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N - REACTOR DEPARTMENT

MONTHLY REPORT

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HANFORD ATOMIC PRODUCTS OPERATION

RICHLAND, WASHINGTON

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49 Pages, Co [REDACTED]**DECLASSIFIED**By Authority of RLO-CG-4N-REACTOR DEPARTMENTDS Lewis 8-27-92MONTHLY REPORT -- AUGUST 1963By J Tang 9-11-92DJ Kruken 9/10/92 Compiled by N-Reactor DepartmentSeptember 9, 1963 - Richland, WashingtonWork performed under Contract No. AT(45-1)-1350 between the Atomic Energy
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TABLE OF CONTENTS

General Summary	A-1 through A-7
N Reactor Fuels Operation	B-1 through B-16
Research & Engineering Operation	C-1 through C-8
N Reactor Project Operation	D-1 through D-12
N Reactor Plant Operation	E-1 through E-4
Financial Operation	F-1 through F-2

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DECLASSIFIEDGENERAL SUMMARYN REACTOR FUELSManufacturing

A record 265 billets, or 47 tons, was extruded during August. This record was established despite a cracking problem with the inner weld of copper cans. First load extrusion requirements are at 85 per cent completion. Fifty-one tons of fuel elements were autoclaved, bringing the first load completion to 273 tons or 71 per cent of requirements. Transfers of finished assemblies to final storage of 94 tons was a significant increase over July, bringing first load completion to date to 118.4 tons or 31 per cent of total first load requirements. In addition, a large quantity of material is currently awaiting certification or installation of thick shoes which if included would increase the first load completion to 45 per cent.

Yields during August dropped approximately eight per cent from previous months for a combined yield total of 81.4 per cent. Total combined yields for first load is 54 per cent.

Engineering

On August 12, 1963, ten billet assemblies failed the vacuum test after preheat. The cause of the failures was due to cracks in the ID weld which appeared to have failed in tension. Most of the ID sleeves involved in the failure had excessive nickel content. An investigation to check weld strength and develop alternate methods of strengthening the joint has been started. A Production Work Request, PWR, has been initiated and approved for the rewelding of production weld rejects. It is anticipated that approximately 50 per cent of weld rejects can be reworked.

Charging machine testing was resumed on August 21, 1963. Four charges of fuels were provided during the week ending August 25 to determine the best magazine adaptor design to eliminate possible flattening damage to the outer supports from the magazine taper. One adaptor was used in these four tests and initial testing was successful and endurance testing is to continue with this adaptor.

RESEARCH & ENGINEERING

The special product study requested by the AEC was completed.⁻¹⁾ This included additional data for intermediate range tritium production capability (about 5 kg/yr) under two assumptions: (a) 6 per cent Pu-240 content, (b) under operating conditions established for minimum unit cost.

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

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A report is being prepared that describes adaption of the N Reactor to concurrent production of weapons grade plutonium and significant quantities of tritium with first loading to be charged starting January 1, 1967. Use of a portion of the 1.25 per cent enriched U-235 (being procured for spike enrichment) is also considered for a prototypical demonstration of the co-producer fuel design.

Work to establish and document methods and specifications for the start-up measurements of lattice parameters and neutron spectral indices is 50 per cent complete.

Analyses of the hazards associated with start-up physics tests confirm that the Ball 3X System will satisfy speed of control criterion for prevention of fuel melting after any credible accident.

A study of the feasibility of using the statistical fluctuation in flux detector outputs to measure $1/B$ is essentially complete. Preparation of a report which evaluates these techniques for reactor noise measurements is underway.

Mathematical development of the steam generator model has been completed.

The third and fourth "first load" charges of N fuel assemblies in KER test loops have reached exposures of 955 MWD/T and 595 MWD/T, respectively.

The prototype (tritium production) target element test in KER-1 loop was discharged at a gas volume ratio (GVR) of 8. Discharge of a similar test in KER-2 loop is scheduled during December at an exposure of GVR 20.

All major physics start-up instrumentation has been shipped except the scaler-timer-printer package which had been promised for delivery by September 16. Shipment of this package about December 1 is now proposed by the vendor. Efforts to expedite procurement are underway because of the critical importance of this equipment to the start-up program.

An analysis has been initiated to evaluate the adequacy of the emergency water supply to 105 and 109-N confinement fog spray systems and to investigate the necessity for tests of the systems to demonstrate adequacy and operability.

N REACTOR PROJECT

Hydrostatic testing of the primary loop piping in the 105 Building and 109 Building, including Cells 1, 2, and 5, has been completed. Chemical flushing of Cell 5 and the left side of the Primary Piping System was completed during the month. Flushing Cell 1 and the right side piping was initiated on September 3, 1963, and is now in process.

Custody transfers were completed for four systems in the 105 Building during the reporting period.

Insulators were on strike from August 1 to August 12 pending contract re-negotiations.

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The four steam generator units in Cells 1 and 5 have been judged to be relatively free from deleterious defects and will be placed in service. Steam generator unit 2A in Cell 2 contains some defective tubes, however, does not leak and will be placed in service for operational testing along with unit 2B. Steam generator 3B in Cell 3 is now being prepared for start of repair operations. Upon completion of repair of unit 3B by sleeving of the tube mouths, this unit along with unit 3A will be placed in service. Steam generator unit 4A is now being 100 per cent examined by eddy current techniques to determine the extent of tube damage.

Design analyses of the operating pressure requirements of NPR have verified the attainability of 150 psia steam generation under Phase II six-loop operating conditions.

Design requirements for accuracy and range of the Beckman gas chromatographs in the pile gas instrumentation system have been modified to permit acceptance of delivered equipment and to avoid a prohibitive scheduling delay of equipment replacement.

Fuel charging tests have demonstrated the effectiveness of a recently developed eccentric tapered magazine adapter in minimizing the upward component of the horizontal charging force and thereby limiting the amount of fuel element support deformation.

Three production diversion valves in the Environmental Test Facility of 189-D Building have accumulated 348 hours of operating pressure and temperature. Timing checks have revealed smooth and satisfactory operation.

N REACTOR PLANT

General Electric began operating the demineralized water facility on August 12 under the guidance of Bumstead-Woolford. Since then the plant has been on a 24-hour day operation making quality water at an average rate of 600 - 1000 gallons per minute.

The demineralized water tank oxygen content continues to give trouble in spite of several tests to find a solution to the problem. A meeting was held with Construction and Design people and a program of investigation was developed.

Two-hundred and twenty-three (223) maintenance procedures have been completed. Training programs for operators and craftsmen continued on schedule.

PERSONNEL STATISTICS

Number of employees as of July 31, 1963
Number of employees as of August 31, 1963

591
602

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	<u>Exempt</u>	<u>Nonexempt</u>	<u>Total</u>
General	2	2	4
Finance	15	8	23
N Reactor Fuels	56	125	181
Research & Engineering	48	10	58
N Reactor Plant	59	159	218
N Reactor Project	<u>92</u>	<u>26</u>	<u>118</u>
TOTAL	<u>272</u>	<u>330</u>	<u>602</u>

Employment

	<u>Exempt</u>	<u>Nonexempt</u>	<u>Total</u>
Additions	2	25	27
Reductions	<u>6</u>	<u>10</u>	<u>16</u>
Net Additions	<u>(4)</u>	<u>15</u>	<u>11</u>

SAFETY & SECURITY

Days without a disabling injury	274
Hours worked without a lost disabling injury	731,509
Medical treatment injuries (August)	10

There were 2 security violations in the Department during August, 1963.

SUGGESTION PLAN PARTICIPATION

	<u>August</u>	<u>Year-to-Date</u>
Number of eligible employees	330	256 (avg.)
Number of suggestions received	32	227
Number of suggestions acted upon	44	171
Number of suggestions adopted	20	71
Net annual savings	\$3 516	\$18 309
Amount of awards	\$ 645	\$ 2 690
Per cent of awards to savings	18.4	14.7
Average amount of awards	\$ 32.25	\$ 37.89

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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 August. 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
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W. M. Mathis
J. S. McMahon
M. C. Leverett

General Manager
N-Reactor Department

RL Dickeman:skd

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N-REACTOR FUELS OPERATION
AUGUST 1963

