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HW--79448-Del.

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N-REACTOR DEPARTMENT

MONTHLY REPORT -- OCTOBER 1963

Compiled by N-Reactor Department

November 7, 1963 - Richland, Washington

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

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GENERAL SUMMARY

N REACTOR FUELS

Production

Input production for October established a new record of 479 extrusions for a tonnage of 86.4 which was 37 per cent over forecast. Daily extrusion records were broken on several occasions with a new high of 22 for inners and 24 for outers. First load to date is 98 per cent extruded. Output production also established a monthly record with 115 tons of assembled fuel transferred to Finished Storage. This brings the material in Finished Storage to 256 tons, or 69 per cent of first load requirements.

Shop yield continues to improve slightly each month, with shop yield for the month of October at 65 per cent for total of inners and outers. Major problems continue to be obtaining satisfactory yields on outer fuels. The major production problem encountered during the month was the unbonding of outer tube extrusions. Of the 250 extrusions produced during the month, 27 were completely unbonded. However, there was only one unbond on inner tube extrusions consisting of 229 billets.

Four boxes of completed assemblies were shipped to the reactor for charging tests. This was the first fuel shipped to 100-N and no problems were encountered in the loading, unloading, and storage procedures.

Quality Control

An intensive program was launched during the month to assure that the first load fuel assembly can be fully certified as to meeting all specifications and standards prior to initiation of reactor charging. Specific groups of material that require further evaluation for certification have been identified and the programs initiated to assure final disposition as rapidly as possible.

Engineering

Evaluation of braze rings from green press chips indicates that the rings have melting characteristics equivalent to those made from conventional casting processes and were acceptable with respect to frangibility. It appears that an eventual price reduction of about 50 per cent can be obtained through this process. In order to further evaluate this process, a requisition to purchase 2,000 of these rings has been sent to the AEC.

The unbond areas of the outer fuel element which occurred during the month appear similar to the inner unbond problem encountered earlier this year. These extrusions were made using 1/4 inch front end plates. Control tests were initiated to determine the effect on bonding of copper nose cones and 1/2 inch thick end plates. No rejects were experienced using this method. Based on these results, 1/2 inch thick front end plates will be used on all future outer billets.

RESEARCH & ENGINEERING

Irradiation of prototype Li-Al target elements with N Inner Enriched (NIE-1) elements for heaters continues as part of the program to determine the technical feasibility of incremental tritium production in the N Reactor. These elements have reached a calculated gas-volume-ratio (GVR) of 10. Goal exposure is 25 GVR. A similar test was discharged in August from KER-1 at a GVR of 8.

First stage tests of the two phase, steady-state pressure drop experiments have been completed in the HL electrically heated mock-up of a N Reactor tube. The results showed satisfactory performance of the present fuel elements at heat transfer rates well above (125%) design conditions.

A transient reactor kinetics calculation utilizing the analog computer model was performed in support of start-up planning. Maximum flux levels and coolant temperatures were determined for various combinations of initial power level, reactivity addition ramp rates, and reactor period trip levels. The development of the over-all N Reactor simulation model is progressing on schedule.

Thermocouple readings from two uranium oxide crud monitors in KER Loop 1 indicate that no significant crud deposition has occurred.

Specifications for the process tube monitoring equipment have been issued (HW-79117 - Rev. 1) and a purchase order for Closed-Loop TV and associated read-out equipment has been forwarded to purchasing for bid consideration.

Test document PPT-1 (HW-79242), Pre-Loading Eddy Current Signature test on reactor process tubes has been approved. The testing crew from Non-Destructive Testing Operation, Hanford Laboratories, will initiate these tests as soon as test preparations by Plant and Project Operations are completed. This program is expected to take six days at three shift coverage to complete.

All parts of the detailed tests procedures for the zero power physics tests have been completed and issued for comment. All major instrumentation required for the physics tests are on hand and testing and installation is in progress.

N REACTOR PROJECT

A design review of the confinement system has indicated that in the event of a second pressurization one reopened roof vent should relieve steam at a sufficient rate to avoid pressurizing the building significantly beyond 5 psig and to retain the effectiveness of the water seal at the fuel discharge pit.

Calculations have been made to determine the amount and frequency of fuel element support deflection that can be tolerated in a given process tube without limiting the operation of that tube.

A reduced value of insulation resistance for the clamp-on RTD's has been accepted in view of project schedules and on the basis of design evaluation and consultation with the manufacturer.

The design has been completed and the drawings issued for construction of an alternate dummy disposal facility of limited initial capacity and low initial capital cost.

Prototype testing of RV-2 relief valve components has verified the effectiveness of corrective changes made by the vendor and production-run testing is now under way.

On October 15, 1963, General Electric Company made Final Acceptance of the 105, 117, 1301, and 1310 Facilities.

The chemical cleaning of the secondary piping system in the 109-N Building was successfully completed October 3, 1963.

Custody of cells 1, 2, and 5 in the 109-N Building was transferred to General Electric on October 28, 1963, and the operational tests on the turbine drive assemblies were initiated.

The last river water pump motor was received from Fairbanks Morse on October 28, 1963, and testing was completed on October 31, 1963.

Repair of steam generator 3B has progressed to the point where the unit is now ready for installation of the sleeves in the tube sheet area. Manufacture of the sleeves has begun and sleeve installation in the 3B unit is scheduled to commence the first week in November, 1963. Work has started on repair of steam generator unit 4A. To date this work has been limited to cutting of welds on the primary side to free the tubes from the tube sheet. Successful field hydrostatic testing has been completed on the primary and secondary sides of all steam generator units in cells 1, 2, and 5.

Effective October 1, 1963, a Plant Engineering Sub-Section was established in the N Reactor Project Section.

N REACTOR PLANT

Boiler revisions were made from October 14 to October 20 and contractor testing resumed on October 29. Rated steam production of 575,000 pounds per hour has been achieved on two occasions, but high flue gas temperatures are still a serious problem. Further revisions are expected to be made by the vendor.

Ammonium hydroxide has been adopted instead of lithium hydroxide for primary loop pH control. This has necessitated extensive revisions to existing

equipment to handle the ammonia. Temporary facilities are being set up for immediate use of ammonia until permanent facilities are available.

Programing for the N Planning and Scheduling data system is 99 per cent complete.

A Planning Center for coordination of departmental activities in N Area was established on October 9.

Four shift coverage by instrument and electrical crafts was initiated to support testing activities and expedite calibration work. The major parts of the plant are now being maintained by Plant Forces.

Preparation of maintenance procedures deemed most likely necessary during fuel loading and start-up continued along with development of procedures needed to maintain the plant now being operated. A review of Maintenance Standards is a part of this effort.

Training effort during the month include certification training for processing operators and supervisors, planning and scheduling system procedures for all operating and maintenance personnel, and plant orientation for mechanical craftsmen in the classroom. On-the-job training was concentrated around the plant system testing operational work.

PERSONNEL STATISTICS

Number of employees as of September 30, 1963 611
Number of employees as of October 31, 1963 614

	Exempt	Nonexempt	Total
General	2	2	4
Finance	15	8	23
N Reactor Fuels	54	124	178
Research & Engineering	50	9	59
N Reactor Plant	64	173	237
N Reactor Project	90	23	113
TOTAL	275	339	614

Employment

	Exempt	Nonexempt	Total
Additions	4	7	11
Reductions	3	5	8
Net Additions	1	2	3

SAFETY & SECURITY

Days without a disabling injury	335
Hours worked without a lost disabling injury	975 680
Medical treatment injuries (October)	21

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

SUGGESTION PLAN PARTICIPATION

	October	Year-to-Date
Number of eligible employees	339	271
Number of suggestions received	42	308
Number of suggestions acted upon	35	234
Number of suggestions adopted	17	101
Net annual savings	$4 438	$24 765
Amount of awards	$ 500	$ 3 485
Per cent of awards to savings	14.3	14.1
Average amount of awards	$ 29.41	$ 34.50

PATENT SUMMARY - OCTOBER, 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 October. 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	R. L. Dickeman
Manager, Employee Relations	C. O. Steinnagel
Manager, Finance	J. Milne
Manager, N Reactor Fuels	L. M. Loeb
Manager, N Reactor Plant	W. M. Mathis
Manager, N Reactor Project	J. S. McMahon
Manager, Research & Engineering	M. C. Leverett

R L Dickeman

General Manager
N-Reactor Department

RL Dickeman:skd

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N-REACTOR FUELS OPERATION
OCTOBER 1963

I. PRODUCTION STATISTICS

	Current Month Scheduled Tons	Current Month Actual Tons	Last Month Actual	First Load Schd. Tons	First Load Tons To Date	First Load Per Cent Complete
Shop Input						
Inners	11.5	33.0	10.2			
Outers	51.5	53.5	33.9			
Total	65.0	86.5	44.1	700	677.3	96.7
Shop Output						
Autoclaves						
Inners	10.0	8.6	18.5			
Outers	30.0	32.7	32.9			
Total	40.0	41.3	51.4	420	365.7	87.0
Transferred to Finished Storage	125	115.4	78.9			
Material in Finished Storage	265	255.9	140.5	372	255.9	68.8

