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FUELS PREPARATION DEPARTMENT

MONTHLY REPORT

AUGUST

1962

Received

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HANFORD ATOMIC PRODUCTS OPERATION

RICHLAND, WASHINGTON

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FUELS PREPARATION DEPARTMENT

HW 82998

MONTHLY REPORT --- AUGUST 1962

Compiled by Fuels Preparation Department

September 7, 1962 - Richland, Washington

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

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MANUFACTURING

Production

ALSi Process

1. High operating efficiency and operation of the plant on nine canning lines for a ten-day period resulted in plant output exceeding the forecast.
2. The inventory of finished fuels reflected a 2.1 month supply at month end, excluding 102 tons of dingot elements.
3. Bare core inventory at month end reflected a 1.0 month supply, excluding 311 tons of oil quench and dingot cores.

Coextrusion Process

1. A total of 152 outer production extrusions were completed during August. Total input to the plant to date represents 24 per cent of the first reactor load requirements.

ENGINEERING

Present Reactor Fuels

Present Canning Processes

Fuel Failures

Five regular production I&E fuel elements failed in reactors during August. No unusual trends were indicated by this experience.

Dingot Uranium

Approximately 64 tons of alloyed dingot uranium were being irradiated at month end and 1733 tons have been discharged at goal. The moratorium, during which no dingot uranium is charged in reactors, is still in effect. Agreement has been reached with IPD to irradiate a major part of the canned OIIIN dingot fuel (99 tons) after subjecting the pieces to special tests designed to upgrade bond quality and closure integrity. An experimental crack tester is being used to examine cores from the 302 tons of bare uranium dingot which is in storage with the objective of developing a reliable system for the detection of transverse cracks in these cores. The development of optimized duplex canning bath conditions for alpha rolled, alloyed dingot cores has been completed. Based on the evaluations of material processed under optimized conditions, it has been recommended that the 302 tons of dingot uranium in inventory be released for canning under the optimized conditions developed. Major conclusions derived from optimized canning evaluations follow: metallographic examinations of the bond structure showed that bonds formed using dingot uranium were equivalent

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to bonds formed with ingot uranium; external and internal bond count data showed no differences between dingot uranium and ingot control pieces; close control of canning furnace temperatures is necessary to maintain uniform can wall thickness using the revised process for dingot cores. Test quantities of dingot cores heated in hollow (rather than solid) core blank form, oil quenched and vacuum annealed were received for etching and canning studies. Mallinckrodt Chemical Works has found that this procedure eliminates quench cracks, reduces surface hydrogen and provides a more reactive core surface for AlSi bonding.

Ingot Uranium

About 24 tons of oil quenched, ingot test cores, heat treated at National Lead Company of Ohio during May during the period of sludge buildup in the salt bath are being returned to National Lead for remelt.

An irradiation test comparing oil and water quenched ingot cores continues with about 9.4 tons having been discharged to date. The charging rate for this evaluation will be increased from 5 to 25 tons per month in September.

Projection Fuels

Irradiation experience continues to demonstrate that "bumper" fuels will effectively minimize gross fuel misalignment in ribbed process tubes and associated hot spot ruptures. About 1665 tons of "bumper" fuels have been charged and 1082 tons have been discharged to date. The over-all performance of "bumper" fuels is a factor of two better than "non-bumpered" fuel. Testing and debugging of a prototype automatic feeder designed to feed elliptical "bumper" rails into the ultrasonic welder is progressing. Production transition from the present rectangular rail design to the elliptical design, which offers lower hydraulic resistance, is contingent upon satisfactory demonstration of a suitable rail feeder.

In order to meet K reactor self-supported fuel requirements in line with their retubing schedule, the thickness of the KVN collapsible bridge rail has been increased from 45 to 50 mils. This design will be used on an interim basis until a more optimum design can be evaluated. Process capability for controlling the maximum projected diameter and minimum rail height for KVNS fuel elements has been demonstrated using a special slotted die.

AlSi Limitation Tests

The AlSi Limitation Tests indicate the AlSi-uranium bond deteriorates after baking for one hour at 500 C and 25 hours at 400 C. Baking for 100 hours at 300 C and 200 C had no effect on the bond which could be detected by differences in total bond count.

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Component Cleaning

Component cleaning tests have shown that a phosphate-chromate conversion coating promotes wetting of the aluminum cans more effectively than the chromate conversion coating currently in use.

