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HW--78490

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N - REACTOR DEPARTMENT

MONTHLY REPORT

JULY

1963

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HANFORD ATOMIC PRODUCTS OPERATION

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N-REACTOR DEPARTMENT

MONTHLY REPORT -- JULY 1963

Compiled by N-Reactor Department

August 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

Manufacturing

Extrusion press input was 19 per cent below schedule due to start-up problems following two week shutdown for major overhaul. Despite difficulties experienced, first load requirements are being met with 500 tons produced to date for 78 per cent completion. Autoclave throughput continues to increase with a total of 66 tons during July, bringing the first load to date to 222 tons for 58 per cent of requirements. Throughput at Final Assembly increased significantly during July with an output of 58 tons. First load total to date of 106 tons is 27 per cent of requirements.

Autoclave failure No. 3 occurred July 30, 1963. The failure was caused by uranium melted into the end cap braze and corrosion provided a water path after approximately six hours and 40 minutes. Assembly records will be checked to assure that no incipient failures from this cause are accepted for first load charging.

Engineering

Fuel elements being prepared for testing include charges for corrosion and start-up testing, for testing of charge-discharge hydraulic tests in the 189-D Reactor mock-up, and prototypic NAE fuel for KER loop charging. Fabrication is on schedule.

Uranium Billet Specifications to the feed material sites have been reviewed and revised in detail and reissued to the AEC.

RESEARCH & ENGINEERING

A study which was made to evaluate the N Reactor capabilities in the production of transplutonium isotopes confirms that N Reactor will be an efficient producer of Np-237 and Pu-238. This study included production rates for two κ values representing both normal reactor core conditions and flux trap conditions for various exposures. The basic production data calculated was extended to show production capabilities for several recycle programs using a flux trap. These recycle programs consist of successive irradiation and separation intervals using irradiation times of 1.5, 3, 6 and 12.5 months. A fixed separations time of 4 months was assumed in all cases during which the Pu-238 was removed and the Np-237 refabricated for further irradiation. Results indicated that 3 to 6 month irradiations are preferable since shorter irradiations lead to excessive target and product losses. Estimates of Pu-239 and Pu-240 or higher isotopes present in the product follow:

<u>Irradiation Time</u>	<u>Pu-238</u>	<u>Pu-239</u>	<u>Pu-240 or Higher</u>
3 months (w/flux trap)	88%	10%	2%
6 months (w/flux trap)	80%	14%	6%

The study of the single tube fuel element has been extended to include a 24 lb/ft fuel element with a flow spacer inside the tube. Study results indicate that this geometry affords lower fuel temperature levels. Its manufacturing costs, however, would be somewhat higher.

A study to clearly define the tritium production capability of the N Reactor is underway. Emphasis is being placed on the optimum methods of producing 5 kg of tritium per year as requested by the RLOO-AEC.

Prototype target elements for tritium production are being irradiated in KER Test Loops 1 and 2. Additional N enriched inner (NEI-1) "heater" elements were charged into these loops to raise outlet temperatures to the desired 280°C. Goal exposures, expressed as the gas-volume-ratio (GVR), of 10 GVR and 20 GVR were chosen for loop 1 and 2, respectively. These exposures will be useful in determining the technical feasibility of tritium production in the N Reactor. Desired GVR levels should be reached about September 1 and December 1, respectively.

Work on a long-range N Reactor action plan is underway. This study will consider future regional and national nuclear requirements and will outline the probable course of action to be taken to assure that customer needs are adequately met.

The third and fourth charges of first load evaluation assemblies have reached exposures of 735 MWD/T and 375 MWD/T in the KER Test Loops.

A report defining burnout heat flux for the NPR tube-in-tube fuel element has been issued by the Thermal Hydraulics Unit, Hanford Laboratories. This report presents results of experiments using electrically heated models of NPR fuel elements which were conducted in support of NRD programs. Data from the report are being applied to define allowable operating conditions for N Reactor process tubes.

Scope documents for the N Reactor Start-Up Physics Program (Start-Up Test N-1) and Low Level Functional Testing (Start-Up Test N-2) have been issued and preparation of the detailed supporting procedures are well underway.

A charge of about 25,000 lbs. of ammonium nitrate was exploded at Gable Mountain 5.2 miles from 105-N Building. Three seismoscopes in 105-N Building did not record any motion of the building.

N REACTOR PROJECT

The effects of leakage and plugging of steam generator tubes have been studied. The design of the radiation monitor system for detection of such leaks has been re-examined.

A preliminary procedure has been issued for conducting an engineering evaluation test of the leaktight capabilities of the Zone I confiner.

The design of the gas system for operation of the 105-N emergency cooling system valves has been augmented by the addition of individual pressure accumulators at each valve for purposes of increased reliability.

Charging tests were halted during transfer of the charging machine from the 314 Laboratory to 105-N for installation. Tests will be resumed when a pending mock-up charging device is installed in the 314 Laboratory.

Hydrostatic testing of the primary loop piping in the 105-N Building and the 109-N pipe gallery was initiated July 15, 1963, and is still in progress.

Examination of the heat exchangers has been completed. Although intergranular corrosion is apparent in all units and stress corrosion apparent in one unit, it appears all but three heat exchangers are satisfactory for service.

The welding of instrumentation tubing in the 105-N Building was completed on July 12, 1963.

Custody transfers were completed for eight systems in the 109-N Building during the reporting period.

A failure occurred in a tube in the 184-N boiler on July 12, 1963. The failure was caused by a boiler design deficiency. Repairs were made, the deficiency corrected, and the boiler was returned to service on July 30, 1963.

N REACTOR PLANT

The following systems were transferred to a provisional custody status during the month:

1. Horizontal Rod Cooling Flow Monitoring Instrumentation System.
2. Horizontal Rod Electrical System.
3. Rooms 108, 109, 157 and 159 in the 105 Building.
4. 105-N Zone IV Heating and Ventilating System.

Temporary construction building (T-10-9) was accepted for interim use for service maintenance occupancy.

Trans-shipment of sulphuric acid from N bulk storage to KER resulting in reduced costs to KER was initiated this month.

The instrument calibration program continues to lag due to delays in having the equipment made available by construction forces.

PERSONNEL STATISTICS

Number of employees as of June 30, 1963 556
Number of employees as of July 31, 1963 591

	<u>Exempt</u>	<u>Nonexempt</u>	<u>Total</u>
General	3	2	5
Finance	17	8	25
N Reactor Fuels	57	115	172
Research & Engineering	47	11	58
N Reactor Plant	58	155	213
N Reactor Project	<u>94</u>	<u>24</u>	<u>118</u>
TOTAL	<u>276</u>	<u>315</u>	<u>591</u>

Employment

	<u>Exempt</u>	<u>Nonexempt</u>	<u>Total</u>
Additions	13	30	43
Reductions	<u>4</u>	<u>4</u>	<u>8</u>
Net Additions	<u>9</u>	<u>26</u>	<u>35</u>

SAFETY & SECURITY

Days without a disabling injury 243
Hours worked without a lost disabling injury 638 213
Medical treatment injuries (July) 13

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

SUGGESTION PLAN PARTICIPATION

	<u>July</u>	<u>Year-to-Date</u>
Number of eligible employees	314	\$ 246
Number of suggestions received	20	195
Number of suggestions acted upon	15	127
Number of suggestions adopted	3	51
Net annual savings	\$ 0	\$ 14 793
Amount of Awards	\$ 30	\$ 2 045
Per cent of awards to savings	0	13.8
Average amount of awards	\$ 10.00	\$ 40.10

PATENT SUMMARY - JULY, 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 July, except as listed below. 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.

Russell L. Brown, Jr. - Improved Eddy Current Testing Probe

G. L. Waldkoetter,

R. B. Jacob, and

C. E. Fitch, Jr. - Critical Angle Ultrasonic Tests.

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

RL Dickeman
 General Manager
 N-Reactor Department

RL Dickeman:skd

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N-REACTOR FUELS OPERATION
JULY 1963

I. PRODUCTION STATISTICS

	<u>Current Month</u>		<u>Last Month</u>	<u>First Load</u>	
	<u>Scheduled</u>	<u>Actual</u>	<u>Actual</u>	<u>Tons</u>	<u>Per Cent</u>
	<u>Tons</u>	<u>Tons</u>		<u>To Date</u>	<u>Complete</u>
<u>Shop Input</u>					
Inners		5.2	10.6		
Outers		21.8	25.5		
Total	45	27.0	36.1	500.1	77.5%

Shop OutputAutoclave

Inners		14.9	5.8		
Outers		50.7	32.6		
Total	45	65.6	38.4	222.3	57.7%

Assemblies

Awaiting Shoes	X	X	X	2.1	6.3%
Awaiting Certi- fication	X	X	X	56.8	14.7%
Final Storage	X	15.9	9.8	24.9	6.4%
Total	X	15.9	9.8	105.8	27.4%

Throughput by Stations

<u>Station</u>	<u>Inners</u>	<u>Outers</u>	<u>Total</u>	<u>In-Process</u> <u>Inventory</u>	<u>Defective</u> <u>Rate</u>
Extrusions (billets)	36	102	138	*	7.2%
Cut-Up First	524	1300	1824	*	----
Cut-Up Rework	---	1344	1344	*	----
Chemical Milling (ends)	---	3846	3846	606	1.2%
Braze (ends)	---	3648	3648	410	9.4%
Heat Treat	---	2428	2428	*	.2%
Straightening	---	6	6	*	.4%
Machining (ends)	---	4597	4597	*	0
End Test (ends)	164	5608	5772	*	1.8%
Vacu-Blast	---	2654	2654	166	.0%
Welding (ends)	---	4134	4134	*	.0%
Clad and Bond Test	---	2242	2242	185	12.4%
Support Weld	2237	3484	5721	5748	.7%
Autoclave	2212	3733	5945	1655	.0%
Final Inspection	2389	3121	5510	15536	.4%

* Less than one day station throughput.

