DECLASSIFIED

HW--75419

DE92 040312

FUELS PREPARATION DEPARTMENT

MONTHLY REPORT

OCTOBER

1962

HANFORD ATOMIC PRODUCTS OPERATION

RICHLAND, WASHINGTON

GENERAL ELECTRIC

MASTER

DECLASSIFIED

DISTRIBUTION RESTRICTED TO U.S. ONLY
KD

DECLASSIFIED

DISTRIBUTION

Copy Number

1
2
3
4
5
6, 7, 8
9, 10

W. E. Johnson
R. L. Dickeman
A. B. Greninger
H. M. Parker
H. D. Tibbals
J. E. Travis, AEC-HOO
F. P. Baranowski
Director - Division of Production
Washington 25, D.C.

11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29

F. E. Crever
Savannah River Operations Office
F. H. Belcher - St. Louis Area Office
C. L. Karl - Fernald Area Office
J. W. Ruch - Oak Ridge Operations Office
M. C. Leverett
L. M. Loeb
W. M. Mathis - J. S. McMahon
W. N. Mobley
W. S. Roe
C. O. Steinnagel
H. E. Berg
A. G. Blasewitz
J. T. Stringer - S. M. Gill
D. C. Worlton
J. R. Carrell
Extra Copy
300 Files
Records Service Center

TABLE OF CONTENTS

General Summary

A-1 through A-12

Manufacturing Operation

B-1 through B-17

Engineering Operation

C-1 through C-31

Financial Operation

D-1 through D-2

NPR Project Operation

E-1 through E-13

GENERAL SUMMARYMANUFACTURINGProductionAlSi Process

1. Another new record high plant operating efficiency of 98.6 per cent was established during the month.
2. The inventory of finished fuels reflected a 1.8 month supply at month's ending, excluding 105 tons of dingot elements.
3. Bare core inventory at month's end is 1.1 month supply, excluding 269 tons of dingot cores.

Coextrusion Process

1. A total of 72 inner extrusions, 99 outer extrusions, and 11 special extrusions, were completed during the month of October. Total input to the plant to date represents 33 per cent of the first reactor load requirements.

ENGINEERINGPresent Reactor FuelsFuel Failures

During October an increase in rupture rates occurred and twelve (12) regular production I&E fuel elements failed in reactors. Seven of these were enriched fuel elements and five were natural uranium fuels. There is evidence that several recent bumper ruptures may have resulted from non-uniform corrosion attack. To date ruptures known, or strongly suspected, to be corrosion related have characteristically occurred in high power tubes at exposures in excess of 800 MWD/T.

Optimized Canning Studies

Optimized canning development has been initiated to improve the quality of enriched fuel prior to the fabrication of the E-N load for E Reactor. Sampling of the bonding produced with the current enriched cores shows a somewhat smaller percentage of the desired UAl_3 in comparison to natural uranium fuels. A test was carried out to determine optimum duplex canning furnace conditions for producing near 100% UAl_3 -type compound. This was successfully accomplished by raising the temperature of the duplex lead bath to 625°C. Heating rate studies have also been made using OIII standard and enriched contoured bare components and steps are under way to improve the heating rate cycle to prevent AlSi freezeout in the can base and the end porosity under the fuel element cap which may result.

DECLASSIFIED

DECLASSIFIED

HW-75419

Vacuum Outgassed Enriched Uranium

One phase of the program to improve the quality of enriched fuel cores involves the initiation of vacuum outgassing of enriched metal in hollow blank form at National Lead Company. This effort is designed to reduce the surface hydrogen which may be evolved during the canning operation causing porous braze layers and poor welds.

Grain Size

The grain size of natural uranium heat treated at National Lead Company with a new type of equipment appears to be larger than the grain size of uranium heat treated with the old Plant 6 equipment. Tests are under way to optimize the cooling rates which occur with the new equipment in order to maintain the required grain control.

Dingot Uranium

A decision was made to discontinue the dingot program for I&E fuel elements. The decision was based on continued marginal performance of dingot uranium and the absence of economic or technical incentives to continue its use. The decision and recommendation included a proposal to maintain the Mallinckrodt Chemical Works technical competence in the metal field based on their significant past contributions to metal technology.

The utilization of 300 tons of bare dingot uranium in inventory will be attempted. Initial production runs during October were discontinued because of a high reject rate for internal bond counts. Work is continuing to improve the canning process for this metal.

ALSI Fuel Testing

Routine auditing of all testers has been initiated in order to obtain an accuracy measure of performance and to correct deficiencies. These audits have shown a consistent improvement in equipment stability. Reliability of the internal bond test has been significantly upgraded. UT-2 (and tester) performance is better because of more precise set-up and standardization procedures.

UT-2 Testers for National Lead Company

A formal request has been received from National Lead Company for acquisition of two automatic UT-2 (uranium core) testers. This request is based on the favorable experience obtained with the earlier test units which have been in use at National Lead Company for a year.

Alternate Process Development

Hot Die Sizing

The evaluation of a test designed to establish optimum process conditions is continuing. A number of important parameters relative to preheat temperature are residence time, aluminum reduction ratios and ram speeds,

Dimensional and clad thickness control, have been defined. A tentative specification for the preheat and hot die sizing steps has been established for the CVN fuel configuration.

Major debugging of the end bonding press has been completed and a test is now being bonded to evaluate desired parameters for this operation. Tooling to investigate the effectiveness of end bonding by differential expansion is 95 per cent complete.

Electroplating

Electroplating of uranium cores for hot-die sizing is continuing effectively. Work is concentrated on the simplification of the process and on the improvement of reproducibility.

Hot-Die Sizing Test Program

Shop fabrication of the hot-die sized fuel inspection station (UE-3) is proceeding on schedule.

A novel electrolytic technique is being investigated as a means of detecting minute cladding defects in nickel plated cores. When cores with pinholes or other defects are submerged in a weak salt solution, an ion current due to battery action can be detected.

A charge of approximately 100 millivolts has been observed with a .010 inch diameter hole in the plate.

Hot Press

The irradiation test comparing Sylcor Hot Press, HAPO Hot Press and HAPO AlSi control fuel elements was discharged. Examination of the HAPO Hot Press piece, which failed at 640 MWD/T, revealed a cladding failure under a self-support rail. Pieces held in storage which were canned at the same time showed marred surfaces under the support rails. These mars were directly related to the use of a unique lot of rails which had an exceptionally low bridge-to-dimple height.

Nondestructive Testing

Ingot Testing

Laboratory efforts have successfully applied the ultrasonic test to ingots for the first time. Results show a marked lack of uniformity between the four ingots examined to date.

Uranium Enrichment Tester

Shop fabrication of the uranium enrichment level detectors has been completed and laboratory check-out is in progress. Two units are being put into service, one for billets, and one to measure the enrichment

DECLASSIFIED

level of AlSi fuel cores. These instruments were designed to ensure nuclear safety by preventing material of unknown enrichment levels from being inadvertently mixed with materials of known enrichment levels.

N Reactor Fuel Development

KER Loop Testing

Loops 1 and 2 are shut down for modifications and it is now anticipated that they will be back on the line about November 15, 1962. Loop 3 is shut down for pump repairs and this loop should be back in operation sometime after January 1, 1963. The fourteen (14) N enriched fuel assemblies (NAE-1) in loop 4 are operating satisfactorily and have reached an exposure of about 290 MWD/T. Goal exposure is 2800 MWD/T. A backup charge of fourteen (14) NAE-1 fuel is available for charging. Throw-away fuels (standard and short N enriched inners) are available for testing the modifications to Loops 1 and 2.

Test Fuel Fabrication

Fifty 1.6% enriched KSE-5 fuels are at brazing in the 306 Pilot Plant.

A test for the purpose of studying the swelling behavior of uranium alloyed with 2 w/o zirconium has been extruded.

Other Extrusions

Four primary, six Zircaloy, one uranium, and one component extrusion were completed and 11.1 inch, 7.15" and 6.0" tooling was used.

Clad Variation Studies

Recent investigations using ultrasonic testing techniques strongly support earlier findings that billets with high ultrasonic attenuation -- which is characteristic of large grain uranium -- tend to produce excessive clad thickness variations on the inner surface of extruded outer fuel tubes. Significantly, it has been further established that such billets are invariably low in additive impurity content. The indicated correlation is supported by metallurgical studies; i.e., added impurities should result in smaller grain sizes. To further test this correlation the following material has been ordered: NOE billets containing respectively 140-190 ppm silicon, 190-250 ppm silicon, and 400-450 ppm silicon. Experimental data has shown that both silicon and iron have equivalent effects on grain refinement but that the higher silicon content is more stable in the uranium matrix. For this reason the test will be carried out using the higher percentage of silicon in preference to iron.

N Inner Billet Yields

The largest loss category in the uranium fuel stream is the rejection of N inner enriched billets after finish machining. The reject rate is directly related to the bow of the primary extrusion. Although the bowed primary extrusion can be machined to be dimensionally concentric, the physical properties of uranium such as grain size are no longer distributed in concentric

rings. During October to control or eliminate bowing on the runout table, a cooling table with a flat insulated surface was set up and the billet extrusions were immediately transferred from the runout to the cooling table where they were slowly rolled during the cooling cycle. Bridgeport Brass Company personnel report significant reduction in warp as a result of this modification. To further improve concentricity the lead ends of test ingots were squared and chamfered prior to extrusion. The preliminary results from the extrusion of these ingots showed a significant reduction had been obtained in front end warp. Of 35 test billets evaluated, only one had warped over 30 mils. Of the 28 control billets, eight were warped over 30 mils.

Warp Yields - N Inner Pieces

During October improved warp yield in the manufacturing process has been obtained by increased attention to and improvement in the straightening-recovery efficiency. During this period of operation instructions on operating techniques, measurement error, etc. have been closely evaluated in coordination with Manufacturing and changes made where warranted.

Alternate Method for Making End Closure Recesses

A method which has the potential of replacing the present production method for preparing end closure recesses is under development and evaluation. This involves machine milling of the uranium to within 15-25 mils of final depth with a subsequent chemical milling finishing step. Tests have also been made to remove the residual uranium by high temperature oxidation followed by abrasive blasting. Potential advantages include reduced cost and improved uranium surface for both braze closures and for processes such as pressure bonding.

Recovery of Autoclave Rejects

Tests have been completed which indicate the feasibility of recovering "white oxide" autoclave rejects. This involved cathodic removal of the oxide film followed by re-etching and re-autoclaving.

Fuel Element Supports

Outer Supports

A new design for the outer support has been selected and evaluations indicate that this design will meet the required criteria. The impact strength of the support arch is approximately five times that of the old suitcase handle support. The load versus deflection properties also meet the criteria of 1000 pound load for .040-.050 inch of deflection. The tooling method used in fabricating this support is yielding 90 per cent acceptable parts in early testing.

Inner Supports

Design modifications of the inner support are not yet firm. It has been established, however, that the original buggy spring design can meet the

DECLASSIFIED

DECLASSIFIED

HW-75419

deflection load criteria if all loops are touching. A problem still exists in determining the method for assembly and sizing of the inner fuel into the outer fuel tube in a way which will not harm the support.

Zircaloy-2 Development for Supports

The Zircaloy-2 program in Hanford Laboratories which is designed to improve the quality of strip is showing good progress. Three types of strip prepared by different processes have shown good ductility and fatigue resistance. Zircaloy strips rolled from plate and that produced by the Turksheading process proved to have twice the fatigue life of strip produced from rolled tube segments.

Nondestructive Testing

Contamination Tester

Alpha counting equipment, which measures uranium cladding and end closure contamination, is ready for installation in the N Fuel Manufacturing Facility.

NPR PROJECT

Thermal transient tests were run on the number three primary coolant pump after increasing the seal clearance. The tests were those required by Byron Jackson in order to give their engineering opinion that the pumps will perform reliably in the field. There was no indication of any operating difficulty during the tests; however, measurements after disassembling the pump indicated the casing cover plate fit had increased in diameter 0.005 inches to 0.011 inches. Byron Jackson have stated that additional tests will be required to provide the information needed to give their engineering opinion that the pumps will be reliable.

Parker "H" mechanical fittings have been approved as an alternate to socket welded fittings for instrument tubing connectors.

The lubricant (Indium plus Electrofilm 66-C) for process tube diversion valves was approved on October 18, 1962, with receipt of statements from Chandler-Evans and Electrofilm that the lubricant will be satisfactory for the 600 F diversion valve service for at least one year.

Brush Instrument Corporation has devised an electrical test to separate good from bad differential transformers in the flow monitor pressure-to-electrical signal transducers. Ten faulty differential transformers were found in the 502 units of the first three instrument racks assembled. These ten units were replaced and the three racks (half of the order) were shipped on October 16, 1962.

Operation of the Environmental Test Facility in the 189-D Building was initiated on October 5, 1962. Conditions employed were 125 gpm, 1762 psi, and 550 F.

All of the concrete walls and columns in the 117-N Building which involve filter frame inserts have now been completed. The slab over the filter cells is now in place over all the cells. "As-Built" information has now been obtained on two of the four cells and only minor correction work will be required in order to comply with the dimensional tolerances.

Work is still in progress on the river water pump motors for the 181-N Building. One motor has been modified and is now being installed for testing.

Installation of the horizontal rod drive assemblies has begun. The installation of the final skin plate on reactor primary top shield is nearing completion. This will complete work on the reactor shielding.

Production in the HUICO shop is now over the peak and personnel are being terminated as the work load decreases. Field erection activities continue at a slow pace. Kaiser Engineers have been increasing the total number of field personnel during the month. All headers, except one, have been placed in the left outlet pipe space.

PERSONNEL STATISTICS

Number of employees as of September 30, 1962 698
 Number of employees as of October 31, 1962 926

	<u>Exempt</u>	<u>Nonexempt</u>	<u>Total</u>
General	2	1	3
Employee Relations	1	0	1
Engineering	48	28	76
Financial	13	8	21
Manufacturing	114	493	607
N Reactor Engineering	16	2	18
N Reactor Operation	44	48	92
NPR Project	87	21	108
TOTAL	325	601	926

<u>Employment</u>	<u>October</u>	<u>September</u>
Additions: Exempt	147	1
Nonexempt	86	17
	<u>233</u>	<u>18</u>
Reductions: Exempt	1	12
Nonexempt	4	144
	<u>5</u>	<u>156</u>

DECLASSIFIED

DECLASSIFIED

HW-75419

The large increase in added personnel was due to the transfer of the New Production Reactor responsibility, on October 15, 1962, from Irradiation Processing Department to the Fuels Preparation Department. This reassignment of functions was responsible for the increase of 146 exempt personnel and 68 nonexempt. Included in this number are 16 exempt and 2 nonexempt for the N Reactor Engineering Operation, which was transferred October 29, 1962. Other additions to FPD included a Technician replacement for Testing Methods; an Instrument Technician and Power Operator Journeyman transfer from IPD for N Area; eight new hires as additional Metal Handlers; an additional Metal Handler on Request for Transfer from IPD; two reactivates from personal illness; a Janitor replacement on Request for Transfer from CPD; three rehires -- one as an additional Metal Handler, one a replacement Junior Power Operator; and a Principal Engineer for N Reactor Operation; and a Millwright Journeyman swap with IPD on Request for Transfer.

Reductions to the rolls during October consisted of a deactivation due to personal illness; transfer of an Instrument Technician on Request for Transfer to HLO; a Millwright Journeyman swap with IPD on Request for Transfer; a resignation of a Pipefitter Journeyman to go into business for himself; and transfer of a Foreman to HLO.

STAFF

General Manager	R. L. Dickeman
Manager, Employee Relations	C. O. Steinnagel
Manager, Engineering Operation	L. M. Loeb
Manager, Financial Operation	W. S. Roe
Manager, Manufacturing Operation	W. N. Mobley
Manager, N Reactor Engineering	M. C. Leverett
Manager, N Reactor Operation	W. M. Mathis
Manager, NPR Project Operation	J. S. McMahon
Consultant, Business Effectiveness Program	J. W. Talbott

Effective October 15, 1962, the General Electric Company responsibilities for the New Production Reactor were assigned to the Fuels Preparation Department.