New Canning Processes

Hot Press

An irradiation test comparing Sylcor hot press, HAPO hot press, and HAPO AlSi bonded fuel elements has progressed to one-half the goal exposure (or to 425 MWD/T) without incident.

Enriched uranium (0.94%) is currently being machined at National Lead prior to shipment to Sylcor for the production of 1000 CIVE Sylcor hot press fuel elements.

Fluid Pressure Bonding

A contract with Battelle Memorial Institute has been approved for the development of optimum process parameters for fluid pressure bonding of HAPO assembled fuel elements in the Battelle facilities.

Hot Die Sizing

Since installation of the sizing press, 210 fuel assemblies have been pressed. Initial cap mushrooming problems have been eliminated and operating conditions have been developed to produce strong uniform bonds with tensile strength of 30,000 psi. Installation of the end bonding press is 75 per cent complete. The nickel plating line has been converted from a modified Thompson bath to a Watt's bath. This pretreatment cycle is the same as used by the Savannah River Laboratory, and was instituted to take advantage of the extensive experience with the Watt's bath at both Sylcor and Savannah River.

Equipment for the inspection of nickel thickness, can wall thickness and bonding of fuel produced by the hot die sizing process is under development. Initial testing will be done in the laboratory on the original N fuel; prototype tester which is being modified for this purpose.

The possibility of employing an AlSi rather than a nickel coat on uranium fuel cores prior to canning by the hot die sizing process is being investigated. Earlier work has shown that cores submerged for about 30 seconds in a molten sonically agitated AlSi bath are readily and thoroughly wet by AlSi. The resulting bond has proven to be weak, however, and additional tests are being made under modified canning conditions in an attempt to enhance the strength of the bond.

Other Nondestructive Testing

External bond tester modifications which lowered the test frequency from 25 to 15 mc have made the equipment more effective in the detection of unbond defects.

One UT-2 station has been modified to stabilize amplification and gating circuits and better discrimination of fuel core grain size has resulted. Modification of the other three UT-2 testers is planned.

Major emphasis is being placed upon improving the reproducibility of the UT-4 testers. Improved setup standards and the use of a smaller transducer nearer the fuel element external surface are being tested and promise to improve the operation of this equipment.

N Reactor Fuels

KER Loop Testing

KER loops 1 and 2 are shut down for modifications and they are not expected to be back on the line until after October 1, 1962. Loop 3 will be discharged during the next reactor outage for pump repairs. The average exposure of 11 NAE-1 fuels in this loop is about 650 MWD/T and about 60 per cent of this exposure has been on single pass water. The 14 NAE-1 fuels in loop 4 have reached an exposure of 1050 MWD/T. Average tube exposure goal for this charge is 1400 MWD/T (peak exposure is 2,000 MWD/T). Goal exposure should be reached about October 1, 1962. This test will be the first prototypic exposure of prototypic N fuel assemblies. Fourteen prototypic NAE-1 fuel elements, with the latest hardware, are available at the KE reactor for charging as space becomes available. Two charges of NAE-1 fuels will be prepared by Manufacturing and shipped to KE on or about October 1 for loop charging as space becomes available.

Uranium Development

In February a four category Feed Site test was designed to evaluate the effect of various uranium processing parameters upon the control of clad thickness during coextrusion. Nearly all the billets in this test have now been co-extruded and analysis of the data is under way.

Solid cast and drilled ingots were ordered from National Lead in August as part of a program to evaluate this material for improved quality and reduced costs in comparison to the presently used hollow cast ingots.

Several high Fe-Al (400 and 700 ppm, respectively) alloy billets have been coextruded and preliminary examinations indicate good clad and wall thickness control.

Fuel Element Supports

Adequate quantities of satisfactory quality outer supports for production are on hand. Fabrication of the inner buggy spring supports in .035" zircaloy-2

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strip stock has not been satisfactory and no supports are currently on hand for production use. Concentrated development activity by both FPD and HLO is under way to develop methods of fabricating these supports without cracking in the outer bends. Variations of orthodox methods for strip formation are being tested as well as new approaches such as coextrusion with copper followed by slitting and flattening.

Extrusions

Four primary extrusions, 14 uranium billets, three copper billets, three zircaloy billets and ten composite billet extrusions were carried out during August. These included primary and tube extrusions for the E.I. duPont Company to determine the effect of varying extrusion reduction ratios on the distributions and size of inclusions.

