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N-REACTOR DEPARTMENT

MONTHLY REPORT -- JANUARY, 1964

Compiled by N-Reactor Department

February 7, 1964 - Richland, Washington

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

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N Reactor Plant Operation	E-1 through E-6

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N REACTOR FUELS

Production

A total of 260 inner billets and 32 outer billets were extruded during the month, representing 44.3 tons and 96 per cent of forecast. As a result of the metal quality problem occurring at NLO, no billets were received during January and all acceptable billets on hand were extruded. The plant is being shut down from February 3 to February 12 for maintenance overhaul. Output during January exceeded the forecast by six per cent for a total of 26.5 tons, representing 1,512 finished assemblies.

Uranium utilization for the month of January was unusually high at 91.4 per cent, however, this unusually high utilization factor reflects the holding of several large categories of in-process material for further evaluation.

At month end, 95 per cent of the first reactor load had been certified acceptable for charging. Three hundred and eleven tons, representing 15,780 assemblies, had been shipped to the reactor site at month end.

Shop Activities

The cutting pattern of extruded fuels has been changed permitting an increase in material utilization of six per cent on inner fuels and two per cent on outers. The inner fuel cutting pattern was increased from 17 to 18 - 24 inch element, and the outer changed from 12 - 24 inch and one 12 inch elements to 12 - 24 and one 18 inch element.

The Shop continued to be plagued by problems associated with clad dimpling. Examination of defects indicates that the dimples are caused by lubrication problems and inclusions. In order to correct this condition, two Process Work Requests are being processed to further define the lubrication and component variables.

Engineering

The metal quality problem occurring at NLO has resulted in a modification of the heating cycle. The initial eighteen billets finished from this new cycle material are free of visible metal quality defects, however, the average carbon level still remains slightly below that which was previously considered to be normal (500 ppm vs. 525 ppm). Metal deliveries from the revised casting cycles should be received at HAP0 at a rate equal to the usage rate, by late February.

A rough draft of the Nuclear Safety Specifications for the 333 Building was issued for comment. These comments have been received, and final draft will be ready by the first week in February.

A test lot of co-product fuels has been completed and will be ready for shipment the first week of February. No significant process problems were encountered in the driver tube fabrication. The Hanford Laboratories fabricated the target fuels. Bonded chevron closures were used on these fuels.

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RESEARCH AND ENGINEERING

New calculations have been made to further define the k_{00} in uniform lattices of cells fueled with spike tubes. These calculations, together with experimental determination of the reactivity increases associated with the substitution of spike tubes for standard tubes during startup, are valuable in determining the reactivity increases which would be available with the use of spike material in a reactor loading.

Physics survey studies and associated calculations for $\text{PuO}_2\text{-UO}_2$, Pu-U and Pu-Al fuel element utilization in N Reactor were summarized (HW-80172). Analyses are in progress to identify the most favorable design in preparation for more intensive study of the base reactivity, transients and burn-up for such a design.

The Reactor Information File (RIF) has been structured, the input data has been specified and programming of the file is under way. A priority listing of output reports is being established to determine which can be economically justified.

The expanded Hanford Laboratories Analog Computer Facility is in its final stages of check out and test. It will be available during February for simulation and analyses of the secondary cooling system and the total N Reactor Plant System.

Tests of the N Reactor Rupture Monitor indicate that the sensitivity of the equipment is five to ten times better than called for in the design criteria.

The third and fourth charges of first load N fuel element assemblies were discharged from the full-sized KER loops at exposures of 2120 MWD/T and 1585 MWD/T respectively. Data from two earlier charges when coupled with the evaluations of these charges will provide performance information over the exposure range from 1250 to 2120 MWD/T.

The program to evaluate fuel element performance during a dump of the primary loop and a delay in the receipt of emergency cooling water continued on schedule. An inner tube enriched fuel element (NIE) that had been irradiated to 2490 MWD/T was heated to 1800 F without swelling in excess of predicted values. Water quenching was not incorporated in this test. Work is continuing on the setup of a test facility to heat (1800 F) and quench a full-sized N fuel element.

N REACTOR PROJECT

The fuel element temperature transient following an accidental dump of the primary loop has been calculated and has been found to be not severe. The fuel element temperatures during the transient are below the actual operating temperatures.

The crushing properties of fuel dummies have been investigated and have been found to be capable of absorbing any of the excess expansions considered in the transient cases.

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The Intermediate Range Nuclear Instrumentation System performed satisfactorily as the nuclear safety backup during physics testing.

Several columns of fuel were dropped from the upper outlet nozzle positions using the production tipoffs. No fuel elements became disassembled to the extent that they were rejected by the AMF equipment.

Small pile physics testing was completed and cold flow tests were initiated on January 18, 1964. Cold flow testing is scheduled for completion February 5, 1964.

Upon completion of the first phase of physics testing, a concentrated effort has been applied to complete the miscellaneous punch list work in the 105 Building.

Most of the control systems in the 109-N Building required for operation of the primary piping systems have been completed and tested. This includes primary pumps 1, 2, and 5.

Each of the graphite cooling heat exchangers has developed leakage due to a tube failure in each. Two of the exchangers have been returned to service by plugging the leaking tube. A repair procedure for the others is being developed with the heat exchanger supplier.

Steam generator unit 4A, which is affected by extensive intergranular corrosion throughout the stainless steel tube lengths, is now being stripped of tubing preparatory to the replacement of the tube bundles with Inconel tubing. Work is currently on schedule and completion of unit 4A repair is expected about August 15, 1964.

A test program wherein two horizontal rod drives were fitted with rod chain hold-down devices and new transducers, showed that such modifications render satisfactory operation. Positive results gained from the tests permitted modifications to all rods.

N REACTOR PLANT

Primary loop water supply was changed over from once-through filtered water to recirculation with quality control on January 20. Primary loop pump and flow tests were in progress at month end.

The 184-N boiler was shut down three times during the month due to tube leakage. During the first outage, Foster-Wheeler Company made an extensive examination of the boiler internals.

No. 1 and 2 circulating raw water pumps were out of service during most of the month when their power cables shorted out. Replacement of the cable to Number 1 pump was completed January 31. Replacement of the other cable was under way at month end.

Completion of 109 facilities and adaptations for WPPSS tie-ins are being finished as rapidly as possible. Sixteen of the thirty-four tie-ins scheduled to accommodate the sixth cell are completed. As possible, a few tie-ins scheduled for the March outage are being accomplished ahead of schedule.

Purchase arrangements for bulk hydrogen were completed during the month. Contacts have been made and details established on the interconnecting equipment required so that the hydrogen facility design could be released.

PERSONNEL STATISTICS

Number of employees as of December 31, 1963 640
 Number of employees as of January 31, 1964 638

	<u>Exempt</u>	<u>Nonexempt</u>	<u>Total</u>
General	2	2	4
Finance	15	8	23
N Reactor Fuels	58	107	165
Research and Engineering	50	9	59
N Reactor Plant	64	212	276
N Reactor Project	<u>86</u>	<u>25</u>	<u>111</u>
Total	<u>272</u>	<u>363</u>	<u>638</u>

Employment

Additions	5	12	17
Reductions	<u>7</u>	<u>12</u>	<u>19</u>
Net Reductions	<u>(2)</u>	<u>--</u>	<u>(2)</u>

SAFETY AND SECURITY

Days without a disabling injury 427
 Hours worked without a disabling injury 1,318,016
 Medical treatment injuries (January) 20

SUGGESTION PLAN PARTICIPATION

	<u>Calendar Year 1963</u>	<u>January</u>
Number of eligible employees	283	363
Number of suggestions received	382	36
Number of suggestions acted upon	297	41
Number of suggestions adopted	126	17
Net annual savings	\$ 31,052	\$ 106,228
Amount of awards	4,285	3,260
Per cent of awards to savings	13.8	3.1
Average amount of awards	\$ 34.00	\$ 191.76

PATENT SUMMARY - JANUARY, 1964

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 January except as noted below. Such persons further advise that, for the period therein covered by this report, notebook records, if any, kept in the course of their work have been examined for possible inventions or discoveries.