I. PRODUCTION STATISTICS

	<u>Current Month</u>		<u>Last Month</u>	<u>First Load</u>	
	<u>Scheduled</u>	<u>Actual</u>		<u>Tons</u>	<u>Per Cent</u>
	<u>Tons</u>	<u>Tons</u>	<u>Actual</u>	<u>To Date</u>	<u>Complete</u>
<u>Shop Input</u>					
Inners	32.1	21.1	36		
Outers	20.2	25.5	102		
Total	52.3	46.6	138	546.7	84.8
<u>Shop Output</u>					
<u>Autoclaves</u>					
Inners	18.6	18.9	14.9		
Outers	37.1	31.8	50.7		
Total	55.7	50.7	65.6	273.0	70.9
<u>Assemblies</u>					
Awaiting Shoes	X	X	X	33.0	8.6
Awaiting Certi- fication	X	X	X	38.7	10.1
Final Storage	89.0	93.7	15.9	118.4	30.8
Total	89.0	93.7	15.9	190.1	49.5
<u>Throughput by Stations</u>					
<u>Station</u>	<u>Inners</u>	<u>Outers</u>	<u>Total</u>	<u>In-Process Inventory</u>	<u>Defective Rate</u>
Extrusions (billets)	146	119	265	99	4.6
Cutup First	2568	1419	3987	17	-
Cutup Rework	289	-	289	999	-
Chemical Milling (ends)	6012	1832	7844	307	.7
Braze (ends)	6069	1956	8025	110	4.8
Heat Treat	3009	930	3939	80	2.5
Machining (ends)	5475	1387	6862	470	0
Straightening	1403	-	1403	0	4.1
End Test (ends)	5538	1488	7026	102	1.7
Vacu-Blast	2808	706	3514	235	0
Preweld Etch	2871	708	3579	12	-
Welding (ends)	5220	1247	6467	46	.2
Clad and Bond Test	2751	1732	4483	120	2.4
Support Weld	3572	2531	6103	1249	1.4
Autoclave	2963	2640	5603	2102	0
Final Inspection	3131	2617	5748	12025	1.5

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Other Statistics

	<u>Inners</u>	<u>Outers</u>	<u>Total</u>
Rework Storage	-	-	-
Support Fabrication	13,416	20,815	34,321
Locking Clip Fabrication	-	6,580	6,580
Special Extrusions	-	-	46
Tubes Scrapped			
Eng. & Materials	27	4	31 (462 lbs)
IPD, Materials		219	219 (4606 lbs)
Steel Shoes	-	-	28,572
Oxide Burner - 55 batches burned			966.25 lbs

Shop Yield

Current Month

First Run	75.0	61.7	67.8
Estimated Rework	8.6	8.8	7.7
Total	81.4	70.5	75.5

Last Month

First Run	82.8	66.5	72.1
Estimated Rework	6.4	11.0	9.4
Total	89.2	77.5	81.5

First Load to Date

First Run	X	X	X
Estimated Rework	X	X	X
Total	62.2	49.3	53.6

II. MANUFACTURING OPERATION

A. Production

Input at the extrusion press of 265 billets, or 47 tons, established a record for the coextrusion shop. This input included a pilot run of 12 natural uranium extrusions. Although a record was established, input was ten per cent below the target schedule. The shortage was the result of a cracking problem with the inner weld of copper cans. Twelve inner billets were set aside at extrusion because of poor vacuum after preheat. Despite these difficulties, first load requirements are being met with 547 tons produced to date for an 85 per cent completion.

Autoclave throughput of 51 tons was below previous month by 15 tons.

Transfers to final storage of 94 tons was a significant increase over July, bringing the first load to date to 118.4, or 31 per cent of requirements. A large quantity of material is currently awaiting certification or thick shoes which would increase the first load completion to 45 per cent.

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Ten chemical workers were obtained on a temporary 90-day loan from IPD Production Fuels, and a partial second shift was established on August 12. Four of these men were assigned to final assembly. Although a considerable amount of training was necessary, the second shift is producing effectively.

B. Plant Problems and Incidents

Support cracking has been a serious problem with the fabrication of outer supports. The use of non-vacuum annealed strip and oiling the strip prior to fabrication apparently have solved this problem.

A barrel of uranium sludge (saw fines from cutoff saw) burned on the oxide burner pad on August 6, 1963. A large area around the oxide burner building was contaminated, requiring considerable man-hours of cleanup, including the scraping and removal of gravel. The fire was investigated and a report and recommendations issued. The recommendations are currently in use or work orders have been issued to carry out the recommendations.

Unbonding of the inner clad on both inner and outer extrusions was again experienced. Of 145 inner extrusions, two were completely rejected and nearly half of five other extrusions. Out of 79 outer extrusions, five were completely lost. Two of the five were extrusions of normal material.

Difficulties were experienced most of the month with the effectiveness of the cleaning operations at vacu-blast and preweld etch. As high as 65 per cent of a day's throughput have had to be rerun. A "tuning up" by Maintenance of the vacu-blasting machines has partially relieved the situation. An engineer has been assigned to study the problem. All pieces are being cycled twice at vacu-blast, reversing the fuel position between cycles.

An estimate 19 pounds of enriched uranium were lost from the process due to a break in the transfer line in the chem bay mezzanine. Steps are being taken to relocate the transfer pump which will eliminate a large portion of the saran-lined carbon steel pipe.

C. Plant Improvements and Achievements

Control of the Preventative Maintenance Program has been simplified by the use of IBM cards. This system was put into service on August 1.

Investigations of problems encountered with the locking clip welder indicated difficulties were due to variation in locking clip dimensions. Electrodes have been modified to accommodate variations experienced with the locking clip. Locking clip welder tooling has been redesigned to facilitate electrode replacement so as to eliminate the maintenance craft work required to interchange electrodes.

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Autoclave efficiency was improved significantly by replacing screwed fittings on the hot water and steam lines with welded fittings. Modifications to the blowdown lines are in progress to further reduce downtime.

Modifications were made to the hydraulic and electrical systems on the beta heat treat conveyor to eliminate equipment malfunction. The changes have significantly improved the operating efficiency of the heat treat operation.

III. QUALITY CONTROL OPERATIONS

The autoradiographic test has been eliminated as a measure of the acceptability of the N-fuel cladding. The test will continue to be used until its sensitivity to uranium contamination is established in braze material. The specification has been revised accordingly.

Examination has been completed of all braze charts of the first load to discover "no-trace" defects similar to those associated with total loss of induction heating control. Approximately 70 pieces were found with indications similar to those associated with autoclave failure No. 3. The data files will be checked to determine the number of pieces included in the first load. All suspect pieces will be pulled for special evaluation.

Approximately 25 per cent of autoradiographic films have been scanned to determine any defects indicating penetration of uranium into the braze. No indicators as severe as the autoclave failure or the associated "green oxide" reject have been found.

A procedure to assure control of all 333 Building gaging equipment was issued. This system, a part of a total quality measurements program, requires specific calibration frequencies and linearity checks for all process gaging, including (1) gage audit and control system, (2) process instrumentation audit system, (3) "MERCY" evaluations of present measurement accuracies and precisions, and (4) evolution of a "measurements policy" specifying requirements in maximum measurement error allowable for critical process and product measurements.

The first significant quantities of data on 305 Test Reactor Reactivity and a-counter Uranium Contamination were issued this month to assist in characterizing the first load from the standpoint of average reactivity and average surface contamination.

A compilation of all data presently being manually filed by Quality Control was issued this month for the information of section personnel and Research and Engineering.

IV. N-FUEL PRODUCT ENGINEERING

Test Fuel Fabrication

Corrosion and Startup Test Fuel

Fabrication of a charge of ten 24-inch NIE-1 fuel elements with shroud tubes was completed last month (PWR-E64). All pre-irradiation

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measurements were completed during August, and the fuel elements are currently at the final assembly station.

Hydraulic Test Charges

A charge of twenty-four 17-inch NAE-1 and thirty-six 11-inch NAE-1 fuel assemblies is being fabricated in the pilot plant for 189-D reactor mockup fuel column hydraulic tests. Expected completion date is September 15, 1963.

Unbonded End Closure

A charge of six 24-inch NIE fuel elements with unbonded end closures is being fabricated in the pilot plant for KER Loop 1 or 2 heater elements (PWR-E71). The cap design is the "chevron" or tapered end cap (60° included angle), and the closure is accomplished with electron beam welding. Elements will be completed September 3, 1963 and shipped September 6, 1963.

Prototypic Backup Charge

A 14-element charge of the most recent (June 1963) 24-inch NAE assemblies produced in the manufacturing Shop was completed this month. The fuel assemblies are in final storage, 306 Building, and will be shipped when storage facilities are arranged at KER.

Uranium Billet Development

High Silicon Test

This test is an evaluation of increasing silicon in the uranium to increase the extrusion constant (or stiffness) and reduce cladding thickness variation. Two billets each, containing low (157 ppm), medium (250 ppm), and high (418 ppm) silicon additives in the uranium, were coextruded under PWR-E68. The coextrusions have been cut into 12-inch lengths with a half-inch wafer taken between each of the 23 resulting pieces. The fuel sections are in the pilot plant awaiting processing and samples are being metallographically examined. The test, starting with the primary extrusion of high silicon ingots, has been started.

Change in Billet Hydrogen Sample Location

A study of yield data has been made for fuels which were made from uranium billets having a new H₂ sample location. This location, which is the first full cross-section in the rear of the primary extrusion, in effect moves the "C" billet three inches closer to the rear end. The new sample location results in hydrogen analyses approximately 0.5 ppm higher than those in the old location.

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The 15 coextrusions resulting from the billets of changed sample location were compared with ten coextrusions chosen at random and made at approximately the same time. The results of the study showed that the reject rates were almost identical in all categories except end closure of the pieces numbered 1 and 2--i.e., those most likely affected.

Zircaloy Cladding Fabrication Development

Tube Reduced Cladding

PWR-68, to qualify NIE inner clad shells made by a tube-reducing operation, is about 80 per cent complete. Three fuels from the test coextrusion were rejected for warp; but, since two of the three fuels involved were from a location adjacent to the end defect, this is not considered cause for immediate alarm. So far, none of the test fuels have been rejected for defective closures or excessive clad variation. Ultrasonic measurements of clad thickness are being supplemented by microscopic measurements of inner clad sections.