SAFETY

Days since last disabling injury	201
Hours worked since last disabling injury	856,921

MEDICAL TREATMENT INJURIES

Operation	This Month No. of Cases	Frequency Rate	Last Month No. of Cases	Frequency Rate	Year-To-Date No. of Cases	Frequency Rate
Engineering	3	2.39	3	2.42	24	1.94
Financial	0	0.00	0	0.00	0	0.00
Manufacturing	41	4.29	33	3.36	283*	3.68*
N Reactor Engineering	0	0.00	--	--	0	0.00
N Reactor Operation	0	0.00	--	--	0	0.00
NPR Project	4	2.17	--	--	4	2.17
Total	48	3.19	36	3.12	473	3.52

* Includes former Plant Facilities: 162 Cases and 4.45 Frequency Rate.

SECURITY

There was one security violation in the Department during October, which was the result of an open file. The calendar year-to-date total for FPD now stands at seven violations.

SUGGESTION PLAN										
<u>Operation</u>	No. Received		No. Evaluated		No. Adopted		Amount of Awards		Net Annual Savings	
	Mo.	CYTD	Mo.	CYTD	Mo.	CYTD	Mo.	CYTD	Mo.	CYTD
General	---	---	---	---	---	---	\$---	\$---	\$---	\$---
Engineering	---	2	---	3	---	1	---	5	---	---
Financial	---	1	---	1	---	---	---	---	---	---
Manufacturing	52	263	21	249	9	115	75	2900	252	17,891
N Reactor Eng'g.	---	---	---	---	---	---	---	---	---	---
N Reactor Operation	---	---	---	---	---	---	---	---	---	---
NPR Project	---	---	---	---	---	---	---	---	---	---
Plant Facilities	---	173	2	257	2	127	10	2705	---	14,241
Total	52	439	23	510	11	243	\$ 85	\$5610	\$252	\$32,132

<u>Operation</u>	COST IMPROVEMENTS (EXCLUDING SUGGESTIONS)	
	<u>Accepted in October</u>	<u>Total Accepted CYTD</u>
General	\$ ---	\$ ---
Engineering	---	124,300
Manufacturing	200,108	583,517
N Reactor Eng'g.	---	---
N Reactor Operation	---	---
NPR Project	---	---
Plant Facilities	---	42,414
Total	\$200,108	\$750,231

Major cost improvements were cost reductions on zircaloy components for the Coextrusion Shop and aluminum components for AlSi Shop.

DECLASSIFIED

DECLASSIFIED

EW-75419

PATENT SUMMARY - OCTOBER 1962

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

"A Method for Stopping Brazing Action on Exterior Surfaces of Aluminum Fuel Cans," dated October 29, 1962

By G. R. Hanson

RL Dickeman

General Manager
Fuels Preparation Department

RL Dickeman:mkm

MANUFACTURING OPERATION
OCTOBER, 1962

CURRENT OPERATIONSProductionStatistics - AlSi Shop

	<u>NATURAL</u>				<u>ENRICHED</u>				
<u>Current Month's Production</u>	<u>C</u>	<u>K</u>	<u>Reg.</u>	<u>Bumper</u>	<u>C</u>	<u>K</u>	<u>Reg.</u>	<u>Bumper</u>	<u>Total</u>
Acceptable Fuel Elements Produced (Tons)	73.2	156.3	70.7	139.7	20.2	69.7	45.5	113.0	618.3
As % of Forecast Production	88	113	70	81	202	103	114	205	98
Cum. % of Forecast for Current Quarter	88	113	70	81	202	103	114	205	98
As % of Past 3 Month's Average Production	349	77	70	123	184	174	379	165	117
As % of Past 12 Month's Average Production	209	62	60	161	155	148	379	148	104
% of Forecast Achieved Last Fiscal Quarter	82	123	134	98	57	64	320	134	108
% of Forecast Achieved Last 4 Fiscal Quarters	75	120	126	76	77	98	145	110	105

Operating Efficiency

Current Month (%)	98.6
Forecast (%)	95.0
Previous Month (%)	98.5

Manufacturing Yield

Current Month (%)	93	91	88	86	88	90	88	89
Forecast (%)	90	90	90	85	90	90	90	85
Previous Month (%)	-	90	89	83	92	-	91	87

Bare Uranium Available for Processing (Tons)	609
Finished Products in Storage (Tons)	993
Work in Process (Tons)	172
Special Products Finished (Pieces) 6" Solid Boll	3226
Uranium Utilization	95.3

DECLASSIFIED

DECLASSIFIED

HW-75419

Statistics - Coextrusion Production (1)

Forecast Process Input	25.0 Tons
Actual Process Input	30.3 Tons

Unit Operation	Station Throughput				Inventory of Pieces Awaiting Processing					
	Outers		Inners		Outers			Inners		
	Pieces Process.	Defect Rate(3)	Pieces Process.	Defect Rate(3)	24"	18"	12"	24"	18"	12"
Extrusions (2)	99	-	72	-	16	Awaiting cutup		None awaiting cutup		
Chemical Milling	1315	0.0	1486	0.1	498	1	0	2	43	4
Braze	660	8.6	1896	7.1	285	0	0	0	0	0
Heat Treat	574	0.0	2079	5.2	49	10	0	0	0	0
Machining	403	-	2157	-	72	0	0	0	34	0
Welding	778	2.7	2290	2.6	0	0	0	170	17	10
Non-Dest. Tester	598	26.0	2364	0.0	0	0	0	143	4	6
Autoradiograph	300	0.0	1974	0.0	9	9	0	519	9	28
Support Weld	-	-	-	-	1675	144	60	3662	344	184
Autoclave	-	-	-	-	94	4	0	0	4	0
Final Inspection	-	-	-	-	1219	31	4	185	52	0

Process Inventory

Production Pieces Held for Rework	895	108	11	434	154	15
Production Pieces Awaiting Evaluation	466	22	1	161	12	2
Production Pieces - Scrap	80	6	4	39	44	51
 Total Process Inventory - Pieces	5342	335	80	5315	717	300
Total Process Inventory - Pounds	144,715	6,787	1,068	72,071	7,263	2,001
Total Process Inventory - Tons	116.95					

Finished Production for October - tons	0
Total Finished Inventory - tons	12.82

Oxide burned - pounds	513.81
-----------------------	--------

- (1) Input and inventory to-date consists of enriched uranium
- (2) Billets
- (3) Includes pieces held for rework, pieces awaiting evaluation and scrap pieces.

ProductionPlant Operation - AlSi

Another new record high in plant operating efficiency was established during October. Nevertheless, production underann the forecast slightly due to the finishing of a high proportion of six-inch production and corresponding lower proportion of eight-inch than scheduled. Nine canning lines per day were in operation during the entire month.

The eight-inch yield was increased during October primarily due to the fact that only two fuel element lots were canned with new vendor components. The AlSi slop rate for those two lots was over four times the normal monthly average rate.

The six-inch enriched yield was down for the month due to AlSi slops and mechanical problems on the semiautomatic welders. The increased bumper yield resulted from improved rail welder performance through both mechanical performance and operator technique.

The yield for the first week of production on the OIWT I&E lithium-aluminum target elements was 25.9 per cent. This figure was derived from the number of pieces machined; not from the number canned as in the AlSi process.

The greatest reject rate was incurred from voids and inclusions in the rod stock with 36.7 per cent rejects.

Projection fuel elements produced during October totaled 183 tons, with yields of 85.8 per cent on the eight-inch fuels and 88.6 per cent on the six-inch. The bumper welding yield was 96 per cent on the six-inch and 95 per cent on the eight-inch material. Production and reactor charging for October and to date are as follows:

	<u>October 1962</u>		<u>To Date</u>	
	<u>Natural</u>	<u>Enriched</u>	<u>Natural</u>	<u>Enriched</u>
FPD Produced	140	43	1691	753
IPD Charged	267	46	1624	677
Finished Inventory	67	76	67	76
Average Welding Yield	95%	96%		

A total of 3226 lithium-aluminum six-inch solid target elements were placed in storage.

The inventory of finished fuels at month end reflected a 1.8 month supply based upon projected reactor usage, excluding 105 tons of dingot elements being held for further evaluation.

Month end inventory of bare cores reflected a 1.1 month supply based upon anticipated fuels process needs, excluding 268 tons of dingot cores being held for further evaluation.

DECLASSIFIED

DECLASSIFIED

HW-75419

One enriched scrap shipment of 13 tons was made during October. In addition, 4.3 tons of copper clad natural metal was shipped for Engineering to du Pont Company. A total of 1210 empty boxes were returned.

The following pieces were processed through the Fuel Recovery facilities during October:

8" I&E	22,621
6" Enriched I&E	4,921
6" Water Mix	<u>1,574</u>

Total 29,116

Plant Operation - Coextrusion

A total of 182 extrusions were completed during October: 72 inners, 99 outers, and 11 special extrusions for Engineering. Six of the extrusions for Engineering were from primary billets. The 171 production extrusions represent an input of 30.3 tons and brings the total input to the plant to date to 213.0 tons, or 33 per cent of the first load requirements. Although the plant was able to exceed the 25 ton input schedule, the lack of acceptable components did interfere with the extrusion schedule.

The lack of a support process is still preventing the processing of material through the support welding and autoclave operations. The backlog of material at the support welders has continued to increase.

Hot warp measurements were started the latter part of the month on the Standard Sample only.

A minor modification to the pit furnaces increased the capacity of the furnaces, and resulted in a doubling of the inner extrusions and a 40 per cent increase in the outers in an eight-hour shift without reloading the furnaces.

Approximately 90 per cent of the zirconium sleeves were given a bright etch to remove objectionable stains. Peel test results indicate the etch was effective and may improve the bonding quality. Future shipments of these sleeves are expected to have an acceptable surface which will not require etching.

A new bond standard of 60 mil unbond replaces the 100 mil unbond. The use of the new standard will provide tighter control on setting up the testers.

Performance at the chemical milling station was improved greatly on both chemical milling depth rejects and surface variation rejects. Surface variation rejects reclaimed from rework storage with the use of masking washers has resulted in savings in both essential materials and labor.

Manufacturing Engineering

Design and Projects

CAF-954 High Pressure Autoclave Development Facility

A Work Authority authorizing \$10,000 to prepare design criteria and perform Title I design was issued October 2, 1962.

CAF-961 Consolidated 303 Area Services Facility - Phase I

The project proposal is still awaiting approval.

CAF-973 Steam Distribution Line Modifications - 300 Area

Authorization of this project is awaiting availability of FY 1963 PAC budget funds.

CGF-979 Pilot Scale Plating Equipment - 300 Area

A Directive authorizing this work was issued October 30, 1962.

CAF-980 Boiler Replacement for Additional Steam Generating Capacity - 384 Building, 300 Area

This project proposal is still awaiting action by the AEC.

Drafting and Duplicating

Drawings Produced

New	87
Revisions	185
Small Charts	14
Large Charts	14
Miscellaneous	35

Duplicating Production

914 Copier Masters Prepared	754
Multilith Impressions	381,469
914 Copier Copies	21,210
Ozalid Copies	7,977
Number of pages collated	251,801
Number of orders processed	1,611

Services and Utilities

Statistics

	<u>October</u>	<u>September</u>
Average steam generated (M lbs/hr)	57	43
Maximum steam generated (M lbs/hr)	88	73

B-5
DECLASSIFIED

DECLASSIFIED

HW-75419

Services and Utilities (Continued)

Statistics (Continued)

	<u>October</u>	<u>September</u>
Total steam generated (M lbs)	41,196	24,549
Coal consumed (Tons)	2,197.15	1,416.50
Evaporation rate (steam/# coal)	9.37	8.66
Efficiency - Actual	61.0	55.3
Efficiency - Theoretical	73.5	68.5
No. of Boilers on: 2 3 4 3 4 2 1		
Date of Change*: 25 27 28 30 2 3 4		
Sanitary water from 3000 Area (M Gals)	120.80	108.37
Total water from 3000 Area (Avg. rate GPM)	2,796	3,136
Peak water consumption for 24 hours (M Gals)	4.4	5.0

* Cut-off date 25th of previous month.

Operating Experience

A scheduled outage of the west export tie line in the 382 Building service water system was required to permit installation of the water sampling device.

The waste sewer line from the 384 Building was cleaned under the direction of a consultant and procedural information has been provided by this firm so that this work may be performed in the future should circumstances require it. Due to the chemical losses experienced through uncapped abandoned lines, the old line was excavated and blanked off.

The vibration problem experienced last month with the No. 6 Boiler forced-draft fan and bearing has apparently been corrected by the installation of the concrete base and balancing of the fan. The No. 6 Boiler overhaul was completed and placed in service October 2, 1962.

The No. 5 Boiler maintenance work was completed and the Third Party Inspection made on October 11, 1962. The Travelers representative made recommendations regarding safety valves and new valves for Nos. 3, 4, and 5 Boilers which are expected to be on site by November 15.

Accoustical sound board was applied to the outer metal wall and the concrete block wall located in the vapor blast area of the 333 Building to reduce the sharp noise of the vapor blasters.

The discharge dampers on the Nos. 1 and 2 supply units in the 329 Building were removed and altered by the installation of self-aligning bearing plates and outside controls for the damper blades. This is the same alteration made on such units in the 326 and 327 Buildings which have proven very satisfactory.

New lighting has been installed in the Sheetmetal Shop by J. A. Jones Company and all the unused circuits, wiring, and conduit have been removed.

PLANT CONDITIONS, INCIDENTS, AND IMPROVEMENTSAlSi Shop

A new record high plant operating efficiency of 98.6 per cent was established in October, exceeding the previous high of 98.5 per cent which was attained last month. About 80 per cent of the downtime was attributed to the change from dingot to ingot metal and for safety meetings.

On October 15, 1962 the canning conditions on three lines were changed for processing dingot metal. During the day shift, a high incidence of internal bond rejects was found as this material reached the UE-1 testers. As the reject rate appeared to be continuing into the swing shift, it was decided to shut down the three lines that were canning eight-inch dingot material as soon as a representative number of pieces had been canned rather than produce a fuel of questionable quality. The problem was not obvious but the internal bond reject rate was higher than would normally be expected using ingot material. Seventy minutes per line were lost on each of the three lines to make the changeover to ingot canning. The sensitivity of the internal bond testers was not altered when production was changed to ingot. No internal bond rejects were encountered the remainder of the shift. The dingot material has been placed in a "hold" category pending a complete quality evaluation.

Considerable operating difficulties were encountered on the cap and can machine this month. About fourteen rails were broken and sixteen to eighteen can or spire baskets damaged. Part of the broken rails can be attributed to the training of new can machine operators, but the major share was caused by mechanical malfunction. Each time a basket of cans or spires was damaged, part of the components were lost due to damage. This contributed to the above-standard consumption of components for the month.

There was a total of 4350 minutes of downtime on the bare core testers for "B" shift this month, of which 55 per cent was attributed to grain testing. A significant amount of this time was due to experimental work to develop the improved grain test. Every attempt will be made to reduce the time required for testing standards.

The bare core tester area became contaminated sufficiently above the HAPO Radiation Protection Standards to require either decontamination or roping the area off as a radiation zone. The floor was approximately two times above desired limits. Although decontamination of the floor with diversey has been successful in the past, the equipment could not be decontaminated with the equipment available and within the limited time at the end of the shift. In order to decontaminate the area properly, it was necessary to use the steam decontaminating unit and perform the work on a Saturday. It is anticipated that the area will not need another such treatment for three or four months.

DECLASSIFIED

DECLASSIFIED

HW-75419

The newly overhauled Acme-Gridley lathe was moved into the #2 position; #2 was moved to #4 position; and #4 was moved out for overhaul. The new automatic fuel element loader on #2 lathe has worked very well except for two items. One of the safety circuits has failed twice and each time has broken one of the rods the load cradle rides on. The unloader is not reliable enough and frequently jams with fuel elements which shuts down the machine. These problems are being worked on by both Maintenance and Engineering.

