergman, EO	Consultant Pasadena, Calif.	9-30 to 10-2	Consult on helium gas loop with HL and on steam generator repairs.

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VISITORS (cont'd.)

<u>Name</u>	<u>Firm and Location</u>	<u>Date</u>	<u>Purpose</u>
Janicello, D.	Avien, Inc. Woodside, N.Y.	8-20 to 9-27	Assist in placing the Tube Flow Monitor System in service
Jarboe, J Woolsey, A.	Aerol Associates Bremerton, Wash.	9-10	Discuss tooling and instrument development.
Wheeler, R.	Ingersoll-Rand Seattle, Wash.	9-19	Discuss application of constant speed air motor design for inlet nozzle boring concepts.

SIGNIFICANT REPORTS ISSUED

<u>HW No.</u>	<u>Classification</u>	<u>Author</u>	<u>Date</u>	<u>Title</u>
HW-78258B	Unclassified	LJ Chockie	9-4-63	Steam Generator Examination Program - Interim Report 3, Complete Eddy Current Examination of Steam Generator 2A
HW-74470	Secret	GF Bailey	9-25-63	Review of NPR Control System Capacities
HW-76889	Unclassified	HS Davis	8-29-63	Strain and Motion Measurements for NPR Primary Coolant Piping 105-N and 109-N Bldgs.
HW-78478	Unclassified	CL Goss	8-23-63	Reliability of the NPR Zone Temperature Monitor Accumulator Circuit
HW-78921	Secret	HR Kosmata	9-12-63	Reactor Design Analysis Monthly Report - July, 1963
HW-78934	Secret	HR Kosmata	9-13-63	Reactor Design Analysis Monthly Report - Aug., 1963

Manager, N-Reactor Project

JS McMahon:mbs

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N REACTOR PLANT OPERATION

N PROCESSING OPERATION

The TG set surge governor was adjusted by the vendor representative on September 3 to allow the generator to achieve rated output. The governor setting is still not reliable throughout the required range of steam pressures and the Lynn office has been requested to furnish the field man with corrective procedures so final adjustments can be made.

The boiler was loaded to 500,000 pounds per hour on September 3 by venting 200,000 pounds per hour of excess steam to the atmosphere. Rated output of 575,000 pounds per hour could not be reached because of excessive flue gas temperatures and flame impingement problems. During a subsequent outage on September 6 - 8 soot elements were realigned, rear baffle leaks were repaired, and some burner adjustments were made. Another attempt to achieve rated output on September 18 resulted in a roof tube rupture at a steaming rate of 500,000 pounds per hour. This failure and the continued high flue gas temperatures resulted in Foster-Wheeler limiting output from the boiler until extensive modifications can be made, probably in November.

Phase I Certification Training has been completed for all groups and Phase II training is in progress for the last group, Group III.

All sub-sections of Systems Descriptions Manual section 21 have been issued or are being printed except certain sub-sections covering some auxiliary facilities, which are currently being written. The most critical parts of this section have been completed.

Operating procedure preparation continued during the month; eleven procedures are being prepared and one procedure is out for comment. The sequential modes operation chart was completed and is in Graphics for publication.

Operating tests are 8.4 per cent complete against 27 per cent scheduled. Two tests were completed during the month and five tests are in progress.

Test procedure preparation is 62 per cent complete against 88 per cent scheduled.

Shift operations began in 105-109 on September 23, with eight operators and one supervisor per shift, in anticipation of the start of operational tests.

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Programming for the N Planning and Scheduling data system is on schedule.

Fabrication difficulties were encountered on the fuel spacer dummy order. Problems were resolved by a vendor visit. Test quantities have been received. The vendor states he will still meet the required delivery date for bulk quantities.

Equipment listing is now over 95 percent complete.

A meeting with Nuclear Materials personnel was held to establish the necessary ground rules for N Plant S.S. material receipts.

Arrangements other than obtaining construction turnover of 105-N Room 182 and the truck plate for the receipt of initial load fuel in October are made.

Quarterly review of the production forecast has been completed in draft form.

Assistance to Accounting Operations in evaluating minimum Department data processing needs was given.

Critical path updating, functional training of the Radiation Monitors, and interim scheduling were continued as scheduled.

Preparations to establish an N Area Planning Center to coordinate department activities here in the area are well advanced.

N REACTOR MAINTENANCE

During the month one additional mechanical maintenance crew was established with personnel obtained from IPD. The four instrument electrical crews continued extensive application of effort to the calibration and test programs as well as to general maintenance systems in facilities which have been accepted. The mechanical maintenance crew was primarily involved with repairs to equipment, correction of equipment problems such as mis-alignment, replacement of leaking valves, replacement of damaged or defective bearings and the cleanout of cooling systems on such items as air compressors.