Billet assembly and coextrusion processes have been monitored on a 100 per cent basis during the past six weeks and this effort will be continued during the next two weeks. This is being done to specially evaluate all aspects of process, manufacturing, and operating effectiveness of the coextrusion process.

Autoclave and White Oxide Studies

Etching and rinsing techniques to prepare N fuel for autoclave have improved considerably during the month as indicated by the low evidence of white oxide on clad surfaces.

End Closure Development

Four groups of brazing alloy samples made by powder metallurgy techniques (contract DDR 137) were received and were evaluated with the objective of defining the best powder metallurgy methods and further improving the process.

Gas Pressure Bonded End Closures

Gas pressure bonded end closures involving "V" type zirconium, copper coated zircaloy-2, titanium and niobium end closure rings have been examined. Specimens with thorium-uranium end closure rings have been bonded but not examined. None of the specimens examined have been completely satisfactory and work is continuing. Work is also under way to evaluate vapor deposited zirconium hydride as a means for producing a diffuse coating on zircaloy-2 end closure rings, to study the vapor coating of end closure rings with titanium, and to produce titanium-zircaloy end closures bonding by coextrusion techniques.

Warp Studies

An analysis of the warp yield after beta heat treating has been completed for all NIE coextrusions made to date. This data is being used to define more precisely the operative forces causing warp in order to improve process capability.

N Fuel Testing

The importance of billet grain structure to the quality of extruded N fuel has been further established. Comparison of nondestructive test data from about 20 billets to eddy current test data from corresponding extruded elements revealed that billets exhibiting large ultrasonic attenuation extruded into fuels with excessive roughness at the inner uranium-zircaloy-2 interface. Of the elements examined, about 22 per cent were rejected because of this defect. Analysis shows that this number would have been reduced to five per cent had the billets been pre-selected on the basis of the ultrasonic test. The possibility of establishing billet acceptance standards based upon the ultrasonic billet test is being evaluated.

Measurement of N fuel uranium surface contamination is continuing on a routine basis.

Equipment for measurement of enrichment level in N billets is on hand and about 75 per cent assembled.

Encouraging results are being obtained in the evaluation of a photo-tube device for the detection of white oxide on the surfaces of autoclaved N fuels.

A modest effort continues to investigate ideas which may lead to the non-destructive detection of hydrogen embrittlement in zircaloy-2. The most promising work has established what appears to be a real correlation between the quantity of hydrogen absorbed in zircaloy samples and the rate of which vibrational energy is dissipated in the samples after removal of a driving force.

PERSONNEL STATISTICS

Number of employees as of July 31, 1962 825
 Number of employees as of August 31, 1962 836

	<u>Exempt</u>	<u>Nonexempt</u>	<u>Total</u>
General	2	1	3
Employee Relations	1	0	1
Engineering	49	28	77
Financial	13	8	21
Manufacturing	88	364	452
Plant Facilities	37	245	282
TOTAL	190	646	836

Employment

		<u>August</u>	<u>July</u>
Additions:	Exempt	2	2
	Nonexempt	16	12
		<u>18</u>	<u>14</u>
Reductions:	Exempt	5	4
	Nonexempt	2	16
		<u>7</u>	<u>20</u>

Additions to the Fuels Preparation Department during the month of August included eleven new hires -- 3 as replacements and 8 additional Metal Handlers; two military reactivates; one Business Training Recruit on rotational assignment; one Principal Engineer transferred from Flight Propulsion, Cincinnati, Ohio; one reactivate from personal illness; one additional Junior Power Operator on Request for Transfer; and an Engineer replacement transferred from ANP, Cincinnati, Ohio.

Reductions included the resignations of two Engineers; one Serviceman transferred to CE&UO for upgrade to Lube and Tireman, one Secretary on leave of absence to move to Schenectady with her husband; one Janitor transferred to IPD on Request for Transfer; one Metal Handler resigned; and one Janitor deactivated on personal illness.