A contour tool holder which has been modified to give a blast of high pressure air at the edge of the tool just as the cut is finished was placed in service on #4 lathe. This air blast provides cooling for the tool, which should extend tool life, and breaks the chips loose from the tool thus preventing their hanging in the holder and scarring the fuel elements. Since this holder has been in service, there have been no lathe curl rejects from #4 lathe due to chips in the contour tool holder. This air blast principle will be tried on other tool holders where applicable.

The ultrasonic welder in 2C position has been modified to provide for the production of self-support fuel elements. It has produced CV self-supports in small quantities and will be available for use on KV fuel elements with the addition of post welder sizing die.

A total defective rate of 4.6 per cent for all models of projection fuel was experienced at the ultrasonic welders during October. Welder efficiency during scheduled operation was estimated at 75 per cent during this period. The marked improvement in yield performance is attributed to:

1. Improvement of reweld yield
2. Reduction of cracked weld rejects
3. Improved model change-over procedure
4. New slide and rail feeder installation
5. Overhaul of oil cylinders and replacement of air cylinders to feeder mechanisms
6. Replacement of a critical capacitor in the power supply
7. Development of procedures for trouble shooting maintenance problems and pinpointing problem areas associated with weld force, frequency, and power

The study of sleeve distortion effect on fuel element dimensional characteristics continues. After approximately 80 cycles for each sleeve there has been no noticeable effect on the fuel element dimensions. Completion of the program is expected in February 1963.

A study has been initiated to investigate currently used silicon determination procedures. A large group of samples of varying aluminum-silicon ratios have been prepared for the study.

The induction coil on an Ajax Furnace failed due to an electrical short between the copper coil and the steel core. The short was caused by the presence of aluminum lathe chips and AlSi in the air space between the coil and core. This condition was the result of using 90 psig air to blow out aluminum and dust accumulation from the lathe and canning areas.

The installation of gears with the incorrect tooth ratio was responsible for incorrect timing sequences on the canning timer of canning line #3 and the quench timer on line #4. There were no out-of-process material losses resulting from this incident. The necessary corrective measures have been taken to eliminate a recurrence of this.

Coextrusion Shop

Billet assembly was down about 30 hours during the month due to a lack of copper inner sleeves. Approximately 60 per cent of the material received was rejected due to galling on the inside of the sleeve. This condition is undetectable until after the copper has been etched. A high defective rate on outer tubes due to pitting on the inside surface of the tube was encountered. This was probably caused from excessive aqua dag when a dipping technique was used for applying the dag. Dipping of outer billets was discontinued and hand application used.

Efforts to use the new billet heating furnace have continued to produce poor results. One of four billets would not come up to extrusion temperature when an attempt was made to preheat four billets for extrusion. Another attempt with eight billets placed in the furnace at various locations resulted in two billets at each end of the furnace heating properly to 1150° F and the four near the center overheating to 1255° F. Several mechanical malfunctions were also encountered.

The extrusion press was out of service two days during the removal of the shear mechanism and associated piping. An oil leak developed from the shear and was creating a fire hazard in the pit under the press. Removal of this equipment will reduce the possibility of oil leaks and will improve working conditions for both operations and maintenance. As an added safety precaution, a fire alarm pull box has been installed at the operating control console. During the outage, the pit area was cleaned. It was found that the sump pump switch had failed to operate this, causing a build-up of oil in the sump. Due to the design of the sump and with the switch operating properly, the oil has to accumulate to a high level before the pump will start. Recommendations have been submitted for installation of a second pump with a more positive float switch.

Maintenance problems with the braze equipment caused excessive downtime and a backlog to build up in front of braze. Major difficulties have centered around the vacuum system and instrumentation. New scope mounts were installed to provide increased rigidity and improved alignment.

Due to the design of the chemical milling tank, NO₂ fumes were escaping during the sparging of the solution. Although minor modifications to the tank made a substantial improvement, a recheck by Occupational Hygiene indicates fumes are still escaping. Maintenance Engineering is taking steps to correct the condition.

Operating efficiency of the nondestructive testers continues to be low due to maintenance problems. Excessive downtime encountered is due mainly to mechanical components. A prototype direct riding head was tried for the clad and bond testers and found feasible. The new head will replace the present tape head and should reduce maintenance downtime by 30 to 40 per cent.

DECLASSIFIED

HW-75419

Double cycling of inner material through vacu-blast has been required all month. Consequently, it has been necessary to operate the vacu-blast routinely on 4-12 shift to meet the present production quotas.

A method of adapting the inner fuel tube support tooling to the wall of outer tube supports was developed and its application should realize considerable savings.

Fabrication of handling equipment for hot warp measurement was completed. Hot warp measurements are now being taken routinely at beta heat treat. It is expected that the correlation of these data and post-irradiation data will make possible improvement of N-fuel quality.

A detailed program definition of the Pre-irradiation Measurement system has been developed and sent to Technical Data Processing. This computer program will provide values for warp, ovality, twist, wall thickness, bending, and average diameters based on measurements over the entire fuel. A value proportional to surface waviness will also be calculated. Data Processing has estimated that the computer program will be complete by March 31, 1963. Collection of data will begin in November.

An investigation has been made of the defect rate of the outer pieces for inner clad variation as compared to billet chemistry. The comparison of high and low iron and silicon concentrates in billets were compared to the defect rates. The study indicated that no significant relationship exists.

Miscellaneous

Installation of an auxiliary instrument panel in the 304 Building has been completed.

The No. 6 compressor installation in the 384 Building has gone as far as possible until the manufacturer's service engineer modifies the control system.

A study is underway to establish a preventive maintenance record and procedures program on all major Department electrical switchgear.

A criticality radiation evacuation practice and alarm test were successfully conducted in the 306 Building. The test of the 303-E Building criticality alarm system was deferred due to removal of source material from the building. The need for this alarm system will be ascertained and a decision made whether to deactivate the system to avoid a potential false alarm.

IBM time clocks were changed back to standard time September 30, 1962.

A rough sketch has been completed of the entire 300 Area electrical fire alarm loop. An as-built drawing and a trouble-shooting procedure will be prepared from the sketch.

FPD HEALTH AND SAFETY

	<u>October</u>	<u>September</u>
Disabling Injuries	0	0
Serious Accidents	0	0
Medical Treatment Injuries	48	36

Central Safety Council inspection of Department facilities during October covered the Coextruded Product Engineering Sub-section.

Orientation for new nonexempt employees was held on October 30. Special orientation meetings for swing shift personnel were conducted on October 9, 11, 18, and 25.

The Program Council sponsored Fire Prevention Month activities were brought to a successful conclusion on October 29 with the announcement of the fire slogan contest winners. Programs included the slogan contest, publicity items, fire safety topics that were distributed to all employees, facility inspections, fire safety display and posters, fire alarm drills, and fire safety meetings.

Criticality alarms in buildings 305, 306, 313 and 333 are now in service following trial evacuations on September 27 and October 5.

The 300 Area Emergency Plan has been approved and is in preparation for printing. Copies have been requested for all FPD exempt personnel in 300 Area.

FPD SUGGESTION PLAN

<u>Suggestion Plan Participation</u>	<u>October</u>	<u>September</u>
Number of eligible employees	596	521
FPD Suggestions received	52	28
Annualized rate per 1000 eligible employees	1047	645
Number of Suggestions adopted	11	24
Net annual savings	\$252	\$1503
Amount of awards	\$ 85	\$ 430
Per cent of awards to savings	33.7	28.6
Average amount of awards	\$ 7.73	\$ 17.92

The suggestion backlog at the end of October increased over the previous month's which was the lowest in four years.

SIGNIFICANT REPORTS ISSUED

HW-75281	K-Area Magazine Loading in 313 Building, 300 Area	10-23-62	TH Whatley
HW-75341	Production Forecast, FPD, October 1962 Through June 1964	10-16-62	RL Dickeman
HW-75399	Uranium Delivery Schedule, FPD-HAPO	10-25-62	WN Mobley
HW-75408	Production Receipts and Inventories, FPD-HAPO	10-26-62	WN Mobley

B-11

DECLASSIFIED

DECLASSIFIED

HW-75419

HW-75442 CY 1963 Goals Forecast, Manufacturing Section, FPD 10-26-62 WK Wright
HW-75455 I&E Bare Core Inventory 10-31-62 RL Dickeman
HW-74429 Papers and Proceedings of the X-Ray Preferred orientation Meeting held at HAPO (June 29 and 30, 1961) 10-5-62 WG Jolley
Unclassified ALSi Fuel Element Autoclave Rupture Incident - 9-13-62 JJ Wick
August 21, 1962

EMPLOYEE RELATIONS

Safety

Personnel of the Manufacturing Operation sustained 39 medical treatment injuries during October.

Radiation and Beryllium Control

Fourteen air samples and 32 smear samples were taken during the period from September 24 through October 24. All of the samples showed continued good control except for two high air samples taken at the lathe during step cutting. The results of these two samples were 1.0 and 2.0/ug of beryllium per M³ compared to a limit of 2.0/ug/M³ average for an eight-hour day. Since the lathe is operated less than eight hours, it is unlikely that the operator breathed air above the limit based on an eight-hour average. The beryllium in air level at the lathe has been returned to the normal level of less than one per cent of the limit by increasing the amount of coolant used during cutting to normal, by improving the exhaust air flow and reducing the flow of ventilating air in the area. The coolant flow had been inadvertently reduced, and this is believed to be the primary cause of the increased beryllium concentration.

The total of the exposures in excess of 100 mrad for Manufacturing Operation personnel for the four-week badge period ending September 7 was 9,235 mrad compared with an average of 7,480 mrad for the previous year. The total for the four-week period ending October 5 was 9,279. During these same two badge periods, there were five and seven exposures above 300 mrad, respectively. The average number of exposures over 300 mrad per four-week badge period for the calendar year to date is 2.1.

The increase in the total exposures above the average is due to increasing exposure in the Coextrusion facility with increased production. The reason for the unusually high number of exposures greater than 300 mrad is not known. All of these exposures were well below the HAPO limit of two rads of beta radiation per four weeks.

One radiation orientation meeting for new employees and five radiation information meetings for old employees were held during the month.

Visits

<u>Name</u>	<u>Company</u>	<u>Contact</u>	<u>Date</u>	<u>Reason</u>
HP Kraemer	Rottler Boring Seattle, Wash.	DB Rottler	10-3-62	Discussion on steel sleeves
	Conrad Corp. Tacoma, Wash.	RM Wilkins	10-3-62	" "
	Western Filter No.Hollywood, Calif.	R Gardner	10-4-62	Discuss water mixers
	R&R Tool & Die No.Hollywood, Calif.	G Del Faro	10-5-62	Discuss alumi- num bumpers
	Harvey Aluminum Torrance, Calif.	GL Christensen	10-8-62 & 10-11-62	Discuss alumi- num cap and can procurement
	Bridgeport Brass Riverside, Calif.	CH Hoehne	10-9-62 & 10-10-62	" "
	Federated Methods San Francisco, Calif.	RC Caldwell P Angelideo	10-12-62	Discuss lead- cadmium dummies
TW Gore	Washington Steel Products, Tacoma	R Mariman	10-9-62	Inspection and study of electro- plating machines
DW Darsow	Rem, Inc. Portland, Oregon	CA Brown	10-15-62	Discuss zircaloy II end caps
	Airline Welding & Engineering Gardena, Calif.	HL Meredith	10-16-62	Discuss copper alloy sleeves
	Harvey Aluminum Torrance, Calif.	GA Mondry GL Christensen	10-17-62 & 10-19-62	Discuss zircaloy II and copper alloy components
	Bridgeport Brass Riverside, Calif.	CH Hoehne	10-18-62	" "

Visitors

GW Schuster	R&R Tool & Die No.Hollywood, Calif.	HP Kraemer DW Darsow	10-1-62	Discuss aluminum bumpers and copper alloy components
HE Castle	Castle Industries Everett, Wash.	DW Darsow	10-3-62	Discuss copper alloy components

DECLASSIFIED

HW-75419

Visitors (Continued)

<u>Name</u>	<u>Company</u>	<u>Contact</u>	<u>Date</u>	<u>Reason</u>
J Foss	Bridgeport Brass Seattle, Wash.	DW Darsow	10-8-62	Discuss copper alloy and zircaloy II
Bill Shaw	National Lead Cincinnati, Ohio	HE Berg	10-11-62	Uranium inventories
DM Guy, Jr. WH Derry	Alcoa Seattle, Wash.	HP Kraemer	10-25-62	Discuss caps and cans
RA Graham	Wah Cheng Corp. Albany, Oregon	DW Darsow	10-25-62	Discuss zircaloy II end caps
RM Wilkins	Conrad Corp. Tacoma, Wash.	HP Kraemer	10-30-62 & 10-31-62	Discuss steel sleeves

Training

Eleven instrument craftsmen received a total of sixty-one hours of individual instruction on tester setup procedures and modifications. Five instrument craftsmen were given fifteen hours of instruction on nondestructive testers in 333 Building.

Considerable on-the-job training of chemical workers has been required due to the hiring of additional personnel and resultant transfers.

Patent Summary

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.

Manager - Manufacturing

WN Mobley:RTM:mj j

UNCLASSIFIED

Statistics, October, 1962

HW-75419

8" NORMAL

8" BUMPERS

6" ENRICHED

6" BUMPERS

UNCLASSIFIED

Statistics, October, 1962

HW-75419

UNCLASSIFIED

HW-75419

Statistics, October, 1962

DECLASSIFIED

HW-75419

ENGINEERING OPERATION

OCTOBER, 1962

VISITORS

<u>Name</u>	<u>Company</u>	<u>Contact</u>	<u>Date</u>	<u>Purpose</u>
JL Klein	Nuclear Metals, Inc. Concord, Mass.	SM Gill	10/8- 10/12 and 10/22- 10/26	Audit purposes.
RA Graham	Wah Chang Corp. Albany, Oregon	GW Riedeman	10/4- 10/5 and 10/24- 10/25	Technical liaison W.C. components for N fuels
GJ Morgan	National Lead Co. Fernald, Ohio	TD Naylor	10/22- 10/23	Discuss inputs to Zernlo process at NLC
DW White	Research Laboratory Schenectady, N.Y.	KW Norwood	10/22- 10/23	Fuel element consultations
AA Johnson	E.I. duPont DeNemours & Co., Aiken, South Carolina	RL Dickeman	10/16- 10/18	Technical discussions
HP Olson	" "	"	10/16-	" "
JM McKibben	" "	"	10/17	" "
F. Mikkelson J. Lowey	Diversay Corporation Chicago, Illinois	JD Schaffer	10/23	Discuss cleaning problems

TRIPS

FW Knight	National Lead Co. Fernald, Ohio	J. Schiltz	10/15	Uranium metallurgy discussions
	Nuclear Metals, Inc. Concord, Mass.	RW Anderson	10/17- 10/18	Uranium program discussions
	Mallinckrodt Chemical Works, St. Charles, Mo.	NF Neumann	10/19	" "
LT Hagie	National Lead Co. Fernald, Ohio	PN McCreery	10/29- 10/30	Data processing
	GE Computer Users Symposium, MSVD-host Philadelphia, Pa.		10/31- 11/1	Attend meetings

<u>Name</u>	<u>Company</u>	<u>Contact</u>	<u>Date</u>	<u>Reason</u>
TR Groupman	Airline Welding Los Angeles, Calif.	R. Meredith, B. Russell	10/15	Discuss copper welding
	Weldmatic Monrovia, Calif.	S. Hamilton	10/16	Discuss & view equipment applicable to NPR support weldin
	Sciaky Brothers Los Angeles, Calif.	P. Tade	10/17	" "
	Acme Welders Los Angeles, Calif.	H. Dally	10/18	" "
	Air Reduction San Francisco, Calif.	H. Bearshan	10/19	" "
TD Naylor	Bridgeport Brass Co. Ashtabula, Ohio	JF Puterbaugh	10/10- 10/12	Observe primary extrusions
	National Lead Co. Fernald, Ohio	PN McCreery	10/15- 10/16	Discuss uranium dev- elopment for NPR
	Nuclear Metals, Inc. West Concord, Mass.	JL Klein	10/17- 10/18	Discuss uranium alloy development
	Mallinckrodt Chemical Works, St. Charles, Mo.	NF Neumann	10/19	Discuss uranium technology
TB Correy	AIEE Electric Welding Committee, Chicago, Ill.	A. Paalu	10/9	Committee meeting
	Sciaky Brothers, Chicago, Ill.	WJ Farrell	10/9	Discuss welding equip- ment development
	Battelle Memorial Inst. Columbus, Ohio	CB Boyer	10/10- 10/11	Discuss metal vapor coating
	Hobart Brothers Troy, Ohio	HB Cary	10/12	Discuss welding equip- ment development
	Research Laboratory Schenectady, N.Y.	JM Houston	10/15	Discuss metal vapor deposition
	GE Engineering Services Schenectady, N.Y.	RW Clark	10/15	Discuss metal joining
	National Research Corp. Cambridge, Mass.	PJ Clough	10/16	Discuss contract prob- lems; metal vapor deposition.