Braze Ring Fabrication Development

Power Compact Braze Rings

A preliminary specification covering closure rings made of compacted alloy powder has been drafted and is being circulated for approval signatures.

Zircaloy Support Strip Fabrication

Turks Head Strip Fabrication

A pilot plant PWR has been initiated to cover work entailed in evaluating the performance of five lots of Turks Head rolled strip, each lot having a different fabrication history. Some of this strip has already been fabricated into buggy spring supports; the last lot of strip involved arrived on site August 27, 1963.

Chemical Processing

Billet Cleaning

Uranium billets processed through the 333 Production Facility this month were spray-rinsed with a high-velocity process water. The incidence of acidic vapors (sufficient to turn moist litmus paper red) emerging from the boxes of the warm, freshly cleaned billets was substantially less when the high-pressure rinse was employed.

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The fabrication of a high-pressure spray apparatus to uniformly spray-rinse the OD and ID surfaces of the uranium billets is essentially complete. Installation and preliminary evaluation in the 306 Pilot Plant should be accomplished by October 1, 1963. Evaluation of the unbonded coextrusions and billet component cleaning processes is continuing.

End Recess Machining

Preliminary work has begun to determine the feasibility of partial machining the end recess. Standard single point cutting tools were found to have insufficient strength to withstand the cutting forces. To increase the cutting tool strength, a tool which resembles a milling machine face mill was designed. This tool is now being fabricated and should be ready for testing.

Extrusion Process

Engineering extrusions performed during the reporting month are as follows:

11-Inch Tooling - 4 Zircaloy Billets. These billets were extruded from 10.950" OC x 18" long to 5.875" OD x 67" long bar stock for use in sheet bar fabrication.

6-Inch Tooling - 20 Zircaloy Billets. These billets were extruded to 3-3/4" x 3/8" bar stock.

6-Inch Tooling - 1 Zircaloy Billet - This billet was extruded for Quality Control use as dummy standards.

6-Inch Tooling - 1 Uranium Billet. This billet was extruded to produce an NIT thin clad standard for use on nondestructive testers.

7-Inch Tooling - 2 Uranium Billets. These billets were extruded as part of PWR-E68. The results were good and the extrusion is being processed in accordance with the PWR.

Natural Uranium - 12 natural uranium billets were extruded as a pilot run.

Unbonding

Inner Tube unbonding problems of the past year were reviewed and a report issued covering the study. As pointed out in the report, unbonding is not yet fully understood, and as long as this situation exists there is a possibility of a return of unbond problems.

Welding Tests

On August 12, 1963, ten billet assemblies failed the vacuum test after preheat. The cause of the failures was due to cracks in the ID weld which appeared to have failed in tension. Most of the ID sleeves involved in the failures had excessive nickel content. An investigation to check weld strength and develop alternate methods of strengthening the joint has been started.

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End Closure Development

Welding - Rework

Outer fuels rejected for weld defects were grouped according to type. Those with defects of a minor nature were successfully reprocessed by machining and rewelding to satisfy acceptance standards. Fuels with major defects, such as blowouts leaving large craters, were not successfully rewelded. Weld blowouts of medium characteristics--i.e., those having plainly observable pits or dimples--were successfully rewelded about 50 per cent of the time. In the first defect category, 30 out of 33 fuels rewelded passed inspection as performed by Manufacturing personnel.

A production PWR has been initiated and approved for the rewelding of production weld rejects.

Unbonded End Closure Weld Process

Encouraging progress has been realized in the development of a T.I.G. weld process for unbonded end closures. The optimum weld joint is still being developed and equipment modifications are in work. However, the results so far attained give every indication that a highly satisfactory weld process can be developed.

Fuel Element Supports

Charge Machine Test

Charge machine testing was resumed on August 21, 1963. Four charges of fuels were provided during the week ending August 25, 1963, to determine the best magazine adapter design to eliminate possible flattening damage to the outer supports from the magazine taper. One adapter was used in these four tests. Initial testing was successful and endurance testing is to continue with this adapter.

It has not been possible, even with the magazine taper eliminated, with any prototypic charging arrangement to use charging forces in excess of 1500 pounds without unacceptable support deformation. Tests are being run to isolate the cause of deformation above 1500 lb F.

Supports

Work has been initiated to develop an alternate outer support. The goal in this design is to make a support which will be approximately twice as strong as the suitcase outer support in compression and which will satisfy the other functional support requirements, at least, to the same extent that the suitcase handle support does.

The general support requirements have been defined and published. At present, a review of past support development is being made and functional tests are being defined. Compression testing has been

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started with sample sizes adequate to provide reliable statistical data at a high level of confidence. Tests are also planned on various support and shoe cross-sections and configurations, and on supports which have been sized up and sized down.

Final Assembly

A document (HW-78622, "A Description of the Fuel Assembly Process") was issued summarizing experience in establishing the final assembly operation and containing recommendations for further operation and testing in this area.

A test has been defined and initial measurements have been made to determine the effect on annulus measurements of shipping fuels to N-Reactor Area. The effect of the foam rubber strip in the pallet fuel element support members is also being investigated.

Specifications and Waivers

Specifications

Engineering specification revisions made during the month are as follows:

1. CX-655.0 - Autoradiographic Clad Thickness Test: This test removed from the specifications.
2. CX-575.0 - Autoclave Testing: (a) Water autoclave cycle removed, (b) sixty-hour cycle permitted on a maximum of ten per cent of the monthly autoclave throughput, and (c) acceptable fuels were redefined to include fuels with white nonpowdery areas on the cladding and localized areas of white corrosion products on the support hardware.

Waivers

No waivers were issued during August.

Equipment Development

Projects Completed

Helium Mass Spec Leak Detector - 306 Building

The leak detector was received, assembled, and checked by the factory representative. The operational checkout was satisfactory

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and the equipment accepted. The Certified Vendor Information (CVI) for the leak detector was prepared and issued.

Support Fabrication

The locking clip forming die was modified to relocate the projection centerline relative to the centerline of the clip and to improve the transverse radius.

Adjustments were made to the outer support die and press in order to eliminate the problems of material cracking and support height variation.

The new steel shoe was completed and installed. About 3000 .015 inch steel shoes were made using the new die; but, as of August 27, 1963, no shoes had been accepted for production due to the tab length of the shoe when formed over the outer support. If required, the first and second stages of the die will be modified.

Projects in Progress

Inner Support Solution Heat Treat

Fabrication of Inner support heat treating equipment has been completed and will be installed upon removal of the pit furnace. Installation of a second one-ton bridge crane has been cancelled on the basis of expense not being justified.

Spike Welder Tooling - 306 Building

Fabrication is scheduled to be complete September 16 and installation complete by September 30.

Support Welder Tooling - 306 Building

The design and the cost estimate is scheduled to be completed by September 18. Estimated completion date for fabrication and installation of the tooling is October 31, 1963. The design of the new electrodes and upper tooling fixture will be completed September 4, 1963.

Locking Clip Pliers

Receipt and inspection of the first lot of locking clip pliers fabricated offsite indicated some wars in the jaws. The drawing covering this purchased item has been modified to prevent a recurrence of this condition.

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New Tool Preheat Furnace

Scope design is under way to provide a larger tool preheat furnace and to improve portions of the billet handling system from the preheat furnace to the extrusion press loader.

High-Pressure Shear Tester for Locking Clips - 306 Building

The high-pressure shear tester was checked out and found to be inadequate for its intended purpose. A clamping fixture was designed and is being fabricated to correct this deficiency.

Pressure Spray-Rinse for Uranium Billets

A prototype pressure spray-rinse device for the uranium billets was designed and the fabrication is 99 per cent complete. We are awaiting receipt of a special nozzle being supplied by an offsite vendor. This should be received by September 6, after which the device will be tested in the pilot plant.

Project CAF-954 - High-Pressure Autoclave

The revised project proposal was prepared requesting withdrawal of the project and is now enroute for signatures.

TESTING METHODS OPERATION

N-Fuels Testing

Ultrasonic Tests on Billets

The rough draft, entitled "Comparison of Billet Extrusion Performance with Pre-Extrusion Test Data", has been completed. No correlation between the test method used and the inner clad variation was observed. Although the test is sensitive to grain structure, the effects of the inner bore crystalline structure could not be isolated and were masked by the billet structure.

Ultrasonic Tests on Zircaloy Cans

Work is continuing on utilizing the boundary wave phenomena to distinguish differences in Zircaloy components. Tests on inner clad outer tube cans have shown sensitivity to cold work and various

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HW-78805

annealed structures. The main objective is to determine if these effects correlate at all with inner clad variations. These extrusion tests will be run in conjunction with the billet correlations.

Uranium Billet and Ingot Grain Size Tester - UT8

Metallography results have been completed on six ingot samples and show very good correlation with UT8 and silicon and iron additive. Four more ingots checked recently also correlate with the additive and UT8 results. These were all beta heat treated ingots.