STAFF

General Manager	R. L. Dickeman
Manager, Manufacturing Operation	W. N. Mobley
Manager, Engineering Operation	L. M. Loeb
Manager, Plant Facilities Operation	E. Hilgeman
Manager, Financial Operation	W. S. Roe
Manager, Employee Relations	C. O. Steinnagel
Consultant, Business Effectiveness Program	J. W. Talbott

Effective September 1, 1962, the Plant Facilities Operation will be deleted from the Fuels Preparation Department organization. Those maintenance functions, exclusive of carpentry and painting, which have been performed for the Hanford Laboratories Operation, will be assumed by them and the supporting personnel transferred to the Test Reactor and Auxiliaries Operation. Those power operators providing ventilation and air balance service to HLO will also be transferred and reassigned to Facilities Engineering Operation. A total of 141 employees - 9 exempt and 132 nonexempt - will be included in the transfer. The remaining personnel will be transferred to the Manufacturing Operation with the Utilities, janitorial and maintenance personnel assigned to a new Services and Utilities Operation.

Effective August 1, 1962, E. D. Sayre was transferred from the Flight Propulsion Department, Cincinnati, Ohio and assigned as Principal Engineer, Fuels Program - Engineering Operation.

SAFETY

Days since last disabling injury	140
Hours worked since last disabling injury	591,463

MEDICAL TREATMENT INJURIES

Operation	This Month		Last Month		Year-To-Date	
	No. of Cases	Frequency Rate	No. of Cases	Frequency Rate	No. of Cases	Frequency Rate
Manufacturing	15	2.25	24	3.96	209	3.63
Plant Facilities	16	3.82	19	4.65	162	4.45
Engineering	4	3.19	3	2.58	18	1.83
Financial	0	0.00	0	0.00	0	0.00
Total	35	2.78	46	3.91	389	36.1

There were no serious or disabling injuries during the month of August.

SECURITY

Two security violations were experienced in Finance, bringing the total calendar year-to-date violations in the Department to six.

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SUGGESTION PLAN

Operation	Number Received		Number Evaluated		Number Adopted		Amount of Awards		Net Annual Savings	
	Mo.	CYTD	Mo.	CYTD	Mo.	CYTD	Mo.	CYTD	Mo.	CYTD
General	--	--	--	--	--	--	--	--	--	--
Engineering	--	2	--	2	--	--	--	--	--	--
Financial	--	1	--	1	--	--	--	--	--	--
Manufacturing	16	183	22	194	9	88	\$655	\$2495	\$4486	\$16,402
Plant Facilities	14	173	24	247	9	119	295	2600	1945	13,975
Total	30	359	46	444	18	207	\$950	\$5095	\$6431	\$30,377

COST IMPROVEMENTS (EXCLUDING SUGGESTIONS)

Operation	Accepted in August	Total Accepted CYTD
General	\$ ---	\$ ---
Engineering	---	124,300
Manufacturing	1,031	383,409
Plant Facilities	---	42,414
Total	\$1,031	\$550,123

PATENT SUMMARY - AUGUST 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 August. Such persons further advise that, for the period therein covered by this report, notebook records, if any, kept in the course of their work have been examined for possible inventions or discoveries.

RL Dickman

General Manager
Fuels Preparation Department

RL Dickman:mkm

MANUFACTURING OPERATION
AUGUST, 1962

CURRENT OPERATIONS

Production

Statistics - AlSi

Current Month's Production	NATURAL				ENRICHED				Total
	C	K	Reg.	Bumper	C	K	Reg.	Bumper	
Acceptable Fuel Elements Produced (Tons)	-	274.8	89.5	111.5	-	105.0	11.1	24.9	616.8
As % of Forecast Production	0	126	138	83	0	100	0	1245	108
Cum. % of Forecast for Current Quarter	86	129	161	89	6	79	0	184	110
As % of Past 3 Month's Average Production	0	131	63	228	0	339	159	66	113
As % of Past 12 Month's Average Production	0	106	71	141	0	228	101	80	101
% of Forecast Achieved Last Fiscal Quarter	68	118	163	34	117	135	250	109	107
% of Forecast Achieved Last 4 Fiscal Quarters	92	113	111	76	90	108	124	102	103

Operating Efficiency

Current Month (%)	97.7
Forecast (%)	95.0
Previous Month (%)	97.8

Manufacturing Yield

Current Month (%)	-	93	91	83	-	91	89	81
Forecast (%)	90	90	90	85	90	90	90	85
Previous Month (%)	93	93	89	83	90	88	-	80

Bare Uranium Available for Processing (Tons)	819
Finished Products in Storage (Tons)	1371
Work in Process (Tons)	154
Special Products Finished (Pieces) Lead	2007
Uranium Utilization	96.6

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Statistics - Coextrusion Production (1)