DECLASSIFIED

HW-75419

<u>Name</u>	<u>Company</u>	<u>Contact</u>	<u>Date</u>	<u>Reason</u>
TB Correy	M&C Nuclear, Inc. Attleboro, Mass.	EJ Finerty	10/17	Discuss metal laminating
	General Electric Co. Syracuse, N.Y.	JP Dietz	10/18	Discuss metal vapor coating
	A.O. Smith Co. Milwaukee, Wis.	JJ Chyle	10/19	Discuss metal joining techniques
DC Worlton	Nondestructive Testing Symposium San Antonio, Texas		10/1- 10/3	Attend Symposium
	Steering Committee of AEC, Los Alamos, New Mexico	GH Tenney	10/4- 10/5	Attend Steering Committee meeting
CJ Denton	Society for Nondestructive Testing New York, N.Y.		10/28- 11/2	Attend Society meetings
CN Jackson	" "		10/28- 10/29	" "
	Metals and Controls, Attleboro, Mass.	E. McDonnagh	10/30- 10/31	Technical liaison
GF Jacky	Washington Steel Products, Seattle, Washington	R. Marimon	10/9	Observe operation of automatic plating machine
JD Schaffer	Bridgerport Brass Co. Riverside, Calif.	CH Hoehne	10/10	Aluminum component problems
	Harvey Aluminum, Inc. Torrance, Calif.	GL Christensen	10/11	" "
	Turco Products, Wilmington, Calif.	K. Newman	10/12	Chemical processing of aluminum
	Oakite Los Angeles, Calif.	S. E. Beal	10/15	" "

PERSONNEL

Additions

A. C. Callen, Engineer, transferred to Engineering on October 29, 1962, from Process and Reactor Development, Irradiation Processing Department.

DECLASSIFIED

HW-75419

T. W. Evans, Engineer, transferred to Advance Fuel Engineering on October 29, 1962, from Process and Reactor Development, Irradiation Processing Department.

W. K. Kratzer, Engineer, transferred to Advance Fuel Engineering on October 29, 1962, from Process and Reactor Development, Irradiation Processing Department.

N. S. Porter, Technical Graduate, transferred to Testing Methods Engineering on October 1, 1962 for a rotational assignment.

L. O. Slind, Technical Graduate, transferred to Advance Fuel Engineering on October 1, 1962 for a rotational assignment.

Removals

L. O. Slind, Technical Graduate, transferred out of Coextruded Product Engineering, effective October 1, 1962, to Advance Fuel Engineering.

R. D. Ehrlich, Technical Graduate, transferred out of AlSi Product Engineering to Purex Technology, Chemical Processing Department, effective October 31, 1962.

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, 1962, except as listed below. Such persons further advise that for the period therein covered by this report, notebook records, if any, kept in the course of their work have been examined for possible inventions or discoveries.

"A Method for Stopping Brazing Action on Exterior Surfaces of Aluminum Fuel Cans," G. R. Hanson, dated October 26, 1962.

SIGNIFICANT REPORTS ISSUED

HW-74822, "Report of the Working Committee of the Fuel Element Development Committee," J. T. Stringer, September 18 through 20, 1962, (Secret).

HW-74891, "Alternate Process Study Trip Report," C. A. Burgess and D. R. Stenquist, September 4, 1962 (Secret).

HW-69886 REV1, "Provisional Process Specifications for the Attachment of Projection Rails by Ultrasonic Spot Welding," W. A. Blanton, September 21, 1962, (Confidential).

HW-75348, "Nondestructive Tests - Engineering Audit Report - AlSi Shop Operation for September," C. J. Denton, October 22, 1962 (Unclassified).

HW-73875, "Computer Utilization in Evaluating Fuel Performance," L. T. Hagie, May 31, 1962 (issued October 18, 1962) (Unclassified).

HW-75359, "Interim Report: The Gallling or Scratching of the NPR Outer Fuel Element by the Inner Fuel Element Supports," R. K. Ronbinson, October 23, 1962 (Unclassified).

SECURITY

There were no security violations in the Engineering Operation during October.
Total CYTD - 1.

ADVANCE FUEL ENGINEERING

Rupture Summary

Twelve regular production I&E fuel elements and one test fuel element failed in the reactors during October. The test failure was in HAPO hot pressed material, the second for this type fuel.

<u>Fuel Element Type</u>	<u>Tube and Reactor</u>	<u>Exposure (MWD/T)</u>	<u>Rupture Classification</u>	<u>Failure Date</u>	<u>Canning Date</u>
Natural					
Non-Bumper	1677-F	416	Side Hot Spot	10-24-62	7-30-62
" "	3959-C	404	Unclassified	10-27-62	5-14-62
Bumper	2166-D	877	Hole	10-15-62	2-15-62
"	3284-D	868	Hole	10-19-62	3-1-62
"	3180-D	779	Hole	10-27-62	1-4-62
Enriched					
Non-Bumper	2970-C	316	Side Other	10-5-62	5-15-62
" "	2660-KW	268	Side Hot Spot	10-12-62	6-26-62
" "	2879-C	413	Side Other	10-13-62	2-9-62
" "	3857-C	659	Unclassified	10-20-62	6-20-62
Bumper	3885-DR	874	Unclassified	10-2-62	5-1-62
"	3967-DR	791	Hole	10-7-62	3-28-62
"	3063-B	858	Side Other	10-10-62	5-8-62
Natural					
HAPO Hot Press (Self-Support)	3677-C	656	Side Other	10-18-62	12-27-61

Rupture resistance of bumper fuel elements appears to have declined, based on the October experience. There is evidence that several recent bumper ruptures, both enriched and natural, may have resulted from non-uniform corrosion attack. Two side-other failures (3768-B, failed 9/29/62, and 3063-B, failed 10/10/62) were severely corroded. A hole failure (2583-D, failed 8/27/62) was apparently caused by groove corrosion in the spire, based on preliminary Radiometallurgy examination results. To date, ruptures that are known or strongly suspected to be corrosion related have characteristically occurred in high power tubes at exposures in excess of 800 MWD/T.

DECLASSIFIED

URANIUM TECHNOLOGY**DECLASSIFIED**Dingot Program

During the month the decision was made to discontinue the dingot program for I&E fuel elements. The decision was based on continued marginal performance of dingot cores and the absence of incentives, economic or technical, to continue further with the dingot program. The decision and recommendation included a proposal to maintain the MCW technical competence in the metals field based on their significant contributions to metal technology in the past. While fabrication of new dingot cores is now discontinued, the utilization of existing dingot core inventories will be attempted. Canning of 300 tons of bare dingot cores was initiated during the month with a modified canning process which had been checked out in the Pilot Plant and 313 Building. However, production canning of dingot cores was discontinued after short operation of the canning lines because of a very high reject rate on internal bond counts.

Grain Size

The grain size of normal uranium core blanks heat treated at NLO in the Amsler-Morton heat treating equipment appears to be larger than the grain size of cores heat treated in the old Plant 6 equipment. The Amsler-Morton baskets hold only 12 core blanks; whereas, there were up to 240 core blanks in the old Plant 6 baskets. The differences in grain size are believed due to a more rapid heat loss during the 43 second air delay because of the reduced mass of cores in the baskets. Some of the cores are probably passing through the beta-alpha transformation before the blanks are water quenched. NLO has run a 4 ingot test on the new Amsler-Morton heat treating equipment comparing a 43 second air delay verses a 19 second air delay between the salt bath and water quench. Alternate core blanks from the same rods had a 43 second and 19 second air delay. Cores from this test will be used to compare differences in grain size, UT-2 voltage and x-ray diffraction. If the results from this test are satisfactory and no undesirable metallurgical properties are found, a basis for changing the normal uranium specification from a 43 second to a 19 second air delay will be developed.

Vacuum Degased Enriched Uranium

Considerable effort will be devoted during the next few months to improving the quality of enriched fuel elements. One phase of this program is to improve the quality of the enriched cores received from NLO by reducing the surface hydrogen content. Surface hydrogen can be evolved during the canning operation resulting in porous braze layers and poor quality welds. It is presently planned to have the surface hydrogen removed by vacuum degassing the enriched metal in hollow blank form after beta heat treatment at the following conditions:

- 1) Temperature of the core blanks during degassing shall be $950 \pm 50^{\circ}\text{F}$ (482 to 538C).

- 2) Time at processing temperature shall be 8 hours, maximum.
- 3) The operating pressure shall be 0.4 mm of Hg, maximum.

ALSI DEVELOPMENT

Dingot Canning

Canning of dingot uranium was initiated on October 15 using the conditions newly developed in the 306 Pilot Plant and the 313 Building to optimize the canning conditions for dingot uranium. These new conditions were as follows:

	<u>New</u>	<u>Old</u>
(1) Core HNO ₃ etch	4-6 minutes	2-1/4-4 minutes
(2) Lead temperature	625 ± 5°C	616 ± 7°C
(3) ALSi temperature	616 ± 5°C	609 ± 7°C
(4) Silicon Concentration	7.5 ± 0.5%	9.0 ± 0.5%

Two canning lines were used (Lines 3 and 4) during day shift and by noon it was apparent that a serious problem existed with the internal bond. Line 4 was generating a considerable number of bond rejects and material flow was therefore diverted to Line 5 at 2:00 p.m.; a lot change was also effected shortly thereafter. The lot started through the testers about 4:00 p.m. and it was apparent that bond problems were also prevalent with the second lot. The canning of dingot metal was discontinued at 6:00 p.m. and the reject data for the three lines were as follows:

<u>Line</u>	<u>Number Tested</u>	<u>Internal Bond Rejects</u>	
		<u>Number</u>	<u>Percent</u>
3	1255	18	1.4
4	1005	297	24.5
5	545	20	3.7

The ingot material which was canned immediately after changing the duplex furnaces back to normal silicon level sustained only one internal bond reject in 1165 fuel elements (0.1%). No reason could be found for the difference in reject rates between lines as all the normally measured furnace characteristics were within limits.

C-7
DECLASSIFIED

DECLASSIFIED

Bond Testing

Studies involving high temperature baking and cycling of AlSi bonded fuels were continued with the objective of developing better methods for testing the uranium to clad bonding. Fuel elements which had previously been baked at temperatures ranging from 200 to 500°C for one to 100 hours were tested by pulling twelve 3/16-inch studs per element. Previously taken bond test data did not detect differences in the bond at baking temperatures of 300°C or less. A deterioration of this bond was noted, though, after baking one hour at 500° and after 25 hours at 400°C. The stud pull data indicated that a decrease in bonding strength occurred after one hour at 500°C, after 4 hours at 400°C, and after 6 hours at 300°C. No significant changes were noted after 75 hours at 200°C. An additional test was conducted by temperature cycling elements from peaks of 400 and 500°C to room temperature by water quenching. Physical dimensions of these elements were taken before and after cycling and UE-1 data were also taken after cycling. The average bond count and change in dimensions are listed below for each group.

Total Bond Count

<u>Cycles</u>	<u>400°C</u>		<u>500°C</u>	
	<u>Internal</u>	<u>External</u>	<u>Internal</u>	<u>External</u>
1	4.6	0.0	25.3	9.2
2	4.4	0.2	1494	1932
4	5.2	0.0	2118	5443
6	4.4	0.0		
8	3.4	0.0		
10	4.2	0.0		
20	6.0	0.2		
30	2719	3422		
40	1986	2674		
50	1479	3883		

Average Dimensional Changes in Thousandths

<u>Cycles</u>	<u>400°C</u>			<u>500°C</u>		
	<u>Length</u>	<u>OD</u>	<u>ID</u>	<u>Length</u>	<u>OD</u>	<u>ID</u>
1	+0.2	+5.7	0.0	-2.4	+1.3	+0.1
2	0.0	+6.1	+0.2	+2.2	+1.4	+0.9
4	-0.2	+1.3	+0.2	+4.8	+20.7	-1.4
6	+2.0	+10.8	+0.6	+67.5	+96.6	-3.8
8	+3.6	+14.1	+0.4	+105.0	+107.9	-4.1
10	+1.4	+13.5	+0.6			
14				+142.6	+137.5	-3.0
20	+4.2	+51.7	+0.7			
30	+13.2	+69.2	-1.2			
40	+13.8	+77.9	-1.1			
50	+36.0	+110.8	-1.5			

The bond count data for the baking test and the temperature cycling test indicate that time at temperature may be more important than thermal shock. It is apparent that considerable dimensional changes take place from the thermal cycling. The OD, ID and length of the element increase which undoubtedly is a factor in the fracturing of the bond which takes place.

Optimized Canning Studies

Studies have been initiated which are aimed at improving the quality of enriched fuel for the coming E-N load of H reactor. Examination of a sample of the metallurgical bonding for the enriched fuel as presently produced revealed for the internal bonding an average of 87.0 percent UAl_3 with a range of 66.4 percent, and for the external bonding an average of 78.6 percent with a range of 48.2 percent. These values are somewhat less than is found for normal OIIIIN fuel elements. A test was performed to determine the optimum duplex conditions for producing near 100% UAl_3 type compound and it was found that this could be accomplished by raising the duplex lead temperature from 610° to 625° . Silicon concentrations of 7 and 8% were tested and found to be satisfactory with respect to percent of UAl_3 , however, the thickness of the bonding layer was found to increase. Also, less variance in total count was found for the higher percentage of silicon. Consequently no change will be made in the presently specified Si content of 9%. Heating rate studies have been made on the OIII normal and enriched contour base components. The preheat time required for the base of a can to reach the primary arrest temperature of the canning furnace melt for OIII normal cans is 96 to 100 seconds. It requires 110-130 seconds for enriched cans. The present can preheat prior to submerge is 47 seconds. With this short preheat, the temperature of the base of the OIII normal can is $554-562^\circ C$ and on enriched can the base is only $542-548^\circ C$. Solid aluminum and silicon will freeze-out of the melt in the base of the can at these low temperatures. This solid material would have to be remelted and would trap gas and air in the base well and prevent melting of the aluminum. This is believed to be a major cause of the base end porosity on non-wet conditions. The problem is more serious with the enriched models.

The heating rates discussed above were taken on contoured-base components. This design was adopted to improve the heating characteristics of the base of the can and data taken at the time of adoption indicated a significant improvement in heating rate and bond quality. Today, because of a number of relaxations in sleeve dimensions the tight fit initially experienced with contour-base cans and sleeves no longer holds. The dimensions of the fit of the base of the sleeve were relaxed to permit a cheaper manufacturing method for the sleeve base. The sleeve bases are now pressed instead of machined from bar stock. This results in little contact in the base for heat transfer. In addition the reinforced sleeve base was eliminated and this resulted in an insulating air pocket on the base of the sleeve during insertion into the AlSi melt.

DECLASSIFIED

DECLASSIFIED

HW-75419

Special sleeves with bases machined to fit the contour of the can have been fabricated in the shops but heating rate data is not yet complete. These tests are to determine if the proposed dimension on the OIIIE model sleeves are adequate. If so, a drawing will be issued for immediate procurement for the fabrication of elements for the E-N program.

A technique has been developed and pilot plant tested which reduced the preheat time on the can to 60-70 seconds instead of the present required of 100-130 seconds. This technique consisted of preheating the sleeve about 80-90 seconds without a can, then inserting a cold can and preheating it to bath temperature. The required preheat time of 65 seconds is longer than now used and testing did indicate a direct relationship between preheat time and non-wetting. Vibration agitation of the assembly after insertion of the can did not improve the heating rate of the can base. The pilot plant evaluation of this technique pointed out several problem areas, the biggest of which is the hazard of splashing AlSi into the sleeve prior to can insertion and the additional operations for the canning operators in a very short time period of the cycle. It was concluded that this technique as attempted is not readily adapted to the present canning cycle.