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<u>Title</u>	<u>Authors</u>	<u>Date</u>
A Method of Lateral Shift Measurement in Ultrasonic Critical Angle Tests	G. L. Waldkoetter C. E. Fitch	January 20, 1964

STAFF

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

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

General Manager
N-Reactor Department

RL Dickeman:pw

N-REACTOR FUELS OPERATION
JANUARY, 1964

I. PRODUCTION STATISTICS

	<u>Current Month</u>	<u>CYTD</u>
1. <u>Input (extrusions)</u>		
.947% Enriched Outer	32	32
.947% Enriched Inner	<u>260</u>	<u>260</u>
Total Extrusions	292	292
Total Tons	44.3	44.3
% of Forecast	96%	
2. <u>Output (Finished Production)</u>		
.947% Enriched Assemblies 24"	828	828
18"	540	540
12"	<u>144</u>	<u>144</u>
Total Assemblies	1,512	1,512
Total Tons	26.5	26.5
% of Forecast	106%	
3. <u>300 Area Month End Inventory</u>		
<u>Finished Inventory</u>		
.947% Enriched Assemblies 24"	1,512	----
18"	1,728	----
12"	<u>828</u>	<u>----</u>
Total Assemblies	4,068	----
Total Tons	65.4	----
<u>Bare Inventory</u>		
.947% Enriched Outer	57	----
Inner	<u>14</u>	<u>----</u>
Total Billets	71	----
Total Tons	14	----
Natural Outer	122	----
Inner	<u>105</u>	<u>----</u>
Total Billets	227	----
Total Tons	41.3	----

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4. Shipments to Reactor (Total First Load to Date)

.947% Enriched Assemblies	24"	13,980
	18"	1,512
	12"	<u>288</u>
Total Assemblies		15,780
Total Tons		311.0

5. Uranium Utilization

	<u>Current Month</u>	<u>CYTD</u>
.947 Enriched Outers	96.3*	96.3
Inners	<u>85.5</u>	<u>85.5</u>
Over-all Total	91.4*	91.4

* The unusually high utilization reflects the holding of several large categories of in-process material for further evaluation.

6. Production Comment

As a result of the metal quality problem occurring at NLO during December, no billets were received at Hanford during January and all billets on hand were extruded. Because of this condition, a plant shutdown for maintenance overhaul is scheduled for February 3 through February 12.

Acceptable uranium billets are expected to be received starting during the first week of February with extrusion commencing February 13.

II. SHOP ACTIVITIES

1. Problems and Incidents

Material continues to be rejected at the Autoradiograph because of indications of uranium in the braze. Eighteen and one-half per cent of the welds processed at Autoradiograph during January were set aside for uranium indications. None of this material has been certified for reactor charging. This material is currently being evaluated on a localized PPM basis. Material under 5,000 PPM is being processed on through and segregated in final storage boxes. Material between 5,000 and 20,000 PPM is being held pending further disposition. Material above 20,000 PPM will be reworked by shortening.

The Shop continued to be plagued by problems associated with clad dimpling. Examination of the defects indicates that the dimples are caused by lubrication defects and inclusions. Two PWR's were run during January to further

define the lubrication and component variables. Severe clad dimpling occurred on more than 50 per cent of these extrusions to date. All components were non-destructive tested before assembly and lubrication procedures were carefully followed and checked. All material in the PWR's had not been processed through copper stripping at month end and these data remain to be analyzed.

Chem mill solution mixers were installed early in January. The mixers can be operated at either high or low speed and tests indicated significantly improved mixing of solution compared to air purging. The mixers, however, do not provide for equal solution aeration and excessive surface variation has occurred. Air entrapped in the solution appears to have a beneficial effect on surface uniformity. The mixers will, therefore, be used only for solution preparation; in-process air purging will continue.

At month end, 95 per cent of the first reactor load had been certified acceptable for charging. The material held for uranium in the braze is ready for release as soon as notification of its acceptance is received from Research and Engineering. The release of this material would constitute 100 per cent acceptance of the first load.

2. Achievements

The cutting pattern of extruded fuels has been changed permitting an increase in material utilization of 6 per cent on inner fuels and 2 per cent on outers. The inner fuel cutting pattern was increased from 17 to 18-24 inch fuels and the outers changed from 12-24 inch and 1-12 inch to 12-24 inch and 1-18 inch.

The material previously held that was welded at the locking clip welder between November 29, 1962, and the two autoclave failures in early 1963 was released this month by agreement between N-Reactor Fuels and Research and Engineering. The material will be assembled early in February for the first load.

A course in the basic philosophy of the theory of probability and its application in statistics is now being conducted by W. R. Krehbiel for the Standards Technicians and Clerical force in Quality Control. W. E. Stavig will conduct, during February, a course in orientation of the usage of the NUF system in conjunction with Electronic Data Data Processing.

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III. ENGINEERING ACTIVITIES

1. Materials

Uranium Quality. All uranium cast at NLO since November has been characterized by significantly lower than average carbon levels and by small voids or inclusions of soft, particulate material in the finished billet. The problem has been attributed to low casting temperature caused by a change in charge composition with no compensating change in the power-time heating cycle.

The heating cycle was modified on January 7, 1964. The initial billets (18 total) finished from this new cycle material are free of visible metal quality defects. The average carbon level still remains slightly below that which was previously considered to be "normal" (500 ppm vs. 525 ppm).

Metal deliveries from the revised casting cycle should be received at HAPO at a rate equal to the usage rate by late February.

Uranium Fabrication. During the month the uranium ingot fabrication process was converted from hollow cast ingots to solid cast ingots. The solid cast ingots are drilled prior to beta heat treatment. This change was evaluated on a pilot scale using the billets produced from twenty-four solid cast ingots. This evaluation showed that fuels fabricated from this material were at least as good as fuels fabricated by the hollow cast method. Solid casting and drilling is a preferred metallurgical practice as it will result in removal of a core of metal that should contain the highest concentration of exogenous materials present in the metal that is the last to freeze.

2. Routine Process Control and Improvement

Test Fuel Fabrication

a. NAE-1

A charge of 56 NAE-1 fuels was randomly selected from the production stream. This sample will approximate a statistical sample representing outer extrusions from 2600 through 6200 and inner extrusions from 1800 through 3400.

b. KSE-5

Fuels will be complete by 2/12/64. All fuels have been completed through end closure welding with no significant process problems. There was no significant difference in the chemical milling characteristics of the two alloys (iron-silicon: iron-aluminum).

c. Co-Product

Co-product fuels are completed and ready for shipment on 2/3/64. No significant process problems were encountered in the driver tube fabrication. Hanford Laboratories fabricated the target fuels. Bonded chevron closures were used on these fuels.

Reduce Coextrusion End Defect Losses. Prior to July, 1963, 17-24 inch fuels were cut from each NIE extrusion. During July, 1963, it was found that an additional six inches of fuel could be cut from each extrusion. During October-November, 1963, several end defects were examined destructively and it was found that additional good material was still available. Early this month PWR-87 was initiated to evaluate the possibility of obtaining an additional 12-18 inches from each extrusion. To date, the evaluation has shown that an additional 12 inches (17-24 inch and 1-18 inch) can be cut without any problem with fuel dimensions. This represents a 2% improvement in material utilization. A total of 29 extrusions have been cut into 18-24 inch fuels. Of these twenty-nine, about seventy per cent have shown an increase in O.D. on the end fuels at pre-mill inspection. These fuels are being processed to determine whether they will meet dimensional requirements after heat treat.

Optimize the Braze Closure Process. Braze contamination continues as a major process problem. The problem with outer tubes was apparently brought into control early in the month when the contamination rate dropped to the 6-7% level using bevelled end caps. This low rate continued during the first part of the inner tube run. After about two weeks of satisfactory performance, the contamination rate increased sharply to the 30-40% level. The cause for this increase has not yet been determined. Efforts to locate and eliminate the cause(s) of uranium contamination will be continued.