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Other Statistics

	<u>Inners</u>	<u>Outers</u>	<u>Total</u>
Rework Storage	----	----	541
Support Fabrication	10,924	23,578	34,502
Locking Clip Fabrication	7,786	----	7,786
Special Extrusions	----	----	4
Oxide Burned	121 batches	995.08 Pounds	

Shop YieldCurrent Month

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

Last Month

First Run	61.0	57.2	58.7
Estimated Rework	2.7	15.9	10.7
Total	<u>63.7</u>	<u>73.1</u>	<u>69.4</u>

First Load to Date

First Run	X	X	X
Estimated Rework	X	X	X
Total	<u>60.8</u>	<u>48.5</u>	<u>52.6</u>

II. MANUFACTURING OPERATIONA. Production

Input at the extrusion press was 19% below schedule due to startup problems following the two-week shutdown for major overhaul. The difficulties were primarily centered around oil leaks and alignment problems attributed to the press being cooled down for a two-week period. During this period, work was concentrated on rework material. Despite the difficulties experienced during the month, first load requirements are being met with 500 tons produced to date for a 78% completion.

Autoclave throughput continued to increase with a total of 66 tons during July. All inner material was annealed in billet heating furnaces in addition to autoclaving.

During the major overhaul shutdown the final etch line in 306 Pilot Plant was utilized on a two-shift operation to assure sufficient assemblies for the autoclaves. First load to date is at 58% of requirements.

Throughput at final assembly increased significantly during July. The output of 58 tons exceeded the previous total to date tonnage of 48 tons. First load total to date of 106 tons is 27% of requirements.

Previous reporting of first load output to finished storage included assembled fuel elements awaiting final certification by the Quality Control Operation. This reported tonnage exceed the amount reported by Accountability in their monthly report. This has been adjusted during July and subsequent reports will be the same as those reported by Accountability.

B. Plant Problems and Incidents

Autoclave failure No. 3 occurred at 6:00 AM, July 30, 1963. This failure was found to have been caused by uranium melted into the end cap braze. Corrosion provided a water path after approximately six hours and 40 minutes. Records will be checked to assure that no incipient failures from this cause are accepted for first load charging. An additional 100 per cent test of material prior to autoclaving to detect the presence of uranium in the welds will be instituted as a part of the Quality System.

On July 22, water was found in the high vacuum part of the billet evacuation unit. This appears to be a major cause of at least part of the failures. The mechanical pump being used in conjunction with the blower in question indicated a marked increase in efficiency after the water was removed providing strong evidence that this was the cause of the high amperage readings on the drive motors. Two units have been shipped to Consolidated Vacuum Corp., Rochester, New York, and are currently being evaluated. The blowers will be taken out of service monthly for cleaning and elimination of water that may collect inside the pump.

A break occurred in the saran-lined black iron pipe line leading from the 333 Building chemical areas to the 313 Building recovery area. The break was not discovered until shortly after the chem mill solution had been pumped. It is estimated that approximately 250 pounds of enriched uranium were lost. To prevent a recurrence the pipe has been replaced with stainless steel. A complete investigation is in progress.

Bond and clad tester throughput decreased significantly during mid-month as a result of reduced probe life. New probe development is being expedited by Testing Methods. Maintenance forces will assume the responsibility for testing of all production line probes.

C. Plant Improvements and Achievements

The annual overhaul program for 333 Building equipment was accomplished during the period starting June 22 and ending July 6. Major work programs were scheduled in the extrusion and chemical process areas of the building. Although there were minor problems with startup, the over-all program accomplishments were excellent. The equipment overhaul accomplishments have been documented in a separate report.

A record eight-hour throughput of 253 fuels at final etch was established by an operator during July. In addition, this operator suggested that a controlled air jet be installed in the acid solution to solve a problem in solution temperature control that had been limiting production. The cold air bubbling through the acid and the added stirring action have proven to be effective in maintaining better temperature control.

On July 15, testing of end reject pieces at the clad and bond testers was discontinued since these pieces will return to the testers after being reworked. This produced an immediate 20 per cent reduction in tester backlog and will result in increased productivity and more available tester time.

At the suggestion of an operator, a compressed air line and filter were installed to dry fuels after pre-braze etch. Observations thus far indicate that the fuels are dried faster and with less heat than with the old method. The number of fuels having to be re-run, because of rapid discoloration, appears to have greatly decreased. Further evaluation is necessary in order to accurately determine the actual benefits.

III. QUALITY CONTROL OPERATIONS

The N-Reactor Fuels Section's Quality Policy was formally documented and issued as a Section Instruction and Procedure. This policy is patterned after the requirements of Company Policy and defines areas of responsibility in the total job of providing product quality. Although issued by Quality Control, the Policy was evolved as a total Section effort.

Ultrasonic testing of billets was discontinued as a part of the Quality System this month. The billet test data has not proved to be a useful tool in the prediction of extrusion characteristics.

A six-point program to improve tester reliability and measurement capability was instituted this month by Manufacturing, Testing Methods, and Quality Control. The six points covered are: 1) put more emphasis on probe and crystal design, 2) devise more rapid feedback on measurement error, 3) put more emphasis on operator qualification, 4) put more emphasis on instrument technician training, 5) provide methods of pre-aligning and checking out

probes prior to use, and 6) test capabilities of specially trained technicians as operators to estimate degree of improvement available by extreme operator skill and care.

The program will be reviewed in three months to determine if gains have been made.

IV. N-FUELS PRODUCT ENGINEERING

Test Fuel Fabrication

Corrosion and Startup Test Fuel

A charge of ten 24-inch NIE-1 fuel elements with shroud tubes was completed this month (PWR-E64). These fuel elements were fabricated for KER loop corrosion testing and startup tests.

Hydraulic Test Charges

A charge of 24 17-inch NAE-1 and 36 11-inch NAE-1 fuel assemblies is being fabricated in the Pilot Plant for 189-D Reactor mockup fuel column hydraulic tests. These fuel assemblies are currently at nondestructive testing. Expected completion date is September 15, 1963.

Prototypic Backup Charge

A 14-element charge consisting of the most recent (June 1963) 24-inch NAE assemblies produced in the Manufacturing shop is being assembled for KER backup. These fuel elements were assembled using the most recent hardware and techniques are currently at final weighing. Expected completion date is August 5, 1963.

Materials Development

Uranium Billet Specifications

During May, 1963, all details of HW-67575, "Specifications for Uranium Metal Billets for NPR Fuel Elements," and HW-76155, "Chemical Specifications for Uranium Metal Billets for NPR Fuel Elements," were discussed with personnel of the National Lead Company of Ohio and the Bridgeport Brass Company. Agreements were reached on each of the requirements, and these documents have been revised and were reissued to the AEC in July, 1963.

Beryllium-Zircaloy Braze Ring Fabrication Processes

Samples of beryllium-Zircaloy wafers were submitted by a potential vendor for braze rings. The wafers were fabricated by pressing a powdered beryllium-zirconium alloy. The "green"

compact was not sintered; however, the mechanical strength properties were satisfactory. The wafers melted within the specified maximum temperature of 985°C and the molten metal appeared to flow smoothly. However, the time required to melt the wafer with an induction coil was excessively long compared to the melting times encountered using the current cast braze rings. Apparently the oxide coating around each of the powder particles acted as electrical insulators.

The primary advantages of the pressed powder process are high material utilization and therefore lower costs. There are some potential advantages if the resistivity of the braze ring can be controlled through particle size or through the addition of chips or wires. The potential advantages in controlling resistivity are to control the relative heating rates of the braze ring, the cladding, the cap, and the uranium. Investigation of this approach will continue.

Zircaloy Cladding Shell Fabrication

A Zircaloy cladding shell vendor has submitted samples of inner cladding shells for inner tubes that were fabricated by tube reducing tubing that has been extruded oversize. This process offers cost advantages over the present process of extruding rod and trepanning the inner clads. Sample coextrusions with copper have been examined. It appears that less cladding thickness variation is encountered using the tube-reduced material than using materials fabricated by the normal process. This advantage is possibly due to the additional grain refinement in the tube-reduced material from the large amount of cold work. The remainder of the samples will be tested with actual uranium coextrusions.