Preliminary testing shows that pulsing of the can-sleeve assembly during preheat (the same as presently practiced for the I&E spires) removes the frozen AlSi from the outside surface of the sleeve in less than 47 seconds. This should also improve the heating rate but testing is not complete. This change in the process should not be difficult to incorporate into the manufacturing facilities although equipment is necessary.

ALTERNATE PROCESS

Hot Press

The irradiation test IP-490-A-FP comparing Sylcor hot press, HAPO hot press and HAPO AlSi controls was discharged from C-reactor on October 18, 1962. A rupture occurred in a HAPO hot press piece at 640 MWD/T. The fuel element was canned on December 27, 1961. There was one cladding failure under a self-support. The failure was identical to the one sustained in September.

Examination of several pieces that were held in storage has revealed that the fuel elements were marred under the rails during self-support attachment. The marred surfaces are directly related to the unique lot of rails that were attached to these fuel elements. This lot of rails had an exceptionally low bridge to dimple height that severely aggravated the attachment marred surface problem.

Hot Die Sizing

The evaluation of the test to locate optimum processing conditions for producing hot die size bonded fuel elements is continuing. Process variable studied are listed as follows:

Preheat temperature	650, 680 and 710°C
Preheat time	8-1/2, 10, 11-1/2 minutes
Aluminum reduction ratio	27, 45 and 64%
Ram Speed	40, 65 and 90 inches/minute

The evaluation by bond testing, finished dimensional control, bond strength (stud pulling) and non-destructive cladding thickness have been completed. The following are the conclusions that have been made from the analysis to date:

- (1) The temperature of the fuel element due to preheat furnace temperature and/or residence time in the furnace is a determining factor in the average finished fuel elements dimensions. The internal bond strength also tended to increase with increased temperature.
- (2) The aluminum reduction ratio has a significant effect on the external bond strength but does not apparently effect the internal bond strength. Increasing the aluminum cladding reduction ratio from 27% to 64% increased the lateral bond strength on the external surface in the cap end area by 28% (220 lbs. of tensile force on 1/4" stud).
- (3) The dimensional control of the finished fuel element was established with 95% confidence that 95% of the population is:

Nominal OD ± 0.002 to ± 0.00326 inches

Nominal ID ± 0.0014 to ± 0.00174 inches

- (4) The non-destructive cladding thickness test indicates a range of 0.003 inch in thickness at a nominal 0.030 inch residual wall thickness.
- (5) The following preliminary results from the metallographic examination of the destructive test samples were:
 - (a) Uranium-nickel and aluminum-nickel diffusion layers were very thin but visible at magnifications of 200X for more reactive test conditions. Magnification up to 1000X were required to examine diffusion layers for less reactive test conditions. SRP had indicated that the diffusion layer thickness was so that that electron microscopy was

DECLASSIFIED

required for diffusion study. It is believed that their process conditions correspond to the least reactive parameters of this test (core preheat for 8-1/2 minutes in a 650°C furnace) where it was impossible to detect either U-Ni or Al-Ni diffusion by optical examination.

- (b) Both the U-Ni and the Al-Ni diffusion layers are very uniform over the entire piece except for end bonding. The lack of bond in the end area is associated with little or no Ni-Al diffusion, however the U-Ni diffusion is excellent. Diffusion layer thickness was slightly greater at the mid sections and along the inner surface due to initial higher temperatures and slower cooling at this point.
- (c) No end bonding was noted under the cap end and on a region extending down from 1/4 to 3/8 inch on the side. Bonding was observed on the lateral surface next to the base end and around the radius but not on the flat surface. The difference in lateral bonding mean the cap and base end may be a function of operating technique and tests are now planned to verify this possibility. Examination of areas that were bonded in both test pieces and heat treated pieces indicated that the process now used is at the threshold of producing Al-Ni diffusion and end bonding. Refinement of temperature and sizing press pressure control could produce bonding during the sizing operation.
- (d) Bonding between the inner and outer aluminum cladding and the cap wafer was produced sporadically during the optimization test and has since been made highly consistent by the use of larger sized caps. Reduced sizing press back pressure enabled use of larger caps by preventing cap mushrooming during sizing. However, it is necessary to increase the back pressure during the final inch of sizing to cause sufficient mushrooming to bond the clad to the cap.
- (e) The ram speed had no measurable effect on any of the variables tested over the range of this test.

Based upon the evaluation completed to date a tentative process specification has been arrived at for preheating and hot die sizing the CVN fuel element configuration:

Preheating temperature	680°C ± 15°C
Preheating time	10±1/2 minutes
Reduction ratio	45% (modified to 65% when components are available)
Ram Speed	75± 5 inches per minute

Major debugging of the end bonding press was completed during the early part of the month. The major problem being one of clearance on the internal moving parts. Preheating studies were completed on thermocouple cores and times and temperatures required for diffusion were determined. A variable test has been designed and is currently being bonded to evaluate the parameters of this operation. The following table is a summary of the range of investigation.

Test I

<u>Variable</u>	<u>Range</u>
Pressing time	5, 7, 9 minutes
Bonding die temperature	560, 600, 640°C
Pressure	1.7, 2.1, 2.8 tons/in. ²

Test II

<u>Variable</u>	<u>Range</u>
Pressing time*	30, 105, 180 seconds
Bonding die temperature	560, 600, 640°C
Pressure	1.7, 2.1, 2.8 tons/in. ²

*This time is greatly reduced because the fuel assembly temperature is raised to ~ 400°C by an initial preheat in an auxiliary furnace set at 680°C for 5 minutes.

A second method of end bonding using the differential expansion method of applying pressure is planned. The tooling to carry out this program is now 95% complete.

DECLASSIFIED

HW-75419

Electroplating Nickel on Uranium

Plating laboratory activities included process tests aimed at simplifying and improving the reproducibility of the uranium pretreatment and preparation of plated cores for hot-die sizing tests.

Tests of the uranium pretreatment process included possible elimination of the neutralization bath, an alkaline dip employed immediately preceding plating. Its purpose was to neutralize any residue of nitric acid remaining on the cores; however it may also have a detrimental effect on adhesion, due to possible precipitation of nickel salts in the presence of an alkaline residue left on the uranium surface. An initial test included the plating of 32 cores with the elimination of the neutralizing step. Plate adhesion and continuity was not reduced as evidence by mechanical removal of a portion of the plate and by exposing the plated cores to 600°C in an air atmosphere furnace for 30 minutes. Sixteen cores were bonded by hot-die sizing and the jacket-core bond tested by conventional stud pulling. Out of 192 studs, only three fractured at the Ni-U interface and these were in the high range of 1000-1500 lbs. of tensile force. Qualitatively based on the stud pull and other tests described above, it appears that elimination of the neutralizing dip had no effect on the Ni-U bond strength.

A second series of pretreatment process tests were carried out aimed at simplification of the steps employed in removal of sludge coating formed during anodic etching. The present process employs both mechanical and chemical removal, the former by a prolonged and vigorous water spray. Consistent and thorough removal of the sludge was difficult. Instead chemical removal with nitric acid was tested, employing a range of concentrations and temperatures which appeared effective based on visual appearance and beaker-scale testing. Preliminary adhesion and continuity tests on a portion of the material indicate no difference between the following sludge removal steps:

1. Two minute spray rinse, six minute soak in 40°C, 7.5-8.0 M HNO₃ (Standard Process).
2. One-half to one and one-half minute soak in 8-10 M HNO₃ @ 65°C followed by 1 to 1-1/2 minute soak in 7.5-8 M HNO₃ @ 40°C.
3. Three and one-half to five minute soak in 10 M HNO₃ at room temperature.

Boron content of the nickel plate from the Watt's bath has been monitored on a bi-weekly basis. The limit of detection for boron is 10 ppm or greater by spectro chemical analysis. There have been six (6) samples analyzed to date with only one sample above the detection limit. This sample had a boron content of approximately 100 ppm. At 10 ppm of natural boron the neutron capture cross section of the nickel plate would be increased by only one per cent.

COEXTRUDED PRODUCT ENGINEERINGN-Reactor Fuel DevelopmentKER Loop Testing

Loops 1 and 2 are still shut down for modifications. It is now anticipated that Loops 1 and 2 will be back on the line about November 15, 1962.

Loop 3

Loop 3 is shut down for pump repairs. These repairs should be completed and the loop back in operation sometime after January 1, 1963.

Loop 4

The fourteen NAE-1 fuels in Loop 4 are operating satisfactorily. Current average tube exposure is about 290 MWD/T. Goal exposure is about 2800 MWD/T but this is quite tentative since there are problems with the pumps on this loop also.

Test Fuel FabricationThrow-away Fuels

"Throw-away" fuels (standard and short NIE-1's) for testing modifications of loops 1 and 2 have been fabricated and are available for charging.

KSE-5 Test

Fifty 1.6% enriched KSE-5 fuels are at brazing in the 306 Building pilot plant.

U-2: Zr - NIN Test

This test is for the purpose of studying the swelling behavior of uranium alloyed with 2 W/o zirconium. Fuels for this test are at the copper removal operation in the pilot plant.

NAE-1 Test Fuels

A backup charge of fourteen NAE-1 fuels is available for charging.

Pilot Plant Fabrication

A schedule of pilot plant fabrication activity is shown on the following page.

Materials DevelopmentUranium BilletsUranium Specifications

Two additional changes have been made in Revision 2 of HW-67575, "Specifications for Uranium Metal Billets for NPR Fuel Elements". These

DECLASSIFIED

HW-75419

C. P. E. PILOT PLANT WORK SCHEDULE

DATE ISSUED: October 29, 1962

Prepared by W. G. Hudson

IN PROCESS DATE	PWR NO.	EXTRUSION DATE	TUBE NUMBER	WORK DESCRIPTION	TYPE AND QUANTITY REQUIRED	PROCESS LOCATION	EXPECTED COMPLETION DATE	COMMENTS
5/29/62	44			Provide heater fuels for KER Loops 1 & 2	(10) 23" NIE-1 (10) 17" NIE-1	Complete	10/15/62	
9/10/62	46			To evaluate the feasibility of using brazing alloy fabricated by the pressed-chip method	(12) NIE (12) NOE	Autoclave	10/1/62	
9/10/62	47			To determine if brazing alloy made with zirconium is superior to the current material zircaloy-2	(12) NIE (12) NOE	Not started	10/5/62	
9/18/62	48			Fabricate 1.6 enriched KSE-5 fuels for loop testing.	(40) KSE-5	Brazing	12/1/62	
10/1/62	49			Provide Ur-Zr alloy co-extruded fuels for KER loop tests to determine effect of irradiation on swelling. Companion pieces of unalloyed ur to be provided	(12) U-2 Zr NIN-1 (40) NIN	Facing after length cut	12/15/62	
10/15/62	50			Determine corrosion characteristics of fuels rejected because of white autoclave films and recovered by cathodic chemical etching	(3) NOE (5) NIE	Complete (Initial Test)		

are: (1) Heat treating of the billets has been discontinued. The billets had been beta heat treated after rough machining and before final machining in an attempt to duplicate the favorable results previously obtained in control of cladding variation of the inner clad of the outer tube by heat treating the billets after final machining at HAPO. However, no improvement resulted. Actually, the billets heat treated before final machining produced fuel elements with greater clad variations than did non-heat treated billets. It is expected that the suspension of heat treating at NLO is a temporary measure pending development of a suitable heat treating process or modification of the uranium alloy to a composition that can be heat treated to a fine-grain size. These programs are discussed herein. (2) The die temperature specification for primary extrusion has been changed to $700^{\circ}\text{F} \pm 50$. The original draft of the specifications stated that the die tooling was to be heated to $750-850^{\circ}\text{F}$ but that reheating was not necessary if less than 20 minutes elapsed between extrusions. However, the die temperature dropped to the 700°F range in approximately 20 minutes. No separate heaters for the die or die carriage are available on the press at Ashtabula. To comply with their understanding of the intent of the specification, Bridgeport Brass was heating the die ring with a torch between extrusions. Since the intent of the specifications was to insure uniformity of temperature rather than a specific temperature, the die temperature specification has been changed to the temperature that the die will normally hold.

Clad Variation Studies

Receipt of 20 NOE billets finish-machined on the I.D. surface prior to heat treating is expected in about two weeks. The objective of this test is to determine if reduction in the coextrusion reject rate for inner cladding thickness variation can be obtained. The best results for reducing this cladding variation obtained to date were realized when the finished billets were heat treated at HAPO. It is believed that the surface layer of rapidly quenched beta heat treated uranium grains may be critical to achieving a smooth and uniform cladding thickness.

A comparison of the coextrusion results and the chemistry indicates that higher levels of iron and silicon impurities correlate with reduced clad variation. This indicated correlation is supported by metallurgical considerations, i.e., added impurities should result in smaller grain sizes and smaller grain sizes should reduce the size of any uranium grain-related cladding distortions.

Variation in iron and silicon concentrations in normal production ingots is not large enough to permit detection or quantitative assessment of this relation. To test the correlation, the following material has been requested:

- NOE billets from ten ingots containing 140-190 ppm silicon.
- NOE billets from five ingots containing 190-250 ppm silicon.
- NOE billets from two ingots containing 400-450 ppm silicon.

Recent experimental data have shown that iron in higher concentrations is not as stable in the uranium matrix as silicon. Also, work with I&E cores has shown that both iron and silicon have equivalent effects on

grain refinement.

DECLASSIFIED

It is planned to accept the billets from the ten ingots with 140-190 ppm silicon for production use by waiver of specifications. These billets should be received about November 30, 1962. The billets from the seven higher silicon ingots may not be acceptable as production material and have been ordered as development material.

Primary Extrusion Warp

The largest loss category in the uranium feed stream is the rejection for wall thickness variation of NIE billets after finish machining. One-third of the billets machined between June 1 and September 30 were rejected for this cause. This reject rate is directly related to the bow of the primary extrusion. When the O.D. of the billet blank is machined after chucking on I-D centers, the bow is removed from the O.D. surface. When the I.D. is bored, the tool follows the contour of the extruded hole and if the billet blank is significantly bowed, wall thickness rejects result. In addition, the uniformity of the coextruded product is related to the concentricity of the billet characteristics. Although the bowed and/or eccentric primary extrusion can be machined to be dimensionally concentric, the physical properties of the uranium, such as grain size, are no longer distributed in concentric rings.

During the October extrusion run, measurements were obtained of warp on the runout table. These measurements showed that in many cases the extrusion was initially straight but during the cooling period settled or bent into the groove in the graphite on the runout table acquiring about a 3/16" bow over the extruded length. In addition, measurements of catch tube alignment showed that misalignment of this device was contributing to front end hook or bowing. To control or eliminate bowing on the runout table, a cooling table was provided beside the runout table and the extrusions were immediately moved to this cooling table which was provided with a flat insulated surface. Further improvements in warp were obtained by slowly rolling the extrusion on this table during the cooling period. This action has not entirely eliminated the bow of the primary extrusion but BBC personnel report that front end hooking has been reduced to the 25-47 mil range compared to values up to 80 mils per 20-inch billet lengths encountered previous to these improvements. A test was designed to determine if improved concentricity would result from squaring and chamfering the lead end of the ingots. Twelve ingots were squared and a 45° chamfer machined on the O.D. concentric with the I.D. This chamfer should cause the ingot to lift on the 60 degree die cone angle just prior to upset. This should center the ingot in the primary extrusion press and result in better concentricity at the start of each extrusion.

The preliminary results from the extrusion of these chamfered ingots showed a significant reduction has been obtained on front end warp. Of the 35 test billets, only one was warped over 30 mils. Of the 28 control billets, eight were warped over 30 mils. These data are the preliminary results obtained at BBC before cutting of primary extrusions into billet lengths and duplicate measurements of these characteristics and analysis

of the entire test will be done by NLO. However, as a result of this favorable experience, NLO has been requested to chamfer the ends of as many ingots as possible. Also, to more definitively isolate extrusion variables from ingot variables, NLO has agreed to design a test and prepare ingots that are machined on the O.D. and ends to provide a truly concentric ingot. Present plans are to extrude these test ingots in November.