Fuel Support Improvements. A ten-column support deflection test was completed using standard 24-inch fuels and normal charge-discharge procedures. Measurement data show that there were no significant damage to the supports during charging.

Supports for driver tubes were fabricated and tested. These supports are about 50 mils higher than the regular N-outer tube supports. They were fabricated from 50 mil strip in order to increase strength. Testing has shown that the driver tube support is twice as strong as the 40 mil production support up to a 140 lb compressive load and slightly less than twice as strong above 140 lb. There were no cracking or other unusual fabrication problems.

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Tooling is being fabricated to produce 50 mil supports for production fuels.

Fuels with and without locking clips were drop tested during testing of the trampoline and AMF handling systems by N-Project Operation. Fuels without locking clips performed about as well as those with locking clips.

Chevron End Closure Development. Thirty-six driver tubes were brazed using chevron design end caps. Three were rejected for non-flow, one for a braze line voids and one for cap to clad unbond. The remaining thirty-one were welded. There were no weld rejects. Sectioned and polished ends showed normal weld penetration and braze continuity. The end caps were well centered with respect to the chevron recess and cap to clad braze thickness for the inner and outer annuli was uniform.

Copper Weld Fracturing. On at least two occasions, it has been observed that the inner copper tube of the inner coextrusion billet has failed at or near the weld bead during billet preheat. Available data on billet preheat conditions indicate that a differential temperatures in the range of 250-500°F can exist between the outer copper sleeve and the inner copper sleeve.

The forces imposed by this temperature differential are causing incipient, or actual failure, in the heat affected zone adjacent to the welds. In some cases of actual failure, the billet vacuum test will detect the loss of vacuum. However, with only a small tear in or near the weld it would be possible to set up conditions which would not be detected by the vacuum check but which could lead to non-bonding during extrusion.

Nuclear Safety. A rough draft of the Nuclear Safety Specifications for the 333 Building was issued by C. L. Brown (HL) and J. E. Ruffin. Comments have been received and the final draft will be ready for 2/7/64.

3. Equipment and Maintenance Engineering

Chem Bay Fume Control

The installation of the chem mill solution mixer and the modification of tank hood slots has essentially eliminated the acid fume leak problem. These modifications have cancelled the need for sealing off the chem bay mezzanine and the installation of a roof exhaustor.

Plant Capability

Schedules for equipment design, procurement, and installation to support N-Reactor Fuels Plant Capability, HW-79772, were

completed. Work priorities were assigned and action initiated in the majority of the equipment areas.

Building Modifications

Installation of the large press room door was completed during January. At month end, the electrical shop was 85 per cent complete. Work on the probe shop is continuing with completion scheduled for February. Design work to intertie the electrical service from one transformer to another in case of power outage is 85 per cent complete.

IV. TESTING METHODS

Support Clip Welding

Ultrasonic examination of suspect locking clips was completed, and the results indicated that some elements could have penetrations of uranium in the weld. However, subsequent metallographic examination showed that none of these were actual penetrations. One high current weld over a non-bond area resulted in a signal loss. Metallography showed the uranium melted and adhered in a few small regions but did not penetrate. It is believed that sufficient work has been done on the locking clip investigation to enable disposition of the suspect elements. A report is in progress and no further work is planned.

Correlation of Extrusion Performance with Pre-Extrusion Test Data

Process Work Request 73 was issued in order to investigate the effect of uranium and zirconium grain structure on the inner clad variation of the NOT fuel. The data are currently being analyzed and progress report, HW-80505, is expected to be completed during February. One group of data demonstrate good correlation including promising results at the .008+ reject level.

Work is also in progress on the tester data for Process Work Requests 80 and 88 in support of engineering studies on the clad and "dimpling" problems. These afford an excellent opportunity to test the conclusion of PWR-73. Analysis of the tester data will be completed during February.

Enrichment Tester - ERT-2

The problem associated with the test head has been resolved and the tester installed in 333 Building in the component receiving area. Evaluation of the "green" uranium problem will proceed as soon as short process cycle billets are available.

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The effect of thickness of zircaloy-2 on enrichment measurement was studied to determine the feasibility of inspecting extruded fuel enrichment. The difference count is reduced 12 per cent at 50 mils. Basically, however, this test has the capability of measuring the level in extruded fuel elements.

X-Ray Fluorescence Tester

The mechanical equipment necessary to test fuel elements by x-ray fluorescence has been constructed. It is expected that this test will replace autoradiograph. Fuel elements will be inspected with this x-ray analysis equipment, rejecting all elements which indicate uranium contamination of the braze in excess of one per cent. Additional evaluations will be made to establish allowable limits for this localized condition.

Separation Testing

The electronic design of a resin level detector was completed and the electronic shop is currently fabricating the circuitry. A complete layout description and circuit design is currently being reviewed by CPD Engineering.

Routine Tester Operation

The availability of the production testers continued during January at a high level with a slight improvement over December. The past four months record is summarized below:

<u>Month</u>	<u>Hours Downtime</u>	<u>% Availability</u>
October	105.0	89.7
November	68.5	94.7
December	66.0	94.1
January	53.0	95.1

Alpha Surface Contamination Testers

Nearly all the suspect fuel elements have been tested with the alpha counters. Full time technical assistance was supplied throughout the month on this program.

Contamination has been measured on several braze rings. The level ranged from 70-300 PPM. Since it could not be detected with the autoradiograph, this would indicate a uniform rather than a concentrated distribution. The braze rings have been contaminating the test head which indicates the contamination may be smearable as well as metallurgical.

Irradiated Fuels Tester - UT-10

Work is continuing on the development of the prints for the UT-10. The electronic prints are essentially complete, and the mechanical drawings are being brought up to date. The instruction manual rough draft is 85 per cent complete.

Improvement of Production Testers

Work on a new bond test is in progress. The effort will be primarily directed toward evaluation of an "outside-in" ultrasonic test for inner clad bonding. A portion of the prototype circuitry is being fabricated in HL shops.

Plutonium Distribution Uniformity in Developmental Fuel

Continued technical assistance has been supplied in the use of the PRTR homogeneity gamma scan equipment. The tester has been of beneficial use, and the results have enabled them to make a power level advancement in the operation of the reactor.

Ultrasonic Detection of Hydriding in Zircaloy Process Tubes

Testing of burst test samples containing fabricated hydride regions has continued to give good correlation. The geometry problem was traced to one tube having longitudinal grooves and is non-typical of reactor tubes. Regions having localized grinding also cause problems, but circuitry to differentiate these effects from hydride are being developed. A complete prototype circuit including a wall thickness compensation is being designed for shop fabrication. A fast readout circuit was developed which provides sensitivity better than 2 per cent.

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N-REACTOR FUELS OPERATION JANUARY, 1964

TRIPS

<u>Name</u>	<u>Company</u>	<u>Contact</u>	<u>Date</u>	<u>Purpose</u>
WE Stavig	G. E.	Mfg. Services Personnel	1/13-17	Quality Control- Process Control Engr'g. Course
	Large Jet Engine Dept., G. E. Evendale, Ohio	JM Scanlon LN Bress HL Seekins Ed Barnes Bob Pitman G Givens	1/20-21	Discuss vendor certification, rating system, quality certifica- tion, and customer complaint system.
	Nat'l. Lead of Ohio	P McCreery	1/22	Discussed vendor certification and vendor rating.
RB Socky	Boeing New Orleans, La.	WA Richardson	1/16-19	Discuss US testing present paper.
	Southwest Res. Institute San Antonio, Tex.	Dr. MC Gonnagle CE Lautzenheimer	1/19-20	Discuss NDT.
	Texas Instruments Dallas, Texas	LD Clark	1/20-22	Consult on elec- tronic fab. and application of NDT
	General Dynamics Fort Worth, Texas	DL Peterson	1/22	Present talk.
GL Waldkoetter	Pacific Tube and General Inspec. Lab. Los Angeles, Calif.	ER Smith	1/13-17	Provide engr'g. counsel and gui- dance.
HP Kraemer	Rem, Inc. Portland, Ore.	CA Brown	1/14-15	Discussion of Zr end cap problems.
TD Naylor	Nat'l. Lead of Ohio	P McCreery	1/8-9-10	Consult on metal quality problem.
RR Studer	Rem, Inc. Portland, Ore.	CA Brown	1/14/	Discuss contract on outer supports and locking clips.