End Closure Development

Cap Design

The tests of a top bevelled cap in the braze closure process have shown a significant yield improvement over the old cap, probably due to the improved hot top design. Test data obtained in the two production runs for outer tube in the 333 Building were submitted to the Applied Mathematics Unit in Hanford Laboratories for analysis. It was their conclusion the lower defective rate of the bevelled cap, as experienced under controlled conditions, could be definitely attributed to the cap characteristics at a 99.75 per cent confidence level.

As a result of the data from these tests, reject caps will be utilized by machining to the new beveled designs. Several thousand of the old design caps will be sent to the vendor

receiving the recent bevel cap production order for machining to the new design. Upon receipt they will be used in the production stream.

A similar request for the conversion of 1,000 inner caps has been made to evaluate the bevelled cap on inner fuels. Bevelled inner caps are presently being machined at on-site shop facilities to provide caps for a production test in the 333 Production Facility.

Rework Process for Weld Rejects

Approximately 100 weld rejects (six inches cut off sections) have been withdrawn from the production stream. They were classified as to the severity of the surface defect and various methods investigated to determine if they can be recovered by producing an acceptable weld. Initially, those defective welds which had a slight irregularity of surface were given a second weld pass by adjusting the amperage and other techniques. Secondly, new weld surfaces were prepared by machining down the weld crown followed by rewelding. The latter method shows more potential for a rework process with the existing welding equipment. This work is continuing and it is expected to result in an initial process to be tested in production under a PWR.

Fuel Element Supports

Charge Machine Test

Testing has been discontinued. The charging machine is being shipped to the reactor area. Testing will resume approximately September 1, 1963, on a charge machine mockup to be constructed by Hanford Laboratories. A summary of the fuels portion of the work performed is being prepared.

Steel Shoes

Over 15,000 steel shoes have been rejected at Final Assembly for rust. Visual standards for rust were established through Quality Control. The majority of the rust was on the shoes when they were received from Hanford Laboratories.

A shoe de-rusting process was devised which is reasonably fast, controllable, and is acceptable to Research and Engineering. Approximately 5,000 shoes have been processed by this method, returned for production use, and provided with improved rust resistance of installed shoes by passivating the surface.

Final Assembly

Recently, inner support deflection strength after sizing has decreased to a level slightly below that required in the Engineering Specifications. Inner fuels are now heat treated prior to assembly to reduce or eliminate the possibility of inner support cracking during assembly sizing. This affects support ductility, and it is believed that some variable in this process caused the change in deflection strength. As an immediate solution, the degree of support sizing was increased slightly by Quality Control and deflection strengths were made acceptable. Supports are now being routinely examined for cracking and the new sizing level appears acceptable. However, the variable which has caused this shift in support characteristics has not been definitely isolated.

Specifications and Waivers

Specifications

Engineering Specification revisions made during the month are as follows:

1. Finished Fuel Element Dimensions (CX-660.0)

Specification was revised to increase inner tube support circle diameter from 1.750 inches to 1.760 inches.

Waivers

1. CX-14 - Extrusion Speed Variation

Waiver was issued for acceptance of NOE and NIE extrusions extruded to die exit speeds ten to 20 inches per minute outside allowable limits.

Equipment Development

Projects Completed

Support Fabrication

All support fabrication equipment to make inner supports, outer supports, and locking clips are in place and operating. Work will be continued in the support fabrication area to improve operating reliability and to direct maintenance and repair of all equipment and dies. Some of the cleanup work to be completed includes as-built drawings and obtaining spare inserts and shears for the dies.

Addition to Exhaust Stack - 333 Building

Construction of the 60-foot addition to the existing chemical bay fume exhaust stack was completed July 8, 1963. Also, maintenance work on the existing stack structural members has been completed. New media were installed in the fume scrubbers on July 1. The continuous fume monitoring equipment has been reconnected into the exhaust stack to determine the net effect of the changes and to determine if any additional corrects will be needed.

Projects in Progress

Outer Support Shoe Fabrication

A lack of tooling to fabricate the outer support steel shoes appears to be one of our major bottlenecks. The new shoe dies would have been completed this month had it not been for the many repairs and changes required on the locking clip die and the outer support die. Presently the fabrication of the shoe die is moving quite rapidly. Test parts have been made in the shop in order to put the finishing touches on the die. Hanford Laboratories shoe dies have been modified to accept 3/4-inch width strip and to be mounted in a couple of Mead air presses. This action is strictly a stop-gap measure, but will also provide Manufacturing with a backup set of dies.

Locking Clip Welder Tooling - 306 Building

Detailed design of the tooling was completed and submitted to Tech Shops for a cost estimate which is due August 1, 1963. Estimate of fabrication time is about six weeks.

Support Welder Tooling - 306 Building

The scope design for the support welder tooling was completed and the detailed design has started. Expected completion of the detailed design is August 19, 1963.

Solution Heat Treating of Inner Fuels

Two new quench tanks were designed, fabricated, and installed to quench the fuels after being heated in a hot air furnace. A new universal inner basket spray shield-lift device was designed and fabricated to fit all inner fuel tube autoclave baskets. The new device will be safer and quicker to use.

Manufacturing requested that a second hoist system be provided in the billet preheat area in order to handle a billet lubrication and solution heat treatment. The design analysis of the supporting structure was completed.

A second one-ton traveling bridge crane can be installed with essentially no modifications to the building structure or supporting structure of the existing bridge crane. The appropriation request for funds and the specifications for the bridge crane and hoist will be prepared.

Hot Air Driers - Component Chem Bay

The two hot air driers in the Component Chem Bay pour hot air directly into the work area which makes the working conditions undesirable. An exhaust system was scoped which would remove a portion of the heated air created by the hot air driers. The scope design also included exhausting of the two billet welders and the billet lubrication degreaser. The estimated cost for this system is about \$3,000. The scope design is being reviewed to see if more of the hot air produced by the driers can be removed. The biggest problem appears to be one of space above the driers in the Chem Bay to accommodate large size duct work.

P.I.M. Weight Measurement Apparatus

Quality Control requested that Equipment Development design and install the necessary equipment for accurate weighing of fuel tubes just prior to assembly and packaging. Preliminary design is being scoped and will be submitted to Quality Control. If the scope is acceptable, cost estimates will be prepared and submitted to them for preparation of the appropriation request.

TESTING METHODS OPERATION

N-Fuels Testing

Component Testing

Ultrasonic Tests on Billets

Testing of 66 extrusions (previously estimated at 75) was completed. Analysis of the data showed no apparent correlation between the present UT-8 test and extrusion performance as related to inner-clad wall thickness variation. It is postulated that the present test, averaging the whole billet wall as it does, cannot assess the inner surface condition which appears to be sensitive to clad wall variations upon extrusion. A new ultrasonic test "boundary waves" (a recent discovery for which an invention disclosure has been made) will be applied to this problem. Preliminary tests have indicated sensitivity to uranium grain size to a depth of about 30 to 50 mils. A probe is being built to apply the test.

Support and Clip Welding

Work is in progress to determine locking clip weld acceptability. Small beta detectors are on order and in the interim a detector holder has been designed and placed in the shop for fabrication. A Hall effect device has been borrowed from Hanford Laboratories to determine the best method of application to this problem. A more refined ultrasonic test set-up was used to scan several locking clips including some containing artificially fabricated defects. The weld region interface could be observed but no disturbance in the signal from this interface was observed. Further work will be done as more definitive standards become available. A scatter tube was completed for the X-ray fluorescence tests and it will be evaluated in August.

Product Certification

Routine Tester Operation

Production operation of the N-Fuels tester for the most part has been satisfactory. Occasional problems occur affecting production. The most recent has been concerned with the inside probe for the outer element. Considerable difficulty in obtaining satisfactory operation has been experienced and has been traced to deficiencies in operation, maintenance, and design. Operators and operator practice, manufacture and maintenance of the probes, and improved design are being scrutinized and corrective action taken. "Mapping" of Eddy current clad thickness measurements and automatic readout are also being investigated to increase utility of the testers.

Bore Camera

Good pictures of the inner surface of both inner and outer elements have been obtained with the renovated bore camera. Depth of focus is sufficient on the outer to obtain details of the locking clip in addition to the surface. Pictures will be taken of a series of elements to help in supplying visual standards for Quality Control.

Post-Irradiation Testing

Irradiated Fuels Tester - UT-10

Additional outer and inner irradiated fuels were tested during the month. Core defects were noted on one inner tube for about two inches of one end. A second outer tube which had been accidentally dropped about ten feet in water was tested. Extensive core cracking over the entire length of the element was indicated; unfortunately, the element had

not been inspected prior to dropping so that it is not definitely known that the core discontinuities are a result of dropping. A test is being set up with four assemblies to test and drop for at least ten trials to determine the extent of breakage damage. The internal bond test was successfully operated for both inners and outers. No unbonding was detected on any fuels, including those which had been accidentally dropped.