Coextrusion Process

The following CPE extrusions were made during the reporting month.

11.1 Inch Tooling

Four Primary Extrusions - PU #80, 81, 82, and 83

PU-80 & 81	Fe-Al alloyed solid cast ingot to N single tube billet dimensions
PU-82	NOE billet stock
PU-83	NIE billet stock

Two Zircaloy Extrusions - Z #142 and 143

Z-142	5.875" rod stock
Z-143	7.500" Zr-3 rod stock for HLO

7.5 Inch Tooling

Two Zircaloy Extrusions - Z #146 and 147

Z-146	Not end cap stock
Z-147	2.500" O.D. zirconium rod stock

One Uranium Extrusion - U-115

U-115	3.9 O.D. x 2.7 I.D. sleeve stock for NOE billet experiment
-------	--

6.0 Inch Tooling

Two Zircaloy Extrusions - Z #144 and 145

Z-144	NIT shroud tube for KER loop testing
Z-145	N single tube inner clad billet component

One Composite - X-40

X-40	NIE size with 25 mil outer clad thickness for thin clad thickness control determination
------	---

DECLASSIFIED

HW-75419

Coextruded Clad Thickness Dimensional Variation

Clad thickness variation on the inner clad of the outer tube is currently the defect causing the highest reject rate in production (10-20%). Actions to correct this problem are discussed under uranium billets.

Development work has been in progress during the past six months to:

- (1) characterize the various types of zircaloy clad variations encountered on production material, and (2) relate these types of variations to the billet components or extrusion effects predominately responsible for each.

The most common dimensional variations of coextruded zircaloy cladding determined from the above work can be placed in four categories according to their dimensional characteristics. These categories and the pre-dominate cause or causes for each can be described as follows:

1. Roughness - A maximum of 2 mils variation in clad thickness is caused by interface roughness or longitudinal wrinkling between the uranium and zircaloy. This roughness has been shown to be a composite of fine and course wrinkle caused by individual zircaloy and uranium grains respectively during coextrusion.
2. Ripple - A maximum of 4 mils variation can be caused by an uneven or rippled clad surface at both the outer zircaloy surface and clad:core interface. The greatest clad variation occurs at the interface and has been shown to be primarily caused by the uranium.
3. Wanderlust - Up to 10 mils clad thickness variation can be caused by local (approximately 1/4 to 1/2 inch circumferentially and 2 inches axially) thinning or thickening of the cladding at the coextruded clad: core interface. The exact cause for this type of defect has not been determined, however, it is believed that orientation effects and/or composition variations in the uranium are the primary cause for wanderlust.
4. Eccentricity - Eccentricity, if present, normally extends along the entire extruded length and results in clad thickness variations of approximately 4 mils maximum. Eccentricity is largely attributed to dimensional variations in billet components, radial asymmetry of billet temperature during coextrusion and uneven friction between the billet and extrusion liner during coextrusion.

It is evident from the above defect characteristics that the uranium billet has been shown to be the major cause of coextruded clad thickness variation. However, the zircaloy cladding components can contribute to clad variation if their fabrication processes are not well controlled.

Warp Yields: N-Inner Pieces

1. Manufacturing Experiences

In August, 1962, it was reported that there had been a trend of

decreasing yield of NIE pieces for warp since the current coextrusion process variables were chosen and fixed. This statement has been true for coextrusions up to #1316. The trend has been reversed in the last batch of coextrusions, #1345 through #1485. The improved yield comes from a reduction in the number of pieces having more than 75 mils TIR warp and an improved straightening-recovery efficiency. Table 1 shows the yield data for the current coextrusion process variables.

TABLE I
Warp Yields - Beta Heat Treated N-Inner Pieces
(1140°F Billet Temperature, 10 ipm Ram Speed)

Extrusion Numbers	No. Of Pieces	Percent With Warp				Straighten- ing Recovery(%)	Total Yield(%)
		30 mils	30	75 mils	75 mils		
1076-1084	118	82.2		17.8	0	86.4	98.6
1095-1103	116	69.8		30.2	0	77.4	93.1
1156-1219	927	59.8		38.5	1.7	89.6	94.3
1247-1265	145	53.8		42.1	4.1	79.4	89.7
1267-1316	704	43.9		47.3	8.8	86.5	84.8
1345-1485	2006	51.1		46.9	2.0	92.2	94.7

In stating that there has been an improvement in the straightening-recovery efficiency, the average value of 92.2 per cent does not show how the progress was made. During this period of operation, close attention was paid to the reverse bending operation (instructions, operator technique, measurement error, etc). The improvement is better noted if the period is divided into quarters with respect to the number of pieces; this is done in the table below.

TABLE 2
Straightening Recovery for Group 1345-1485

Quarter	No. of Pieces Processed	No. of Pieces Recovered	Straightening Recovery (%)
1	208	172	82.7
2	251	236	94.0
3	185	170	91.9
4	296	288	97.3
Total	940	866	92.2 overall

From the above presentation, it is easier to see that there has been an improvement in this step of the process.

2. Correlation of Warp Yields vs Coextrusion Process Variables

During July, 1962, extensive effort was devoted to organization of the early-production warp data into the form currently used in the NPR Data System. When suitably arranged, an analysis was made

DECLASSIFIED

nearly 4000 pieces. The analysis tried to relate "Coextrusion Process Variables" versus "Warp". As from all earlier analysis, it was concluded the "production data" are not amenable to statistical interpretation. Basically, the changes in the coextrusion process variables have not been made as one makes changes in a balanced experiment. From a production view point, there is too much at risk to deliberately investigate conditions that have not yet been tried.

Though the analysis was generally abortive, there was indication that both "total delay time" and "lubrication delay time" played a strong part in an interaction with ram speed. This finding substantiates earlier speculation that lubrication variability may be the cause of the asymmetrical textures that are said to be the driving force for warp.

Chemical Processing

Horizontal Chemical Milling

During the past month, two tests have been performed in the 333 Building facilities to evaluate the horizontal milling of production fuel elements within the solution control limits used for vertical milling. The coextrusion pilot plant milling basket was used in these tests.

The first test was satisfactory in producing a recess within specifications for depth and surface smoothness. However, a serious pitting of the outer clad occurred on the areas which were in contact with the teflon liners in the basket. Subsequent tests were performed in the pilot plant using fuels which were copper stripped only before milling and fuels which were copper stripped and zircaloy stripped before milling. Fuels which had been zircaloy stripped were free of pits while the fuels which had been copper stripped only produced serious pitting on the basket-fuel contact areas. These tests were repeated using material other than teflon, e.g. Koroseal for basket liners. Pitting occurred with both materials when as-copper stripped fuels were processed.

Zircaloy stripping was formerly a part of the process prior to the use of silicon alloy copper extrusion cans. The unalloyed copper more readily diffused into the copper and created processing problems in subsequent etching. The last test was performed using fuels which had been copper stripped and zircaloy stripped to a depth of one mil. All fuels were within recess specifications and were free of outer clad pitting.

Results of these tests indicate that the removal of zircaloy clad to a depth of approximately one mil is a requirement before chemical milling to insure protection of the clad from pitting when fuels are milled in a horizontal position with a basket of the present design.

Pitting on the outer clad of fuels horizontally milled in the pilot plant had been observed from time to time but had not been associated with the chemical milling process. The irregular occurrence of pitting in the pilot plant can be attributed to retaining of the zircaloy strip process in the

pilot plant for a considerable period of time after it had been discontinued in the production plant.

Development work on the horizontal milling process is being continued to adapt the process for production use. The present pilot plant basket has been modified to anchor the fuels so they do not shift while processing. Additional masking washers and holders are being fabricated to produce more uniform recessed surfaces and reduce over-all milling time.

Machined End Closures and High Temperature Oxidation of Uranium

End closure recesses have been prepared by machine milling uranium to a maximum depth and diameter permissible due to tube eccentricity. This would normally leave about 15-25 mils of uranium on a portion of the cladding within the recess. The residual uranium is removed by chemical milling solution. The recess depth is machined to within about 15-25 mils of the final depth to allow for the depth increase due to the subsequent chemical milling finishing step.

Tests have been performed in the pilot plant to remove the residual uranium after machining by high temperature oxidation to replace the acid milling. Results have shown that heating in a muffle furnace to 400°C for 2-3 hours removes uranium from the clad and leaves a flat uranium core surface (± 2 mils). The recess areas are abrasive blasted to remove zircaloy oxidation on the clad and followed by pre-braze etching. This method has certain advantages:

1. A smooth flat uranium surface will provide improved quality of brazed surfaces and is a requirement for end closure processes such as pressure bonding.
2. Fuels having uranium zircaloy alloys can be processed safely by this technique.
3. This method has the potential of replacing the present production method to achieve improved end closure quality at reduced production cost.

Chemical Process Review

A study has been initiated reviewing the chemical processing steps in the NPR fuel element fabrication, some associated problem areas, and the development areas relevant to the process and fuel element performance. The expressed purpose of this study is to critically evaluate the chemically related processes as they now exist with regard to fuel element quality and process economics, and to establish a basis for current and future development work.

The first report of a series to be issued, titled "Etching, Rinsing, and Autoclaving Zircaloy-2 Clad Fuel Elements" is nearly complete and will be issued the early part of next month.

Autoclave and White Oxide

Zircaloy-2 Scratching: Assembly Operation

Evaluation of the corrosion behavior of scratches and the gray oxide produced

DECLASSIFIED

HW-75419

thereby in the bore of the NPR fuel element during assembly is about one-half completed. Micrographic examination of the scratches, produced by sliding inner fuel elements with buggy spring supports oversized 10, 30, and 30 mils per support through outer fuel elements, indicated scratch depths of 0.2 to 0.7 mils. Examination of the scratched areas after 6, 30, 36, and 66 days in 400°C steam and 30 days in 360°C water resulted in corrosion product thickness ranging from 0.1 to 0.6 mils or from 1 to 2-1/2 times the thickness of the oxide over the bulk metal.

For all but two coupons, which exhibited un-explained anomalous corrosion behavior, and one being studied further, the amount of hydrogen pickup (15 to 40% of theoretical amount available) and thickness of corrosion product compares favorably with that of "good" zircaloy-2 exposed to the same media.

Exposure to 400°C steam and 360°C water is continuing for 10, 20, 30 and 30 mil interference fit per support samples. An interim report has been issued stating the results obtained to date (HW-75359).

Recovery of Autoclave Rejects

A test was performed to determine whether autoclave rejects can be recovered by cathodic removal of the oxide film followed by re-etching and re-autoclaving. Two types of rejects were processed, (1) white spots on the outer clad, and (2) white oxide on end closure welds after 72 hours steam at 400°C and 1500 psi. The fuels which had been previously autoclaved for 72 hours showed no change at the end of the extended cycle. The welds of the additional recovered fuel had white oxide specks over the welded areas.

A set of zircaloy-2 coupons was prepared to simulate a recovered fuel. These were autoclaved and cathodically etched to remove part of the autoclave film. A second set of coupons cut from strip zircaloy-2 was used to simulate a normally processed fuel element surface. Both sets were bright etched and autoclaved for 400 hours in steam at 400°C and 1500 psi. The corrosion for both sets of coupons, as indicated by weight gains, was normal for zircaloy-2 under these conditions.

The foregoing test indicates that recovery is feasible and that the corrosion characteristics of the recovered areas are satisfactory.

Additional tests will be made to adjust the cathodic etching and subsequent bright etching techniques to produce uniformly black film on reprocessed autoclave rejects.

End Closure Development

Brazed Closure

Powder Metallurgy Rings

Additional samples of brazing alloy rings made by sintering pressed zirconium and beryllium powder were received from the General Astro Metals Company as part of their work on DDR-137. These samples were

used to make trial brazes on NIE elements in the 306 Pilot Plant. The results with these samples were about the same as with former samples made with these materials, in that in all cases the alloy gave off fumes and vaporized metal upon melting. Samples of the vaporized material which deposited on the bell jar were analyzed spectrographically and found to contain significant amounts of magnesium, aluminum, and calcium. The vendor is attempting to locate a source of zirconium powder which is free of impurities so that this vaporization problem can be eliminated. In spite of this problem, the alloy appears to make satisfactory brazes. It does not appear to lack fluidity as does zircaloy-beryllium alloy made by powder metallurgy. However, the zirconium beryllium alloy cannot be considered satisfactory unless this problem is eliminated and until appropriate corrosion and other tests are completed.

Thermal Cycling Tests On Braze Closures

Work is underway to see if the endurance limit for thermal cycles (730°-20°C) can be established for the current braze closure. If the endurance limit can be established, it will be used as a basis for comparison with other closure methods and closure designs.

Gas Pressure Bonded End Closure

Lot No. VII

Two NOT and two NIT specimens with 0.120" thick titanium end closure rings have been autoclaved in 360°C (680°F) water for 96 days with no failures. The corrosion on the surface of the titanium was negligible. Metallographic examination of the corrosion penetration of the Ti-Zr-2 bond after 37 days showed a penetration of 0.006" to 0.011", and after 81 days 0.011" to 0.017".

Lot No. IX

Metallographic examination of specimens containing massive, 0.120" thick thorium closure rings disclosed that diffusion had taken place between the thorium:zircaloy-2 cladding, thorium:uranium and thorium:titanium. There were small voids in the diffusion zone indicating that bonding pressure was inadequate.

Preparation of specimens which have been single and double beta heat treated is in progress.

Lot No. X

This test used single piece zirconium rings with smooth cylindrical surfaces. Metallurgical examination of specimens that had survived 72 hours in 400°C (752°F) steam was made. Examination of as-bonded, as-bonded plus one beta heat treatment, and as-bonded plus two beta heat treatments disclosed small voids in all zircaloy-2:zirconium diffusion areas for all conditions. In two instances there appeared to be small unbonded areas near the cap-clad outer surface. Peel tests of areas

DECLASSIFIED

showing small voids did not fracture the bond. A peel test of one unbonded area indicated that the bond was made up of very small, about 0.001" bonds separated by approximately 0.005" areas. With the exception of one striation, the remaining areas were at least mechanically bonded as they showed no penetration from steam autoclaving. Cause of the unbonded condition is not known.

Lot No. XI

In order to try to eliminate the "pipes" produced by the residual cladding striations, ridges were machined around the inner and outer circumference of the closure rings of two groups of samples. The first group, autoclaved in 400°C (752°F) steam for 72 hours, was composed of four NOT sections, 2 inches long, and four NIT sections, 2 inches long. No failures occurred in this lot. The second group, autoclaved under the same conditions, was composed of one NOT section, 5 inches long, two NOT sections, 2 inches long, two NIT sections, 5 inches long, and three NIT sections, 2 inches long. No failures occurred in either lot.

Long term autoclave testing of three NOT sections 2 inches long and four NIT sections 2 inches long in 400°C (752°F) steam and three NOT sections 2 inches long, one NIT section 5 inches long and three NIT sections 2 inches long in 360°C (680°F) water is underway.

Lot No. XII

This lot is composed of six NOT and six NIT specimens, five inches long, prepared with zirconium caps having circumferential ridges around the circumferential surfaces. These were prepared for thermal cycling at beta heat treating conditions to determine the number of cycles needed to fracture the bonds. The weld on one end of one NIT specimen leaked and this end did not bond. All other specimens have a very small uniform shrinkage of the cladding at the cap-core-clad interface, with no evidence of clad wrinkling.

The specimens were prepared for thermal cycling by facing off the closure welds and extensions used for bonding, cutting a 0.060 inch wide by 0.030 inch deep step cut over the bond area and making a fusion weld over the cladding-cap-bond area.