Support and Clip Welding

The semiconductor beta detectors have been received and the laboratory setup is complete and ready for checking for locking clip weld contamination. Ultrasonic tests and Pan Bore camera photographs have been completed on 15 N-fuels having potentially bad welds. No indication of uranium-zircaloy interface disturbance could be detected ultrasonically on any of the elements. The placement of the locking clip under one of the outer supports prevents checking two of the four welds, thus severely limiting application of this test. Use of this means of detecting uranium in the locking clip welds will require a means of getting the x-rays into the bore of the outer tube such as a rod anode source being investigated.

Routine Tester Operation

Increased effort has been placed on improving N-fuels production tester operation. Problems with the inner probe for the outer element has been lessened by working with maintenance forces on improving probe construction; N-Fuels has started fabrication of its own probes. Evaluation of all transducers before production use appears to be a feasible method of decreasing transducer problems. Considerable variations in vendor-supplied transducers still exist and only by completely testing evaluating them can uniform tester operation be obtained.

Modifications for Improvement of Production Testers

The eddy current clad thickness mapping system has been shown to be feasible. The two new units of combined UE2-b/UT9 (designated UE-4) have been completed by the shop and are now about 50 per cent debugged in the laboratory. An eddy current thickness test for zircaloy support strip has been set up in 333 Building and is being operated to measure thickness variations.

Pan Bore Camera

Use of the camera for black and white pictures is now routine and a developing service has been obtained from 700 Area. Color film has been obtained which can be handled by Photography Operation and will be evaluated on white oxide standards.

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Irradiated Fuels Tester - UT10

Several irradiated N-fuels were tested, then subjected to a drop test. All fuels tested sound before dropping. Two of the fuels broke after one to five drops; one longitudinally split, the other in a transverse fracture. Signals have been observed from inside the cap and are being investigated, but as yet remain anomalous. The test will be inoperative for about two weeks while the chain drive for the transducer assembly is modified and repaired.

AlSi Fuel Testing

Hot Die Sized Fuel Element Tester - UE-3

The equipment has been set up in 306 Building and operated to determine optimum operating procedures. These procedures are being incorporated in the manual which is about 60 per cent completed. Almost 500 pieces were tested satisfactorily in test runs and the bond data will be compared with the 306 Building UE-1 results.

Routine Tester Operation

Grain size standards have been selected and a set has been transmitted to NLO for their tester. Additional standards at the fine-grain end will be obtained to complete this work. All testers at both sites will be set on these standards with NLO testers set for rejecting a slightly narrower range than HAP0 testers.

Irradiated Fuels Tester - UT11

Testing of 480 bumper fuel elements has begun after an extended inoperative period due to manpower shortage and vacation scheduling. These elements are being mapped and will provide an evaluation test of system performance.

Reactor Testing

Ultrasonic Detection of Hydriding in Zircaloy Process Tubes

A complete prototype readout system has been developed for further test evaluation. Pulse time shift is utilized to provide coincidence at various hydride levels using variable delay lines. It is necessary to vary the delay for different amounts of cold work in the process tubes. A program of checking numerous samples is being started to determine if there are variations within the tubes which cannot be differentiated from hydriding. Circuit optimization for reliability and stability will not be started until the evaluation tests of the method are complete.

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HW-78805

N-REACTOR FUELS OPERATION AUGUST 1963

TRIPS

<u>Name</u>	<u>Company</u>	<u>Contact</u>	<u>Date</u>	<u>Purpose</u>
C. J. Volmer	GE, Schenectady	Mr. Ohmart	8/22-23/63	Tour plant and Manufacturing Engineering Services.
	GE, Crotonville	Bill Short	8/25-30/63	Attend conference, "Methods & Work Measurements".
T. D. Naylor	Bridgeport Brass Co. Ashtabula, Ohio	J. F. Puterbaugh	8/26-27/63	Monitor primary extrusions; plan tests for NPR billet improvement.
	National Lead Co. Cincinnati, Ohio	G. K. Stearns	8/28-30/63	Same as above.
W. R. Krehbiel	Bridgeport Brass Ashtabula, Ohio	J. F. Puterbaugh	8/27/63	Uranium Primary Operation.
	National Lead Cincinnati, Ohio	Paul McCreery	8/28/63	Final inspection procedures.
	GE, New York	W. J. Masser	8/21-30/63	Quality system appraisal for N-Fuels.

VISITORS

Fred Walls	Consolidated Electrodynamics Corporation, Palo Alto, Calif.	D. C. Lehfeldt	8/15/63	Check out new leak detector purchased on P.O. HA-63-888-3225.
R.A. Graham K.W. Bird	Wah Chang, Albany	D. W. Darsow H. P. Kraemer	8/29/63	Discuss support fabrication.

ORGANIZATIONAL AND PERSONNEL

	<u>7/31/63</u>	<u>8/31/63</u>	
Exempt	57	58**	
Nonexempt	115	123	
	172	181	
			Tech Grads Assigned to N-Reactor Fuels Section - <u>4</u>

Transfers

<u>Name</u>	<u>From</u>	<u>To</u>	<u>Effective Date</u>
J.T. Adams (Nonexempt)*	IPD	Quality Control	8/5/63
F. Benson (Nonexempt)*	"	Manufacturing	"
D.E. DeWitt (Nonexempt)	Product Engineering	HL	8/19/63

*Temporary transfers for 90 days.

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

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HW-78805

Transfers

<u>Name</u>	<u>From</u>	<u>To</u>	<u>Effective Date</u>
S. T. Field (Tech Grad)	N-Fuels Product Engineering	Rotation	8/1/63
G. C. Gardner* (Nonexempt)	IPD	Manufacturing	8/5/63
J. L. Guthrie (Exempt)	N-Fuels Product Engineering	Leave of Absence	8/30/63
E. L. Houchin * (Nonexempt)	IPD	Quality Control	8/5/63
F. A. Laird * (Nonexempt)	IPD	Manufacturing	8/5/63
N. D. Merrill* (Nonexempt)	IPD	Manufacturing	8/5/63
D. H. Milicia* (Nonexempt)	IPD	Manufacturing	8/5/63
R. J. Mohr * (Nonexempt)	IPD	Quality Control	8/5/63
S. E. Richardson* (Nonexempt)	IPD	Quality Control	8/5/63
J. F. Riley* (Nonexempt)	IPD	Manufacturing	8/5/63
R. J. Welch (Nonexempt)	IPD	Manufacturing	8/5/63

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 August, 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.

SIGNIFICANT REPORTS

<u>HW Number</u>	<u>Classification</u>	<u>Author</u>	<u>Date</u>	<u>Title</u>
HW-78530	Unclassified	D. H. Walker	8/2/63	Gage Audit and Calibration System
HW-78455	Unclassified	D. H. Walker	8/2/63	Measurement Error - Coextrusion Shop - Pre-Mill Inspection - 2nd Quarter, 1963
HW-78153	Unclassified	C. N. Jackson	7/9/63	Als1 Fuel Enrichment Tester - ERT-1

*Temporary transfers for 90 days.

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HW-78805

<u>HW Number</u>	<u>Classification</u>	<u>Author</u>	<u>Date</u>	<u>Title</u>
HW-78622	Confidential	J. P. Keenan C. B. Ruhter	8/12/63	A Description of the Fuel Assembly Process
HW-78642 RD	Confidential	R. K. Robinson	8/14/63	A Critical Review of The NPR Fuel Element Autoclave Cycle
HW-78762	Confidential	R. G. Curran	8/27/63	Summary of Inner Tube Unbond Problem for Period From November 26, 1962 to Date
HW-78707	Confidential	T. D. Naylor	8/23/63	Phosphorus Contamination in NPR Fuel Material
HW-78971	Confidential	J. P. Keenan	8/26/63	General Requirements for an Improved Outer Support

SECURITY VIOLATIONS

There was one security violation in the N-Reactor Fuels Operation during August.
Total CYTD - 8.

Manager - N-Reactor Fuels

IM Loeb:pml

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DECLASSIFIEDRESEARCH AND ENGINEERING1. ADVANCE TECHNOLOGY

At the request of the AEC, a special product study including additional data for intermediate range tritium production capability in N-Reactor was made. Specifically, the study presented cost and production data for a mode of operation that produced about five kilograms of tritium annually under two assumptions, namely:

1. the by-product plutonium was weapon grade (6% Pu-240 content), and
2. the operating conditions were established for minimum unit costs.

A letter presenting the results of this study was transmitted to the AEC, (HW-78671, "Special Product Study - N-Reactor," R. L. Dickeman, August 16, 1963.)

A report is being prepared that presents a proposal for adaption of N-Reactor to the concurrent production of weapons grade plutonium and significant quantities of tritium. It is proposed that the first full pile loading of co-producer fuel elements will be charged starting January 1, 1967. It is also considered that a portion of the 1.25% U-235 enriched uranium, being procured as a spike enrichment material, could be used for prototypical demonstration of the co-producer fuel design.

2. REACTOR ENGINEERING

Work is continuing towards preparation of technical bases for establishment of operating limits for the individual process tube. Accomplishments made thus far have indicated that the coolant channel flow split and surface heat flux distribution in the tube-in-tube fuel geometry may have a critical bearing on the maximum feasible operating power for a process tube, as limited by non-boiling criteria under current rear riser pressure limitations. This situation is due to an imbalance of channel coolant enthalpy rise, primarily created by variation of heat flux among the various fuel surfaces. The large relative heat flux at the inner surface of the inner fuel cylinder makes the center flow channel critical with respect to boiling potential.