Forecast Process Input (Tons) 35.0
Actual Process Input (Tons) 31.3

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	152(2)	-	0	-	No extrusions awaiting cutup					
Chemical Milling	1681	2.1	0	-	168	6	2	14	1	4
Braze	1444	8.7	0	-	172	0	0	0	0	0
Heat Treat	1913	0.1	0	-	54	1	0	0	0	0
Machining	1631	-	0	-	155	1	0	0	0	0
Welding	1237	0.2	518	1.2	196	4	0	0	0	0
Non-Dest. Tester	1321	13.3	470	0.0	220	4	0	57	0	1
Autoradiograph	788	9.9	806	0.6	340	7	0	51	10	0
Support Weld	831	0.1	33	0.0	385	38	54	1639	121	54
Autoclave	763	-	172	-	484	19	0	0	19	0
Final Inspection	447	9.4	171	5.9	990	52	4	342	73	0

Process Inventory

Production Pieces held for rework	737	88	10	494	133	14
Production Pieces awaiting evaluation	167	34	12	112	31	9
Production Pieces - Scrap	358	46	47	115	24	18
Total Process Inventory - Pieces	4426	300	129	2824	412	100
Total Process Inventory - Pounds	119,900	6,078	1,722	38,293	4,174	667
Total Process Inventory - Tons	85.42					
Finished Production for August	8.6 tons					
Total Finished Inventory	11.54 tons					

Oxide burned - pounds 238.4

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

Production

Plant Operation - ALSi

Production output exceeded the forecast as a result of high operating efficiency and operation of the plant at nine canning line shifts per day during the last ten days of the month. A total of 194 canning line shifts were operated during the month.

A general increase in production yields was experienced for 8-inch material; reduced reject rates were noted in the CPR reject category and the marred surface reject category. The CPR reject rate was lower primarily due to unusually low ALSi slopover and stuck sleeve rejects during an extended KIVN product model run.

For 6-inch material, reduced reject rates were noted in the weld reject category and the marred surface reject category. The welding improvement is attributed to extensive overhauls completed on the semiautomatic welders in July. The marred surface rate was lower for both 6-inch and 8-inch material primarily due to greater diligence in controlling the sources of marred surface and fewer problems with the conveyor system.

Projection fuel elements produced during August totaled 136 tons, with yields of 83.0 per cent on the 8-inch fuels and 80.8 per cent on the 6-inch. The bumper welding yield was 95 per cent on the 8-inch and 93 per cent on the 6-inch material. Production and reactor charging for August and to-date is as follows:

	<u>August 1962</u>		<u>To-Date</u>	
	<u>Natural</u>	<u>Enriched</u>	<u>Natural</u>	<u>Enriched</u>
FPD Produced	111	25	1419	678
IPD Charged	1*	23*	1203	605
Finished Inventory	216	73	216	73
Average Welding Yield	95%	93%		

* Adjusted to reflect incorrect figure in July report.

One autoclave failure occurred in the ALSi process during the month of August. The failure mechanism was difficult to identify due to extreme distortion of the cladding structure. However, the braze was pulled away from the spire in the base closure area indicating a possible spire nonwet area. Two autoclave failures have been experienced during the calendar year.

The inventory of finished fuels at month end reflected a 2.1 month supply based upon projected reactor usage, excluding 102 tons of dingot elements.

Month end inventory of bare cores reflected a 1.0 month supply based upon anticipated fuels process needs excluding 311 tons of oil quench and dingot cores.

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Two scrap shipments were made during August, totaling 70 tons of natural and enriched uranium scrap. Two shipments of 840 boxes with lids were also made.

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

8" Normal R&E	15,865
6" Enriched R&E	10,724
6" Water Mix	18
Total	26,607

Plant Operation - Coextrusion

A total of 152 outer extrusions were made for production during August, an equivalent process input of 31.3 tons.

Internal clad variation of outer material has been a major problem during the month with a defective rate of 13 per cent being experienced. Although the defective rate was more severe on material produced early in the month from heat treated billets, the rate was also high on non-heat treated billets at month end. Engineering evaluation of the problem is underway.

Outer material is currently being clad and bond tested prior to brazing to evaluate extrusions and to avoid the processing of bad material through braze.

Manufacturing Engineering

Design and Projects

CGF-903 Projection Fuel Element Modifications, 313 Building

	<u>Scheduled</u>	<u>Actual</u>
Design	100	100
Construction	100	100

The third ultrasonic welder has been prepared for production usage and the conveyor has been connected. The new elevator which serves both as an elevator and a separator to provide for distribution to two or more conveyor tracks functions satisfactorily.