Lot No. XIII

Work to date indicates that autoclave failures of the smooth zirconium closure rings were caused by insufficient pressure during bonding leaving pipes through the bond area permitting steam to come into contact with the uranium. On the basis of BMI-1512, "The Mechanism of Pressure Bonding", recently published by Battelle Memorial Institute, it appears that raising the bonding pressure from 10,000 PSI to 15,000 PSI may correct the condition. About January 1, 1962, BMI will have an autoclave that will go to 50,000 PSI permitting specimens to be pressure bonded at higher pressure. It is planned to evaluate pressures up to 20,000 PSI.

The lot will be composed of eight each NOT and NIT specimens, two inches long. Anticipated shipping date to BNL is 11/12/62.

Lot No. XV

The lot is composed of six each NOT and NIT pieces, five inches long, that have been brazed by the standard Be-Zr process for corrosion studies in 360°C (680°F) water and 400°C (752°F) steam. After brazing, the ends were faced off flat to the standard depth without the step cut for welding. It is planned to autoclave these pieces for six months or failure if sooner.

Metal Coating of Closure Rings

At the present time, the best zircaloy-2 to zircaloy-2 bonds have been obtained using titanium as a diffuser. Its corrosion rates for a six months period in both water and steam are satisfactorily low. A supply of .005" thick titanium foil has been procured for use in coextruding titanium-clad-cap stock.

Fuel Element Supports

Outer Support

New designs for the outer support have been evaluated and a selection made. The new design is a 3/8 inch wide arch type support with a 1/4 inch arch radius. Preliminary evaluation of this design indicates it will meet the required criteria. The impact strength of the arch support is approximately five times more than the old suitcase handle support. The new design is deflected .006" by a 1 foot pound blow whereas the suitcase handle is deflected .030" by a 1 foot pound blow. The load vs deflection properties of the new design also meet the criteria of 1000 pound load for .040-.050 inch of deflection.

Because of the problem in the past of meeting support circle tolerances the new design includes the concept of sizing the support down to meet the required height after the support has been welded to the fuel. The feasibility of this concept has been demonstrated with a slight increase of deflection strength noted after sizing. A machine and tools to size the supports and provide a proper crown contour are being fabricated.

Dies for fabrication of the new support are being tested to assure producing crack-free supports from standard zircaloy sheet. The tooling method, which is more complicated than the tooling for the old design, is yielding 90% acceptable parts in early tests.

The shoe design for the outer support is not yet firm. Several concepts are being evaluated by pull tests and step discontinuity tests.

Welding developments have included an evaluation of spot welding vs projection welding. Spot weld tests evaluated by metallography indicate a uranium heat affected zone such that more development will be needed to give a

positive answer as to whether it has any advantage over projection welding. Various projection heights are being evaluated and electrode designs are being evaluated for the new support design. It is desirable from the strength standpoint to plan to make the welds very close to the sides of the arch. Some 400 welds tested to date have passed the 650 pound shear strength proof test.

Inner Supports

Design modifications on the inner support are not yet firm. However, it has been determined that the original buggy spring design can meet the load deflection criteria of 20 pounds per mil if all loops are touching. The problem is how to assemble the inner fuel into the outer fuel such that the sizing operation does not harm the properties of the support. Further testing of the assembly and sizing operation will be required to finalize the design.

The zircaloy-2 fabrication program in HLO is showing good progress. Accelerated fatigue tubes were made in a large sample of supports from each of the three strip fabricating processes outlined in last months report. All had good fatigue strength, but the strip produced from rolled plate and that produced by the Turkshead process had two times the fatigue life of strip produced from rolled tube segments. Samples from all the candidate strip processes successfully passed the 72 hour autoclave test. Supports made from this strip, after sizing, meet the mechanical criteria of 20,000 pounds per inch of deflection.

Production of pilot quantities of ductile zircaloy-2 strip has started with about 20 pounds out of 200 through the rolling process. This material will be ready for fabrication studies this month.

Two types of machines for forming the inner supports were constructed, and each operate satisfactorily.

TESTING METHODS ENGINEERING

N Fuel Testing

Routine testing of N billets continues in an attempt to elucidate the relation between billet extrusion performance and pre-extrusion ultrasonic test. Recent investigations have strongly supported earlier findings that billets with high ultrasonic attenuation - which is characteristic of large grain uranium - tend to produce, when extruded, excessive clad thickness variations on the inner surface of the outer fuel tube. Significantly, it has been further established that such billets are invariably low in impurity content. A study of some fifteen billets has shown that billets containing less than about 150 ppm iron and 115 ppm silicon have high ultrasonic attenuation and thus would be expected to extrude into fuel with excessive clad thickness variations. These particular extrusions will be carefully investigated by destructive and nondestructive tests to more completely evaluate the importance of impurities on billet extrusion performance.

Analysis of recent data has established a more quantitative method of interpreting the ultrasonic test results. Billets are now categorized by number on a scale of eight, the number referring to major divisions on the ultrasonic chart record. Billets giving readings in the range of 5 to 8 give good extrusions in terms of clad thickness uniformity; readings of 3 and below are not considered acceptable for extrusion. Readings of 4 appear to be a borderline situation in which some billets extrude acceptably and others do not. Continued efforts are being made to develop methods of more precisely defining the optimum value at which billets may be segregated.

Laboratory efforts have successfully applied the ultrasonic test to ingots for the first time. Results show a marked lack of grain uniformity between the four ingots examined to date. It is of interest to learn if these variations persist through primary to final extrusion and are detrimental to final fuel quality. Hopefully, this and other questions regarding the effect of uranium quality on the extrusion process will be answered by work now in progress. It appears likely that this work will suggest the desirability of installing ingot inspection equipment at National Lead Company of Ohio Feed Site.

Alpha counting equipment capable of measuring uranium cladding and end closure contamination of outer fuel geometries has received its final laboratory check out tests and is ready for 333 Building installation. Next efforts will be to complete the checkout of the N billet enrichment detectors. Shop fabrication of these gamma monitoring instruments has been completed. Two units are being put into service; one intended for billets, the other to measure the enrichment level of AlSi fuel cores.

AlSi Fuel Testing

A method of routinely auditing all testers has been adopted in order to obtain a more accurate measure of tester performance, and to more quickly reveal and correct

DECLASSIFIED

HW-75419

operating deficiencies. Tester availability (available time/total production time X 100) for October was: UT-2, 91.3; UE-1, 91.5; UT-4, 84.4, down slightly on the average from the previous month. These audits have also shown a consistent improvement in equipment stability. Reliability of the internal bond test has been significantly upgraded. UT-4 performance is better, largely as a result of more precise set-up and standardization procedures. A summary of tester performance is being documented and distributed monthly.

A formal request has been received and accepted from National Lead Company operation for the construction of two automatic UT-2 test stations. This project, which will bring NLO's total complement of UT-2 test stations to four, was in large measure prompted by the favorable experience obtained with the earlier test units which have been in use at NLO over a year. The total cost of the present work is \$57,000, it is scheduled to be complete late February, 1963.

Hot Die Size Fuel Test Program

Shop fabrication of the hot die size fuel inspection station (UE-3) has been initiated and is proceeding on schedule. Present development effort is aimed at overcoming difficulties in applying the internal probe to inspection of the spire. Modified probes have not, as yet, been entirely successful.

A novel electrolytic technique is being investigated as a means of detecting minute cladding defects in nickel plated cores. Under the present experimental arrangement, the plated cores are submerged in a weak solution of salt water. Pinholes, or other cladding defects which allow the liquid to contact the core gives rise to an ion current flow from the cladding to core by battery action. An electrode placed in the solution adjacent to the fuel element detects this current flow by a slight change of its electrical potential with respect to the fuel element. Approximately 100 mv change has been observed with a 0.010 inch diameter artificial hole drilled through the plate of a nickel plated core. Unfortunately, the test is troubled with changing surface conditions of the electrode which effects the voltage readings. It seems likely that this difficulty may be minimized to permit the detection of holes within the 0.050 inch diameter range.

General

Previous investigations have shown that zirconium process tubes containing small patches of 500 ppm hydrogen, and above, give a characteristic reverberation pattern when inspected with ultrasonic waves at a frequency equal to the third harmonic resonant frequency of the tube wall. The effect is not observed on normal zirconium. This past month identical wave traces have been observed in other samples of process tubes with 700 ppm, hydrogen at the 5th, 7th and 9th harmonic frequency. While the response seems to be most favorable at these particular frequencies, it is not certain that the odd-harmonic aspect bears any significance to the test procedure. Certainly, no theoretical reason is known why they should. This interesting point is being investigated further.

Surprisingly, other tests made on smaller samples prepared as one-half by two inch coupons in order to utilize a smaller, and supposedly better, hydriding furnace are not revealed by this test technique. Attempts are now being made by destructive analysis to determine if the hydrided metal of the small samples is metallurgically different than the tubular samples examined. The possibility that edge effects of the small samples may somehow interfere with the ultrasound propagation to mask the desired signal is also being examined.

KW Nowood
 for Manager, Engineering

LM Loeb

DECLASSIFIED

UNCLASSIFIED

HW-75419

FUELS PREPARATION DEPARTMENT
FINANCIAL OPERATION

OCTOBER, 1962

Product Cost and Budgets

A study was prepared on FY 1962 feed material shipments from NLO which included information on the number of freight cars handled and their weight content. This information will be used in negotiations for lower freight rates.

Cost coding and procedural changes necessary to ensure smooth transfer of accounting responsibility for N Project end functions were made during October. Concurrently, work on Mid-Year Budget Review, while somewhat delayed by the addition of NPR functions, is progressing satisfactorily. Manpower estimates for the Department have been firmed up, and detailed expense estimating is now in progress.

Forecasts of costs for the coextruded product were developed in the following areas:

1. Estimate of FY 1963 fund requirements for Financial Plan purposes.
2. Estimate of first-load cost for following cases:
 - a. Completion of first load by August 1, 1963
 - b. Completion of first load by November 1, 1963
 - c. Completion of first load by February 1, 1964
3. Preparation of detail estimates for CY 1963. Work toward establishing coextrusion shop measurement criteria for man hours of effort and material usage was continued with the October-December, 1962 period being designated as a base for CY 1963 measurements.

A detailed analysis of first quarter 02 Metallurgy R&D costs was prepared for the Engineering Section. The information provided included a cost-budget status summary, outstanding commitments and planned expenditure patterns for both internal and HL sponsored funds.

At the request of Utilities and Services Operation, a steam unit cost and coal consumption comparison was prepared for the first quarters of FY 1962 and FY 1963. In addition, a study of Manufacturing Engineering time distribution procedures and end function personnel assignments was continued during the month.

Plant and Equipment

A review of the Department's procedures for accruing and distributing depreciation has been completed, and a report is being prepared.

Equipment expenditures have been low thus far during the year. As a result, total expenditures will be somewhat lower than was previously anticipated. A review of requirements for the balance of the year resulted in about \$400,000 being released for other Plant uses or return to the AEC as appropriate.

UNCLASSIFIED

Unitization of CAF-847, New Fuel Cladding Facilities, is now complete. The report is being prepared and data is being keypunched for addition to the plant records. The value of the facility, which is the largest single addition to the FPD plant since its inception in 1956, is \$3.7 million.

Audits and Procedures

Two cost improvement proposals covering aluminum and zircaloy components and reflecting savings of \$96,828 and \$103,280, respectively, were received during the month. These two items plus Suggestion Plan cost reductions of \$252 brought total savings for CY 1962 to \$782,363, 87% of goal.

A mid-year review of data processing costs and data processing equipment expenditures for FY 1963 was conducted with the Managers, Manufacturing and Engineering. Cost of data processing services from C&AO were established at \$125,000 for FY 1963. Equipment requirements for the balance of FY 1963 include approximately 30 pieces of equipment at an estimated cost of \$101,000.

The need for more formal authorization and delegation of authority to request data processing work has become increasingly evident. The level and nature of this authorization, together with implementing procedures are being studied.

Travel

Travel expense recorded during October was \$11,366, nearly double the year-to-date monthly average. This high activity was largely due to personnel transfer costs which totaled \$6,200. Current month charges of \$222 for attendance at Professional and Trade Society meetings include trips to Seattle for the Western Regional Quality Control Conference and the Vacuum Society of America Conference. Currently, two Engineering employees are attending a meeting of the Society for Nondestructive Testing in New York; cost commitment figures are not yet available for these trips.

The transfer of NPR functions to FPD are expected to nearly double our historical level of travel. The majority of this increase is expected in the NPR Project group.

Organization and Policy Guides

A revised Department OPG on procurement was issued. Preparations of a procurement manual was been delayed pending receipt of supplemental data from Purchasing Operation. Expected issue date of this document has been moved up to November 15.

Completion of the final draft of the FPD OPG on Travel has been postponed until action is taken by HOO on Modification No. 24 to Appendix B.

One security violation was incurred in October.

for R.C. McKlaugh
Manager - Finance

WS Roe:pw

NPR PROJECT OPERATIONRESPONSIBILITY

Effective October 15, 1962, the General Electric responsibilities being performed by the NPR Project Operation were transferred to the Fuels Preparation Department.

ORGANIZATION AND PERSONNEL

	<u>9/30/62</u>	<u>10/31/62</u>
<u>Exempt</u>		
Permanent	89	86
<u>Non-Exempt</u>	<u>23</u>	<u>21</u>
TOTAL NPR PROJECT PERSONNEL	112	107

Transfers

<u>Name</u>	<u>From</u>	<u>To</u>	<u>Effective Date</u>
White, DH (Exempt)	Reactor Plant Design	Hanford Laboratories	10/1/62
McIntosh, WW (Exempt)	Principal Engineer - Primary Piping	Manager, H Reactor, IPD	10/15/62
Wade, GE (Exempt)	Reactor Plant Design	Facilities Engineering IPD	10/22/62
Pleake, Belva (Non-Exempt)	NPR General	Union Relations - R&OH	10/8/62

Terminations

<u>Name</u>	<u>From</u>	<u>To</u>	<u>Effective Date</u>
Mayberry, Nancy (Non-Exempt)	Reactor Plant Design	Accompany husband to Wash. State College	10/12/62

SAFETY AND SECURITY

No disabling injuries and no security violations were reported.

INVENTIONS OR DISCOVERIES

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

NPR PROJECT OPERATIONTRIPS

<u>Name</u>	<u>Firm and Location</u>	<u>Date</u>	<u>Purpose</u>
McCullough, JD	Information Systems, Inc. Los Angeles, California	9/17, 10/8 and 10/9	To review equipment fabrication and tests.
	Barton Instrument Corp. Monterey Park, Calif.	9/17 to 9/19/62 and 10/8 and 10/9	To review reliability of "Metrisite" units
	Sprague Engineering Corp. Gardena, California	10/10/62	To provide cable lay-out information.
	Avien, Inc. Woodside, New York	10/15 to 10/18/62	To review current design of Process Tube Flow Monitor and production testing techniques.
Pierce, LR	Lundell Electric Chicago, Illinois	9/18 to 9/20/62	To witness annunciator tests at vendor's plant.
Ward, CW	Parker Aircraft Company Los Angeles, California	9/27 and 9/28/62 and 10/1/62	To discuss quality control and production techniques on "H" fittings.
	Boeing Airplane Company Renton, Washington	10/1/62	Same as above.
Flickinger, JK	Black, Sivals and Bryson Tulsa, Oklahoma	9/28 to 10/2/62	To discuss specifications and inspection requirements on some control valves for NPR Loop.
Swezea, GL Mollerus, FJ, Jr.	Bailey Meter Company Cleveland, Ohio	9/30 to 10/6/62	To discuss engineering problems with Bailey Meter and Burns and Roe, Inc.
Nesbitt, JF Marinos, D	May-Fran Engineering Cleveland, Ohio	10/2 and 10/3/62	To witness discharge conveyor tests.
Nesbitt, JF	Tacoma Boatbuilding Tacoma, Washington	10/1/62	To resolve filter frame tolerance problems.
Reinig, LP	General Engineering Lab. Schenectady, New York	10/3/62	Dry film lubricant evaluation
	Chandler-Evans Hartford, Connecticut	10/4/62	Resolve diversion valve actuator timing problems.