Throughput by Stations

Station	Inners	Outers	Total	In-Process Inventory	Defective Rate
Extrusions (billets)	229	250	479	29	5.1
Cut-up First	4,824	3,192	8,016	678	---
Cut-up Rework	328	180	508	1,224	---
Chem. Milling (ends)	9,202	4,443	13,645	501 pcs.	1.0
Braze (ends	9,106	4,342	13,448	471 pcs.	3.8
Heat Treat	4,190	2,216	6,406	91	0.2
Straightening	783	2	785	0	0.9
End Test (ends)	8,132	4,420	12,552	18 pcs.	1.5
Vacu-Blast	4,297	2,316	6,613	274	---
Welding (ends)	6,914	4,218	11,132	110 pcs.	0.0
Clad and Bond Test	3,481	2,410	5,891	100 pcs.	3.7
Support Weld	2,060	2,293	4,293	59	0.4
Autoclave	1,423	2,490	3,913	29	---
Final Etch	1,943	2,441	4,384	79	12.6
Material to Rework	261	963	1,224		

Other Statistics

	Inners	Outers	Total	
Support Fabrication	29,537	22,985	52,522	
Locking Clip Fabrication	0	5,775	5,775	
Special Extrusions			11	
Tubes Scrapped*	37	25	69	1,088.91 lbs.
Oxide Burned			97 batches	1,441.15 lbs.

Special Products: Target Elements 331 pieces

* Does not include scrap transferred to Materials Operation for use as "throwaway" charges.

Shop Yield

	Inners	Outers	Total
Current Month			
First Run	80.9	48.6	55.8
Estimated Rework	4.9	10.5	9.2
Total	85.8	59.1	65.0
Previous Month			
First Run	79.9	56.7	60.2
Estimated Rework	6.4	8.0	7.6
Total	86.3	64.6	67.8
First Load to Date			
First Run	64.6	51.2	55.4
Estimated Rework	----	----	----
Total	64.6	51.2	55.4

II. SHOP OPERATIONS

A. Production

Input production for October established a new record of 229 inner and 250 outer extrusions for a tonnage of 86.4, 37 per cent over forecast. Daily extrusion records were broken on several occasions with a new high of 22 for inners and 20 for outers.

Output production also established a monthly record with 115.4 tons of assembled fuels transferred to finished storage. Finished production transferred to storage was eight per cent below forecast due to an imbalance of inners and outers at the final assembly operations.

Four boxes of completed assemblies to be used for reactor charging tests were transferred to N-Reactor during the month. This was the first shipment of material to the reactor site and was used to test the loading, unloading, and storage procedures prior to the commencement of routine, larger scale shipments. No problems were encountered.

A total of 331 lithium-aluminum target elements were fabricated by Production Fuels, IPD, and delivered to N-Reactor Fuels during October. These elements will be used as poison in selected control rods in N-Reactor.

B. Plant Problems and Incidents

Considerable difficulties were encountered with outer tube bonding during the month. Of the 250 extrusions produced, 27 were completely unbonded. Of 229 inner tube extrusions, there was one unbond - this was possibly associated with a bent evacuation tube during the loading procedure. In the inner category, a total of 343 extrusions have been completed in succession without unbonds and all were with one-half inch end plates. Ninety-two outer extrusions were made with one-half inch end plates and all were satisfactorily bonded. Nose cones were used, but unbonds were found on some of these tubes.

Surface variation at chem milling has continued as a problem during the month. Discussions have been held with Quality Control and Engineering in an effort to broaden the limit by ten thousandths of an inch. Pre-braze etch is continuing to have difficulty with the reoxidation of the uranium. It is frequently necessary to change the nitric acid two or three times per shift. This problem is currently under study.

C. Plant Improvements and Achievements

A new production record of 389 inners processed without relief on an eight-hour shift was established at copper stripping on October 18. A similar production record of 358 inners was set at pre-weld etch on October 26, 1963. New highes were also set on October 38 on the end closure welder (524 ends) and support welder (355 inners).

Vacuum switches were installed on both inner and outer support welders on October 24, 1963. The switches are also in use on the spike welder and assure 1) that a weld cycle is not made without a support in place, and 2) that the weld cycle is not made unless the support fits properly in the electrode.

III. QUALITY CONTROL OPERATION

A MERCY analysis of the Nondestructive Tester Measurement Error for the third calendar quarter indicates a marked improvement in measurement error as a result of the program to improve tester reliability. Tester availability for production use has also improved.

Radiation Monitoring Services

A proposal was made this month to Radiation Protection Operation that radiation monitoring services be provided on a direct-charge basis to both Fuels Sections, rather than being provided within N-Reactor Fuels Section. A formal acceptance has not been received, but it is expected that responsibility for radiation monitoring services will be transferred to the Hanford Laboratories about mid-November.

Certification of First Load

An intensive program was launched this month to assure that the first load can be fully certified as meeting all specifications and standards prior to initiation of reactor charging. Specific groups of material that require further evaluation for certification were identified and programs were initiated to assure final disposition as rapidly as possible. The NUF data system has been invaluable in double-checking all procedures to assure that inadvertent mixups have not occurred.

IV. ENGINEERING

Materials Engineering

Tests on the effects of increased silicon levels on uranium fabrication characteristics will be continued to determine if increased silicon content will result in a reduction of inner cladding thickness variation of the N outer tube. Initial coextrusion results reported last month for six billet sections indicated that a significant reduction in cladding variation could be obtained. The range of silicon concentrations tested was 157 to 418 ppm. High silicon ingots primaried at HAPO are to test cladding variations over the range of 74 to 238 ppm silicon. Plans are to coextrude this material during November or December.

Alternate Processes and Sources for Ductile Zircaloy Strip

Five-thousand pounds of 10.95 inch diameter by 18-3/4 inch long Zircaloy has been ordered as starting material for on-site fabrication of strip. In addition, a small amount of six-inch diameter x 11 inch long billets that have been forged to size, then machine conditioned, will be purchased, extruded directly to sheet bar, and used to make an experimental lot of support strip. If satisfactory support items can be made from this

starting material a considerable dollar savings will be achieved as the 10.95 inch diameter billets must be double extruded before rolling to strip.

Braze Ring Fabrication Technology

Nuclear Metals has proposed fabrication of braze rings from green pressed chips, with an eventual price reduction of 50 per cent, assuming the rings are satisfactory. Evaluation of samples of pressed chip rings after a vacuum anneal indicates that the rings had melting characteristics equivalent to those made from the conventional casting process, and were acceptable with respect to frangibility. A requisition to purchase 2,000 outer rings for a more complete evaluation was prepared and sent to AEC Purchasing.

Uranium Specifications

Agreement has been reached relative to preparing NPR uranium billet specifications on a product oriented basis, including drawings. The specifications will be a complete description of the product and the essential procedures for fabrication. This approach will eliminate duplication and assure that all essential criteria are included. Final approval and acceptance of these new specifications are scheduled for January 1, 1964.

Extrusion Unbond Problem

On September 1, a new run of NOT fuels was started and during September a high unbond reject rate of outer tubes was encountered. The unbond areas were usually confined to the inner clad, similar to the inner unbond problem encountered earlier this year. The standard front end plate is 1/4 inch thick. Controlled tests were initiated to determine the effect of copper nose cones and 1/2 inch thick end plates on bonding. No rejects were experienced using either the copper nose cones or the 1/2 inch end plates. Based on these results, 1/2 inch thick front end plates will be used on all future outer billets.

Optimize Braze Closure Process

Zircaloy end cap specifications have been modified to allow use of the beveled end cap in production. Final acceptance of these specifications should be obtained by November 11, 1963.

Outer Support Improvement

Development work and testing has been initiated to modify the present N-fuel outer support in order to improve its load deflection characteristics.

A "T" shaped cross member, fabricated from mild steel and crimped under the 45° outer supports is currently being tested. Indications are that support strength can be at least doubled using a "T" shaped cross member.

Also under test is the one hundred per cent use of 0.015 inch shoes coupled with support sizing as a mechanism to improve support strength. It is possible to at least double support strength through this mechanism, but it may not be possible to accomplish this without violating some specified dimensional requirements. Initial indications are that it may be possible to quadruple support strength through use of sizing and the "T" cross member. A report will be issued during November on the results of these investigations.

Charge Machine Testing

Charge machine testing was resumed during October with a prototypic reactor charging arrangement, including a modified magazine, new magazine-to-nozzle adapter, a new process tube, and the magazine loading equipment. Ten charges of fuels with alternating autoclaved and non-autoclaved supports have been processed through the equipment under initial reactor loading conditions with no support deflections greater than 0.004 inch. The supports used in this testing have been the recent production type. The steel shoes have exhibited very light wear marks and process tube scratching has not been initiated. Twelve-inch and 18-inch fuels are being prepared for similar testing. The test program is continuing as outlined in last month's report.