CAF-954 High Pressure Autoclave Development Facility

Informal word has been received that funds for preliminary design have been approved and that formal authorization is in process.

CAF-961 Consolidated 303 Area Services Facility - Phase I

The project proposal has been transmitted to the Washington AEC.

CAF-973 Steam Distribution Line Modifications - 300 Area

This project proposal has been approved. No further action is expected until FY 1963 PAC funds are available.

CGF-979 Pilot Scale Plating Equipment - 300 Area

The project proposal for this facility was approved by the HAPO General Manager on August 16, 1962, and forwarded to the AEC.

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

The project proposal for this facility was approved by the HAPO General Manager on August 15, 1962, and forwarded to the AEC.

Miscellaneous

AlSi Shop

Work on the temporary maintenance space in the 313 Building was completed. This work included the installation of partitions, lighting, water supply, air supply, drain, and refrigerated air conditioning units.

An appropriation request was issued to provide for conveyor modifications in the Finishing Area. These modifications are expected to reduce marred surface rejects to a considerable extent. The appropriation request was for \$10,500 and is expected to have a payout period of less than one year.

Modifications to provide for the production of KV fuel elements are progressing. These modifications include revision to the dispensing drum on the duplex loader, auxiliary sleeve preheat basket assemblies, a quench machine setup mandrel, new collet pads and snap rings for the latches, new welder contacts, stamper modifications, tester probes, ultrasonic welder collets and rail feeders, and rail sizing dies.

Coextrusion Shop

Design was completed on a walkway for the chemical storage tanks east of the 333 Building. This walkway is being provided as a safety measure to simplify operations and maintenance work on the tanks and improve the working conditions.

General

The gamma monitors for the criticality alarm system were evaluated by the Nucleonic Instrumentation Operation, HLO. The evaluation report confirmed the fact that the instruments performed as required by specifications.

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A revised 300 Area Evacuation Route plan was completed to reflect recent changes in the evaluation of potential incidents. The revised route provides a more direct 300 Area exit pattern.

Drafting and Duplicating

Drawings Produced

New	79
Revisions	98
Large Charts	1
Small Charts	25
Miscellaneous	74

Duplicating Production

914 Copier Masters Prepared	1,172
Multilith Impressions	393,014
Ozalid Copies	8,269
914 Copier Copies	13,994

PLANT CONDITIONS, INCIDENTS, AND IMPROVEMENTS

ALSI Shop

Plant operating efficiency during August remained at a high level which closely approached the record high attained during July. About 66 per cent of the downtime was caused by equipment malfunctions, while the remainder was caused by operational problems.

The UT-2 Tester No. 4 readout circuitry has been modified to give large-grain readout. This circuit retains for visual presentation a reading proportional to the largest grain segment of a bare core. The circuitry in the amplifier section was also modified to obtain better temperature and voltage stabilization. At this time, the tester is also being calibrated with a range of three standards. These changes in amplifying circuitry and in the calibration procedure have resulted in a significant reduction in tester measurement error.

A number of UT-4 reject fuel elements are being evaluated to determine the correlation between UT-4 and metallographic results. Preliminary data show the defects as measured metallographically to be less severe than indicated by the tester. For example, one piece was tested with the UT-4 indicating a crack or void area extending the entire length of the braze line with a circumferential width of approximately one-fourth of an inch. The sample was progressively sectioned and polished and all that was found was a series of nonconnecting voids scattered throughout the area. Further evaluation will be required to obtain conclusive data.

A test has been designed and conducted to determine the individual and cumulative effects of various independent process factors upon ultrasonic weld tensile pull strength. Tensile testing is now in progress.

It is hoped that the test results will assist in isolating the more critical factors affecting weld strength and also provide a basis for future development work.

A modified spire basket with teflon spacers has been put into service for evaluation. The purpose of the modifications is to provide for reduced damage to the spires during the basket loading and processing operations.

The automatic stamper has been installed on a production lathe. Preliminary results indicate satisfactory operation can be achieved. Some additional adjustment and modifications are required before the unit can be considered production equipment.