Up to the present time there has been only a limited verification of heat and flow splits in the current fuel design determined by analytical methods. In the absence of thoroughly reliable data of this nature, conformance with non-boiling criteria would necessitate establishment of operating limits

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that may be unduly restrictive. Thus effort is now being directed towards obtaining experimental data for comparison with analytical results. A study of data from thermocouple measurements in KER-3 has indicated that future experiments in KER may yield data sufficiently accurate for heat split comparisons, following refinement of instrumentation and instrument calibration techniques to suit the purpose. The possibility of use of the NPR-PCE Full Scale Facility in the 189-D Equipment Laboratory to determine flow splits is being explored.

Pressure drop data have been obtained from tests of fuel element spacers incorporating the recent design change made to eliminate variation of pressure drop caused by change in radial orientation of the spacers. These data have indicated a significant reduction in the variation of the pressure drop with radial orientation. For some reason mean pressure drop obtained with the revised fuel element spacers is slightly higher than that obtained with the original design. No theoretical reason for this is apparent; however, the increase in pressure drop is not believed significant.

An analysis has been started by Reactor Design Analysis, N-Reactor Project Section, to evaluate the adequacy of the emergency water supply to the 105-N and 109-N confinement fog spray systems and to investigate the necessity for tests of the systems to demonstrate adequacy and operability. Basic data for use in the analysis will be provided through separate tests of the four different types of spray nozzles installed in the systems. The testing will be performed under the title of Design Test 1188 by Equipment Laboratory Testing, Irradiation Processing Department, and will be aimed towards determination of discharge characteristics of the nozzles and minimum supply pressures required for satisfactory performance. Preparations for testing were begun on August 30, 1963.

3. REACTOR PHYSICS

The work to establish and document methods and specifications for the startup lattice physics experiments is approximately 50 percent complete.

Work on the design and selection of detector shapes and locations is underway. Pins and sector foils will be employed as has been done in the past in Hanford Laboratories experiments.

Work to define the hazards associated with startup physics tests is now in the final stages. The consequences of excursion during startup and equilibrium testing conditions have been investigated assuming the rod system failed to scram and the Ball 3X System terminated the excursion. As was expected, coolant boiling occurred in many cases due primarily to the reduced coolant flow which is used during the tests.

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The cases analyzed were identical to those analyzed using rod scrams as the termination mechanism. These were startup and just critical power levels with unpressurized, 20 C inlet temperature coolant or pressurized 273 C inlet temperature coolant.

The maximum credible positive reactivity ramps expected during all phases of the testing program would result from control rod withdrawal accidents. The largest of these would probably not exceed 1.5 mk/sec. In all cases the excursions would not result in fuel melting for ramps at least as large as 1.5 mk/sec even assuming that all heat transfer between fuel and coolant ceases upon reaching the coolant boiling point. Therefore, the ball system will satisfy the speed-of-control criterion of prevention of fuel melting after any credible accident.

Design Analysis, Hanford Laboratories, has begun work on the preparation, accomplishment and interpretation of a series of experimental gamma and neutron traverses throughout the N-Reactor shield plug. It is anticipated that this work will cost about \$15,000.

A set of physics parameters for N and K Reactors, which were on a consistent basis for comparison purposes, was generated in cooperation with R. Nilson, Research and Engineering Section, Irradiation Processing Department. These are published under separate cover in HW-78547.

The document describing the FLEX 2 computer code is currently being reviewed. Three additional program errors in FLEX 2 were uncovered and corrected. Two of the errors pertained to oxide fuel and the other to Xe concentrations in the green reactor.

Recent physics studies of the single tube fuel element concept have been restricted to conditions conforming to expected NPR Phase II operating conditions. At a given power level of operation, heat flux values, as well as clad and fuel temperatures, are higher for the single tube element than for the tube-in-tube fuel. These conditions, however, can be noticeably improved by introducing a "flow spacer" into the center of the fuel, while retaining the same relationship between the temperature increases in the two coolant channels. For a given weight of fuel per foot of element, this provides more heat removal surface and a thinner fuel region. For fuel weights of 20 and 24 lb/ft for example, insertion of a flow spacer may lower the maximum fuel temperature by as much as 50 to 100 degrees C. Although data on the temperature coefficients for single tubes with flow spacers is not yet complete, marked differences have been noted between the graphite and water coefficients for single tubes with spacers and those for tubes without spacers. The calculated values of the water temperature coefficient for the 20 lb/ft element with flow spacer is approximately three times larger (more negative) than that of the 20 lb/ft element without flow spacer. Fuel temperature coefficients calculated to date are nearly equal for the same fuel weight.

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HW-78805

Estimates have been made of the rate of heat generation in a Np-237 target element inserted into an N process tube from nuclear processes originating in that tube. The target element considered contained Np-237 O₂ with approximately 35 grams Np-237 per foot of element. It was assumed to be irradiated under flux trap conditions. The following processes were considered, and the energy per event is shown at the right:

a. Neutron capture in Np-237	(5.05 Mev)
b. Beta decay of Np-238	(1.42 Mev)
c. Neutron capture in Pu-238	(5.71 Mev)
d. Fission of Pu-238	(200.0 Mev)
e. Neutron capture in Pu-239	(6.42 Mev)
f. Fission of Pu-239	(200.0 Mev)

Reaction rates were calculated and heat generation rates derived. From these results, a reasonable value indicated for the heat generation in the specified target element is approximately ten percent of that for a normal fuel element.

4. CONTROLS, INSTRUMENTS AND SYSTEMS ANALYSIS

A preliminary criteria document outlining the process tube characteristics to be monitored has been issued, and a systems specification for the Process Tube Monitor System is being generated. Proposed characteristics to be monitored are:

- a. Visual monitoring of internal tube wall defects
- b. Depth of wall defects
- c. Inner diameter (horizontal and vertical)
- d. Hydriding

The proposed probe design includes a rotatable depth gauge, followed by television camera; linear variable differential transformers for I.D. measurement, and eddy current head employing two frequencies for measuring hydriding.

The process tube will be dry during monitoring. Water inlet and outlet lines will be blocked with sleeves or plugs interlocked with the nozzle cap so that they cannot be left installed after monitoring is finished.

A drive under study includes a semi-rigid rod attached to the probe and driven from a drive device mounted on C elevator. The rod will back out into a monotube held on the W elevator.

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HW-78805

A study to determine the feasibility of using the statistical fluctuation in flux detector outputs to measure *e/B* is nearing completion and a report is being prepared on reactor noise measurements in large reactors. Another report will follow with cost and accuracy estimates for measurements on the N-Reactor.

Rod oscillator and pulsed neutron techniques are also being investigated as part of the noise analysis program. The analyses of these two techniques are not too different if reactivity changes are kept small. The rod oscillator constitutes a changing neutron sink and hence the same equation should hold for rod oscillators and neutron sources.

The time delays through the cleanup heat exchangers of the KER test loops are in the order of two minutes, thereby causing the lack of N-16 gamma peaks in the water sample. Repiping and addition of a small heat exchanger are being expedited to provide the 30 to 80 second delay which is needed for efficient operation of the fuel rupture monitor.

A uranium corrosion rate test has been performed in the N-Reactor pH water conditions at various temperatures to determine the size fuel sample to be used in the calibration tests during Phase II of the program.

Mathematical development of the steam generator model has been completed. Scheduling of the steam generator for analog simulation has been delayed because analog computer personnel are involved in another analog study which has taken considerably more time than expected.

Based on reactivity transient studies, the recommended trip levels of the bulk outlet temperature detectors and the nuclear instrumentation trip levels have been specified. Draft copies of these technical bases have been issued to other areas of Research and Engineering for comment.

The proposed interface level indicator system to be installed in one heat exchanger for calibration purposes by Bailey Meter Company was reviewed. An electrical probe method by Fisher Company is also being studied.

A digital program is being prepared to statistically separate the total reactivity change into graphite and water coolant effects. An input data routine has been written to be compatible with a regression analysis program, "Simple George."

Assistance was provided Design Engineering, N-Reactor Project Section, in the modification of the specifications for the chromatograph for the Reactor Gas System instrumentation. Assistance was given Field Engineering, N-Reactor Project Section, in the area of Rupture Monitor Sample Valves and the Gross Monitor Interconnections.

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5. CHEMISTRY AND METALLURGY

The third charge of N fuel element assemblies being irradiated in the KER loops reached an exposure of 953 MWD/T on August 16, 1963. A fourth charge reached 592 MWD/T that same date.

The prototype (tritium production) target element test in KER-1 was discharged at a gas volume ratio (GVR) of 8 during the August 22 outage. The next test in KER-1 will be an evaluation of the post-decontamination cruding characteristics of coolant containing NH_4OH for pH control. The prototype (tritium production) target element test in KER-2 is also at an exposure of GVR of 8. Goal exposure of GVR of 20 is expected during December.