Process Control and Improvement

The following extrusion specifications were rewritten and submitted to Research and Engineering for approval: CX-410.0 - Billet Preheat, CX-420 - Tool Preheat and Lubrication, CX-430 - Cutoff Preparation and Preheat, and CX-450 - Extrusion Operation.

In order to improve the efficiency of the abrasive blasting process and establish necessary operating techniques and controls to assure complete removal of heat treat oxide scale, the following remedies were applied to re-establish optimum cleaning: a) more frequent nozzle inspection and replacement, b) increased processing time, c) more frequent abrasive addition. Although remedies a) and b) resulted in slight improvements, the addition of abrasive was the critical factor affecting cleaning effectiveness. During the period of one week over 1,000 fuels were processed with only five being returned for recleaning.

Manufacturing PWR No. 70 covering rewelding of 171 outer fuel weld rejects was completed in October. Rewelded fuels were processed through autoradiograph and all were in Class I indicating no detectable uranium contamination in the end closures. Over-all rewelding yield was 74 per cent. Favorable to excellent yields depend on the type of defect characterizing the reject.

Nuclear Safety and Process Specifications

Approval was obtained for the type of information to be included in the Engineering Specifications, Material Specifications, and Quality Control manual. A rough draft has been written for one-third of the Process Specifications. A purchase specification for cladding shells is being written to be used as a sample for preparing other Material Specifications.

Certain nuclear safety limits for 0.95 weight per cent U-235 inner tubes were reduced as a result of recommendations by Critical Mass Physics, Hanford Laboratories. The reduction of the isolated batch limit from 5,775 pounds to 2,977 pounds was the most severe. Several changes were made to Nuclear Safety Specification, NR-6.02, and the rough draft was forwarded for approval to Research and Engineering on October 16, 1963.

Temporary nuclear safety specifications for 1.25 and 1.6 per cent enrichments were approved. The procedures for handling ingots and billets and for primary extrusion were prepared and issued. Procedures to cover coextrusion and fuel processing are being prepared.

Equipment and Maintenance Engineering Activities

Fume sampling tests of the modified fume stack and scrubbers were conducted under varying conditions to determine if the ground level fume contamination was within M.A.C. limit. Conclusions reached from the results of the tests indicate that the NO_2 fume ground level contamination is well within the M.A.C. limit provided all fume exhaust fans are operating.

The revised project proposal requesting withdrawal of CAF-954, High Pressure Autoclave, was approved by RLOO-AEC. A new directive was issued and the construction completion and cost closing papers are being prepared.

V. TESTING METHODS OPERATION

N-Fuels Testing

The special production test using uranium billets and Zircaloy cans to be tested with critical angle ultrasonics was started by testing 66 billets prior to extrusion. Analysis of the data is not complete, however, trends can be summarized as follows: 1) The clad variation in an extrusion appears to depend on both the Zircaloy and the uranium. 2) Forging memory can be observed in the Zircaloy test, and those pieces having forging memory, in general, increase the average clad variation. 3) Zircaloy components from different suppliers give a different response which must be factored into the correlation work. 4) The maximum clad variation appears to be influenced more by the uranium than by the Zircaloy. Work on this test will continue to determine if a recommendation for production implementation can be made.

The development and evaluation of the X-ray fluorescence tester for braze layer uranium contamination is approximately 90 per cent complete. The equipment was temporarily installed in the 306 Building Pilot Plant area and is operating satisfactorily within safe radiation limitations. The tester has demonstrated its ability to detect small vriations in the uranium content of the braze area. Further developments consist of a motorized drive mechanism, a positive indexing system, and absolute uranium contamination level determination. Satisfactory resolution of these remaining items would clear the way for a recommendation for use in 100 per cent inspection at the braze stations for process control.

Reactor Testing

The first of a series of low temperature hydrided samples was made available for testing this month. The sample was made to nominally contain 500 ppm hydride and was obtained by diffusing hydrogen through the tube wall at temperatures below 400°C. Use of a low temperature presumably eliminates annealing effects. Applying the ultrasonic pulse time shift method described in prior reports, the hydrided region was readily detected. Positive verification of the amount of hydriding and absence of annealing will be obtained after the sample is burst tested and metallographic and gas analysis performed.

Separations Testing

Assistance was provided CPD in troubleshooting a resin level detector (UT-3) malfunction. The UT-3 units are ultrasonic detectors for measuring resin levels in ion-exchange columns used in the separations processes. CPD is exploring the possibility of buying one or two additional testers. Estimates will be prepared for supplying the testers.

N-REACTOR FUELS OPERATION
OCTOBER 1963

VISITORS

Name	Company	Contact	Date	Purpose
Polson, CE Bussert, CE McCreery, PM	National Lead Co. of Ohio Cincinnati, Ohio	TD Naylor	10/22/63	Discuss uranium billet specifications.

TRIPS

Loeb, LM	General Electric Co. Saratoga Springs, N.Y.		10/12/63 to Present	Attend Modern Engineering Course
Socky, RB	Cleveland, Ohio		10/18 to 10/25/63	Attend Society for Nondestructive Testing Meetings.
	Picker X-Ray Cleveland, Ohio	W Black		Crystal orientation device.
	Republic Steel Cleveland, Ohio	M Rosummy		Eddy current testing.
	National Lead Co. of Ohio Cincinnati, Ohio	JM Clark		U metal production and testing.

ORGANIZATION AND PERSONNEL

	9/30/63	10/31/63
Exempt	56*	55*
Non-Exempt	121**	122**
Total	177	177

Tech Grads Assigned to N-Reactor Fuels = 3

* Includes two temporary upgrades to exempt from non-exempt rolls.

** Includes temporary employees.

ORGANIZATION AND PERSONNEL (Continued)

Terminations

Name	From	To	Effective Date
Groupman, TR (Exempt)	N-Fuels Engrg.	Employment elsewhere	10/15/63

Transfers

Samuel, JR (Exempt)	N-Fuels Engrg.	Transferred to Picayuane, Mississippi	10/10/63
Arnold, WW (Exempt)	Placed on permanent assigned in N-Fuels Engineering off the Tech Grad Program		10/1/63
Stevenson, ML (Non-Exempt)	Steno Pool	Support Services	10/7/63

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 October, 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

HW Number	Classification	Author	Date	Title
HW-79445	Secret	JW Nickolaus	10/30/63	Uranium Delivery Schedule - N-RD - HAPO
HW-79185	Secret	LM Loeb	10/8/63	Official Production Forecast - N-Reactor Fuels Operation - October 1963 Through June, 1968.
HW-79152	Confidential	JP Keenan	10/4/63	100% Support Strength Testing on NPR Production Fuels
HW-78879	Confidential	TR Groupman WG Hudson	9/6/63	Rewelding of Production Fuels
None	Unclassified	P Conrad	10/22/63	Deionized Water Survey Report

SECURITY

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

Acting Manager - N-Reactor Fuels

JW Nickolaus:mf

RESEARCH AND ENGINEERING

1. ADVANCE TECHNOLOGY

A study, showing the feasibility and incentive for a fully enriched loading of N-Reactor while producing tritium and steam, has been made (HW-79306, "Production of Special Nuclear Materials in N-Reactor," D. L. Condotta, E. G. Pierick, October 21, 1963). The fuel element consisting of a Al-Li target tube, fully enriched uranium driver tube and Al-Li target rod was developed. A fuel design based on the tube-tube-rod concept was used to provide a basis for production and cost estimates. This fuel design is consistent with our present knowledge of the physics and engineering involved, however, considerable research and development, and analytical studies would be necessary to mature an optimum fuel design.

Firm estimates of the capital expenditures required for the multi-product program (enrichment levels of 1.34 w/o and 2.05 w/o uranium) for N-Reactor were made available to the NRD financial section. The capital expenditures shown in the table below would provide for new and modified equipment made necessary for handling the higher uranium enrichment in the Fuel Fabrication Shops, Reactor Plant, and the Chemical Processing Plants.

		Capital Requirements			
Case No.	Fuel Design	Fuel Fabrication	Reactor Plant	Separation Facility	Total
II	Al-1.2 w/o Li (40.6 w/o Li-6) Rod in 1.34 w/o U-235 Uranium Tube, Zr-2 Cladding	$170,000	$120,000	$ 620,000	$ 910,000
III	Al-3.3 w/o Li (95 w/o Li-6) Rod in 2.05 w/o U-235 Uranium Tube, Zr-2 Cladding	$675,000	$145,000	$1,160,000	$1,980,000

This information has been forwarded to those concerned through the N-Reactor Financial Section.