Coextrusion Shop

The development of a billet vacuum test has been completed. No further laboratory development appears necessary. Satisfactory tube holding devices have been designed and fabricated. Tests can be made on evacuation tubes exceeding one inch in length --1 1/4 inch to 1 1/2 inch being optimum. Difficulties with assuring vacuum-tight closures after pinch off of the sample have deterred the use of the test in the production stream. A promising hydraulic pinch-off device has been placed on order and delivery is expected early in September. Should this device prove effective, the vacuum test will be tried on a production scale.

A study of Inspection methods for supports was made. Tests of cracking in the curved portion of inner supports by Xyglo techniques showed the existence of severe cracks in both the inner and outer bend. The tests also showed that a large number of visually inspected and accepted supports were defective. It was noted in the Xyglo testing that cracking, "orange peel," and false indications could be differentiated. X-ray tests were also conducted as a potential inspection tool. These tests were not encouraging. Under the best conditions, x-ray was only able to detect cracks that were readily detected visually.

Further work on the H_3PO_4 chemical bond test has shown that satisfactory results are obtainable in two hours at 140 F and 86 per cent H_3PO_4 . The H_3PO_4 chemical bond test and the peel test were found to be in 86 per cent agreement using the inner and outer bond ratings as a comparison basis. The data are based upon the testing of 132 pieces. Ninety-three per cent agreement was obtained when using the final disposition criteria for 28 extrusion tubes involved in the test. The majority of disagreement was found in pieces rated "fair" in the peel test. Further testing is planned to study the areas of disagreement between the test.

A gauge audit system has been set up in the 333 Building and will be placed in operation early in September. Collection of data for assessing measurement error at the support welding and final inspection stations have begun. The MERCY program is to be utilized for routine analysis of the data.

New, more accurate gauges for measuring inside and outside diameters have been received. These gauges are capable of measuring to 0.0001 inches and will provide accurate measurements of etch and vacu-blast losses.

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Improvements were made to the chemical exhaust system which provided a reduction in oxides of nitrogen in the effluent of approximately 50%. The exhaust had previously been borderline, but is now considered more than adequate.

As a result of the study of the braze vacuum system and its control equipment, one station was set up with a prototype control circuit. This circuit was designed to make sure the hi-vacuum valve closed first and opened last during valve switching. Also, the thermocouple gauge was set up with improved control characteristics. The prototype circuit has functioned as desired for about three weeks. An ECN has been issued to rewire all three stations to incorporate the new circuit.

The maintenance engineering program status is as follows: Spare parts, 95% complete; lubrication instruction, 80% complete; maintenance procedures, 45% complete. The program is currently two to three weeks behind schedule because of process and equipment changes and additions.

A document, HW-74777, entitled "Final Storage of NPR Fuels", was completed. A recent change in process specifications simplified shipping and storage requirements. Use of protective plastic sheeting material, existing pallets, and additional racks should furnish adequate fuel element protection.

Testing of a prototype "inner tube" autoclave basket was completed and the required quota for forecasted production levels is being fabricated. Since fuel elements will be autoclaved as assembled rather than separate, this basket was designed for occasional inner tube autoclaving and for possible separate autoclaving of inner and outer tubes prior to assembly.

Additional portable deionized water tanks were selected and recommended for procurement. Recent changes in process specifications require storage in deionized water between final etch and autoclaving.

Methods and procedures to accomplish hot warp measurement of individual tubes were developed, tested and evaluated from an economic and safety standpoint. It was determined that this measurement is feasible from a manufacturing standpoint.

FPD HEALTH AND SAFETY

	<u>August</u>	<u>July</u>
Disabling Injuries	0	0
Serious Accidents	0	0
Medical Treatment Injuries	35	46

Central Safety Council inspection of Department facilities for August covered the Manufacturing Maintenance shops and work locations.

Orientation for nonexempt and exempt employees joining the Department were held on August 9 and 29 respectively.

Installation of evacuation arrows has been completed in FPD buildings equipped with high level radiation detectors. Standard emergency signal placards are being posted in all Department buildings, and the work should be completed prior to month end.

Overhead pipe lines in the 300 Area have been posted with new signs designating clearance at points of intersection with area streets. The new black on yellow signs are mounted on street center and hung directly from the pipe lines.

As a result of 321 Building being removed from the list of potential criticality sources, a review has been made of proposed area evacuation routes. An evaluation is being made of the practicality of a dirt-filled concrete radiation shield for the north end of 326 Building. Such a barrier would further simplify evacuation routing.