6. PROCESS EVALUATION AND CONTROL

All major physics startup instrumentation equipment has or is being shipped except the scaler-timer-printer package. The vendor indicated in late August that the promised delivery date for the latter item could not be met. Shipment of a manual control system by mid-September, (on loan), was proposed by the vendor with shipment of the automatic system about December 1, 1963. The AEC has been requested to expedite this procurement. The worst consequences of this delay would be:

- a. increased physics crew manpower by three per shift and about \$25,000 additional wages.
- b. extension of test time about two days.

The final issue of the physics test scope document is being completed and will be circulated for signatures next week.

The documentation for the physics test details document is approximately 35 percent complete.

A comment letter detailing the proposed physics process support has been issued. The scope will shortly be finalized. Work is progressing on revised xenon tables and equilibrium control rod patterns.

A complete review of the N-Reactor nuclear safety and safeguards status was presented to the Advisory Committee on Reactor Safeguards on August 14 and 15, 1963.

SIGNIFICANT REPORTS ISSUED

HW-78192, "Loss of Electrical Power to 100-N Area on June 3, 1963," by J. R. Bolliger, July 9, 1963 (Unclassified).

HW-78294, "N-Reactor Hazards Summary Report - Supplement No. 1," Edited by R. E. Trumble, August 10, 1963 (Secret).

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HW-78805

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

HW-78698, "N-Reactor Operational Safety Review," Edited by R. E. Trumble, August 19, 1963, (Unclassified).

TRIPS

<u>Name</u>	<u>Firm & Location</u>	<u>Date</u>	<u>Purpose</u>
R.W. Benoliel	General Electric New York City	August 6-9	Discussion of Laboratory functions
J.R. Bolliger	General Electric San Jose, California	August 19	Discuss nuclear instrumentation
G.H. Strong	Spokane, Washington	August 26-27	Attend AIEE meeting
D.H. Curtiss	New York, New York	August 26-29	Attend International Conference on Creep

VISITORS

None

PERSONNEL

Additions

<u>Name</u>	<u>From</u>	<u>To</u>	<u>Date</u>
F.O. McBarron	IPD, Manufacturing	Advance Technology	8-5-63
D.L. Renberger	IPD, Research & Engrg.	Process Evaluation and Control	8-15-63

Transfers

M.H. Barron	NRD, Research & Eng'g	NRD, N-Reactor Project	8-5-63
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SECURITY VIOLATIONS

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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 August, 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.

Manager
Research and Engineering

MC Leverett:LCC:vb

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N-REACTOR PROJECTPROCESS DESIGN OPERATIONProcess Research and Development

A computer program has been completed for calculating fog spray performance. The program is intended as an aid in determining the minimum amount of fog spray required.

An analysis was made of the actuation controls which operate the reactor emergency cooling water valves (V-3 and V-4). It was determined that the system would not respond as required if only one of the two identical master actuation circuits sensed a need for emergency cooling. Minor modifications to the circuitry have been initiated to correct the problem.

An analysis of the operating characteristics of the standby boiler has been made to determine the necessity for maintaining backup electrical power supply in the event of loss of the primary electrical supply. It was determined that the standby boiler can satisfactorily sustain the transient stresses during a rapid shutdown following the complete loss of electrical power.

A study has been completed which develops methods to estimate primary loop flows and temperatures and corresponding secondary steam pressures as a function of fuel element pressure drops. The purpose is to enable the designer of future fuel elements to be reasonably sure that the elements being considered meet the thermodynamic requirements of N-Reactor operation.

Previous estimates of secondary loop radiation levels, based on comparative ratios with Dresden levels, have been compared with current calculations based on shielding analyses of the various pieces of equipment. The agreement has been good; however, there are still areas where additional data will be of value. For example, the Shippingport plant could be an important source of information in the analysis of radiation levels in the condenser air ejectors.

Conversion

A study of N-Reactor operating pressure requirements has verified the attainability of Phase II six-loop operating conditions necessary for 150 psia secondary steam generation. The effect of the fuel element center tube power split appears at this time to cause a slight limitation at the Phase II five-loop operating conditions. The calculations will be refined as additional fuel element testing data become available.

Project CAI-816Gas System Instrumentation

Two design deviations have been granted Beckman Instrument Company, supplier of the gas chromatographs in the pile gas instrumentation system. The originally specified accuracy of $\pm \frac{1}{2}$ per cent has been changed to ± 1 per cent for compatibility with the equipment as it is now installed. Delivery of replacement equipment would require at least another year. Also, in lieu of the originally specified continuously adjustable range, Beckman has been authorized to provide a dual range which is essentially equivalent. By manual range selection, the proper attenuation can be obtained for direct readout. Calibration gases for both ranges will be provided.

Confinement

Calculations have indicated that the maximum allowable confinement pressure of 5.0 psig for Zone I of the 105-N Building can be increased to 6.2 psig based on a 33-1/3 per cent increase in design stresses for steel and concrete. The ultimate permissible pressure is around 7.3 psig, at which point some minor buckling of certain truss diagonals and minor cracking of concrete are anticipated. Damage caused to the building structure by a peak pressure of around 7 psig of short duration, say less than two seconds, is expected to be tolerable. The elastomeric coating on the inside surfaces of the Zone I confiner should still be intact after such a pressure surge.

Charging Machine

Following the transfer of the charging machine to 105-N, a mock-up charging test facility was placed in operation at the 314 Laboratory on August 19, 1963. A prototypical eccentric magazine adapter with a full polyethylene insert was tested to determine the effectiveness of the adapter design in minimizing fuel element support deformation. In order to eliminate the effect of the nozzle-to-tube joint for test purposes, the adapter was coupled directly to a 2.7-inch ID magazine serving as the receiving tube. A 2.9-inch ID magazine with the tapered end removed was used at the charging end.

A column of fuel was charged through the above setup at a 1500-pound column force. No significant surface damage was observed and no deformation over 0.006 inch was determined. A second fuel column was charged at 1900 pounds, and the results were essentially as favorable as at 1500 pounds.

Subject to confirmation by additional testing, the prototypical magazine adapter appears to have raised the threshold of charging force from 800 pounds to over 1500 pounds without resulting in appreciable fuel element support deformation.

Review of Supports for Primary Piping

Computer analyses of Cell No. 5 piping by the Electric Boat Division of General Dynamics have indicated that certain supports in the 109 Building are overloaded and this condition can be corrected by providing an additional spring hanger at the trunnion supports for each PCR line where it penetrates the cell walls. This problem has been discussed with Burns and Roe engineers. Electric Boat has been instructed to perform a thermal analysis of Cell No. 2 piping, where the piping near the trunnion is stiffer than in the other cells, to verify that loads are satisfactory when a spring hanger is provided at the trunnion support.

Approval for computer studies by General Electric Advanced Technology Laboratories of a primary piping loop and a connector loop in the 105-N Building was made on August 14, 1963. The object of this program is to confirm methods and results obtained during Electric Boat's dynamic analyses and earthquake studies.

Connector Interference

A design review has been made of a field interference between the center column of connectors and the thermo-barrier bracket at the corners of the reactor. The stress distribution data were studied on the basis of no clearance at 70F, and the allowable limits were found to be exceeded in the connector at operating temperatures. The conclusions were confirmed by Electric Boat calculations. The problem is being corrected by relocation of the thermo-barrier brackets to clear the connector piping by an adequate margin.

Ball and Vacuum Systems

Procurement has been initiated to obtain a replacement set of top works for each of seven valves in the Ball 3X and vacuum system piping. The new top works will be spring-loaded to close on loss of control air in order to provide a fail-safe seal for Zone I confinement.

Equipment Development and Testing

The Environmental Test Facility at 189-D was shut down on August 21, 1963, to permit resumption of operation of the Component Test Loop for continued prototype testing of the RV-2 relief valve assembly. Up to this latest shut-down date, the Environmental Test Facility accumulated 152 days of operation at pressure and temperature (1700-1800 psig and 580-585F). Rolled joints, Grayloc couplings, inlet valves and venturis have all been exposed to this length of testing. Three production diversion valves, installed in July, 1963, have accumulated 348 hours at steady-state conditions of pressure and temperature and have experienced 16 thermal cycles between 585F and below 150F. All three diversion valves exhibited LiOH deposits in the vicinity of the packing glands, indicating some leakage at pressure and temperature. When cold and pressurized, the valve packing leakage was determined to be not greater than four drops per minute. Timing checks on diversion valve actuation have revealed smooth and satisfactory operation. Six production nozzle caps installed have accumulated 392 hours of steady-state conditions and the same temperature cycle conditions as the diversion valves, exhibiting slight leakage after this exposure. Checks are to be made on bolt tightening torque to determine if the testing conditions tended to reduce the loading on the cap gaskets.

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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.

Zone Temperature Monitor System	8/19/63
Seismoscope System	8/19/63
Reactor Thermocouple System	8/19/63
Area II and III Heating and Ventilation Systems	8/26/63

Air balancing of the Zone IV H and V System was started August 6, 1963. Initial balance is about 80 per cent complete.

As of August 18th, the installation of wire and cable was 95 per cent complete. On the same date termination of conductors was 78 per cent complete.

Approximately 32 per cent of the electrical conductor penetrations in Zones I and II have been sealed and tested. Zone I external seals are 72 per cent complete.

General Electric personnel are proceeding with the 109-N H and V System instrumentation calibration.