TRIPS (Continued)

<u>Name</u>	<u>Firm and Location</u>	<u>Date</u>	<u>Purpose</u>
Haugland, GT	American Welding Society Milwaukee, Wisconsin	10/1 to 10/3/62	Assistance in discussion period of paper on boron steel welding.
	General Electric Co. Evandale, Ohio	10/4/62	Discuss and view tubing and fitting tests.
Rohrbacher, RA Hosack, GR	Western Piping & Engineering San Francisco, California	10/5 and 10/6/62	To discuss problems associated with welding small diameter stainless steel tubing.
Newell, GA McKay, NW	Puget Sound Naval Shipyard Bremerton, Washington	10/10/62	To discuss AEC requested horizontal rod testing.
Bainard, WD	Tidewater Oil Company Martinez, California	10/11/62	To discuss operating experience with special recorders being considered for use in NPR.
Kratz, EM	Byron Jackson Company Los Angeles, California	10/13 to 10/15/62	To witness thermal transient tests on NPR primary coolant pump.
Christopher, D.	Gray Tool Company Houston, Texas	9/27/62	Discuss Grayloc flange finishes and six-inch clamp retainer design.
Schoenwetter, H.	Burns and Roe, Inc. Hempstead, New York	10/3 to 10/5/62	Discuss comments on water quality monitoring system.
Erickson, HR	Bergen Pipesupport Woodridge, New Jersey	10/4/62	Pipe supports in 105-N and 109-N Buildings.
McBean, K	Holmes and Narver Los Angeles, California	10/17/62	Structural audit.
Francis, HW Burns, LG Ritter, W	Chandler-Evans Hartford, Connecticut	10/17/62	Discuss diversion valve actuator lubrication and timing problems.
Carson, AB	General Engineering Lab. Schenectady, New York	10/10 to 10/12/62	Discuss control rod seal development testing and tour of 189-D test Lab.

UNCLASSIFIED

HW-75419

NPR PROJECT OPERATION

SIGNIFICANT REPORTS ISSUED

<u>HW Number</u>	<u>Classification</u>	<u>Author</u>	<u>Date</u>	<u>Title</u>
HW-74577	Secret	Agar, JD	10/1/62	KER Loop 1 Tube Temperatures
HW-74976	Unclassified	Mollerus, FJ Jr.	9/21/62	User's Manual for the IBM 7090 Digital Computer Piping Flexibility Analysis Program
HW-75074	Unclassified	White, DH	9/28/62	NPR Dummy Vibration and Impact Corrosion
HW-75075	Unclassified	White, DH	9/27/62	NPR Process Tube Bellows
HW-75156	Unclassified	Bailey, GF	10/4/62	The Physics of the Hanford Graphite Superheat Reactor
HW-75207	Secret	Condotta, DL	10/9/62	Reactor Design Analysis Monthly Report - August and September, 1962

UNCLASSIFIED

NPR PROJECT OPERATIONPROCESS DESIGN OPERATIONProcess Research and Development

The response characteristics of the NPR Ball Hoppers, as presently designed, have been studied and will meet all foreseeable requirements including Phase III operation.

The User's Manual for the IBM 7090 Piping Flexibility Analysis Program has been prepared and issued.

A rough draft copy of the Bailey Meter Company analog study of the NPR Secondary Cooling System has been received and is being studied. The results of this report, in general, confirm the analysis previously made at Hanford.

A report updating and combining the preliminary reports of the failure sequence analysis of the heat dissipation instrumentation systems has been prepared.

A study to determine the need for installing orifice plates in the NPR inlet connectors prior to reactor startup has been completed. It was recommended that no orifice plates be installed prior to startup.

Project CAI-816Emergency Dump System

As requested by the Atomic Energy Commission, alternates to the currently scoped emergency dump system were studied in an effort to reduce cost for the system. Primary loop dumping into the 109 Pipe Gallery and the fuel storage basin were studied but were discarded. A preliminary concept of a minimum cost, limited life dump tank exterior to the 105-109 Buildings was completed consisting of an open basin (115 feet x 90 feet x 30 feet deep) with suitably lined sloping sides, located roughly in the area formerly reserved for the seventh loop. A "high-spot" estimate indicates that this basin and appurtenances can be constructed for \$250,000, more than a \$100,000 saving.

Chemical Waste Storage and Disposal

As requested by the Atomic Energy Commission, the facilities for chemical waste storage and disposal were studied in an effort to reduce cost.

It was determined that some chemical waste storage facilities will be required shortly after startup for such items as decontamination of a cell to find and plug a leaking heat exchanger tube; maintenance upon a primary pump; and maintenance upon inlet valves, diversion valves, and temperature detectors. These typical maintenance operations will require localized decontamination procedures or use of once-through decontamination techniques. For these, a limited volume of chemical waste storage will be satisfactory.

It was agreed to defer the facilities for final chemical waste disposal with an estimated cost reduction of approximately \$500,000.

It was agreed to defer the following Chemical Waste Storage Facilities with an estimated cost reduction of approximately \$150,000: one tank; its foundation; associated piping; all motor-operated valves; half of the hand-operated valves; one recirculation pump and one export pump along with associated motor starters and lead wiring; half of the instrumentation; and part of the shielding dike.

Dummy Element Disposal

At the request of the Atomic Energy Commission, the facilities for disposal of carbon steel dummy elements were reviewed in an effort to reduce cost.

It was agreed that radioactive dummy elements could be stored for eighteen months after reactor startup in one of the cask loading pits with minor temporary modifications at an estimated cost reduction of \$60,000.

Primary Coolant Pumps

Byron Jackson has been notified that the maximum shaft seal outleakage guarantee has been revised to not exceed 625 gpm for five pumps. This will allow increasing the seal throttle bushing clearance to about 0.020 inches.

Thermal transient tests were run on the number 3 primary coolant pump after increasing the seal clearance. The tests were those required by Byron Jackson in order to give an engineering opinion that the pumps will perform reliably in the field. There was no indication of any operating difficulty during the tests; however, measurements after disassembling the pump indicated the casing cover plate fit had increased in diameter 0.005 inches to 0.011 inches. Byron Jackson has stated that additional tests will be required to provide the information needed to give an engineering opinion that the pumps will be reliable.

Process Tube Diversion Valves

The lubricant (Indium plus Electrofilm 66-C) for process tube diversion valves was approved on October 18, 1962, with receipt of statements from Chandler-Evans and Electrofilm that the lubricant will be satisfactory for the 600F diversion valve service for at least one year. This completes design approvals for the diversion valves.

Process Tube Flow Monitoring

Brush Instrument Corporation has devised an electrical test to separate good from bad differential transformers in the flow monitor pressure-to-electrical signal transducers. The fault has been traced to a failure to insulate the lead wire joints properly with mylar tape and to the output of one individual who apparently failed to insulate the lead wire joints on approximately 25 of the 100 units he assembled. Ten faulty differential transformers were found in the 502 units of the first three instrument racks assembled. These ten units were replaced and the three racks (half of the order) were shipped on October 16, 1962.

Cone Valves

Work on cone valves has been accelerated by the Chapman Division of the Crane Company in a concentrated effort to complete the entire order by mid-December, 1962. Chapman, however, is still experimenting with their hot test facility for the optimum procedure which will provide acceptable accuracy with a minimum of testing time. General Electric is cooperating to the maximum extent possible with a quick engineering review of each procedure change, and by expediting the results via telephone to Kaiser Engineers and also through the immediate hand delivery of the corrected or approved procedure to General Electric Inspection. Similar engineering action has been taken to expedite the delivery of the remaining Atwood and Morrill Company 4-inch cone and "two-way check" valves, and consequently no further delay in the completion of this order is anticipated.

Horizontal Control Rod Drives

A total of 21 horizontal control rod drives out of 49 tested to date has been approved by General Electric inspection; 15 have been received at Hanford. Four of the drives, out-of-specification on maximum deceleration, have been accepted by approving deviation requests. Inspection has rejected 28 drives, four with slow or fast speed out-of-specification, and the remainder out-of-specification on maximum deceleration. The vendor has been requested to determine the cause of the high deceleration.

Equipment Development and TestingEnvironmental Test Facility

Operation of the Environmental Test Facility in the 189-D Building was initiated on October 5, 1962. Conditions employed were 125 gpm, 1762 psi, and 550F.

Instrument Tubing Connectors

Parker "H" mechanical fittings have been approved as an alternate to socket welded fittings for instrument tubing connectors.

FIELD ENGINEERING OPERATIONConstruction105-N & 109-N Buildings

The work on thermo-barriers in the inlet and outlet pipe spaces is continuing, including the installation of structural steel and stainless steel liner plates. Work has also been started on the hinged panel doors. The rear vertical lift thermo-barrier door has been partially assembled on the "D" elevator.

The Subcontract SC-87 for general architectural and electrical work in the 105 superstructure has now been completed and accepted from the subcontractor with one exception. The exception is the removal of roofing tar from the fascia on the building, however, this exception will be completed after the tar becomes embrittled by cold weather.

The punch list has now been made for Subcontract SC-78, 105-N Building general mechanical work, and the subcontractor, Harder Industrial, is now working on these items. Their sheetmetal subcontractor, M & N Sheetmetal, is now in bankruptcy and has been replaced by Holiday and Edgeworthy of Yakima for completion of the punch list items.

Routine bench checking of the relays to be installed in the power and relay panels in the 105-N Building has established that about 25 per cent are faulty and must be repaired or replaced by the vendor.

Approximately 1,000,000 feet of process control cable has now been pulled in the 105-109 inter-tie cables.

The installation of the heating and ventilation control instrumentation system is now nearly completed. Cleanup of punch list items and calibration remain to be done.

The installation of instrument tubing is continuing to make slow progress on the rupture monitor system, flow monitor system, and the primary and miscellaneous water systems. A mechanical two-piece coupling (Parker "H" fitting) was authorized as an acceptable alternate to welded couplings on high pressure instrument lines.

The first shipment of 3/16" O.D. stainless steel tubing to replace that which was removed several months ago gave indication of extensive surface cracks. A statistical quantity of this tubing was checked by eddy current methods. Of the 100 lengths checked, 99 were rejected, therefore the first shipment is totally rejected. The second shipment of tubing was also checked by the same method and found to have a 95 per cent rejection rate. Kaiser Engineers have found an alternate supplier and new tubing is being procured.

Two reactor nuclear panels, two pile gas panels, one confinement panel, and the reactor control console were set in place in the 105-N control room.

The tempo of the work in the 109-N Building is now beginning to increase significantly. Considerable progress is being made on installation of secondary loop and steam and condensate piping.

117-N Building

All of the concrete walls and columns in the 117-N Building which involve filter frame inserts have now been completed. The slab is now in place over all the cells. "As-Built" information has now been obtained on two of the four cells, and only minor correction work will be required in order to comply with the dimensional tolerances.

The installation of installed electrical conduit has been completed.

181-N Building

The motor for pump unit #3 has now been returned from Midway Substation and reinstalled. Testing of this unit is now in progress.

182-N Building

Work is now under way in this building on the high pressure piping from the injection water pumps. Considerable electrical test work is now in progress including determination of power factor for the 2000 HP drives.

163 - 183-N Building

The testing of the demineralizer plant for the 163-N Building is still being delayed by leaks in the piping system and the replacement of strainer 'T' bolts.

184-N Building

Calibration of instrumentation is still under way and most of the hydrostatic testing is now completed and pipe flushing has started.

The three boiler feed water pumps are now ready for testing.

Pile Erection

Completion of piping and electrical work is continuing in the rod rooms and the installation of the horizontal rod drive assemblies has been started. Installation is also continuing on the shield cooling piping. Installation of the outer skin plate for the reactor primary top shield is essentially complete. This completes the work

of installation of the reactor shielding.

The modification of the Ball 3-X trip mechanism at the J. A. Jones Shop is continuing with machining and testing completed on approximately one-half of the units. Installation of the hydraulic elevator components is continuing although some delay was experienced by damage to the "C" elevator hydraulic cylinder when the plunger was accidentally dropped when being inserted.

Primary Loop Engineering

Four hundred seventy-six (476) pipe spools have now been shipped to the field which represents a total weight of 351.8 tons. Of these spools, two hundred sixty (260) are for the 105 Building and two hundred sixteen (216) are for the 109 Building.

Production in the HUICO Shop has now passed the peak and production personnel are being terminated as the work load decreases. There are now approximately 300 HUICO employees which is a decrease of over 200 from the peak period of mid-September.

Field activities are slowly increasing with the addition of a 15-man swing shift on October 22, 1962.

Administration

The following material has been issued during the period of September 23, 1962 through October 26, 1962.

Drawings	28
Criteria	3
Specifications	2
Requisitions	54
ATP's	3
Other	<u>6</u>
Total	96

Reviews were completed and formal comments were offered on engineering material as follows.

Drawings	1
Specifications	1
Scope	0
ATP's	<u>1</u>
Total	3

Bailey Meter material processed as of October 21, 1962, is as follows:

Released as Noted for Fabrication Drawings	137
Released for Information	64
Released for Fabrication Drawings	84
Not Released for Fabrication Drawings (B&R)	4
Approved without Exceptions (GE)	6
Not Approved (GE)	<u>1</u>
Total	280

Following is the status of Subcontract KE-11252 (HUICO) data as of October 26, 1962:

Total Number Received	2781 (Includes 2001 received for Information Only)
Number Approved	730
Number Approved with Exceptions	28
Number Not Approved	21
Number Currently Being Reviewed	
By GE & B&R Jointly	1
By B&R (109-N)	0
Number Received for Information Only - No Approval Required 2001	

PROGRAM EVALUATIONDesign Status

	<u>Wt'd Total</u>	<u>Certified Schedule</u>	<u>Actual % Complete</u>
<u>Reactor Plant as of 11/1/62</u>			
<u>Title I</u>			
Scope		100	100 (1)
<u>Title II (2)</u>			
Drawings	60	97.5	97.6
Specifications	5	100.0	100.0
Requisitions	10	91.5	84.5
ATP's	10	72.0	60.4
Development and Testing	<u>15</u>	<u>97.5</u>	<u>96.7</u>
Total	100	94.5	92.6

Heat Dissipation Plant as of 11/1/62

<u>Title I</u>			
Scope		100	98.8
<u>Title II</u>			
Detail Design		100	96.0
	<u>Req'd</u>	<u>No. Issued to 10/28/62 Scheduled</u>	<u>Actual</u>
Preliminary Drawings (bid)	1130	1108	1014
Detail Drawings (for const.)	1130	1108	1108
Specifications (bid)	153	152	150
Requisitions	183	169	169
ATP's (preliminary)	15	6	6
(final)	15	2	2

<u>Composite Design Completion as of 11/1/62 (Reactor and Heat Dissipation Combined)</u>	<u>Certified Schedule</u>	<u>Actual % Complete</u>
Total	97.5	94.9

- (1) This percentage represents only the completion of 44 criteria and does not include updating or revising.
- (2) Weights and schedule revised 5/1/62 and submitted to AEC for approval.

Costs

Congressional approval was granted for increasing to a total of \$188 million for NPR. The President signed the Bill during the fourth week of October. AEC-Washington released an additional interim authorization of \$6,250,000 (10/4/62). The Hanford release for Project CAI-816 now totals \$162,950,000.

Kaiser Engineers are preparing a new cost estimate. The first meeting of the Cost Estimate Review Task Force was held on October 31, 1962, and will continue until completed.

Schedules

On April 13, 1962, HOO-AEC submitted Revision # 4 to the Certified Construction Schedule to Washington for their consideration. This schedule shows construction completion October 1, 1963.

The construction status as of 11/1/62, based on the Revision # 4 to the AEC Construction Schedule, dated April 13, 1962, is as follows:

	<u>Scheduled</u>	<u>Actual</u>
Temporary Construction	85	85
General Area Systems	79	75
105-N Building	81	65.9
109-N Heat Exchanger Building	82	58
163N-183N Water Treatment Facilities	98	97
181-N River Water Pump House	100	99.4
182-N High Lift Pump House	99	97
184-N Standby Power House	97	96
153-N Switchgear Building	91	98.9
NPR Project (CAI-816)	81	67.5

Kaiser Engineers are preparing a new schedule in connection with their revised cost estimate which is scheduled to be submitted in final form about mid-Nov.

Manager, NPR Project Operation

JS McMahon:mf

END

**DATE
FILMED**

11 / 12 / 92