AlSi Fuel Testing

Can Wall Wash-Away Tester

As a check on proper operating conditions at the canning station, spot measurement of can wall thickness immediately after quench would materially aid production. A differential Eddy current system, measuring rings at the two ends of the element, would provide a relatively simple, low cost, sensitive system. Preliminary investigation and scoping has been initiated. Available equipment has been modified and encircling coils are being built so that prototypical experiments may be carried out.

Routine Tester Operation

Effort in the reduction of biases of the nondestructive testing equipment in Production Fuels (IPD) continued with further work on standards. Write-ups are being prepared to cover the standardization work to date. A potential reorganization in Production Fuels will not affect the organization or operation of the group now working on the testers.

Reactor Testing

Ultrasonic Detection of Hydriding in Zircaloy Process Tubes

Efforts to minimize effects other than hydriding, i.e., wall thickness, grain size, have effective and have increased knowledge of the test. Use of a flat transducer enables a destructive interference pattern in one pulse while the previous pulse is unaffected. Comparison of the two pulses can be then utilized as a hydride signal. Attempts to utilize surface waves to detect surface hydriding have not been successful.

N-REACTOR FUELS OPERATION
JULY, 1963

VISITORS

<u>Name</u>	<u>Company</u>	<u>Contact</u>	<u>Date</u>	<u>Purpose</u>
RE Reynolds	Eastmak Kodak Co. X-Ray Division Sepulveda, Calif.	RB Socky	7/18/63	Discuss non-destructive testi
E Fast	Phillips Petroleum Idaho Falls, Idaho	RB Socky	7/18 to 7/20/63	Bond testing thorium fuel elements.
TH Bryan	Tektronix, Inc. Portland, Oregon	CL Frederick	7/31/63	Demonstrating oscilloscope.
SJ Miller	DuBois Chemical Cincinnati, Ohio	DW Darsow	7/1/63	Discuss chemical cleaning agents for N-fuel proces
CL Luft	DuBois Chemical Walla Walla, Wash.	DW Darsow	7/1 and 7/25/63	" " "
BR Pepka	Renton Coil Spring Renton, Washington	DW Darsow	7/25/63	Discuss Zr-2 oute supports and locking clips.
SW Yih A Riesen RA Graham CA Brown	Wah Chang Corp. Albany, Oregon	DW Darsow	7/29/63	Discuss Zr-2 stri and support production.
MA DeSesa GK Stearns CE Bussert	National Lead Co. Cincinnati, Ohio	TD Naylor	7/10 to 7/12/63	Technical relation regarding primary extrusions and uranium in processing.
JF Puterbaugh HG Carmichael RL Bean	Bridgeport Brass Ashtabula, Ohio	TD Naylor	7/9 to 7/11/63	Technical relation regarding primary extrusions.
PE Tade	Sciaky Brothers Los Angeles, Calif.	TB Correy	7/29/63	Discuss direct current welding power supplies.

TRIPS

<u>Name</u>	<u>Company</u>	<u>Contact</u>	<u>Date</u>	<u>Purpose</u>
DW Darsow	Production Parts Mfg.	WJ Freeman	7/12/63	Cu-Si end plates, production and delivery.
DH Walker	Sunnen Products Co. Issaquah, Washington	Mr. Keir	7/22/63	Reading internal diameter gage.
	United Control Issaquah, Washington	WE Land	7/22/63	Quality assurance plan.

ORGANIZATION AND PERSONNEL

	<u>6/30/63</u>	<u>7/31/63</u>
Exempt	57	57
Non-Exempt	<u>117</u>	<u>114</u>
	<u>174</u>	<u>171</u>
Tech Grads Assigned to N-Reactor Fuels	<u>5</u>	<u>5</u>

Transfers

<u>Name</u>	<u>From</u>	<u>To</u>	<u>Effective Date</u>
JE Hansen (Tech Grad)	New Hire	N-Fuel Product Engrg.	7/8/63
RG Curran (Exempt)	New Hire	N-Fuel Product Engrg.	7/15/63
KV Clark (Non-Exempt)	N-Fuel Product Engineering	Hanford Laboratories	7/1/63
AJ Karnie (Exempt)	N-Fuel Product	Hanford Laboratories	7/1/63
DL Bosso (Non-Exempt)	Steno Pool	Quality Control	7/15/63
PL Chiesa (MTP)	New Hire	Quality Control	7/3/63
WM Scott (Tech Grad)	New Hire	Quality Control	7/15/63
Wilfert, GL (Tech Grad)	Testing Methods	Rotation	7/1/63

Terminations

<u>Name</u>	<u>From</u>	<u>To</u>	<u>Effective Date</u>
L Goulet (Non-Exempt)	Quality Control	Leave of Absence	7/12/63
JS Eller (Non-Exempt)	Manufacturing	Leave of Absence	7/26/63
RA Schumaker (Exempt)	N-Fuel Product Engineering	Employment elsewhere	7/1/63

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 July 1963, except those as listed below. 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.

Russell L. Brown, Jr.	Improved Eddy Current Testing Probe
G. L. Waldkoetter, R. B. Jacob, and C. E. Fitch, Jr.	Critical Angle Ultrasonic Tests

SIGNIFICANT REPORTS

<u>HW Number</u>	<u>Classification</u>	<u>Author</u>	<u>Date</u>	<u>Title</u>
HW-74597	Unclassified	CL Frederick GL Waldkoetter	6/29/63	The Feasibility of Ultrasonic Inspection of Thick Wall Steel Pipe for Weld Defects
HW-78277	Unclassified	CJ Denton	7/63	N-Reactor Coextruded Fuels Tester - UE2-b
HW-78153	Unclassified	CN Jackson, Jr.	7/9/63	AlSi Fuel Enrichment Tester - ERT-1
HW-78268	Unclassified	CN Jackson, Jr.	7/16/63	Al Alpha Scintillation Tester for Surface Contamination Reactor Fuel
None	Confidential- Undocumented	JW Nickolaus	7/3/63	Target Schedule, July

SECRET

<u>HW Number</u>	<u>Classification</u>	<u>Author</u>	<u>Date</u>	<u>Title</u>
None	Unclassified	CJ Volmer	7/25/63	Introduction of 26.2 inch Super-Enriched Fuels - 333 Building
None	Confidential-Undocumented	CJ Volmer	7/29/63	Business Planning
HW-67575 Rev. 3	Unclassified	TD Naylor	7/5/63	Specifications for Uranium Metal Billets for NPR Fuel Elements
HW-76155 Rev. 1	Confidential	TD Naylor	7/5/63	Chemical Specifications for Uranium Metal Billets for NPR Fuel Elements
HW-78147	Unclassified	DH Walker	7/8/63	Measurement Error - Coextrusion Shop

SECURITY VIOLATIONS

There were no security violations in the N-Reactor Fuels Operation during July. Total CYTD - 7.

Manager, N-Reactor Fuels

LM Loeb:mf

DECLASSIFIED

RESEARCH AND ENGINEERING

1. ADVANCE TECHNOLOGY

Work on a long range N-Reactor action plan is continuing. This study will consider future regional, and national nuclear requirements, the part N-Reactor will likely play in providing these products, and finally, outline the probable course of action to be taken to assure that the customer's needs are precisely fulfilled.

A significant effort was expended on a study evaluating N-Reactor's capabilities in the production of transplutonium isotopes. There is considerable evidence which substantiates the assertion that N-Reactor will be an efficient producer of Np-237 and Pu-238. Various methods of irradiating Np-237 in N-Reactor have been evaluated.

A study is being carried out to more clearly define the tritium production capability of the N-Reactor over a broad spectrum of operating conditions. At the request of the AEC special emphasis is being placed on the optimum methods of producing 5 kg of tritium per year.

2. REACTOR ENGINEERING

An outline has been prepared of all Technical Bases needed for the Primary Cooling System. A schedule and individual assignments have been set up for preparation of these Bases. Work is currently proceeding on the Technical Bases related to single process tube operating limits, primary pump operation, and system operating pressures.

A program defining additional laboratory testing of the Process Tube Flow Monitor System has been prepared. The purpose of this testing program is to supplement the Operational Testing Program to provide additional data about the accuracy, time response, and performance characteristics of the Flow Monitor System. In addition, the laboratory testing program will permit a pilot method of verifying or checking data obtained during the OTP program.

This testing program will be incorporated as a part of the continuing design-development testing of the flow monitor system.

A report defining burnout heat fluxes for NPR tube-in-tube fuel elements was issued by Thermal Hydraulics Unit, Hanford Laboratories (HW-77470, "Burnout Heat Fluxes for NPR Tube-in-Tube Fuel Elements"). This report presents the results of experiments conducted using electrically heated models of NPR fuel elements. Experimental conditions covered the expected range of NPR operating conditions. Empirical equations were developed defining the burnout heat flux in the annular flow channels. These burnout heat flux data will be applied, with an appropriate safety factor, to define the allowable operational conditions for the N-Reactor process tubes.