2. REACTOR ENGINEERING

Comment issues of the Technical Bases for N-Reactor Process Standards for the pressurizer have been released. The sections issued include:

Section	Title
4.1.9	Pressurizer, Function and Description
4.1.9.1	Pressurizer Pressure Relief and Venting System, Settings - Interim Basis
4.1.9.2	Level Limits, Alarm and Trip Settings
4.1.9.3	Pressure Control - Operation and Limits
4.1.9.4	Temperature Limits - Interim Basis

Comments on Section 4.1.9, 4.1.9.2, 4.1.9.3, and 4.1.9.4 have been received, and revised final drafts are currently being issued.

Cavitation limits for suction pressures have been determined for the primary cooling system pumps over the complete range of pump capacities and speeds, and throughout the range of coolant temperatures expected during pre-startup testing, and normal reactor operation. These data have been issued in graphical form for use during the startup testing period. They will also be incorporated into the Technical Bases for the primary pumps.

The end of the first stage of tests of the electrically heated fuel column has been reached, on completion of the two-phase, steady-state, pressure drop measurements. This series of tests covered a range of process tube powers up to the equivalent of about 125 per cent of the maximum design tube power. The results have shown satisfactory performance of the present fuel elements at heat transfer rates well above design conditions. Results are being put in a form which will allow direct application to the N-Reactor process tube.

Thermal-hydraulic criteria for design of a rod and tube fuel element, using 1.25 w/o U-235 uranium in the tube and Lithium-Aluminum alloy in the rod, have been established. These criteria were established so that a demonstration multi-product load could be charged into the reactor and would be compatible with the thermal-hydraulic operating limits. Heat flux limits and outlet enthalpy limits were established based on burnout calculations using a reference fuel design. A specific fuel design was then chosen from FLEX II computer runs. Additional calculations were then made to show that the proposed fuel design satisfied the thermal-hydraulic criteria.

A study is being carried out to review the design of the primary piping system, and the subsequent stress analyses - such as the Electric Boat Program, to identify points where maximum pipe vibrations will be expected. These points will then be measured for vibration during flow testing of the cooling system.

A compilation of design heat removal load data for the Circulating Raw Water System has been made. This study will provide the heat removal criteria for the determination of circulating water system flow distribution for Technical Basis 1.1.3. It is considered necessary to define the minimum required flows for major CRWS components under various conditions of scram transient and steady-state reduced reactor power levels using the best available design values. The flow requirements are lumped into five groups:

1. Dump Condensers
2. Graphite Cooling Heat Exchangers
3. Drive Turbine Condensers
4. Turbine Generator Condenser
5. Auxiliaries (High Lift Pump House, Filter Plant, etc.)

Computer or hand flow distribution calculations will provide flow requirements as a function of reactor power level, pump availability, and river level and temperature for Basis 1.1.3.

3. REACTOR PHYSICS

Lattice Parameter and Spectral Index Experiments

Details of the designs of special fuel elements for the lattice parameter and spectral index experiments have been completed. Work orders for uranium machining and fuel element assembly have been written and the uranium machining is well underway.

The technique of putting sector foils or pins in short sections of fuel is being used for the cold tests. These short sections will be assembled with spacers and canned in aluminum instead of special zirconium tubes. End-drilled production line fuel elements are being used for the hot tests. Uranium rods machined to fit the holes will carry pins of the radioactivants and will be inserted in the end-drilled fuel elements. This latter technique yields a finished fuel element having nearly the same integrity as obtained on the production line.

The aluminum clad elements will be autocalved at standard IPD autoclave conditions. This will provide an oxide film capable of better resistance to the 20 C - 50 psi-pH-10 water planned for the cold tests. Helium leak tests will also be made where possible. The Zircaloy-2 clad elements will be re-autoclaved at standard NRD autoclave conditions except for those containing cadmium. A reduction of autoclave conditions to 550 F - 1500 psi for 72 hours has been authorized for elements containing cadmium. This will prevent melting or distortion of cadmium covers. The melting point of cadmium is $\sim$ 610 F.

Irradiation of the special fuel elements during the "hot tests" is presently scheduled in the middle of the temperature coefficient tests. Period measurements during the temperature coefficient experiments at

varying temperatures prior to and after the irradiation will produce undesired radioactivity in all radioactivants installed in the special fuel elements. This problem has been investigated with respect to its effect on counting rates of the base activities of Lu-177 ($t_{1/2}$ = 6.7 days), Au-198 ($t_{1/2}$ = 2.7 days), and Eu-152 ($t_{1/2}$ = 9.3 hours), which are to be used to obtain spectral indices in the method not utilizing cadmium. In all activants this additional activity is of the order of 5 per cent of the total activity. This amount is significant, and because it will be induced at temperatures different from those during the primary irradiation, it must be subtracted from the measured activity. Error analysis indicates that 1 per cent uncertainties in counting ratios induce 10 per cent and 3 per cent uncertainties in inferred values of Westcott's r values and neutron temperatures, T_n, respectively. The correction for the undesired activity is expected to yield about a 1 per cent uncertainty in activity ratios. Statistical counting uncertainties in the activities are expected to be approximately 1 per cent also, hence T_n and r are expected to have maximum errors of ± 15 C and ± 0.02 respectively, from the measurements which do not utilize cadmium. It is anticipated that the value of r alone will be obtained with better accuracy from the cadmium covered measurements.

One method of interpreting these experiments will involve normalization of counting rates of detectors irradiated in N-Reactor to counting rates of detectors irradiated in a thermal column in TTR or PCTR. For these ratios to be independent of the respective flux-time irradiation curves, the latter must be identical. Making the thermal column irradiations identical to the hot test irradiation will be difficult in view of all the period measurements. This problem becomes acute with respect to activity ratios of fission product samples, since decay rates depend upon exposure history. The solution to this problem is under investigation. A special hot test for these experiments without multiple period measurements would, of course, circumvent these difficulties and may be advisable.

T^3 and Np^{237} Production Rates for a Highly Enriched Fuel Loading

The production rates of T-3 and Np-237 for highly enriched fuel loadings have been estimated for inclusion in HW-79306, "Production of Special Nuclear Materials in N-Reactor," D. L. Condotta and E. G. Pierick, October 21, 1963.

The fuel element design considered consisted of an outer tube of Li-Al, a central driver tube of highly enriched uranium in zirconium, and an inner target rod of Li-Al alloy. The driver tube contained ~30 w/o U of which ~93 per cent was U-235. The estimates of the Np-237 production were made in hand calculations with the use of effective cross sections based on Westcott r and T_n values. The production rates of the Np-237 for this fuel geometry were found to be heavily dependent upon the self-shielding effects of U-236 for the case in which the fuel is recycled.

Graphite Heat Generation

Graphite heat generation calculations were also made for the same target-driver-target geometry assumed in the studies of the production rates of T-3 and Np-237 for a highly enriched loading. The specific results of the heat generation calculations are of some general interest and are discussed here.

The results show that the heat generation in the graphite would be about 1.51 times that which is expected to result from the Phase I tube-in-tube fuel geometry. This amounts to 13.2 mev/fission as compared to 8.74 mev per fission (HW-76343) for the Phase I geometry. The calculations assumed that the neutron energy contribution from slowing down would be about the same as calculated for various other fuel geometries (HW-59075), i.e., ~4.2 mev/fission. The γ-ray energy contribution was 9.0 mev/fission which is about twice the γ-ray contribution for Phase I geometry. This can be broken down further into 3.78 mev/fission from prompt fission γ energy, 3.19 mev/fission from fission product γ energy, 1.69 mev/fission from U-Zr-2 fuel (n,γ) γ energy, and 0.34 mev/fission from Zr-2 cladding and process tube and graphite (n,γ) γ energy. As was expected from the above results, the γ-ray energy dissipated in the Zr-2 process tube was calculated to be ~2.02 mev/fission or about twice that of Phase I geometry.

The γ energy dissipation was calculated with the aid of the IBM 7090 code COLPRO which will yield a Monte Carlo calculation of the collision probability in all regions for a γ-ray of given energy originating in a given region. In order to simplify the calculation with a small sacrifice in accuracy, the lattice was assumed to consist of four homogenized regions whose diameters were 1.473 inches (inner target and its cladding, inner water annulus, and inner cladding of fuel tube), 1.772 inches (U-Zr-2 fuel only), 2.708 inches (outer cladding of fuel, central water annulus, outer target and its cladding and outer water annulus), and 3.658 inches (process tube only).

The calculations were carried through two γ-ray collisions which accounted for almost all of the γ-ray energy which would be given up in the graphite. Of the (n,γ) reactions which occur in the N lattice only the Zr-2, U-235 and graphite (n,γ) reactions were considered. All γ-ray energy resulting from graphite (n,γ) reactions was assumed to be lost entirely in the graphite, and all γ-rays which escaped through the process tube into the graphite were assumed to lose the remainder of their energy in the graphite.

Prompt and fission product γ-ray energy spectra, total γ-ray attenuation cross sections and γ-ray energy absorption cross sections were obtained from ANL-5800. U-235, Zr-2 and graphite (n,γ) γ-ray energy spectra and total γ-ray attenuation cross sections for Zr-2 were taken from the previously referenced HW-76343.