VISITORS

W Sells	Alaskan Copper Seattle, Wn.	HP Kraemer	1/25	Discuss copper tubes.
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ORGANIZATION AND PERSONNEL

Exempt	12/31/63	1/31/64
Nonexempt	57	58
	116	107
	173	165

Additions

<u>Name</u>	<u>From</u>	<u>To</u>
JF Barnes (MTP)	IPD	Materials Operation
NW McKay	N-Reactor Project	N-Fuels Engineering
LI Lewis (MTP)	CPD	Quality Control
LH Steves	C&AO	Materials Operation
JL Kiliany (MTP)	IPD	Support Services

Deletions

PL Chiesa (MTP)	Quality Control	CPD
JR Hansell (MTP)	Materials	IPD
R Nielsen (MTP)	Quality Control	Terminated
M Fitch	Management Staff	Terminated
JR Goggin	N-Fuels Engineering	Deceased
RJ Murphy (TG)	Quality Control	C&AO

Moves

PW Hood	Shop Operations	Materials
---------	-----------------	-----------

The following Chemical Workers were loaned to IPD, Production Fuels for approximately five weeks:

CL Babcock	MR McColley
AW Davis	RR Musselman
HL Jackson	SB Varvel
DC Wyatt	

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 January, 1964, except as noted below. Such persons further advise that for the period therein covered by this report, notebook records, if any, kept in the course of their work have been examined for possible inventions or discoveries.

<u>Title</u>	<u>Author(s)</u>	<u>Date</u>
A Method of Lateral Shift Measurement in Ultrasonic Critical Angle Tests	GL Waldkoetter CE Fitch	1/20/64

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SIGNIFICANT REPORTS

<u>HW Number</u>	<u>Classification</u>	<u>Author</u>	<u>Date</u>	<u>Title</u>
HW-80221	Confidential	WA Hendricksen	12/31/63	Interim Report No. 1 Status of the Fabrica- tion Process for Targe Elements for the Co- Product Assemblies
	Confidential- Undocumented	CH Shaw	1/7/64	Cost Estimate for Zr Clad Coextruded I&E Fuel
	Unclassified	JW Nickolaus CH Shaw	1/10/64	Cost Estimate for BI_2O Element
HW-80459	Confidential- Undocumented	JW Nickolaus	1/17/64	N-Fuels Engineering Program
	Confidential- Undocumented	JW Nickolaus	1/18/64	Economic Consideration in N-Fuel Element Desi. and Manufacture
HW-80490	Confidential	RG Curran	1/20/64	Coextrusion of Aluminu and Lithium-Aluminum Alloy
	Confidential- Undocumented	CH Shaw WA Hendricksen	1/27/64	Cost Estimate for Co- Product Pilot Load Fabrication

SECURITY

There were no security violations during the month of January in
N-Reactor Fuels Operation.

Manager, N-Reactor Fuels

LM Loeb:bk

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RESEARCH AND ENGINEERING

1. ADVANCE TECHNOLOGY

A review of progress in FY-1964 and plans for the balance of FY-1964 and FY-1965 for the O2 Research and Development program was presented to personnel of RLOO-AEC.

A report dated December 23, 1963, HW-80124, "The Production of Plutonium-238 in N-Reactor," evaluated the feasibility and incentive for the operation of the N-Reactor with flux trap mode of operation producing plutonium containing 12.1 per cent plutonium-240, plutonium-238, and steam. This preliminary study indicated that by 1972 the N-Reactor would be able to produce as much as 50 kg of plutonium-238 each year at a unit cost of \$433/gram. Current estimates of plutonium-238 unit costs for the 1972 period range from \$300 to \$500 per gram. It was concluded that additional studies are necessary to optimize the production of the valuable by-product neptunium-237, as well as to develop a spectrum of plutonium-238 productive capabilities.

2. REACTOR ENGINEERING

A special experiment has been made in the Thermal Hydraulics Laboratory to determine the critical parameters required for refinement of the analysis of second pressurization. The experiment involved dry heating a short test section, representing the inner annulus of the N-fuel to 1350 - 1500 F; then introducing 150 F water at low flow rates (equivalent to about 30 gpm in a process tube). Pressure and metal surface temperatures at three locations along the test section, together with inflow were continuously recorded during the quench. The data have been delivered to Reactor Design Analysis for their interpretation.

All permanent instrumentation for use in measuring vibration in piping has been installed.

3. REACTOR PHYSICS

The Subsection has been temporarily operating with one-half of the permanent staff members on assignment with the Physics Startup Crews. One rotational trainee has also been working directly in support of the startup experiments.

New calculations have been made to further define the increase in k_{∞} in uniform lattices of cells fueled with spike tubes. Spikes consisting of (a) 1.25% outer tubes in conjunction with 0.94% inner tubes and (b) 1.25% outer tubes in conjunction with 1.2% inner tubes have been studied.

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The reactivity increase associated with the substitution of a spike tube for a standard tube is a function of the type of fuel surrounding the spike tube. Only the changes in k_{∞} associated with changes in enrichment in a uniform lattice can be readily calculated. The spike tubes could be used either separately or in groups. Thus, the experimental determinations of the reactivity increase associated with the substitution of spike tubes for a standard tube obtained at startup are of value in determining the reactivity increase available from spike material.

The physics survey work on $\text{PuO}_2\text{-UO}_2$, Pu-U and PuAl fuel element utilization in N-Reactor has been completed. A report (HW-80173) has been published which discusses the calculations. Also incorporated into that report are preliminary calculations on the formation rates of the Cm isotopes. Effects of self shielding were neglected. Westcott cross sections and a flux level typical of the Phase I tube-in-tube fuel loading were used as input. Study of the information is now in progress. The primary objective is to utilize the information already available on the various fuel designs so that the most favorable type can be selected. Once this selection has been made, the study in Hanford Laboratories on that design can be intensified to obtain more accurate information on the base reactivity, transients, and burnup.

Work on the evaluation of the N-Reactor shield continued on schedule. This consists of (1) measurements in the shield plug assembly during startup, low power demonstration, and perhaps into the ascension program, and (2) analytical work which will be normalized to the measurements and used to evaluate the shield performance, limitations, and chances of deterioration.

4. CONTROLS, INSTRUMENTS, AND SYSTEMS ANALYSIS

Several meetings were held between Research and Engineering, G. E. Purchasing and AEC Purchasing to discuss the specifications for the closed circuit TV system for process tube monitoring. Revision 4 of HW-79117, "Specification for Radiation Resistant TV System," has been accepted by the AEC Purchasing and is being forwarded to potential vendors for bid. Detail design drafting has started on the assembly for the drive unit and on the layouts for the TV camera front end section. Work in the Hanford Laboratories and the Fuels Section on the eddy current and ultrasonic hydride detection probes is continuing on schedule.

The Reactor Information File (RIF) has been structured, the input data has been specified and described, and the programming of the file has started. Work on the specification and description of the output reports to be obtained from the Reactor Information File. A study has been initiated to determine a priority listing of the output reports to determine which can be economically justified.

A report (HW-79504) has been issued to define the availability of data within the N-Reactor control room.

A 4-node N-Reactor kinetics model is being programmed for the analog computer to provide cold water injection studies and zone temperature monitor trip level determinations. This program will be debugged and operational by the first week in February.

The expanded analog computer facility of the Systems Research Operation of Hanford Laboratories is in its final phases of check-out and test. It will be available for simulation and analysis of the secondary coolant system and the total N-Reactor Plant System during the month of February.