Fifty-eight per cent of Bailey Meter panel terminations have been made.

All Hoke valve stem assemblies for the Rupture Monitoring System have been received and replacement is complete on the right side valve racks. Adjustments are being made at the direction of the vendor's representative.

Installation and testing of Zone Temperature RTD's has been completed.

Installation of outlet temperature strap-on RTD's is continuing.

Shield cooling thermocouples are being installed on the outlet face of the unit.

117-N Building

The installation of roof insulation has been started.

1310-N Facility

The installation of the 4" export line is complete to the valve box. The 24" and 10" fill lines between the pump house and waste storage tank have been installed. The waste storage tank is complete and

bedded in vermiculite concrete except for the access blackout.

181-N Building

The test run of the 181-N No. 2 motor has been completed and the motor is now in use.

182-N Building

Material delivery is holding up completion of latest wiring revisions.

A new membrane for the AHR storage tank has been ordered. The design has been modified by the addition of a venting hose on the top of the membrane.

163-N and 183-N Buildings

Bumstead-Woolford is producing, on a continuing basis, 1000 to 1500 GPM of quality water for construction purposes, but is still experiencing problems in transferring resin. General Electric plant operators assumed operation of this facility under Bumstead-Woolford direction on August 12, 1963.

184-N Building

The Foster-Wheeler Test Engineer has adjusted the burners on the boiler and a preliminary heat level run was conducted September 3, 1963, when the boiler was operated up to 500,000#/hr before being shut down due to high stack temperature. Additional adjustments will be necessary to meet the 575,000#/hr requirement.

1900-N Outside Lines

The fire loop has been completed with the exception of two hydrants, has been hydrostatically tested and is now in use.

1300-N Emergency Dump Basin

The overflow piping from the basin to the outfall structure has been completed. The foundation for the basin is in place and the outer wall bases are being placed.

Primary Piping

Hydrostatic testing was completed on the 105 Primary Loop Piping System and the primary loop piping in the 109 pipe gallery and cells 1, 2 and 5 during the reporting period.

Chemical flushing was performed in cell 5 and the left side of the 105 primary loop on August 23d and 24th. Chemical flushing was

initiated for Cell 1 and the right side piping on September 3d.

Chemical cleaning of the 109 Secondary Piping System is scheduled for September 23d. Preparations for this work have been essentially completed.

The majority of the 109 Secondary Piping System was hydrostatically tested during the reporting period.

Pile Erection

Installation work and hydrostatic testing has been completed on the horizontal rod assemblies and functional testing has been initiated. The hydrostatic testing of the primary loop indicated 24 leaking Grayloc couplings. These were successfully repaired. The Pile Gas System has been completed and operational testing was initiated September 3, 1963. Contractor testing on all the hydraulic elevators in the 105 Building has been initiated. The electrical check-out of the Ball 3-X System has been completed and functional testing of the system has been initiated.

NPR Testing Program

During the report period, three additional test procedures were issued for comment, three were issued as approved and actual testing of four systems was initiated.

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

Total Number of Pre-Critical Tests	38
Scoped	37
Issued for Comment	28
Issued as Approved	18
Tests Started	10
Tests Completed	4

	<u>Preparation</u>		<u>Performance</u>	
	<u>Scheduled</u>	<u>Actual</u>	<u>Scheduled</u>	<u>Actual</u>
This Month	78.0%	56.4%	12.0%	6.7%
Last Month	73.0%	51.0%	18.5%	4.5%

*Scheduled performance revised to conform to latest official target schedule (SK-1-27854, dated July 23, 1963).

Steam Generators

The four steam generator units in cells 1 and 5 have been found relatively free of deleterious defects and will be placed in service.

Eddy current examination on a 100 per cent tube sample has been completed in unit 2A. The data show that 16 per cent of the tubes contain intergranular defects penetrating 80 per cent or more of the tube wall thickness. Hydro testing of this unit revealed no leakage. Steam generator 2A will be placed in service for operational testing without plugging of the affected tubes.

Eddy current examination on a 100 per cent tube sample is currently under way in unit 4A. Data to date show that over 50 per cent of the tubes contain intergranular defects penetrating 80 per cent or more of the tubing wall thickness.

Preparations are now under way for start of repair of unit 3B which is affected by stress corrosion cracking in the tube mouth area. The repair will consist of sleeving the tube mouth area.

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. The AEC July Cost Report and Estimate to Complete shows an indicated cost of \$192,820,000, which includes \$3,500,000 contingency.

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.

The construction status as of September 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	93	96
General Area Systems	96	96.6
105-N Reactor Building	94	98.2
109-N Heat Exchanger Building	92	94.5
163N-183N Water Treat. Facilities	100	99.7
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)	94	96.8

RESPONSIBILITY

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

ORGANIZATION AND PERSONNEL

	<u>7-31-63</u>	<u>8-31-63</u>
<u>Exempt</u>		
Permanent	94	93
Summer Professor	1	1
Tech. Grads.	1	2
<u>Nonexempt</u>	<u>24</u>	<u>26</u>
<u>Total Personnel</u>	120	122

Personnel Changes

<u>Name</u>	<u>From</u>	<u>To</u>	<u>Effective Date</u>
RW Steffens (Tech.Grad.)	IPD/Equip. Dev.	Process Design	8-1-63
CC Hayes (nonexempt)	IPD	Draw., Spec., & Mat'l. Control	8-5-63
TD McCall (nonexempt)	New Hire	" " "	8-5-63
M Barron (nonexempt)	NRD-Res. & Eng'g.	N-Reactor Project	8-5-63
DW Getz (nonexempt)	Draw., Spec., & Mat'l. Control	IPD	8-12-63
DB Richardson (nonexempt)	" "	NRD, N-R Plant	8-12-63
RB Stewart (nonexempt)	New Hire	N-Reactor Project	8-21-63
J Scherger (exempt)	Field Engineerin	Terminate	8-30-63

SAFETY AND SECURITY

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

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.

VISITORS

<u>Name</u>	<u>Firm and Location</u>	<u>Date</u>	<u>Purpose</u>
Zahu, R	Rush Drake & Associates Seattle, Washington	7-21-63	Discuss strain gage system switching devices
Legas, E	Chicago Pneumatic Seattle, Washington	8-1-63	Discuss aspects of air-driven automatic nozzle cap wrench
David, HT Wurster, DE	Bailey Meter Company Wickliffe, Ohio	8-5 to 8-9-63	Present final comments on ATP-2420
Pulsifer, DD	Air Reduction Co. Seattle, Washington	8-20-63	Discuss design requirements for the hydrogen storage facility
Bucalo, B	Burns and Roe, Inc. Hempstead, N. Y.	8-23-63	Review the recently completed computer analysis of the primary piping support system

TRIPS

Strand, NO	Combustion Engineering Chattanooga, Tennessee	8-15 & 8-16-63	Review repair methods for 3B steam generator
Dowis, WJ	AEC Division of Production Washington, D. C.	8-19 to 8-22-63	Production studies.
	IEEE Conference Spokane, Washington	8-27-63	Present paper
Kratz, EM	Bonneville Power Admin. Portland, Oregon	8-12 & 8-13-63	N Reactor Conversion

TRIPS

<u>Name</u>	<u>Firm and Location</u>	<u>Date</u>	<u>Purpose</u>
Richards, WA	Burns and Roe, Inc. Hempstead, New York	7-8 and 7-9-63	To discuss conversion problems.
	Bailey Meter Company Wickliffe, Ohio	7-10-63	Conversion and NPR instrumentation.
	Scam Skokie, Illinois	7-11-63	Conversion - Equipment alteration.
Fastabend, JH	Gray Tool Company Houston, Texas	8-5-63	Acceptance of 6" clamp retainers.
	Bruce Industries Gardena, California	8-6-63	Evaluation of rejected nozzle caps.
	Microdot, Inc. South Pasadena, Calif.	8-7-63	Discuss high-temperature strain gage system for N primary piping.
Bainard, WD	Beckman Instrument Co. Fullerton, California	8-12 to 8-14-63	Review and approve drawings for the Hot Water Quality Laboratory instrumentation package.
Bollinger, RK	GE-APED San Jose, California	8-20-63	Discuss technical details and delivery prospects on ion chambers.
Swezea, GL	IEEE Annual Meeting Spokane, Washington	8-26 and 8-27-63	To present technical paper.
Hoffman, RH	IEEE Annual Meeting Spokane, Washington	8-26 and 8-27-63	To present technical paper.