Technical Bases

The hazards associated with hot startups are being investigated at this time. The consequences of an incident during this period of operation would probably be more severe than for normal startup or equilibrium

incidents because (1) high inlet water temperature, (2) startup ramps of 1 mk/sec are still obtainable, and (3) the pressurizer has not restored full system pressure by the time rod withdrawal must be initiated.

Physics Study of Single Tube Fuel Element

A further examination of the data assembled for the single tube fuel element reveals that the selection to date of engineering constraints such as pressure and flow rates has not been fully appropriate. The principal fault with present data is the appearance of unreasonably large coolant flow values. Apparently the cause of this problem is the improper use of the relationship between ΔP (pressure drop across the active zone) and the total reactor coolant flow in determining appropriate input for the FLEX 2 code. A well-founded selection of ΔP (across the active zone), ΔT (temperature rise in the coolant across the active zone), and use of the proper options in FLEX 2 should solve the problem. Use of the code in this manner is underway. A delay of perhaps two weeks in the completion of the survey study is anticipated as a result of this difficulty.

Code Development FLEX 3

Further improvements and modifications in the FLEX code are in progress. The capacity to handle the higher Pu isotopes in fuel regions and further flexibility in the handling of non-fuel materials in fuel regions are being incorporated. The first trail run of FLEX 3 has uncovered many errors in both the mechanics of programming and in logic. It is anticipated that the debugging of the modified program will be rather slow and it may take several months to make the code operable.

4. CONTROLS, INSTRUMENTS AND SYSTEMS ANALYSIS

Specifications for the closed-loop TV and associated readout equipment for process tube monitoring have been revised and issued as HW-79117 REV 1, and have been sent to Purchasing for preparation of a proposal request to be sent to vendors.

The requirements for the design and fabrication of a drive unit, control console and probe assembly for the process tube monitoring program were discussed with on-site personnel and cost and schedule estimates were obtained.

Work is continuing in Hanford Laboratories and N-Fuels Section on the eddy current and ultrasonic hydride detection probes, respectively.

A transient reactor kinetics calculation utilizing the analog computer model was performed. Maximum flux levels and coolant temperatures were determined for various combinations of initial power level, reactivity addition ramp rates, and reactor period trip level.

The development of the over-all N-Reactor simulation model is continuing. The programming of the steam generator mathematical model is presently being checked out.

Assistance continued on the development of an N-Reactor data system. A listing of all variables for each piece of system equipment is being generated, this listing being coordinated with the N-Reactor Operation Planning and Scheduling System coding system.

Fuel Element Rupture Monitor Tests

The preliminary testing of selected sample chambers indicates that they are of acceptable operating quality, even though the welds have porosity and poor penetration. Pressure tests to rupture have shown hoop failure of the body with no indicated failure at the welds. Corrosion cycling is underway on five sample chambers to determine effect of reactor decontamination chemicals on chamber strength.

The Phase II production test procedure is still awaiting final approvals. Scheduling the test in the KER loops is still to be firmed up. A production model of the gamma energy spectrometer has been received from the vendor and has been assigned to replace the prototype of the spectrometer now in service for the rupture monitor tests.

Heat Exchanger Interface Level Indicator

The survey of the various methods of steam-water mixture interface level measurement has been completed, and a draft report has been written covering a description of the methods and a comparison of their design and operating features.

Bailey Meter Company, the vendor on the control and instrumentation of the steam generators, has also recognized the need for a more direct method of measuring level, and is providing a float-type level measuring device on one of the steam generators to supply calibration data for their indirectly calculated interface level system. Therefore, no development work will be performed by Controls, Instruments, and Systems Analysis until the Bailey Meter Company float gauge has been evaluated.

Technical Assistance to Field and Design Engineering on Seismoscope

A study was made of the seismoscope switches and they were found to be incapable of providing the required performance. The cone and ring contacts were found to be non-concentric and with no means for alignment provided. The axes of the cones are cocked with respect to the axes of the rings and produce a non-uniform switch gap, making the device direction sensitive. Also, the switches are non-failsafe, in that failure of the pendulum suspension wire will not trip the switch. It was recommended that the switches be rebuilt to make them acceptable, and that the work should be done in Instrument Research Development of the Hanford Laboratories.

Pre-Production Test PPT-1
Pre-Loading Eddy Current Signature Test on Reactor Process Tubes

The test document, PPT-1 (HW-79242), has been prepared and approved. The probe has been completed and the testing crew from Non-Destructive Testing Operation of the Hanford Laboratories is standing by for immediate starting of the test when preparations by Plant Operations and Projects are completed. The availability of the "C" elevator is the deciding factor in the starting of this program, which is expected to take six working days at three-shift coverage to complete.

5. CHEMISTRY AND METALLURGY

KER-1

Irradiation of the two uranium oxide crud monitors continues. Five of the six thermocouples appear to be working well and indicate that no crud deposition has occurred. The NIE-1 elements with unbonded closures have reached an exposure of 300 MWD/T. Discharge of this test is planned for mid-December.

KER-2

Irradiation of the prototype Li-Al target elements continues as part of the program to determine the technical feasibility of incremental tritium production in N-Reactor. The elements have been exposed to a calculated GVR of 10. Goal exposure is 25, to be reached in April.

Evaluation of "First Load" N Fuel Element Assemblies

Irradiation testing of first load fuel element assemblies is continuing in KER-3 and KER-4. Exposure since the last reporting period was low because the reactor has been shut down for process tube replacement. As of October 8, 1963, the third charge of assemblies reached 1213 MWD/T and the fourth charge of assemblies reached 824 MWD/T. Neither test has departed from standard operating conditions.

6. PROCESS EVALUATION AND CONTROL

All parts of the detailed test procedures for the zero-power physics test have been issued for comments. The work of incorporating comments and redrafting is about 80 per cent complete. Portions covering testing with the cold reactor are ready for typing and editing. All major items of instrumentation required for the physics test are on hand and testing and installation is in progress. Test crew assignments have been made and approval of assignments has been requested from management.

The status of Process Standards required for the zero-power physics test is as follows:

12 standard have been approved.
2 standards are being routed for approval. These are B-215, Emergency Cooling System, and B-220, Graphite Cooling
2 Interim Standards are being routed for approval. These are B-230, Gas System, and 501, The Over-all Interim Standard for startup test N-1.

Work has started on the remaining 29 standards required for regular plant operation.

The six system studies listed last month are being pursued. The study of the flow-monitor system has started.

A Disaster Plan for the N-Reactor Department has been drafted and is being routed for comment.

Work has started on the Preliminary Hazards Summary Report for Phase II operation.

An internal surveillance plan has been prepared in first draft.

The status of the operational testing program as of October 24, 1963, was as follows:

	Completed	
	Scheduled*	Actual
Test Procedure Preparation	94%	73%
Tests Conducted	43%	11%

*Schedule percentage based on completion of all tests prior to December 15, 1963.

The scope for Startup Test N-2 "Low Power Testing Program," has been revised and is being circulated for approvals.

SIGNIFICANT REPORTS ISSUED

HW-77917 PT3 RD, "Comment Issue, N-Reactor Startup Physics Test Program, Test Procedures, Full Pile Tests," J. W. Hagan, October 3, 1963, (Confidential-Undocumented).

HW-78426, "Startup Test N-1, N-Reactor Startup Physics Test Program," J. W. Hagan and W. S. Nechodom, August 1, 1963 (Confidential).

HW-78968, "FLEX 2 - A Fuel Element Design/Analysis Code," R. J. Shields, September 18, 1963 (Unclassified).

HW-79028, "Estimated Losses in Pu Production Rates from Simultaneous Irradiation of Np-237 Target Material," E. E. Mills, September 18, 1963, (Secret).

HW-79104, "Consequences of Heat Exchanger Tube Rupture at N-Reactor," J. W. Vanderbeek and R. E. Trumble, October 17, 1963 (Secret).

HW-79183, "Monthly Technical Report, September, 1963 - Reactor Physics," P. F. Nichols and Reactor Physics Staff, October 1, 1963 (Secret).

HW-79227, "N-Reactor Hazards Summary Report Supplement No. 3, Use of 1.25% Enriched Uranium Fuel," W. S. Nechodom and N. R. Miller, October 14, 1963 (Confidential).

HW-79228, "Nuclear Safety Criteria for Special Test Loads, N-Reactor," W. S. Nechodom and N. R. Miller, October 14, 1963 (Confidential).

HW-79242, "Pre-Loading Eddy Current Signature Test for Reactor Process Tubes," G. W. Morrow and D. W. Leiby, October 14, 1963 (Unclassified).

HW-79306, "Production of Special Nuclear Materials in N-Reactor," E. G. Pierick and D. L. Condotta, October 21, 1963 (Secret).

HW-79437, "Proposed Interim Limits on Operation of N-Reactor," N. R. Miller, October 31, 1963 (Confidential).