On December 31, 1963 a calibration and sensitivity test was performed at the KER facility on a fuel rupture monitor system mock-up constructed of production instrumentation and mechanical sampling components. During the test a bare natural uranium sample located near the center of the reactor was slowly corroded away in the process loop to slowly increase the fission product activity. Analyses show that the sensitivity of both the gross gamma monitor and the gamma energy monitor were below 10^{-8} grams per milliliter concentration of irradiated normal uranium. This sensitivity is approximately 5 to 10 times better than that called for in the design criteria.

A study of effects of uranium contamination of fuel elements on fuel rupture monitor performance has been completed. The results of this study indicated that this contamination will not seriously increase the background level seen by the rupture monitoring equipment.

5. CHEMISTRY AND METALLURGY

Testing of the two stainless steel clad enriched uranium dioxide elements equipped with thermocouples for monitoring crud deposition continued during the month in KER Loop #1. The loop has been operating at pH-10 using ammonia for pH control. The reactor was shut down January 23 for an extended outage for process tube replacement. KER-1 will be decontaminated during the outage to prepare for startup simulation test, which will use ammonia for pH control. Four N Inner Enriched (NIE-1) elements with tapered end caps and unbonded welded end closures are included in the test charge as heater elements. The exposure level for the heater elements is about 400 MWD/T.

The N-Reactor Rupture Monitor Test was successfully carried out during the first week of January, using NIE-1 elements (with tapered end caps and unbonded closures) added as heater elements. These elements were discharged during the January 17 outage and the loop operated empty until the January 23 outage. During this period the pH was controlled at 8.5 in order to observe crud deposition characteristics under water conditions similar to those of the graphite cooling system.

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Irradiation testing of first load fuel element assemblies is continuing in the full size loops of the KER facility. A third and fourth test were discharged on January 23 and January 24, 1964. The third charge reached an exposure of 2120 MWD/T tube average and the fourth reached 1585 MWD/T.

Performance data from two earlier charges, when coupled with the results of these tests, will complete the picture on performance over the exposure range from 1250 to 2120 MWD/T. Examination of the fuel elements in the last two charges begins on February 3, 1964.

The program to evaluate fuel element performance during a dump of the primary loop and a delay of emergency raw water cooling continued. Two tests have been run to assess the damage that could occur from heating an irradiated fuel element to 1800 F; neither test has incorporated water quenching.

In the first test, three small cubes of uranium which had been irradiated to 3100 MWD/T were heated to 1800 F and held at temperature for 0, 5, and 30 minutes; the swelling, determined by weight change in water, was 19 per cent, 26 per cent and 38 per cent respectively. These swelling values, however, did not represent the situation under study because of a too-rapid heating rate which produced gross macro cracks.

The second test, with proper control of heating rate, used an inner tube fuel element (NIE) that had been irradiated to 2490 MWD/T. Using a 2-inch long induction coil, 3 separate locations on the fuel element were heated to 1800 F. Visual observation indicated that little swelling occurred. A section cut from the middle of the heated sections confirmed these observations and showed only 4.6, 7.9 and 12.8 per cent swelling for 0, 5, and 30 minutes at 1800 F.

Work is continuing on the set-up of a test facility to heat and quench a full-size inner and outer fuel element. If the full-scale test is properly controlled at 1800 F, there is every reason to believe that the fuel element will retain integrity during the thermal cycle.

5. PROCESS EVALUATION AND CONTROL

The first phase of physics testing (Cold Physics Tests) was completed on January 18.

Process Change Authorizations issued during the month:

- 1-64 - Fuel Handling Equipment Testing
- 2-64 - Horizontal Rod Circuit Testing During N-1 Physics Tests
- 3-64 - Startup of Boiler with High-Oxygen Feedwater Supply
- 4-64 - Coolant Removal from Horizontal Rods
- 5-64 - Inserted Rods During Ball Hopper Manual Trips
- 6-64 - Permission to Dry Out Process Channels Without Inserting All Rods

SIGNIFICANT REPORTS ISSUED

- HW-80124 "The Production of Plutonium-238 in N-Reactor," E. G. Pierick and H. W. Slater - December 23, 1963 Secret
- HW-80393 "Interim Limits for Primary Pump Operation," R. H. Shoemaker, January 13, 1964 Unclassified
- HW-68900 Technical Bases Topic 4.3.0 Injection Water System - Function and Description
Topic 4.3.1.1 Injection Water Pump - Hydraulic Requirements
- HW-80173 "Utilization of Pu Fuel in N-Reactor - The Study to-Date," P. F. Nichols, E. E. Mills, R. A. Dieterick - December 26, 1963
- HW-80120 "N-Reactor Physics - 1963: A Summary," P. F. Nichols - December 26, 1963
- HW-79504 "N-Reactor 105-N Control Room Data Logging and Data Display," C. F. Poor December 2, 1963
- HW-79746 "N-Reactor Startup Test N-2 - Low Power Testing Program (OTP-T-0060)," K. L. Berrett and R. E. Hall, editors, dated January 20, 1964 Confidential
- HW-79840 "N-Reactor Phase II Operation - Preliminary Hazards Summary Report," J. R. Bolliger and N. R. Miller January 15, 1964 Confidential

PERSONNEL CHANGES

D. L. Condotta transferred to Project Section

SECURITY VIOLATIONS

None

INVENTIONS

All Research and Engineering personnel engaged in work that might reasonably be expected to result in inventions or discoveries advise that to the best of their knowledge and belief, no inventions or discoveries were made in the course of their work during January 1964. Such persons further advise that

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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. Hunt
Manager
Research and Engineering

MCL:LCC:dd

N-REACTOR PROJECTPROCESS DESIGN OPERATIONProcess Research and DevelopmentAnalysis of an Accidental Primary Loop Dump

The actual fuel temperature transient following an accidental dump of the primary loop has been calculated. This is the first time that such a transient has been examined, since in the past the cases of interest have generally been the more severe cases based on fuel element ruptures preceding the dumps. The most critical portion of the present calculation is the determination of the actual core flow during the transient. This is not necessarily the flow out of the dump line since the system is blowing down and has capacity for surge in the hot and cold legs and recirculation. It was determined that a minimum flow of 1.38 lbs/sec in the hot channel tube would occur at a time of 38 seconds following the dump. The temperature of the fuel rapidly decreases at the onset of the blowdown due to the reactor scram, coupled with a relatively high flow rate through the core. The temperature reaches a level of about 450F at a time of 20 seconds at which time it begins to rise and peaks out at the minimum flow period previously mentioned. At this time the temperature reaches approximately 660F. From this point the fuel temperature decays throughout the balance of the dump transient. In summary then, from a fuel temperature standpoint, the dump transient is not severe since the fuel element temperatures during the transient are always below the actual operating temperatures.

Dummy Crush Tests

The crushing properties of the N-Reactor fuel dummies were investigated in relation to predictable expansion problems in the loaded fuel column. The results of axial loading in a test section of NPR process tube indicated that plastic deformation of the dummy begins at a force of 22,000 to 24,000 pounds. Next the crushing properties of a dummy combined with a cold green fuel element were investigated. At a terminal test load of 59,000 pounds, no damage had occurred to the fuel element while the dummy exhibited the same classic buckling at each perforation as when tested alone. The conclusion reached from these tests is that the dummies will easily absorb any of the excess expansions considered in any transient and will do so with no damage to the fuel column. In the most severe case of complete coolant loss, the dummy will take the 9 to 10 inches of expansion needed without rupture of the process tube or nozzle.

Project CAI-816Reactor Nuclear Instrumentation

The Intermediate Range Nuclear Instrumentation system was utilized as the nuclear safety backup for the recent physics testing commencing December 1, 1963, and terminated January 24, 1964. A number of problems were encountered but were remedied or isolated, and the system performed satisfactorily. Except for two minor modifications, the equipment is ready for continuous

service and can be expected to perform within design specifications. One modification involves installing an isolating relay to prevent interference from the annunciator system, and the other involves a minor circuit change in the blocking oscillator of the trip circuit. Design assistance has been received from the vendor on the latter item.