The study of the consequences of an NPR nozzle end cap failure has been completed. If an end cap failure occurred such that the end of the process tube became completely open, the hydraulic pressure in the system would push out the fuel charge in that tube. Since the thermo-barrier door is close to the end of the process tube, there is some possibility the first spacer element would impinge on this door and hold the fuel element in the process tube. However, this cannot be assured, and it is also likely the fuel elements would be ejected and fall to the floor of the piping spaces (into water at the rear face). If fuel is ejected either mechanical or thermal damage is likely such that fission product release within Zone I is probable. The analyses show, however, that the maximum steam release accompanying a nozzle end cap failure does not exceed the capacity of the fog spray and filter systems. Thus no unfiltered release of fission products from the confinement zone would occur. The study also concludes that the likelihood of a nozzle cap failure is extremely small.

3. REACTOR PHYSICS

The nuclear and physical characteristics of N-Reactor make it well suited for production of various isotopes. Thus further study of Pu-238 production by irradiation of Np-237 in N-Reactor has been made. The study includes work on basic production rates, production cycles and product quality. Production rates were calculated for r values of 0.0 and 0.11, and for various exposures. Effective cross sections were used in the calculations. After an exposure of 8×10^{20} neutrons/cm², the percentages of initial Np-237 converted to Pu-238 are ~ 11 per cent and ~ 18 per cent respectively, for $r = 0.0$ and $r = 0.11$. A ϕt value of 8×10^{20} neutrons/cm² corresponds to a continuous irradiation of $\sim$ one year in N-Reactor under normal conditions and a continuous irradiation of something like three months in a flux trap environment. An r value of ~ 0.11 is appropriate for the normal environment and an r value of something less than ~ 0.05 is appropriate for a flux trap environment. The higher flux value present in a flux trap would make it seem to be the best environment for use in Pu-238 production in N-Reactor. The basic production data calculated was extended to show production capabilities for several recycle programs using a flux trap. These recycle programs consist of successive irradiation and separation intervals, using irradiation times of 0.5, 3, 6 and 12.5 months. A fixed separation time of 4 months was assumed in all cases, during which the Pu-238 was removed and the Np-237 refabricated for further irradiation. The results of these calculations indicate that the 3 and 6 month irradiations are probably preferable, since shorter irradiation times lead to excessive processing costs and longer irradiations lead to excessive loss of target and product. Losses during separation were neglected in this study. Estimates were made of the amount of Pu-239 and Pu-240 and higher plutonium isotopes present in the product. This was based upon a consideration of the fate of the Np-237 lost which was not present as Pu-238 after a given exposure. The following results were obtained for the 3 and 6 month irradiation cycles:

<u>Irradiation Time</u>	<u>Pu-238</u>	<u>Pu-239</u>	<u>Pu-240 or higher isotopes in the irradiation and decay chain</u>
3 months	88%	10%	2%
6 months	80%	14%	6%

A considerable amount of data on the characteristics of the single tube fuel element have been obtained. These data include required enrichment levels, region temperatures, flow conditions and in some of the cases temperature coefficients of reactivity. For a given power level, the region temperatures and required coolant flows differ significantly from those of the tube-in-tube geometry in an unfavorable direction.

The work was also extended to include a 24 lb/ft single tube fuel element with a flow spacer inside the fuel tube. Initial results indicate that this geometry is preferable to a single tube alone, on the basis of fuel temperatures. However, the addition of the flow spacer would lead to somewhat higher manufacturing costs. More complete study of the data is in progress.

Lattice parameters and space-energy distributions of neutrons are to be measured during N-Reactor startup. A general description of the work has been prepared for inclusion in the revised scope document for the startup program.

Parametric studies of the hazards associated with the startup physics tests have continued. Analyses were made for various reactivity ramp inputs to the subcritical as well as the critical reactor. Initial conditions were based on best estimates of the condition which will exist during the physics tests. The resulting transients were studied with the use of the TRIP code which solves the reactor kinetics equation and heat transfer equations to provide temperature feedback to the reactivity ramp. The results of these studies to date reveal no serious consequences relating to fuel or coolant temperature effects. Some further work is in progress.

4. CONTROLS, INSTRUMENTS AND SYSTEMS ANALYSIS

An engineering memorandum, "Development Considerations in the Design of a Process Tube Monitoring System," which was written to provide background material for the information of all who may be concerned with the design, development, and application of a N-Reactor process tube monitoring system, was issued and distributed. Discussion meetings have been held with various groups within NRD and HL to collect information on the requirements, developments, state of the art, and operating experiences in the field of sensing and monitoring such as in-core television cameras, bore scopes, defect depth measurement, tube ID measurement, hydride detection. A preliminary criteria for the requirements of a monitoring system has been developed in conjunction with the Chemistry and Metallurgy Operation.

A study is being made of the $\beta/1_0$ measurement techniques which can be applied to N-Reactor as part of the Noise Analysis Program. The present effort is being directed toward the application of statistical techniques, with rod oscillation, neutron pulse methods, and rod scrambling to be considered also.

A draft of the Phase II test procedure for the fuel monitor rupture has been issued for comment.

A program has been prepared for the testing and analysis of a number of sample chambers to determine the effect of decontamination cycling upon the strength of the chambers.

The analog simulation of the pressurizer has been set up and the data runs have been taken. Interpretations of the data and the writing-up of the final report are now in progress.

Work has begun on the simulation of a multi-node primary side steam generator model, with the analytical development and analog programming proceeding concurrently.

A draft of the Nuclear Instrumentation Technical Bases specifying set-back and scram trip levels in the startup range, intermediate range, and the power range has been circulated for comment. These trip settings were determined from an analog study of the reactor kinetics and a simplified model of the primary loop and the steam generator.

Work has started on a project whose ultimate goal is the obtaining of an improved steam-water mixture and steam interface level measurement in the steam generators. A survey has been made of the possible techniques which may be applied to this problem and the methods are being evaluated for possible further considerations.

Personnel of the Sub-section have provided assistance in several design areas. The acceptance test procedure is being written for the N-Reactor Gas System. A system for injecting steam at controlled rates into the gas system piping has been designed for operational testing of the gas dryer.

5. CHEMISTRY AND METALLURGY

Irradiation testing of first load assemblies for N-Reactor is continuing. As of July 22, 1963, the third charge of assemblies reached 735 MWD/T and a fourth charge reached 375 MWD/T exposure in KER Loops 3 and 4.

Prototype target elements for tritium production are being irradiated in KER-1 and KER-2. N inner enriched (NIE-1) elements are being used to maintain high loop water temperatures. The tests began June 9. KER-1 was on single pass operation because of a leak until July 4 when the leak was repaired. KER-2 could not be operated at water temperatures above

250° C, apparently because the number of heater elements was too small. Two more NIE-1 elements were added to KER-2 and one extra one was added to KER-1 on July 4. Both loops are now operating with an outlet temperature of 280° C, as desired.

In the process studies carried out to date the peak goal exposure of the target alloys (expressed as the gas-volume-ratio or GVR) has been in the range 5-10 or even lower. Goal exposures of 10 and 20 GVR were selected for the KER-1 and KER-2 tests respectively in order to provide data for determination of the technical feasibility of tritium production in N-Reactor. These exposure levels will be reached on about September 1 and December 1. The current exposure level is a GVR of 5.7, calculated on the basis of 0.13 per day.

6. PROCESS EVALUATION AND CONTROL

Startup Test N-1, "N-Reactor Startup Physics Test Program," scope document has been issued. The first of three detailed procedure documents has been issued. Startup Test N-2, "Low Level Functional Testing Scope Document" has been issued for comment, and preparation of the detailed procedures document is being started.

The 100-N Area lost power from the 230 kv Hanford Loop on June 3, 1963. The incident has been investigated and reported. The power loss was caused by switching operations involving less-than-completely-adequate equipment.

A charge of 20,000 to 25,000 lbs. of ammonium nitrate was exploded at the foot of Gable Mountain on August 1, 1963, at about 5:32 p.m. The explosion site is about 5.2 miles distant from the 105-N Building. No motion of the 105-N Building (or of the 1100-N office building) was noted. Three seismoscopes were installed in the 105-N Building and set to trip at MM-2, about MM-3 and about MM-4. No trips occurred.

SIGNIFICANT REPORTS ISSUED

- HW-77917 RD, "Comment Issue - N-Reactor Startup Physics Test Program, Test Procedures - Approach to Critical and Minimum Critical Size," by J. W. Hagan, June 24, 1963, (Confidential-Undocumented).
- HW-78254, "Physics Study of Pu-238 Production Capability in N-Reactor," by E. E. Mills, July 15, 1963, (Secret).
- HW-78255, "Criteria and Scope Startup Test - N-2 - Low Power Testing Program, N-Reactor," by R. E. Hall and E. E. Leitz, July 15, 1963, issued for comment (Unclassified).
- HW-78428, "Consequences of NPR Nozzle Cap Failure," by P. Riggle, July 29, 1963 (Unclassified).