- "Primary Pump Suction Limits," by R. H. Shoemaker, October 25, 1963, (Unclassified).

TRIPS

Name	Firm & Location	Date	Purpose
K. O. Creek	General Electric Co.,Palo Alto	10/7	Discuss preliminary
	American Micro-wave Co. San Carlos	10/7	specifications " "
	Dage TV Company, Inglewood	10/8	" "
	Inter. Tel. & Tel. Co. San Fernando	10/9	" "
	Kintel Co., San Diego	10/10	" "
J. W. Riches	General Electric Co. Burlington, Va.	10/16-21	Discuss desalination technology
	AEC-Washington	10/22	" "
R. E. Hall	Phillips Chemical Corp. Finley, Wash.	10/21	Technical Discussion Aqua ammonia for N-Reactor

VISITORS

None

PERSONNEL

Additions

Name	From	To	Date
J. A. Mitchell	New Hire	Reactor Engineering	10/14/63
J. W. Riches	Chemistry & Met.	Advance Technology	10/28/63

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 October, 1963. Such persons further advise that for the period herein covered by this report, notebook records, if any, kept in the course of their work have been examined for possible inventions or discoveries.

M. C. Leverett

Manager
Research and Engineering

MC Leverett:LCC:mk

N-REACTOR PROJECT

PROCESS DESIGN OPERATION

Process Research and Development

Additional calculations have been made of the building pressures attributable to a theoretical incident involving a second Zone I pressure surge resulting from a fuel meltdown incident followed by readmission of the primary coolant due to delayed operation of the emergency diesel pumps. Previous calculations, which were based on all confinement vents remaining closed during this time, showed that a peak building pressure slightly under 7 psig would result. Although this value exceeds the Zone I building design level of 5 psig, it would be of short enough peak duration to preclude intolerable structural damage. The method of calculation assumed that the water seal at the fuel discharge pit would be blown out and steam would be vented through Zone III to the outside. Recent calculations have been made on the basis of reopening one or more vents when the building pressure attains a level of 5 psig during the second pressurization. If one vent were reopened, it would cause an immediate depressurization followed by a surge to about 5.3 psig at the end of 115 seconds from the time of operation of the emergency coolant pumps. If two vents were reopened, the peak surge would be reduced to about 3.2 psig. In both cases, the water seal would remain intact and steam would not bubble through to Zone III.

Detailed analyses have verified the results of early studies which indicated the feasibility of attaining temperatures in the neighborhood of 500F by using primary pumping energy to heat the reactor and the primary loop. The calculations have now given greater consideration to other variables such as the number of loops in operation, the mode of operation of the moderator cooling system, the extent to which the primary pump seals are operated, the position of the control rods, and whether the process tubes are empty or loaded. In summary, it has been determined that a primary loop temperature of 500F can be achieved in a period of approximately two days with three or four loops in operation. The time can be decreased if the inleakage rate of seal water to the primary pumps is decreased.

Calculations have been made to determine the number of fuel elements with a given support deflection which could be charged into a process tube without limiting the operation of that tube. As an example, it has been determined that up to six fuel elements with deflections of 10 mils each could be tolerated in one tube charge, but that one fuel element with a deflection of 30 mils would limit the operation of the tube.

Project CAI-816

Hydrogen Facility

The redesign of the hydrogen facility has been completed to meet code requirements for safe handling of inflammable gases. The hydrogen piping within 182-N has been removed to eliminate the explosion hazard in that building, and the bulk storage outside 182-N has been strategically re-

located for safer handling. The new design provides a minimal facility at a relatively low initial cost.

Process Tube Flow Monitor

Preliminary operational testing of the Process Tube Flow Monitor has indicated that the accuracy stability capabilities are well within specified requirements. An undesirable interaction between the high flow and low flow en masse trip adjustments was found to be due to changes in the 420-cycle excitation voltage resulting from line loss variations during en masse adjustments. Two additional load centers have been ordered to isolate the varying loads and correct the problem.

Gross Gamma Monitor

The 24-volt DC supply to the gross gamma differential alarm modules is being augmented by an additional 4-volt supply in order to provide satisfactory operation and tracking of the en masse trip sensitivity adjustment.

"H" Fitting Installation

The first widespread use of "H" type mechanical tube fittings at N-Reactor was begun with the installation of Inconel-X tube unions in the rupture monitor sample take-off lines in the outlet pipe space. Prior to installation, an instruction and training session for the craftsmen was conducted covering all phases of the installation, such as: tube end preparation and inspection, tube cleaning and marking, adjacent tube weld protection, sleeve cleaning, tool operation, fitting assembly and final inspection. In addition to the installation of the "H" type tube unions, a variety of "H" type tees and elbows, of Inconel-X and in sizes 1/4", 3/8", and 1/2", have been assembled for testing at 189-D.

Clamp-on RTDs

During installation of the clamp-on type resistance temperature detectors in the "all tube" monitoring system, some of the RTDs exhibited lower values of insulation resistance than had been specified in the design. In order to determine the cause, representative units were returned to the Engelhard factory, and testing was witnessed there by a General Electric design engineer. The lowered resistance was found to be due to minute holes in the RTD body allowing inleakage of air. On the basis of the testing, it was concluded that the insulation resistance would not degrade in service but would very likely be improved by the temperatures in service. In order to meet project schedules, a design modification has been initiated to permit acceptance of the lower value of insulation resistance.

Dummy Disposal Facility

On the basis of revised scope requirements, an alternate design was completed and the drawings were issued for construction of an underground dummy disposal facility of limited initial capacity and low initial capital cost. In developing this alternative, it was found possible to locate the dummy disposal vault closer to the reactor storage basin than in the original, more extensive, design concept. Provisions have been included for future expansion of the modified facility to meet the long-term needs of the reactor.

Equipment Development and Testing

The Component Test Loop at 189-D has been reactivated following installation of a recirculation bypass line from the pump directly to the pressurizer, permitting it to be filled more rapidly after loop evacuation from relief valve tripping. Prototype testing of the RV-2 relief valve assembly has been substantially completed and has demonstrated the effectiveness of the corrective changes made by the vendor. Emphasis has now shifted to testing the production-run RV-2 relief valve components prior to final installation in the N-Reactor primary loop.

The Long Term Test Facility of the NPR-PCE Loop has been valved off for a two-month period to determine the possible pitting effect of water stagnation on the riding feet of the fuel element spacers.

Evaluation of radiation effects on the inlet barrier wall seal plugs has been completed. After exposure to an accumulative gamma radiation of 4×10^{9}R, the rubber body of the plug exhibited a slight compressive set. Hardness was not appreciably changed. In view of the anticipated N-Reactor service conditions, which should be less severe than those of testing, radiation does not appear to be a problem. Although a non-irradiated wetted plug held significantly better than an irradiated wetted plug, both performed adequately within the required limits.

FIELD ENGINEERING OPERATION

Construction

105-N Building

The 105-N Building was transferred to General Electric on a Final Acceptance basis on October 15, 1963, with the exception of:

1) Reactor Nuclear System
2) Outlet Temperature Monitor System
3) Fuel Rupture Monitor System
4) Audio Communication System, and
5) Elevators

On October 26th, the Reactor Nuclear System and the Audio Communication System were transferred to General Electric on a Final Acceptance basis.

Work order authorizations are being issued to J. A. Jones and Kaiser Engineers to complete the punch list items remaining on the various systems.

Balancing work continued on the Zone II & III Heat and Vent System in the 105-N Building. Zone II-III Supply System "rough" balancing has been complete and Zone I Supply "rough" balancing started. Final balancing of the Zone IV Exhaust System is continuing.

Approximately 57 per cent of the Zone I & II electrical conduit and sleeve seals and approximately 32 per cent of the interstice seals have been completed. The external pipe and tubing Zone I seals are approximately 79 per cent complete.

The Flow Monitor System venturi ports were reseated and the sensing lines connected to the venturies. The mechanical portion of the system is now complete with the exception of the hydrostatic test of the final connections at the venturies.

The 3000# hydro tests were completed on both the right and left side Fuel Rupture Monitor valve racks and sample lines. The right side has been completely connected to the process tube connectors with "H" fittings and the left side tie-in has started. The electrical installation is approximately 90 per cent complete and construction testing in progress.

The building radiation monitor system 100 channel space monitor construction testing was completed. The system mechanical construction testing is completed and the balance of the electrical construction testing is in progress.

The installation of the rod position data logging section of the integrated data system has been completed, construction testing and calibration completed and final coupling (calibration) of rod position transducers to rod drive mechanisms is in progress.

The ISI integrated data systems received concentrated installation effort and equipment checkout under the direction of two ISI representatives the week of September 30th through October 5, 1963. Construction testing and preliminary calibration work are in progress on the equipment.

Replacement of all electrical connectors on the Ball X hopper mechanisms, installation of surge protectors on the mercury relays and repositioning of all proximity switches was completed. Broken Alnico magnets were discovered during the testing; these have been replaced with spares on hand and an order processed for the balance required to complete the installation.