RV-2 Relief Valves

Functional testing of the RV-2 pressure-loaded relief valves in the 189-D NPR-PCE high-pressure test loop facility was halted after sufficient test data had been collected to safely permit the installation of these valves in the 105-N Primary Coolant System, even though a minor hot water operational malfunction was still present. This minor malfunction is manifested in a slight leakage past the ball-type disc of the 6-inch integral cylinder primary valve, due to incomplete seating. The leakage persists for approximately five minutes after the closing action has been initiated. Based on testing experience and in consultation with the manufacturer, heavier primary closure springs have been ordered to replace the present springs and to correct the problem.

Fuel Discharging

Several columns of fuel have been dropped using the production tipoffs. It was noted that the long cantilever beam formed by the outlet nozzle added enough spring to the fuel element to cause more rotation than is desirable. In spite of this, the trampoline appeared to do an effective job of decelerating the fuel elements. Several 24-inch elements without locking clips were dropped from the top row of process tubes. No fuel elements became disassembled to the extent that they were rejected by the AMF equipment.

Injection Water Strainers

In order to protect the primary pump seal arrangement from damage due to foreign matter in the injection system, the decision was made to install injection water strainers at each primary pump. This was to be accomplished in two stages - temporary and permanent. The temporary strainers are 600-pound flanged Y-type with the strainer itself constructed of a light gage perforated metal cylinder lined with 100-mesh stainless steel screen. This strainer was felt to be too weak for the possible pressure drops which could occur. Therefore, a stacked disc-and-spacer type cylinder lined with 100-mesh screen was fabricated, tested, and used for the temporary installation.

The testing was performed in the 189-D NPR-PCE loop and consisted of determining pressure-drop versus flow characteristics for various degrees of clogging of the strainer. Pressure drops up to 7 psi were experienced at flows up to 250 gpm. Based on the 150 gpm flow (maximum expected), the test results indicated 3 psi pressure drop as the warning point for changing out of a strainer. Instrumentation has been designed to provide measurement and alarm of high strainer differential pressure. Operating limits have been established consistent with the capabilities of the temporary strainer installation.

Conversion

A requisition was issued to provide the Power Calculator channel for the sixth loop, and a drawing showing the change was issued for comment. The document giving the original five-loop Power Calculator range information is being revised to give the new six-loop data.

Equipment Development and Testing

The Environmental Test Facility at 189-D is being modified and expanded to include six additional diversion valves. The present three inlet and three diversion valves were actuated after 90 days of no movement. Sticking was evidenced with one of the diversion valves when no activation was accomplished until the tenth attempt. It is felt that actuator packing leakage is the major contributor to this hesitant operation.

The Environmental Test Facility is pointing out another problem area in the primary loop components - that of adequate anti-seize compounds. The loosening torque requirements for nozzle caps in the ETF after extended test periods have been exceptionally high. It appears that the high-temperature anti-seize compound used on the threads of the nozzle caps, forms a bond, which is partially corrosion, between carbon steel components after long periods at high temperature and temperature cycling. A special high-temperature anti-seize and sealing compound is being evaluated in the NPR-PCE loop and so far gives every indication of being the answer to the problem.

FIELD ENGINEERING OPERATIONConstruction105-N Building

Since January 20th, maximum effort has been applied on punch list items in the 105-N Building to take advantage of the access available since completion of the first phase of physics testing. Good progress has been made on the installation of the RV-2 relief valves on the primary loop and the completion of numerous features in the confinement systems.

The Zone I and II confinement seals in the 105-N Building are essentially completed. The revisions to the 105-109 common wall ventilation barriers have also been essentially completed. Most of the systems in the 105-N Building have now been turned over for operational testing.

The extension trench for the radioactive waste crib was completed during the month.

Erection of the perimeter security fence was started and is essentially complete.

109-N Building

The contractor testing for the Bailey Meter Systems in the 109 has continued to make good progress throughout the month. The primary loop pressure control system, the pressurizer level process and injection pump control system, the decontamination control system, the chemical injection control system, primary loop flow control system, and the graphite cooling system controls have all been completed.

Approximately 52 per cent of the valves in the 109 Building have been tested to Category "A" status; this is a total of about 900 valves.

Tube failures have occurred in each of the four heat exchangers in the graphite cooling system. Two of the heat exchangers are operable at the present time and a repair procedure is currently being developed for permanent repairs on all four. Failures have been mechanical due to vibration of tubes in the tube supports at high flows on the shell side. Operation at reduced flows has reduced the vibration problem.

Primary loop pumps in Cells 1, 2, 3 and 5 have been reassembled and made ready for operation. The operational testing of the primary loop has been started, using Cells 1, 2 and 5 for recirculation. The primary piping in Cell 3 has been flushed with a TSP

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solution through temporary strainers in the heat exchangers. These strainers have been removed and the pump has been operated for the cell recirculation test.

Temporary strainers have been installed in the inlet nozzles on all process tubes loaded with fuel and in the outlet nozzles on all other process tubes in an effort to collect any rust, dirt, or other matter during recirculation tests.

Conversion

The installation of the electrical cable conduit from the new motor control center into Cell No. 1 and from Cell No. 1 to the new junction box at the west end of the pipe gallery in the 109 is completed. Termination work is in progress in the motor control center.

Work has continued during the month on the penetration in the west wall of the 109-N Building preparation for the sixth cell construction.

The installation of the two 24" sectionalizing valves in the steam piping above the roof of the 109 Building has been completed. The installation of the condensate sectionalizing valves at the -4' elevation in the 109 Building turbine bay has been started. Work is continuing in the pipe gallery on the primary loop tie-in piping.

NPR Testing Program

During the report period, two additional procedures were issued for comment; four (plus two partial) were issued as approved; actual testing was initiated on two systems and two tests were completed.

Issued for Comment

T0016 - Primary Coolant System
 T0060 - Post Critical Operation Tests

Issued as Approved

T0004 - Circulating Raw Water System
 T0008 - HP Injection System
 T0016 - Primary Coolant System - Sect. 7.1
 (Static Primary Loop Tests)
 Primary Coolant System - Sect. 7.2
 (Full Pile Flow Tests)
 Primary Coolant System - Sect. 7.3
 (Cold Flow Misc. Tests)
 Primary Coolant System - Sect. 7.4
 (Charge-Discharge Control Tests)
 T0020 - Heating & Ventilation - 105-N
 T0040 - Water Quality Sample System - 109-N
 T0060 - Post Critical Operation Tests (partial)

Tests Started

T0012 - Decontamination System
 T0020 - Heating & Ventilation - 105-N

Tests Completed

T0021 - Control Rod Systems Test
 T0045 - ERWS Controls, Instrumentation & Flow Tests

In addition, supplementary approval was obtained for fifteen of the tests which will be started or continued after initial fuel loading.

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

Total number of tests scheduled	39
Scoped	39
Issued for Comment	38
Issued as Approved	33 / 3 partial
Tests Started	32
Tests Completed	11

	<u>Preparation</u>		<u>Performance</u>	
	<u>Scheduled</u>	<u>Actual</u>	<u>Scheduled</u>	<u>Actual</u>
This Month	98.5%	92.1%	41.0%*	39.8%
Last Month	96.5%	85.3%	56.5%**	27.5%

*Based on NRD Integrated Sequence Schedule - NRD Testing Program
dated January 31, 1964.

**Based on original target schedule.

Steam Generators

The existing stainless steel tubing is now being removed from steam generator unit 4A. The north head of the secondary vessel has been cut from the unit to provide access to the interior. Replacement tubing panels of Inconel are scheduled to arrive on site about May 1, 1964. Repair of steam generator unit 4A is scheduled for completion about August 15, 1964.

Subsequent to completion of repair of steam generator unit 4A, testing and completion of construction of cell 4 equipment will require approximately six weeks. Cell 4 is expected to be ready for operational service by October 1, 1964.

N-PLANT ENGINEERING

N-Plant Engineering continued to provide around-the-clock electrical engineering coverage during physics tests and for performance of OTP's during the latter part of the month. Coordination of instrument calibration was also continued for the N-Plant.