TRIPS

<u>Name</u>	<u>Firm & Location</u>	<u>Date</u>	<u>Purpose</u>
A.E. Guay	Mallinckrodt Chemical Works St. Louis, Mo.	July 15-16	Consult on uranium feed-site technology
	National Lead Co. Cincinnati, Ohio	July 17-19	"
T.W. Evans	MIT, Cambridge, Mass.	July 9-19	Attend Metallurgy Course
	duPont, Wilmington, Del.	July 22	Discuss fuel element development programs
	duPont Co., Savannah River	July 23	Technical discussions
J.W. Vanderbeek	General Electric, Vallecitos, California	July 17	Discuss radiation protection matters

VISITORS

<u>Name</u>	<u>Firm & Location</u>	<u>Date</u>	<u>Purpose</u>
D.E. Simpson	AEC, Chicago Operations Office	July 1	Review N-Reactor startup and testing plans
C.E. Bussert M.A. DeSesa G.K. Stearns	National Lead Company Cincinnati, Ohio	July 10-12	Discuss NPR feed production
D. Cochran	General Electric Co. Cincinnati, Ohio	July 15-16	General plant orientation

PERSONNEL

Additions

<u>Name</u>	<u>From</u>	<u>To</u>	<u>Date</u>
G.H. Strong	NRD, N-Reactor Project	Process Evaluation & Control	7-1-63
L.L. Grumme	IPD, Research & Engrg.	Process Evaluation & Control	7-15-63
E.G. (Bonnie) Edwards,	IPD, Manufacturing	"	7-22-63

Transfers

E. D. Sayre	NRD, R&E, Advance Technology	Contract & Admin., C&AO	7-8-63
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SECURITY VIOLATIONS

One

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 July, 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.

Manager
Research and Engineering

MC Leverett:LCC:mk

DECLASSIFIED

N-REACTOR PROJECTPROCESS DESIGN OPERATIONProcess Research and Development

Investigations have been made of radiation levels and river contamination which could result from leakage of primary loop water into the secondary side of the steam generators, based on normal reactor operation and also on operation during a fuel element rupture. A review was made of the secondary coolant radiation monitor design for detection of the above type of leakage. It was calculated that a leak rate of about one gpm could be detected by this system, varying somewhat with reactor power level, blowdown rate, and sample system delay time. Calculations were made of steam pressures as a function of power level which could be obtained if some of the steam generator tubes were to be plugged. Within the postulated circumstances, the effect on testing and startup appeared to be very small.

Primary coolant flows as a function of steam flow available to the primary pump drive turbines have been calculated. Flow values were obtained for both the loaded and unloaded reactor cases and for ambient and elevated loop temperatures.

Recent investigations have indicated the possibility of cavitation at the dump condenser raw water control valves under predictable conditions of operation. Corrective proposals have been made and are being evaluated for relative effectiveness.

The process requirements have been tabulated for calibration of instruments and controls in all systems of 105-N except fuel rupture detection, which is scheduled next. The tabulation of 109-N data has been brought to 50 per cent completion.

Conversion

Increasing attention has been given to the design review of conversion instrumentation drawings and other details of conversion design being prepared by the Architect-Engineer. Close study has been given to items that are critical to the attainment of scheduled steaming goals.

Project CAI-816Confinement

A preliminary test procedure was issued for conducting an engineering test of 105-N and 109-N Zone I leaktightness. It proposed pressurizing Zone I with the 105-N ventilation supply fan and recording the pressure decay curve. A preliminary evaluation procedure was issued to provide a method of evaluating the above test results as they become available during

testing. The design criteria document for Confinement System Instrumentation was updated to reflect the current objectives of the control system, one of which is the ability to differentiate between steam release and fission product release over the range of possible incidents. The revised criteria for Building Radiation Monitoring will soon be issued to include a proposal for monitoring the confinement system steam vents for fission product release. The Burns and Roe portion of the Confinement System acceptance test procedure has been received and is being integrated with the previously approved 105-N portion of ATP-2410. Design analyses have been initiated to determine the extent of 105-N modifications required if the confinement structure is called upon to withstand an internal pressure of 7 psig instead of the originally established value of 5 psig.

Flow Monitor Test Equipment

Test equipment originally built and used by Avien in their production line testing of controllers, amplifiers, and flux bars has been purchased and received to be evaluated for potential NPR test application and to assist in the current design of a shop test facility.

Modal Station

A comprehensive engineering audit of the Modal Station design was completed and the results reviewed with the field office of Burns and Roe. The first draft of the Modal Station test procedure was issued for comment as Division XIII of ATP-2420, which is the "dry run" testing of the Heat Dissipation Plant instrumentation control systems. The modal control system consists of the Reactor Operation Mode Selector Station on Console AA, the Discontinuous Scram Action Bypass switches on the Safety Circuit panel, and the modal control relays. A four-position modal selector switch permits preselection of the desired operating mode: Startup, Steady State, Normal Shutdown, or Water-to-Water. The discontinuous scram actions are programmed to occur following a scram and are chosen to conserve heat and water, to insure an adequate rate of heat removal, and to prevent thermal shock to the heat removal equipment.

Charging Machine

Charging tests at the 314 Laboratory were halted to permit scheduled transfer of the charging machine to 105-N for final installation. Alternate designs of a magazine adapter have been initiated to eliminate the upward force component of the 2.900-inch to 2.700-inch magazine taper, which has been determined through testing to be responsible for fuel element support deformation. Work authorization has been established for a mock-up charging device to be installed in the 314 Laboratory to permit continued N-Reactor fuel charging tests.

Reliability of Emergency Cooling System Valves

An analysis of the 105-N emergency once-through cooling system has indicated the possibility that a certain type of failure in the nitrogen supply piping to any one of the valve operators could result in all of

the emergency cooling system valves being rendered remotely inoperable. A design change has been initiated to limit the possibility of valve operational failure to only the one valve at which the gas system leakage might occur. This is accomplished by the addition of a small leak-tight check valve and a cylinder type pressure accumulator at each of the subject valves.

Equipment Development and Testing

The final phase of testing the production-run inlet barrier wall seal plugs has been initiated to evaluate the holding and sealing qualities of the plugs when irradiated. Although the results to date have indicated a general reduction in holding and sealing qualities with increased irradiation exposure, the test performance so far has given good assurance that the plugs will meet the anticipated service requirements in accordance with the design specifications.

FIELD ENGINEERING OPERATIONConstruction105-N and 109-N Buildings

The custody of the 105-N Building Zone IV Supply Exhaust Ventilation System was transferred to General Electric on July 15, 1963. The air balancing crew is continuing their preliminary work for the actual balancing.

Approximately 15 per cent of the electrical conductor penetrations in Zone I and Zone II have now had confinement seals applied and tested. The application of confinement seals on other penetrations is approximately 60 per cent complete.

The welding of instrument tubing in the 105-N Building was completed on July 12th.

The installation of electrical cable in the 105-N and 109-N Buildings is approximately 94 per cent complete. About 70 per cent of the electrical terminations in these two buildings have now been completed.

The custody of the following systems in the 105-N Building was transferred to General Electric during the past month.

- Graphite Cooling Instrumentation
- 24 Volt DC Electrical
- 125 Volt DC Electrical
- 120/208 Instrument Power Supply
- Horizontal Rod Control and Position Indication
- Ball Safety Control
- Horizontal Rod Cooling Flow Monitor

Hydrostatic testing on valve racks and transducers and sensing lines has been completed on the left side portion of the tube flow monitor system. Hydrostatic testing is under way on the right side portion of this system. The flow instrumentation system panels for the control room and room 6 have been received and installed. Work is currently under way on routing and terminating electrical cables.

The installation of tubing for the Fuel Rupture Monitor System has been essentially completed. All of the valve stem assemblies on the valve racks for this system, however, are being returned to the manufacturer for replacement of the "O" ring stem seals. This is necessary because the "O" rings were found to be defective.

The calibration of the graphite cooling system flow monitor for the 105-N Building has been completed. Calibration of the Bailey instrumentation for the 109-N Building has been started. Calibration

has also been started on the Zone Temperature Monitor System and Horizontal Rod Cooling Flow Monitor System in the 105-N Building.

The installation of the zone temperature monitor RTD's has been completed for the right side and is under way on the left side.

117-N Building

All of the second and third stage filter frames have been delivered to the job site and are being set in place.

1310-N Facility

Fabrication of the waste storage tank by Chicago Bridge and Iron has been completed.

Kaiser Engineers is currently installing the piping between the tank and the pump house.

181-N Building

The second rebuilt river water pump motor arrived at the job site July 15, 1963 and has been installed. Now ready for testing.

182-N Building

Burns and Roe instituted a testing program in connection with the membrane problem in the demineralized water storage tank. This testing is not yet complete, however, the present indications are that the membrane will function satisfactorily if a correct operating procedure is followed.

Construction run-in tests have now been completed on all of the pumping equipment in this building.

163-183-N Building

The steam piping within the 163-N Building which supplies steam to the ejectors on the degassifier has been replaced with larger size piping. At the present time the building is supplied steam from one of the temporary construction boilers.

Since the available steam is limited by the TC boiler capacity, the output from the demineralizer plant is limited to about 400 gpm. The plant at the present time, however, is producing demineralized water in this amount within the specified limit for oxygen content, although only one train of units is being utilized. Work is continuing on modifications to the remaining ion exchangers and the regeneration units.