Electrical construction testing of the horizontal rod controls is in progress and approximately 98 per cent complete; the safety circuit testing is in progress and approximately 75 per cent complete.

The video communication system construction testing has been completed under a vendor representative's direction. Vendor deficiencies were found in the TV camera and monitor units and these components have been returned to the manufacturer for correction.

An incident occurred during the testing of the "W" elevator whereby two of the four hydraulic pistons were actuated and were raised approximately four feet, causing severe stress within the structure. The incident occurred during contractor testing and was caused by a Todd Company representative. The main cylinders do not appear damaged, although connection to the platform will require repair.

The representatives from American Machine and Foundry are continuing with their assistance in checking out the Irradiated Metal Handling System. Several broken parts have been discovered and replacement parts are being made in the J. A. Jones Shop.

109-N Building

The installation of wiring and the termination work was started this month in the pressurizer enclosure in the 109-N Building. All of this wire is now in place and termination work is proceeding.

Wire terminations in Consoles AA, BB, CC, DD, EE and FF in the 105-N Control Room were completed during the week of October 21st.

The contractor testing of remotely operated valves was completed for the graphite cooling system. This did not include the regulator and

control valves. The contractor testing of remotely operated valves in the primary loop from the 105-N Control Room through the relay and terminal cabinets and motor control centers was started during the week of October 21st.

The 109-N Heat and Vent System was transferred to General Electric custody on October 14, 1963.

The chemical cleaning of the secondary piping in the 109-N Building was completed October 3, 1963. Approximately one-half of the cleaning solution was discharged to the river immediately and the remaining half was held in the SOH and CPA tanks until the cap was removed from the export line. This cap was removed the week of October 21st and all cleaning solution was discharged to the river on October 24th and 25th. Every effort is being made to keep the secondary piping in a dry layup condition until just prior to operations.

Agreement has been reached with Kaiser Engineers and the Atomic Energy Commission to transfer 109 Cells 1, 2 and 5 and the respective drive turbines to General Electric by Custody Agreement on October 29, 1963.

117-N Building

The 117-N Building was transferred to General Electric on a Final Acceptance basis on October 15, 1963. J. A. Jones is completing miscellaneous punch list items.

163-N Building

The Bumstead-Woolford contract was completed Friday, October 25, 1963 and the 163-N Demineralizer Equipment was accepted by General Electric. Operational testing of this equipment was immediately initiated.

181-N Building

The motor for #1 Pump was received October 28th and is now in place and ready for test run. This pump was put in use October 31st.

182-N Building

The latest information on the membrane for the AHR Tank is that shipment will not be made until November 30, 1963.

184-N Building

Foster-Wheeler completed their work on the boiler October 20, 1963. Intermittent testing has been in progress. A preliminary high level run was made, but the performance indicates that high stack temperatures have not been completely resolved. Foster-Wheeler is reviewing data, but no decision has been made as to further modification.

1301-N Facility

1301-N Waste Crib was accepted on a Final Acceptance basis on October 15, 1963.

1310-N Facility

The 1310-N Chemical Waste Facility was accepted on a Final Acceptance basis on October 15, 1963.

1900-N

The temporary cap was removed from the dissipator on October 22nd and water was diverted through the outfall line the following day.

NPR Testing Program

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

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

Total number of tests scheduled	39
Scoped	38
Issued for Comment	33
Issued as Approved	22
Tests Started	18
Tests Completed	8

	Preparation		Performance	
	Scheduled	Actual	Scheduled*	Actual
This Month	94.0%	73.0%	43.0%	11.0%
Last Month	88.5%	62.0%	27.0%	8.4%

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

Steam Generators

The tubes within the tube sheet of steam generator unit 3B have been cleaned and rerolled and the tube ends have been milled flat to provide a uniform weld surface for seal welding of the repair sleeves after installation. Ultrasonic translator and helium mass spectrometer testing has been utilized to ascertain the effectiveness of the rerolling work on the existing tubes. No evidence of leakage was found. Procurement of acceptable Incoloy 800 has been completed

and this material is now being manufactured into sleeves. Installation of Incoloy sleeves in unit 3B is scheduled to begin during the first week in November, 1963.

Work has been started on retubing of steam generator unit 4A. The flange on the tube sheet divider plate has been removed and the tube to tube sheet fillet welds cut free by grinding. The following steps will be to remove one head from the secondary shell and remove all of the existing tubes from the unit. New tubing of Inconel 600 will then be reinstalled, welded to the tube sheet and the head replaced on the secondary shell. Procedures for this work have not been received for approval.

The six steam generator units located in cells 1, 2, and 5 have been successfully hydro tested on both the primary and secondary sides. In addition, unit 4B in cell 4 has also been successfully hydro tested on the primary and secondary sides and unit 3A in cell 3 has been successfully hydro tested on the secondary side.

Conversion

The Commission requested an estimate of the costs for modifications which need to be made to existing 105-N Instrumentation Systems that were designed and procured by General Electric. The systems include the power calculator, data logger, safety circuits and confinement and shielding door control. An estimate of $23,000 for the design review and preparation of the requisition and an estimate of $18,000 for procurement were transmitted to the Commission. These estimates do not include general plant overhead.

Estimates of maximum steam availability to the generating plant were provided in response to a request from the Commission. The information is for use of BPA in their load resource studies and in their evaluation of the benefits of a sixth primary loop.

PLANT ENGINEERING

Effective October 1, 1963, a Plant Engineering subsection in the N-Reactor Project Section was established. Current emphasis is being placed on preparation of maintenance standards, development of maintenance tools needed for startup and staffing the subsection with qualified personnel.

Maintenance Standards

Four hundred ten maintenance standards are scheduled to be prepared. Twenty-five standards have been issued for comment, of which four have been submitted for approval. Emphasis is being placed on the critical equipment maintenance standards needed prior to power ascension.

Equipment Development

A program has been scoped to provide special maintenance tools needed for plant startup.

PROGRAM EVALUATION

Design Status

Title I - 100 per cent complete.

Title II - 100 per cent complete.

Costs

On October 28, 1963, General Electric received AEC Work Authority Number 816 (11) authorizing $250,000 additional punch list funds and $184,000 engineering funds. This now brings the total authorized engineering funds up to the General Electric estimate to complete.

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 105 Reactor Building was transferred to General Electric on October 15, 1963, and the 109 heat dissipation building is scheduled for transfer on November 15, 1963.

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

	Scheduled	Actual
Temporary Construction	95	98
General Area Systems	98	99.5
105-N Reactor Building	98	99
109-N Heat Exchanger Building	97	97.5
163N-183N Water Treat. Facilities	100	99.9
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)	97	98.6

On October 31, 1963, an integrated sequence schedule was issued to all parties concerned. This schedule displays the major items of remaining construction, contractor testing, calibration, and operational startup.

RESPONSIBILITY

Effective October 1, 1963, a Plant Engineering subsection was established in the N-Reactor Project Section.

ORGANIZATION AND PERSONNEL

	9-30-63	10-31-63
Exempt		
Permanent	93	92
On Loan	1	3
Tech. Grads	2	3
Nonexempt	25	24

Personnel Changes

Name	From	To	Effective Date
AB Dunning (exempt)	Field Engineering	N-R Plant	10-1-63
JL Rand (exempt)	N-R Plant	Plant Eng'g.	10-1-63
JE Stice (exempt)	Field Engineering	G.E.-San Jose	10-18-63
M Barron (nonexempt)	N-R Project	Biology-HLO	10-21-63
ES Burke (nonexempt)	Process Design	HLO	10-28-63
IE Flanagan (nonexempt)	New hire	N-R Project	10-14-63

SAFETY AND SECURITY

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

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

Name	Firm and Location	Date	Purpose
Richards, WA	Sola Electric Chicago, Illinois	10-7-63	To check production status of power supplies for 105-N.
	Scam Instruments Chicago, Illinois	10-7-63	To obtain additional programs for NPR Data System.
Davis, HS	Bently-Nevada Corp. Minden, Nevada	10-7-63	Non-contacting vibration pickups.
Richards, WA	Engelhard, Inc. Newark, New Jersey	10-8-63	To discuss RTD problems and observe tests.
Davis, HS	ASCE Structural Conf. San Francisco, Calif.	10-8 to 10-11-63	Technical conference on seismic design of building structures.
	Endevco Corp. San Francisco, Calif.	10-9-63	Vibration measuring equipment.
Richards, WA	Burns and Roe, Inc. Hempstead, New York	10-9 to 10-11-63	Conversion
Mollerus, FJ,Jr.	Adv. Tech. Lab.; Elec. Util. Eng. Op., Schenectady, N. Y.; Missile & Armament Dept. Burlington, Vermont	10-15 to 10-26-63	To attend Systems Eng. Seminar; discuss plant optimization techniques; and to discuss saline water conversion, respectively.
Bainard, WD	Beckman Instruments Fullerton, California	10-22 to 10-24-63	To review and approve drawings for the Water Quality Laboratory.
Hoffman, RC	Beckman Instruments Fullerton, California	10-22 to 10-24-63	To review and approve drawings for the Water Quality Laboratory.
Strand, NO	Combustion Engineering Chattanooga, Tenn.	10-2 to 10-4-63	Repair of steam generator units 3B and 4A.
Haugland, GT	Ladish Cudahy, Wisconsin	10-28/29	Engineering assistance for inspection of piping for conversion.
	Combustion Engineering, Chattanooga, Tenn.	10-30-63	Consultation on steam generator unit 3B sleeve manufacture.
Rand, JL	Scam Instrument Corp. Skokie, Illinois	10-6 to 11-6-63	Training for maintenance of Central Data Logger.
Kratz, EM	Burns and Roe, Inc. Hempstead, N. Y.	10-9 to 10-12-63	Conversion design and construction.