Horizontal Control Rods

A test program wherein two horizontal rod drives were fitted with rod chain hold-down devices and new transducers showed that such modifications render satisfactory operation. Problems encountered earlier for which the modifications were proposed to resolve included failure of the chain-sprocket linkage to remain coupled with resultant rod transducer failures; and electrical control components, diodes, for the rod drive equalizing function allowed stray voltages to be impressed on rod control circuits and produced spurious operation.

Positive results gained from the tests permitted modifications to all rods. Testing performed thereafter indicated all rods to be satisfactory for operation as modified. The chain-sprocket relationship should now be satisfactory from all indications of the tests.

During the installation of modified chains and transducers, 14 transducers failed; 11 failures occurred in the left side rod room and three on the right side. An investigation, although not absolutely conclusive, indicated that the position transducers were exposed temporarily to a condition wherein such damage could be produced. There was no positive indication of a design or fabrication deficiency in the damaged transducers.

Safety Circuits - T0035

During the last two weeks of the month, ten trip functions were checked out thus completing those sections of T0035. This completed all requirements for continuation of physics testing with exception of circulating raw water -- flow trips which is still in the construction check-out phase. Verification was made of practically all reset circuit functions and approximately 50 per cent of the set-back circuit. At this point, T0035 is approximately 90 per cent complete.

Concurrently with safety circuit work, tests were made on horizontal rod control circuits. Analysis of the test data by N-Plant Engineering and others indicates that diodes, which have been applied in the design to actuate secondary functions such as the equalizing valves and indicator lights produced stray voltages on the control circuits. These stray voltages were of sufficient magnitude to potentially affect the control function even though the diodes were in an undamaged condition. It was conclusively proven the failed diodes produce spurious rod control action. All such diodes have been removed from the rod control circuits.

Maintenance Standards

Three additional maintenance standards were approved and issued. Progress for preparation of maintenance standards to be submitted to the Commission prior to fuel loading is now estimated to be 40 per cent complete. Plans for expediting the maintenance standard program have been implemented with the assignment of an individual to spend half-time on coordination of this program.

Equipment Development

Equipment Development Operation of IPD reported considerable design progress for the N-Reactor Tool Development Program. Designs were completed for process tube mandrel, cap plug redressing tool, process tube deburring tool, tube expander stress collar, "C" elevator conveyor, nozzle and equipment carriage and the crate spot-facing tool. Shop fabrication of all of these tools has been scheduled to begin during the second week in February; thereby, complying with the schedule for development of these key reactor tools.

A program has been organized for development and testing of improved trip mechanisms for the Ball 3X and safety circuit primary trip circuit breakers. Schedules and costs are yet to be agreed upon.

In response to an Inquiry, the Advanced Technology Laboratory has submitted a report which surveyed the state of the art of dry film lubricants potentially useful for N-Reactor service. It has been scheduled for the Advanced Technology Laboratory to initiate development and testing of the most promising applications.

Assistance to the Operational Test Program

Three individuals have been assigned as test directors for OTP's having the need for considerable electrical engineering direction. Tests involved are T0024, Electrical Power Supply and TG Set; T0030, Rupture Monitor System; and T0035, Safety Circuits. Plant Engineering has agreed to provide the engineering for system high speed recordings for the N-2 physics tests.

PROGRAM EVALUATIONDesign Status

Title I - 100 per cent complete.

Title II - 100 per cent complete.

Costs

No change during this reporting period.

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 February 1, 1964, based on Revision #5 to the AEC construction schedule dated February 1, 1963, is as follows:

	<u>Scheduled</u>	<u>Actual</u>
Temporary Construction	98	99.6
General Area Systems	99	99.9
105-N Reactor Building	98.6	99.7
109-N Heat Exchanger Building	98.6	99.4
163N-183N Water Treat. Facilities	100	100
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)	98.8	99.6

Revision 8 of the integrated sequence schedule was issued on February 2, 1964 to all parties concerned. This schedule displays the major items of remaining construction, contractor testing, operational testing, calibration, and operational and physics startup steps. The schedule was extended to detail the above items to low power testing.

Small pile physics testing was completed on January 18, 1964. Cold flow tests were initiated on January 18, 1964 and are scheduled to be completed on February 5, 1964.

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RESPONSIBILITY

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

ORGANIZATION AND PERSONNEL

	<u>12-31-63</u>	<u>1-31-64</u>
Exempt	89	86
Nonexempt	<u>26</u>	<u>25</u>
Total	115	111
Technical Graduates	1	1

Personnel Changes

<u>Name</u>	<u>From</u>	<u>To</u>	<u>Effective Date</u>
LS Sandlin (exempt)	HUPO	Program Eval.	1-1-64
CR Sample (exempt)	Field Eng'g.	N-Reactor Plant	1-1-64
GE Hammett (exempt)	Field Eng'g.	HLO	1-1-64
NW McKay (exempt)	Field Eng'g.	N-Reactor Fuels	1-1-64
JT Bobo (nonexempt)	Drawing, Spec. & Material Control	Leave of absence	1-3-64
GI Henjum (exempt)	Field Eng'g.	Termination - ROF	1-15-64
GL Gray (exempt)	Field Eng'g.	N-Reactor Plant	1-15-64
DL Condotta (exempt)	NRD Research & Engineering	Process Design	1-21-64

SAFETY AND SECURITY

There were no disabling injuries reported during the month; total CYTD - 0.

During January, there was one security violation reported; total CYTD - 1.

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INVENTIONS OR DISCOVERIES

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

TRIPS

<u>Name</u>	<u>Firm & Location</u>	<u>Date</u>	<u>Purpose</u>
GT Haugland	Sawhill Tubular Products Sharon, Pennsylvania	1-29/30	To review manufacturing procedures and arrange for inspection of Inconel tubing for steam generator repair.
	Combustion Engineering Chattanooga, Tennessee	1-29/30	To review procedures and arrange for inspection of manufacture of Inconel tubing and tube panels for steam generator repair.
RK Bollinger	General Electric, APED San Jose, California	1-8 to 1-10	To check on ion chambers.
JK Flickinger	Foxboro, Inc. San Leandro, California	1-18 to 1-21	To discuss modifications to power calculator, approve drawings and expedite delivery.

VISITORS

<u>Name</u>	<u>Firm & Location</u>	<u>Date</u>	<u>Purpose</u>
E Legas	Chicago Pneumatic Seattle, Washington	1-8	Discuss air-driven tooling application in N-Reactor maintenance tooling program.
R Wheeler	Ingersoll-Rand Seattle, Washington	1-14	Discuss air-driven tooling application in N-Reactor maintenance tooling program.
P Medwed	AMF Atomics	1-14/15	Tests on irradiated metal handling system.
S Friezner	Specialized Testing Service North Hollywood, California	1-13/14	Consultation on strain gage system.

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SIGNIFICANT REPORTS ISSUED

<u>Doc. No.</u>	<u>Classification</u>	<u>Author</u>	<u>Date</u>	<u>Title</u>
HW-72046	Unclassified	RA Rohrbacher	1-17-64	Test Report - Evaluation of Nickel, Nickel-Cadmium and Cadmium-Titanium Coatings for N-Reactor RTD Cable
HW-77195	Confidential	FJ Mollerus, Jr.	1-23-64	N-Reactor Conversion Project Engineering Studies of Secondary Cooling System Performance during Phase II Operation
HW-80245	Secret	HR Kosmata	1-2-64	Reactor Design Analysis Monthly Report, November, 1963
HW-80454	Secret	HR Kosmata	1-16-64	Reactor Design Analysis Monthly Report, December, 1963
HW-80575	Secret	JD Agar	1-27-64	Temperature Calculations for a Newly Designed Flexible HCR for the K Reactors

Manager, N-Reactor Project

JS McMahon:mbs

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N REACTOR PLANT OPERATION

N PROCESSING OPERATION

The small pile zero power physics tests were completed on January 18. Four hundred and twenty tubes were charged. Preparations were in progress at month end for full pile loading and completion of the zero power testing program.