184-N Building

A failure occurred in the roof section of a water-wall tube in the 184-N boiler on the morning of July 12, 1963. This failure occurred as a result of loss of water circulation in this particular water-wall tube.

The boiler manufacturer has indicated that the loss of circulation is the result of the designed tube configuration around the main burner openings in the boiler wall. There are a total of eight water-wall tubes of this identical design, including the one which failed.

A revision of the tube bend design for these eight tubes has been provided by Foster-Wheeler. The original tubes have been removed in the vicinity of the burner openings and have been replaced with tubes bent according to the new design. The section of tubing which failed has also been replaced and one other section of roof tube approximately five feet in length has been replaced. The latter tube portion was replaced because of visual evidence of excessive temperatures.

The boiler was restored to service on July 30, 1963.

1900-N Building

The portion of the area fire loop which was relocated to clear the emergency dump basin was satisfactorily hydro tested on July 22, 1963.

Primary Piping

Field erection of primary piping is approximately 98 per cent complete. Hydrostatic testing has been initiated on the right side of this system and is now in progress. Preparation has been completed for the pressure test on the left side of the system. Testing in the 109 cells has been rescheduled because of the heat exchanger experience.

The chemical cleaning of the secondary system has been rescheduled for September. Temporary jumpers to facilitate this cleaning have been fabricated and installed.

Testing of the heat exchangers has been completed to confirm stress corrosion is present in one unit only. Intergranular corrosion is apparent in all units, although this appears minor in all except two units. Further testing is now under way to determine the extent of repair.

Pile Erection

Hydro testing of all hydraulic systems for the horizontal rods has been completed. All rod tips and seal sections have been installed on the right side and 12 on the left side.

All diversion valves have been installed and connectors made up ready for hydrostatic testing of the primary piping system.

Pressure testing of pile gas facilities has been completed. The final run-in of equipment is under way prior to charging the system.

The installation of the barrier wall has been completed.

The hydraulic elevators have been cleared for test runs with final punch list work under way for acceptance test operation.

NPR Testing Program

During the report period six additional test procedures were approved and issued. In addition, two procedures were issued for comment, bringing the current total to 15 and 25 respectively.

Testing of the miscellaneous area heating and ventilation systems was started and completed during the month which brings the total number of completed tests to four with two others in progress.

Over-all testing progress during the report period may be summarized as follows:

	<u>Preparation</u>		<u>Performance</u>	
	<u>Scheduled</u>	<u>Actual</u>	<u>Scheduled</u>	<u>Actual</u>
This Month	73.0%	51.0%	18.5%	4.5%
Last Month	55.5%	43.9%	17.0%	2.1%

PROGRAM EVALUATIONDesign Status

Title I - 100 per cent complete.

Title II - 100 per cent complete.

Costs

No change has been made in the Official Budget Estimate during this reporting period. The current estimate for Project CAI-816 remains at \$188,320,000. Effective July 1, 1963, AEC will assemble the over-all project cost report and estimate to complete. The June cost report and estimate to complete has not been issued at this time.

Schedules

On February 1, 1963, RL00-AEC issued Revision #5 to the Certified Construction Schedule. This schedule shows a construction completion of March 15, 1964.

The construction status as of August 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	92	94
General Area Systems	94	95
105-N Reactor Building	93	97.3
109-N Heat Exchanger Building	92	92.3
163N-183N Water Treat. Facilities	100	99.6
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)	 92	 95.5

RESPONSIBILITY

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

ORGANIZATION AND PERSONNEL

	<u>6-30-63</u>	<u>7-31-63</u>
<u>Exempt</u>		
Permanent	93	94
Summer Professor	1	1
Tech. Grad.	0	1
<u>Nonexempt</u>	<u>23</u>	<u>24</u>
<u>Total Personnel</u>	117	120

Personnel Changes

<u>Name</u>	<u>From</u>	<u>To</u>	<u>Effective Date</u>
RM Halleen (Summer Prof)	New Hire	Process Design	6-1-63
JA Schuster (exempt)	CE&UO	Drafting	7-1-63
RH Worley (exempt)	CE&UO	Drafting	7-1-63
JE Bernhard (exempt)	CE&UO	Drafting	7-1-63
JG Rissberger (exempt)	CE&UO	Drafting	7-1-63
TH Richards (nonexempt)	CE&UO	Drafting	7-1-63
IMA Garcia (exempt)	CE&UO	N-Reactor Project	7-1-63
VV Johnson (exempt)	Field Engineering	N-Reactor Plant	7-1-63
FJ Arndt (exempt)	Field Engineering	Terminated	7-26-63
WO Duncan (exempt)	Field Engineering	Terminated	7-26-63
HW Heavner (exempt)	Field Engineering	N-Reactor Plant	7-1-63
JR Heald (Tech. Grad.)		Process Design	7-19-63

SAFETY AND SECURITY

There were no disabling injuries or security violations reported during July.

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>
EM Kratz	Burns & Roe, Inc. Hempstead, N. Y.	7-21 thru 7-26-63	Conversion design.
	General Electric Co. Schenectady, N. Y.		ISTG Turbine design.
WJ Love	General Electric Co. Schenectady, N. Y.	7-9 thru 7-13-63	Progress of control rod seal contract, and foreign literature pertaining to steam generator operation.
WD Bainard RC Hoffman	Beckman Instrument Co. Fullerton, California	7-8 to 7-11-63 and 7-29 to 8-1-63	To review and approve drawings for the Hot Water Quality Laboratory
FJ Mollerus, Jr.	Burns & Roe, Inc. Hempstead, N. Y.	7-22/23	Discuss Heat Dissipation Plant control during Phase II.

VISITORS

<u>Name</u>	<u>Firm and Location</u>	<u>Date</u>	<u>Purpose</u>
GD Shannon	Resistoflex Corporation Seattle, Wash.	6-26-63	Discussion of special high-temperature, high-pressure pipe couplings.
OJ Harper	Parker Aircraft Penton, Wash.	7-8-63	Discuss mechanical fitting.
RW Hyde	Arthur D. Little, Inc. Cambridge, Mass.	7-11-63	Discuss design and condition of N and K reactors for CA-379.
D Allen	Univ. of Sidney Sidney, Australia	7-11/12	Discussions regarding use of high-density concrete.

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VISITORS (cont'd.)

<u>Name</u>	<u>Firm and Location</u>	<u>Date</u>	<u>Purpose</u>
S Friezner	Specialized Testing Service, North Hollywood, California	7-15/16	Discuss weldable strain gage usage.
Yates Hickey	Parker Aircraft Seattle, Wash.	7-17	Discuss "H" fittings.
FC Rosch DR Rogers	DeVar-Kinetics Div. of Consolidated Electronics Corp., Bridgeport, Conn.	7-17/18	Witness RV-2 relief valve tests and for engineering consultations on these valv
P Hodel	Huntington Rubber Co. Portland, Oregon	7-23	Discuss Hyear hose applications and deteriorations.

SIGNIFICANT REPORTS ISSUED

<u>Document No.</u>	<u>Classification</u>	<u>Author</u>	<u>Date</u>	<u>Title</u>
HW-78179	Unclassified	EM Kratz	7-9-63	N-Reactor Conversion Project Representatives Meeting No. 9
--	Unclassified	GT Haugland	7-12-63	Engineering Evaluation Test No. 1, 105N-109N Confinement Zone Leak Tightness
HW-76661	Confidential	HR Kosmata DL Condotta	7-15-63	Design Bases N-Reactor Conversion to Phase II Dual Purpose Operation
HW-76663	Confidential	HR Kosmata FJ Mollerus, Jr. RK Robinson	7-2-63	N-Reactor Conversion, Design Criteria, Design Operating Parameters and System Transien
HW-76666	Unclassified	RK Robinson	7-8-63	N-Reactor Conversion Design Criteria, Injection and Auxiliary Water Systems
HW-78171RD	Unclassified	JF Nesbitt	7-10-63	Scope Study-Special Irradiated N-Reactor Fuel Handling Facilities
HW-78172RD	Unclassified	JF Nesbitt	7-10-63	Design Criteria-Special Irradiated N-Reactor Fuel Handling Facilities
HW-78194	Confidential	RK Robinson	7-17-63	N-Reactor Secondary Steam Pressures with Reduced Heat Exchange Area

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D-11

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SIGNIFICANT REPORTS ISSUED (cont'd.)

<u>Document No.</u>	<u>Classification</u>	<u>Author</u>	<u>Date</u>	<u>Title</u>
HW-78264	Secret	HR Kosmata	7-15-63	Reactor Design Analysis Monthly Report - June, 1963
HW-78381	Confidential	RK Robinson	7-26-63	Curves to Predict N-Reactor Coolant Flow During Pre- Nuclear Testing

Manager, N-Reactor Project

JS McMahon:mbs

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D-12

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N REACTOR PLANT OPERATION

N PROCESSING OPERATION

The following 105 facilities were transferred on provisional custody status:

1. Horizontal Rod Cooling Flow Monitoring Instrumentation System
2. Horizontal Rod Electrical System
3. Various Rooms (Architectural Only), 105 Building
4. 105-N Zone IV Heating and Ventilating System

At present there are 18 partial or complete systems transferred under the terms of the custody agreement. No significant operating problems exist at this time with these facilities.