TRIPS (cont'd.)

Name	Firm and Location	Date	Purpose
Dowis, WJ	Burns & Roe, Inc. New York, N. Y.	10-15-63	Discussions on saline water conversion.
	General Electric Co. Burlington, Vt.	10-17-63	"
	General Electric Co. Schenectady, N.Y.	10-18-63	"
	General Electric Co. New York, N.Y.	10-21-63	"
	Office of Saline Water Washington, D.C.	10-22-63	"
	General Electric Co. Washington, D.C.	10-22-63	"
	Atomic Energy Comm. Germantown	10-22-63	"
	General Electric Co. Lynn, Mass.	10-23-63	"

VISITORS

Name	Firm and Location	Date	Purpose
Smith, WR	General Electric Co. San Jose, Calif.	10-23-63	Consult on welding methods for steam generator unit 3B repair.
Bergman, EO	Consultant	10-19-63	Consult on tube rolling methods for steam generator unit 3B repair.
Janicello, D	Avien, Inc. Woodside, N. Y.	8-20 to 10-17-63	Assist in placing the Tube Flow Monitor in service.
Friezner, S.	Specialized Testing Service, North Hollywood, Calif.	9-25-63 thru 9-27-63	Consult on strain gage system and training of electrical craftsmen in gage installation technique.
Knoedler, Dr.	Sheppard T. Powell Associates, Baltimore, Md.	9-30 to 10-7-63 and 10-24-63	Consult on chemical cleaning. Reviewed water sampling equipment at Beckman Instrument Co.

VISITORS (cont'd.)

Name	Firm and Location	Date	Purpose
Beloastro, J	Sprague Eng'g. Corp. Gardena, Calif.	10-9/10	Assist in measurement of the Tube Flow Monitor 420 cycle power supply loads.
Pitman, WH	AMF Atomics Greenwich, Conn.	10-21 to 10-25-63	Title II tests on irradiated metal handling system
Loesby, R	Keystone Valve Corp. Kirkland, Wash.	10-21-63	Examination of supplied valves to determine reasons for leaking.

SIGNIFICANT REPORTS ISSUED

Doc. No.	Classification	Author	Date	Title
HW-78938A	Unclassified	GT Haugland	10-21-63	Project CAI-816, Steam Generator Examination Program, Program Status Report No. 1
HW-79022	Unclassified	JH Fastabend	9-20-63	Interim Report - N-Reactor Process Tube Rolled Joint Step Removal
HW-79075	Unclassified	J Muraoka	9-27-63	Dimensionless Heat Transfer Characteristics for Cylindrical Fuel Elements
HW-79161	Secret	HR Kosmata	10-4-63	Reactor Design Analysis Monthly Report - September, 1963
HW-79209	Secret	JD Agar	10-10-63	Old Pile HCR Operating Temperatures
HW-79315	Conf.-Undoc.	HR Kosmata	10-21-63	Optimum Phase II Operation Considering Combined Product Values

Manager, N-Reactor Project

JS McMahon:mbs

N REACTOR PLANT OPERATION

N PLANNING AND SCHEDULING

Programming for the N Planning and Scheduling data system is 99 percent complete.

A Planning Center for round-the-clock coordination of departmental activities in N Area was established on October 9. The principal participants are Field Engineering and Plant forces.

The first trial shipment of nuclear fuel was received on October 22. The schedule for shipment of physics test and initial load requirements has been established.

Difficulties in fuel spacer dummy acquisition were encountered again. Our utmost efforts in expediting this order have been required to acquire the first shipment on October 31. The vendor will not meet the purchase order delivery date, however, it appears his partial shipments can be timed so that dummy acquisition should not cause any delay in fuel loading.

Special handling was needed to acquire an initial supply of aqueous ammonium hydroxide on a one-week notice that it was to be used in lieu of lithium hydroxide.

Organizational responsibilities and the general methods to accomplish the production scheduling function for N Reactor are now firm. Details to establish this function are in preparation.

Equipment listing is virtually complete except in the 105 Control Room.

Final training of P & S personnel, the shift schedulers, and the clerks was started Monday, October 28.

Functional training of the Radiation Monitors procedure review and Standards review were continued as scheduled.

N PROCESSING OPERATION

The boiler was operated at rated capacity (575,000 pounds per hour) on two occasions following extensive revisions to piping and steam drum during the outage of October 12 to October 20. The boiler is still not acceptable because of high flue gas temperatures and more revisions appear to be required.

The demineralized water plant was accepted on October 25 and operational testing of the facility is currently in progress.

Ammonium hydroxide has been substituted for lithium hydroxide for primary loop pH control. Extensive changes are required in our equipment in order to handle this volatile chemical. At the present time temporary facilities are being set up so that early use of ammonia in the primary loop water may begin.

Operational tests began in 105-109 during the month.

Operator work assignments are now being made in accordance with the Option III staffing plan pending a final settlement with the Union. This plan assigns all 105-109 work to Chemical Workers and has created considerable unrest among the Operators.

Operating tests are 13 per cent complete as against 47 per cent scheduled.

Test procedure preparation is 73 per cent complete as against 94 per cent scheduled.

Operating procedure preparation continued during the month. Twenty-one procedures are being prepared at the present time which are required for initial fuel loading.

Fuel elements and dummies began arriving during the month.

Certification training on shift continued during the month. A two week orientation course for maintenance mechanics was conducted and training guides for operating fork lifts, cranes, and hoists were issued.

N REACTOR MAINTENANCE

The four Instrument-Electrical crews were put on shift and provided around-the-clock coverage for instrument calibration and systems test support. In addition, these crews applied a substantial number of man-hours to regular Plant maintenance of accepted facilities. With 50 per cent of the mechanical craftsmen divided into two crews on day shift, the accepted facilities were maintained, equipment repaired, and deficiencies corrected to provide the necessary support of test work and ready the Plant for operation.

Twenty-five percent (4) of our millwrights and pipefitters were loaned to IPD to support the tube replacement outages at KE and KW reactors.

Maintenance Procedure effort was directed toward approval and issue for use by craftsmen on planned work in conjunction with the continued day-to-day effort of procedure preparation and consultation to resolve maintenance work problems.

The transfer of approximately $250,000 worth of operational spare parts from Kaiser to GE custody was completed and acquisition of needed tools and supplies from Kaiser stocks continued.

The indoctrination training of 75 percent of the Maintenance craft group was completed. Equipment familiarization was obtained at vendor's plants such as at Beckman where five instrument personnel studied water quality instrumentation.

The review of Maintenance Standards in significant numbers was conducted and analysis undertaken to match the standards program with the maintenance procedure preparation activity.

At month end N Maintenance personnel had assumed responsibility for and were performing the maintenance function for the major segments of N Plant.

SIGNIFICANT REPORTS ISSUED

None

TRIPS

Name	Location	Date	Purpose
H. A. Carlberg	Seattle, Wash.	10-7-63	Northwest Power Systems Development
H. A. Carlberg	Schenectady & New York	10-15-63 to 10/20/63	Discussions with Electrical Utility Engineering and Manufacturing and Engineering Services.
E. W. Wilson	Hempstead, New York	10/9/63 through 10/11/63	Conversion Design
C. D. Shadinger	Milwaukee, Wisconsin	10/27/63 to 10/29/63	Conversion Piping

VISITORS

None

PERSONNEL

Additions	From	To	Date
A. B. Dunning	Project Sect.	Planning & Scheduling	10/1/63
C. H. Foit	IPD	Plant Maintenance	10/14/63
J. R. Marty	IPD	Plant Maintenance	10/14/63
R. E. Smith	IPD	Plant Maintenance	10/14/63
W. H. Wood	IPD	Plant Maintenance	10/14/63
E. E. Westenberg	Reactivate	Plant Processing	10/15/63

Deletions

J. L. Rand	Plant Maintenance	Project Section	10/1/63

WM Mathis:GVRS:ds

Manager - N Reactor Plant

END

DATE FILMED

1/26/93