A Design Change modifying the control rods was completed during the month and testing was in progress at month end. This change included replacement of chains and modifying sprockets and installing a chain hold-down device to prevent chain skipping during scrams; installation of 21 turn transducers to replace the 20 turn type and give greater over-travel; removal of hydraulic equalizing valves to simplify rod control circuits without sacrificing operational control. This work is complete except for 60 transducers that had not been received at month end.

Primary loop water supply was changed over from once-through filtered water to recirculation with quality control on January 20. Primary loop pump and flow tests were in progress at month end.

The standby boiler experienced three leaks during the month, causing outages for repair as follows:

January 1 - The boiler was shutdown to repair a plug that began leaking from a tube failure that occurred on December 9. The boiler remained down until January 10 for steam drum modifications and inspections.

January 23 - The boiler was shutdown for a leak in a faulty weld and a relocated water wall tube. The tube was plugged off and operations were resumed the same day.

January 29 - A leak in a water wall tube necessitated a shutdown. This leak was due to inadvertent tack welding of a refractory case support bracket for the auxiliary burner during construction. The leak was repaired and operations resumed January 30.

Inspection of the deaerator on January 2 revealed the trays to be bent and several spray nozzles broken, apparently due to steam surges from the faulty steam supply valve. Repairs were made, the steam supply valve was revised and the deaerator was returned to satisfactory, normal service on January 14.

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Two times during the month heavy steam header vibrations were experienced during boiler load changes. The exact cause is unknown and may involve condensation in steam pipe, reducing valve chatter, or pipe supports out of adjustment. One critical pipe support was found out of adjustment and was corrected. During a significant rod variance test to simulate the conditions of vibrations following this pipe support adjustment no significant vibrations were detected. Further studies of the problem are in progress.

Boiler load tests were conducted by Foster-Wheeler and Bailey Meter from 20 per cent to full load conditions from January 25 to the end of the month. The purpose of these tests was to gather data for setting cams for automatic operation. One problem revealed during the tests was that the forced draft fans are not identical in their output. One fan has a 14 per cent higher air flow than the other. Resolution of this problem was in progress at month end.

No. 1 and No. 2 circulating raw water pumps were out of service during most of the month when their power cables shorted out. These cables were found to be faulty and were in the process of being replaced at month end. No. 1 pump cable was replaced and the pump returned to service on January 31.

Phase I and II Certification Training was completed on January 31 for 8 Pile Operators. These operators have been immediately assigned to shifts. This concludes the present program of formalized class room training. Significant training for Certification will be done on the job.

N MAINTENANCE OPERATION

Three major efforts involved 13.8 KV power supply cable replacement for circulating raw water pumps one and two; checking line-up and replacement of seals and bearings in primary pumps 1, 2, 3 and 5; and installation of modified horizontal control rod position read-out transducers and drives.

Acquisition of materials, tools and spare parts was characterized by an abnormally high level of emergency procurement actions not untypical of plant start-up circumstances.

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109-N OPERATIONSPrimary Drive Units

Subsequent to the seal bushing trouble with primary pump No. 2 in December, pumps No. 1 and No. 5 were dismantled for inspection. Seal bushings were galled and the mechanical seals were in poor condition in both pumps, thus no primary drive units were available for use. The following actions were taken:

- a) Vendor consultant services and close support for parts needs were quickly arranged. Pump No. 4 was dismantled to make parts available so that work could proceed immediately.
- b) Under Project direction, construction forces installed 100 mesh strainers in the injection seal water supply lines downstream of the emergency supply. Pressure differential instrumentation was installed for each of the four strainers. Lines between each strainer and pump were flushed prior to placing in service.
- c) The drive unit oil systems were each drained, the tanks cleaned, the oil returned, heated, circulated, and the tanks drained and cleaned again. This procedure was successful in cleaning up the heretofore unflushed pump return leg of each system.
- d) Alignment has been checked on units 1, 2, 3, and 5. Running alignment checks are being conducted on each unit as it is first brought to speeds over 2000 rpm.
- e) Operational Test T-0047 has been run on units 1, 2, 3, and 5.
- f) Under Project direction Cell No. 3 has been hydroed. Plant forces have assembled the pump. Cell piping has been cleaned by TSP recirculation with temporary transition pieces with strainers in them and the permanent transition pieces installed.

Valve Checks

Operational valve checks required for T-0016 were conducted. Experience has shown that bringing the remotely operated valves to a status where they consistently respond and indicate as required will be a long, arduous job. Approximately 500 valves have been checked to date. Approximately 70 valves of the 500 still need some degree of work to bring to an acceptable condition.

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WPPSS Tie-In

Sixteen of the thirty-four tie-ins scheduled to accommodate the sixth cell are completed. As possible, a few tie-ins scheduled for the March outage are being accomplished ahead of schedule.

Sectionalizing Valves and Relocation Work

The two 24-inch sectionalizing valves between main steam header quadrants have been installed. Insulation and permanent support are yet to be done.

Installation of the four 16-inch sectionalizing gate valves in the COND-2 header and the two 20-inch valves in the COND-1 header is in progress. Work is approximately 60 per cent complete this date.

Relocation of the COND-2 pipe and valves and the 4-inch HPR trap station in the west end of the 109 Building, -16' level is in progress.

109 Air Systems

All 109 compressed air systems have been reworked to minimize excessive leakage.

Design Change Work

Work is in progress to accomplish Design Letter 392 modification on the cell sump pump controls and piping systems.

Work on the shaft seal shielding water to change the water source is complete.

T-0017 - Secondary System

The RD outline for this test is in comment stage. Work to develop the required valve check lists and control sequence information is in progress.

Graphite Heat Exchangers

Two are serviceable with plugged tubes. A proposal was sent to the vendor via the Commission on what actions are required to bring Units 3 and 4 to a serviceable condition. Each of these units have loose tube sections which must be removed.

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N PLANNING AND SCHEDULING

The N-Reactor planning and scheduling system was put into effect at 8:00 a.m., January 6, 1964. Under this planning concept every function and every man on every shift are covered. While the system has been in operation only a short time, the potential advantages are already very obvious. Work assignments have been streamlined with more physical work being performed with less effort.

Bids for bulk hydrogen were opened on December 23, 1963 with Industrial Air Products of Portland being the low bidder at \$0.67 per 100 cubic feet. Since that time, contacts have been made and the details established on the interconnecting equipment required so that the hydrogen facility design could be released.

SIGNIFICANT REPORTS ISSUED

None

TRIPS

<u>Name</u>	<u>Location</u>	<u>Date</u>	<u>Purpose</u>
E. W. Wilson	Hempstead, New York	1/26-31	Conversion Design and Scheduling Areas.

VISITORS

W. H. Barkley	Real Estate & Construction Schenectady	1/7-9	Consultation on Boiler Problems
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PERSONNEL

<u>Additions</u>	<u>From</u>	<u>To</u>	<u>Date</u>
C. R. Sample	N Reactor Project	Plant Maintenance	1/1/64
W. D. Baxter	IPD	Plant Maintenance	1/6/64
J. L. Gibson	Military Reactivate	Plant Processing	1/6/64
W. F. Wagner	IPD	Plant Maintenance	1/6/64
R. W. E. Wickersham	IPD	Plant Maintenance	1/6/64
D. A. LeCount	*New Hire	Plant Maintenance	1/14/64

* Temporary

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PERSONNEL (CONTINUED)

<u>Additions</u>	<u>From</u>	<u>To</u>	<u>Date</u>
G. L. Gray	N Reactor Project	Plant Maintenance	1/15/64
W. M. Bricker, Jr.	IPD	Plant Maintenance	1/20/64
L. E. Johnson	CPD	Plant Maintenance	1/27/64
D. S. Remy, Jr.	CPD	Plant Maintenance	1/27/64
<u>Deletions</u>			
F. H. Dale	Plant Processing	IPD	1/13/64
J. J. Gibson	Plant Maintenance	IPD	1/20/64

W. M. Mathis
Manager - N Reactor Plant *by ds*

WM Mathis:ds

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END

**DATE
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1 / 26 / 93