During a boiler operational test on July 12 a roof tube failed and forced a shutdown. Failure was attributed to overheating in this tube due to insufficient flow. This was recognized by the vendor as a design deficiency and the tube in question and seven other tubes were replaced with a modified design to promote adequate circulation. The boiler resumed operation on July 31.

The seal in the afterheat removal tank was removed because it was damaged beyond repair. The tank is presently operating without a seal until it has been replaced or redesigned. The demineralizer tank seal was repaired and tests are being run to determine the effectiveness of the seal.

The faulty B phase lightning arrestor on the main 230 KV feed to the area was replaced on July 25.

Orientation Class VIII finished on July 19 and Class IX started July 1.

T. M. Hall took over responsibility for setting up the Certification Training Program and Schedule on July 15. Phase II Certification Training for Group I operators began on July 22.

Preparation of detailed operating procedures and operational test procedures continued during the month. Ten operating procedures were started during the month, none were completed. Test procedures preparation is 51 per cent complete.

Test performance is 4.5 per cent complete; 14 per cent behind schedule due to equipment malfunctions and incomplete facilities.

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N PLANNING AND SCHEDULING OPERATION

A milestone was reached on July 31 with the receipt of the first complete draft of the data processing definition for our system. Programming is now under way.

Orders are active for all required equipment for P&S except the Collector-Accumulators. These must be procured through the AEC. The feasibility study for this equipment, forwarded April 30, received AEC approval this month, but the initial bids were rejected. Planning boards and the Flexowriter-Key Punch are on order. The approved Reader-Printer request was forwarded to Office Equipment Operation.

Interim work scheduling was initiated July 15 under cognizance of T. A. Small and H. W. Heavner.

The first trans-shipment of sulphuric acid from N Plant to 1706 KER was made on July 5. This distribution service will result in a significant saving in transportation cost for HAPO since KER can purchase their relatively small requirement at our reduced bulk prices.

The order for fuel spacer dummies was placed on July 22. Total order receipt by November is assured by the vendor. Limited quantities for monotube testing were promised by the vendor by September 9 at the latest.

Discussions were held with Process Design to emphasize the scope of work necessary prior to our receiving bulk hydrogen. Present facilities would not allow safe receipts.

A survey of the space available and the radiation protection and security requirements for storing fuel pallets in initial load quantities was made.

The mid-year production forecast was prepared for the General Manager's signature and issuance.

A forty-hour orientation in P&S was presented to fourteen people in the Section during the week of July 22.

Preparation of the parent "100-N Emergency Procedures" document was completed.

Listing of all plant process equipment in place is approximately 85 per cent completed.

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N MAINTENANCE OPERATION

Rooms 108 and 109 (105 Building) tool crib and warehouse areas were released for General Electric occupancy which permitted unpacking tools and equipment needed for maintenance of accepted facilities.

Temporary construction building (T-10-9) was released for our general service maintenance occupancy and set up of power tools.

Mechanical, electrical and instrument maintenance personnel were utilized to calibrate instruments and systems, to support operational tests and to perform normal maintenance functions on accepted facilities.

Scheduled start dates for calibration and test work continued to be deferred as a general trend due to several reasons including delays by the contractor in release to custody status.

The primary cause of failure has been the debris in the systems using pumps, valves, condensers and compressors. The contractor would normally have performed this maintenance work and corrected the conditions during a shakedown equipment operation acceptance period. Extensive consumption of operational spare parts to perform the work requires that much of the spare parts inventory be replaced before startup.

SIGNIFICANT REPORTS ISSUED

None

TRIPS

<u>Name</u>	<u>Firm & Location</u>	<u>Date</u>	<u>Purpose</u>
E. W. Wilson	Burns & Roe Hempstead, N.Y.	7/22-25	Conversion

VISITORS

<u>Name</u>	<u>Firm & Location</u>	<u>Date</u>	<u>Purpose</u>
W. E. Pearson	Control & Steam Co. Seattle, Washington	7/30	Demonstrate Delcon Ultra- sonic Leak Detector
J. W. O'Brien	National Cylinder Co. Seattle, Washington	7/16	Prospective Bulk Hydrogen Vendor

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PERSONNEL

<u>Additions</u>	<u>From</u>	<u>To</u>	<u>Date</u>
I. C. Burt	IPD	Plant Processing	7/1/63
B. L. Carter	IPD	Plant Processing	7/1/63
L. W. Coates	IPD	Plant Processing	7/1/63
H. W. DeHaven	IPD	Plant Processing	7/1/63
J. W. DeWane	IPD	Plant Processing	7/1/63
A. A. Fleenor	IPD	Plant Processing	7/1/63
J. J. Jochim	IPD	Plant Processing	7/1/63
T. L. Manley	IPD	Plant Processing	7/1/63
A. E. Martin	IPD	Plant Processing	7/1/63
R. W. Pulliam	IPD	Plant Maintenance	7/1/63
V. J. Regimbal	IPD	Plant Processing	7/1/63
V. R. Richards	IPD	Plant Processing	7/1/63
R. R. Roehl	IPD	Plant Processing	7/1/63
R. A. Smith	IPD	Plant Processing	7/1/63
R. B. Stull	IPD	Plant Processing	7/1/63
W. H. TerHark	IPD	Plant Processing	7/1/63
R. D. Thayer	IPD	Plant Processing	7/1/63
D. E. Thomas	IPD	Plant Processing	7/1/63
R. A. Tucker	IPD	Plant Processing	7/1/63
R. D. Wodehouse	IPD	Plant Processing	7/1/63
H. W. Heavner	N Reactor Project	Plant Maintenance	7/1/63
V. V. Johnson	N Reactor Project	Plant Processing	7/1/63
D. T. Thompson	CPD	Plant Maintenance	7/8/63
T. W. Blakely	CPD	Plant Processing	7/8/63
T. E. Edwards	Off-Site	Plant Processing	7/16/63
R. A. Soderquist	IPD	Plant Processing	7/29/63

Deletions

L. E. Tompkins	Plant Processing	IPD	7/1/63
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Manager - N Reactor Plant

WM Mathis:GVRs:ds

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FINANCIAL OPERATION
JULY, 1963

The following were the principal activities in the NRD Financial Operation during July, 1963 other than those activities of routine and continuing nature.

N-Reactor Business Information Project

Activities in this area have now been expanded to include study not only of a planning and scheduling system for N Reactor, but to include an information system on N-Reactor Fuels and a reactor data system. At present work is proceeding in developing the total information requirements of the Department and the most economical way for obtaining this information.

With respect to the planning and scheduling system, program definition has been completed and programming is proceeding according to schedule. The order for the 3101 data collection system was scheduled to be placed on July 1, 1963. However, difficulty in obtaining RLOO-AEC approval of the equipment feasibility study and a bidding error by the computer department of General Electric Company has delayed procurement activities. The delivery of equipment will now be approximately 30 days after the November 1, 1963 scheduled completion date for the system; however, other equipment is available for use during the interim period.

N-Reactor Production Studies

In addition to the study information furnished during June, 1963, the AEC requested (1) clarification of certain items, (2) details of costs which would be involved in shutdown of the N-Reactor, and (3) a direct comparison of advantages of the N-Reactor and the K reactors. In addition we have been requested to furnish a study of N-Reactor based on production of five kilograms of tritium as well as plutonium. Information oriented towards answering the latter two requests will be furnished on August 16, 1963. All other information has been supplied to the Atomic Energy Commission.

Finance Program Milestones

Milestone charts have been prepared and are now being used by the Financial Operation for all CY 1963 objectives of this Section. These charts are being used on a monthly basis to measure progress toward achievement of these objectives.

NRD File Cabinet Requirements

The critical file cabinet shortage which has existed in the Department has been alleviated through utilization of equipment made available by other HAPO components and Hanford construction, primarily Kaiser Engineers. Some of this equipment will require replacement at an early date due to the lack of locks and the marginal state of repair. However, the availability of this equipment has served to satisfy our immediate needs.

Duplicating Facilities - 100-N Area

A study of duplicating facility requirements for the 100-N area has been completed. As a consequence IPD has been requested to establish and staff a duplicating facility at

100-N. The facility will be staffed by one employee and will provide copying and offset duplicating services.

Research and Development Cost Reporting

During July programming and debugging of the automated Research and Development cost reporting system was completed. The first automated report was issued based on July information. This report was available within five days after the close of the fiscal month.

Financial Personnel

As of July 31, 1963 personnel assigned to the NRD Financial Operation consisted of 17 monthly salaried employees and eight weekly salaried employees, for a total of 25 people. This represented an increase of one employee over the end of the previous month. This employee is a Business Training Recruit who was assigned to the Department effective July 1, 1963.

J. Milne
Manager-Finance

J Milne:pw

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01/22/93**