SIGNIFICANT REPORTS ISSUED

HW-78258	Unclassified	NO Strand, SH Bush LJ Chockie, AP Larrick	7-16-63	Steam Generator Examination Program
HW-78258A	Unclassified	GT Haugland	8-9-63	Steam Generator Examination Program Interim Rpt. 2-Program Outline
HW-78650	Secret-Red Label	WJ Dowis, LW Lang	8-16-63	K and N Reactor Capabilities
HW-78591	Unclassified	WJ Dowis	8-27-63	Dual Purpose vs. Single Purpose Nuclear Plants for Sea Water Distillation
HW-78761	Unclassified	WJ Dowis	8-27-63	Relationship Between Cost of Heat and Cost of Distilled Water

SIGNIFICANT REPORTS ISSUED

HW-76671	Unclassified	HR Kosmata	8-12-63	Reactor Conversion Design Criteria - Sectionalizing of the Secondary Coolant System
HW-77195	Confidential	FJ Mollerus, Jr.	8-6-63	N-Reactor Conversion Project Engineering Studies of Secondary Cooling System Performance During Phase II Operation
HW-78171	--	JF Nesbitt	8-19-63	Scope Study - Special Irradiated N-Reactor Fuel Handling Facilities
HW-78172	--	JF Nesbitt	8-19-63	Design Criteria - Special Irradiated N-Reactor Fuel Handling Facilities
HW-78196	Confidential	DD Stepnewski	8-23-63	N-Reactor Secondary Loop Contamination
HW-78647	Confidential	RK Robinson	8-21-63	A Method to Rapidly Estimate 6-Loop, N-Reactor Performance for Various Fuel Element Designs
HW-78652	Secret	GF Bailey	8-13-63	Calculated N-Reactor Physics Parameters

Manager, N-Reactor Project

JS McMahon:mbs

N REACTOR PLANT OPERATIONN PROCESSING OPERATION

The inboard bearing on the No. 1 forced draft fan at 184 Building failed on August 1. It was replaced and returned to service on August 2.

During a load test of the turbo-generator on August 2, the maximum output was limited to 12.5 megawatts instead of 15 megawatts normal rating. It appears that some adjustment in the surge governor mechanism is required so the proper generator output may be achieved.

On August 20, while the area feed was being supplied from the D tie-line a power failure occurred when one of the 2000 horsepower high pressure injection pumps was started at 182. We met with Electrical Distribution following this failure and worked out a closer control procedure with them to avoid any power loss when starting heavy equipment in the future.

Phase I Certification Training has been completed for Groups I and II and starts for Group III September 3. Phase II Certification Training has been completed for Group I and starts for Group II September 3. A one week and a four week Orientation Course are ready for presentation if required to new people who arrive in the area in the future.

Operating procedure preparation continued during the month. One procedure draft was completed and 11 other drafts are in progress. The work location safety rules for the entire 105-109 Building are now 90% complete. As an aid to easier procedure writing a master sequential mode chart is being made giving the complete startup and shutdown procedures.

Ten subsections of Systems Description Manual Section 21 were issued during the month and six other subsections have been completed and are currently in Printing.

Operation test performance is 6.7% complete as compared to 12% scheduled for completion. Six tests are currently in progress.

Test procedure preparation is 56.4% complete as compared to 78% scheduled for completion.

N PLANNING AND SCHEDULING

The definition for N Planning and Scheduling data processing was finalized and the programming continued.

The Flexowriter-Keypunch combination equipment was received. Orders for all other P&S equipment including the Collector-Accumulators are placed.

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HW-78805

Testing of the report generation programs has been performed by EDPO with good results. The guide for operating procedure generation was revised and reissued.

A purchase order for No. 6 fuel oil requirements through December 31 for an estimated quantity of ten million gallons was processed.

We have not yet received the initial shipment of fuel spacer dummies needed for monotube testing. Delivery was to have been September 9 but has been changed to September 13.

Listing of equipment in place is approximately 90% completed.

A purchase order for four new beta-gamma hand and foot counters was issued August 15.

Interim scheduling, critical path updating, training of radiation monitors and participation in NRD Data Processing task force activities were continued as scheduled.

N MAINTENANCE OPERATION

Approximately 223 Maintenance Procedures have been completed to date. Re-evaluation is being made to determine the balance of procedures required to cover fuel loading conditions.

We completed the moving of stocks of tools (procured from surplus) from the minor construction warehouse to 105-N tool crib, acquired and moved two truck loads of tools and equipment from Kaiser Engineers' warehouse to the 105-N tool crib and initiated the moving of shelving from Kaiser Engineers to the 105-N warehouse. We intensified the effort to borrow and rent additional test equipment from other sources and acquired some additional tools and heavy equipment (radial drill) from Excess.

The preparation of stock adjustment request documents was continued but the effort was limited by manpower applied to solution of immediate spare parts problems resulting from operation of accepted facilities and routine maintenance and repair.

Special engineering maintenance services included elevator inspection as a service to Project Section, technical consultation on a wide variety of subjects as a service to Operations, Maintenance and Project Section personnel and review of installed pressure vessels to assure code compliance, etc.

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HW-78805

Accepted facilities including 184 powerhouse, 183 and 182 Buildings, created sufficient routine maintenance problems to absorb most of the time of four mechanical craftsmen and three or four instrument technicians and electrical journeyman. This level of activity may be expected to increase as we convert facilities to operational status in support of testing and calibration work.

Maintenance craftsmen were provided in support of the test program and very nearly the entire crew of 44 electrical and instrument craftsmen was applied to preparation for, or actual performance of, work related to the calibration program. Serious interference with the progress of this program has resulted from difficulties in obtaining release of systems for calibration, and because of the jurisdictional problems constantly arising between the construction forces and plant forces craft groups where custody agreements are in force.

The special training program for electricians was completed by five electrical personnel during the month. Ten more are due to complete during October.

The instrument technicians and electrical journeymen were divided into four numerically designated crews each with a supervisor. All are continuing to work day shift in support of calibration and test programs for the next several months.

SIGNIFICANT REPORTS ISSUED

None

TRIPS

<u>Name</u>	<u>Location</u>	<u>Date</u>	<u>Purpose</u>
H. A. Carlberg	San Francisco	8/20-22	WesCon Meeting of IEEE

VISITORS

<u>Name</u>	<u>Firm & Location</u>	<u>Date</u>	<u>Purpose</u>
D. D. Pulsifer	Air Reduction Pacific Seattle, Washington	8/19	Prospective Bulk Hydrogen Vendor.

PERSONNEL

<u>Additions</u>	<u>From</u>	<u>TO</u>	<u>Date</u>
D. B. Richardson	Project Section	Plant Maintenance	8/12/63
T. K. Andrews	CPD	Planning & Scheduling	8/12/63
D. W. Simpson	IPD	Planning & Scheduling	8/12/63

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HW-78805

Additions (Continued)

<u>Name</u>	<u>From</u>	<u>TO</u>	<u>Date</u>
M. K. Ragland	New Hire	Plant Maintenance	8/12/63
Sandra Burt	Stenographic Practices	Plant Processing	8/19/63
J. J. Taylor	IPD	Plant Maintenance	8/19/63
R. A. Hellbusch	New Hire	Plant Maintenance	8/26/63

Deletions

E. L. Alexander	Plant Maintenance	IPD	8/1/63
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H. S. Lewis for
Manager - N Reactor Plant

WM Mathis:GVRs:ds

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FINANCIAL OPERATION
AUGUST, 1963

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

N-Reactor Business Information Project

During the month of August additional requirements for data were identified by employees of the N-Reactor Department. In order to proceed with necessary work and to effectively analyze all identified data requirements for the Department, work has been authorized to proceed on the following items:

1. Complete the N-Reactor Planning and Scheduling System so it will be operational by December 1, 1963.
2. Audit the proposed Fuels Data System to determine whether all data is required and cost information correct.
3. Perform a feasibility study on a completely mechanized N-Reactor Production and Scheduling System.

Items 2 and 3 above are to be completed by September 30, 1963 and October 15, 1963, respectively.

With respect to the Planning and Scheduling System work is proceeding according to schedule. The order for the 3101 data collection system has been placed and delivery is expected on November 1, 1963.

N-Reactor Production Studies

During August work continued on supplying information to the Atomic Energy Commission on a series of production studies. Four additional cases involving N-Reactor (cases 20, 21, 22 and 24) are being worked on. These cases include varying amounts of tritium production and a higher power level for the reactor. The results of studies on these cases will be issued on September 20, 1963 except for a fully enriched fuel loading case for which the final report will be issued on October 21, 1963.

100-N Duplicating Facility

The need for a duplicating facility in the 100-N Area was identified in July, 1963. However, a formal request to Irradiation Processing Department to establish such a facility was delayed until August 15 pending determination of the practicability of taking over the existing facility operated by Kaiser Engineers. Inasmuch as it did not appear that the Kaiser workload would decrease until early in calendar year 1964 this possibility was abandoned.

The planned facility will be located in the 1101-N building. Offset duplicating services should be available about mid-September and photocopy duplicating in 60-90 days.

Essential Materials Mechanization

Programming of the revised essential materials mechanized system is presently under way. It is anticipated that this system will be completed in time to operate manual and mechanized systems in parallel during November, 1963. After several months of dual operations the manual system will be discarded. In order for N-Reactor Department to participate in the mechanized system several items of work must be completed. This work will be completed by October 1, 1963.

Financial Personnel

As of August 31, 1963 personnel assigned to the NRD Financial Operation consisted of 15 monthly salaried employees and eight weekly salaried employees, for a total of 23 people. This represented a decrease of two monthly salaried employees compared with the end of the previous month. This decrease consisted of one Summer Professor and one position which will no longer be filled.

Trips by Employees

D. R. Stenquist visited the offices of the Atomic Energy Commission in Washington, D.C. on August 19 through 21 in connection with the production studies.

Manager-Finance

J Milne:pw

**DATE
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01/22/93**