Maintenance procedure work continued to the extent possible with limited personnel. Approximately 65 additional procedures were initiated. The final number of procedures required cannot be established at present. We are continuing to work on this problem and estimate that the number will be in excess of several thousand. However, the number of procedures required to match maintenance standards will be significantly less than this and we hope to have an approximate number for this item by the end of this month.

Activity continued toward the movement of tools and equipment from Kaiser custody to 105 maintenance areas and action is underway to effect transfer of approximately \$250,000 worth of operational spare parts presently held in the Kaiser warehouse to the 105-N. This action will also involve approximately \$165,000 worth of operational spares which are on order but not yet received by Kaiser. Other items and material such as paint stocks are being examined and evaluated for possible transfer from Kaiser to General Electric.

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None

TRIPS

None

VISITORS

<u>Name</u>	<u>Firm & Location</u>	<u>Date</u>	<u>Purpose</u>
J. A. Haaga	General Electric Co. San Jose, California	9/23-24-25	Consult on startup problems

PERSONNEL

<u>Additions</u>	<u>From</u>	<u>To</u>	<u>Date</u>
C. C. Akland	New Hire	Plant Maintenance	9/3/63
B. J. Biehler	New Hire	Plant Maintenance	9/3/63
B. L. Combs	New Hire	Plant Maintenance	9/3/63
J. R. Bockman	IPD	Plant Maintenance	9/9/63
J. W. Ball	IPD	Plant Maintenance	9/9/63
B. E. Cunningham	IPD	Plant Maintenance	9/9/63
N. M. Dubois	IPD	Plant Maintenance	9/9/63
H. N. Montgomery	IPD	Plant Maintenance	9/9/63
J. J. Parent	IPD	Plant Maintenance	9/9/63
L. A. Ellingson	CPD	Plant Maintenance	9/16/63
C. E. Hixson	IPD	Plant Maintenance	9/16/63
D. L. Howard	IPD	Plant Processing	9/16/63
R. S. Beebe	CPD	Plant Maintenance	9/23/63

Deletions

E. E. Westenberg	Plant Processing	Illness Leave	9/17/63
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W Mathis
Manager - N Reactor Plant

WM Mathis:ds

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FINANCIAL OPERATION
SEPTEMBER, 1963

The following will summarize the principal activities other than those of a routine and recurring nature which were carried on by the Financial Operation of N-Reactor Department during September, 1963.

Production Studies

The item of a non-routine nature which continued to require a substantial amount of time of section personnel was the production studies. Studies performed during September were principally those in which the reactor was operated in a tritium producing mode and also those in which the reactor was operated at a power level 20 per cent in excess of design rating. A final report on these studies will be issued during October, 1963.

Budget Review

Department financial personnel are engaged in a detailed review of funding requirements for Fiscal Year 1964. Changes have been made in the program for the year and as a consequence it is necessary to reappraise the adequacy of budgeted funds to carry on essential Department activities. This review will be completed prior to the end of October, 1963.

Project Unitization

We were advised by the Atomic Energy Commission that as of the end of September Kaiser Engineers would no longer have personnel available to work on unitization of Project CAI-816. As a consequence, the decision was made to cost the project by use of General Electric Company personnel. This work was planned in detail and the present schedule requires that the unitization be complete by the end of Fiscal Year, 1964.

General Electric Auditors' Review

During September the results of a review of Department activities by auditors of Auditing Department, General Electric Company, were reviewed with the Department General Manager and the Manager-Finance. Appropriate steps have been taken on recommendations made by the auditor. These recommendations related primarily to the cash advance and travel and living expense areas.

Financial Controls

A review by Department personnel was completed of controls on accounts assigned to N-Reactor Department. The review indicated that controls in place were, for the most part, adequate. Steps have been taken to correct the minor deficiencies noted.

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Business Systems

A review of the informational needs of all Department personnel was completed. Because of cost and time it was decided to continue work on three systems which are vital to the operation of the Department. These three systems are:

Reactor Planning and Scheduling System
Reactor Production and Charge-Discharge Sequencing System
Fuel Manufacturing and Engineering System

A task force has been organized to ensure that these systems are in place when necessary. Additional systems will be added onto the above base when economic or other justification has been established.

Personnel

At September 30, 1963 the Financial Operation, N-Reactor Department, consisted of 23 employees. Of these, fifteen were monthly salaried and eight were weekly salaried employees.

J. Milne
Manager-Finance

J Milne:pw

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END

**DATE
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