FPD SUGGESTION PLAN

<u>Suggestion Plan Participation</u>	<u>August</u>	<u>July</u>
Number of eligible employees	646	636
FPD Suggestions received	30	26
Annualized rate per 1000 eligible employees	557	491
Number of suggestions adopted	18	15
Net annual savings	\$6431	\$2538
Amount of awards	\$950	\$405
Per cent of awards to savings	14.8	16.0
Average amount of awards	\$ 52.78	\$ 27.00

SIGNIFICANT REPORTS ISSUED

HW-74777	Final Storage of NPR Fuels	8-29-62	B. B. Wyborny
HW-74678	Uranium Quality Control Analytical Results	8-20-62	G. B. Hansen
HW-74623	AlSi Fuels Quality Measurements Data Processing Program	8-16-62	J. R. Killen
HW-84627	AlSi Slop Investigation	8-13-62	H. G. Powers
HW-74772	Uranium Delivery Schedule	8-28-62	W. N. Mobley

EMPLOYEE RELATIONS

Safety

Members of the Manufacturing Operation sustained 15 medical treatment injuries during August.

Security

No security violations were incurred in the Manufacturing Operation during August.

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Radiation and Beryllium Control

Four air samples and 29 smear samples were taken during the period from July 24 through August 20. The sample results continue to indicate good control. All of the air sample results were less than 10 per cent of the limit and the only smear sample result above the contamination control limit outside of beryllium zones was taken on coextruded fuel elements. Samples taken on the ends of these fuel elements after brazing, facing, or welding usually contain beryllium on the same order of magnitude as the control limit.

In addition to the routine samples, 100 samples were collected for the test to determine the beryllium analysis accuracy. Duplicate samples were taken and submitted to two laboratories for analysis by different methods. This test will be completed by September 28.

The total of the exposures in excess of 100 mrad for Manufacturing Operation personnel for the four-week badge period ending July 13, was 9,540 mrad compared with an average of 7,030 mrad for the previous year. There was one exposure in excess of 300 mrad during the badge period. The average number of exposures in excess of 300 mrad is 1.1 per badge period for the calendar year to date.

Visits

<u>Name</u>	<u>Company</u>	<u>Contact</u>	<u>Date</u>	<u>Reason</u>
H.G. Powers J.E. Ruffin	Western Regional Quality Control Conf., Seattle	Conference Members	8-16-62 thru 8-17-62	Attend Conference
H.C. Money	Alcoa Edgewater, N.J.	A. VanVorst M.A. Ziegler	8-13-62 thru 8-14-62	Discuss quality and delivery problems
	Alcoa Massena, N.Y.	M.A. Ziegler	8-15-62	Observe the manufacture of 8001 alloy rod stock
	Cliff Mfg. Wickliffe, Ohio	A. Katz	8-16-62 thru 8-17-62	Discuss quality and delivery problems
A.J. Karnie	Battelle Memorial Inst., Columbus, Ohio	C.B. Boyer E.S. Hodge	8-14-62	Obtain information on high pressure, high temperature autoclaves
	Autoclave Engs. Erie, Pa.	J. Allison D. Fredericks D. Walker	8-15-62	Same

Visits (Continued)

<u>Name</u>	<u>Company</u>	<u>Contact</u>	<u>Date</u>	<u>Reason</u>
A.J. Karnie	Westinghouse Electric Pittsburgh, Pa.	H. Brunks P. Ruzicka E. DeSchamp	8-16-62	Obtain information on high pressure, high temperature autoclaves
	Barogenics Inc. New York City	V. Braymon N.M. Kramarow P. Zeitlin	8-17-62	Same
	American Instruments Silver Springs, Md.	A.R. Freeman W.E. Hoke	8-20-62	Same
H.P. Kraemer	Alcoa Edgewater, N.J.	M.A. Ziegler	8-13-62 thru 8-15-62	Discuss Caps and Cans
	Cliff Mfg. Wickcliffe, Ohio	A. Katz	8-16-62 thru 8-17-62	Same
	Z&W Mfg. Wickcliffe, Ohio	P. Konet	8-16-62 thru 8-17-62	Discuss water mix- ing spools
H.P. Kraemer	ALCOA Seattle, Wn.	D.M. Guy	8-22-62	Discuss Caps and Cans
D.W. Darsow	Western Pneumatic Tube Co., Seattle	C. Eckmann	8-23-62	Discuss copper- silicon sleeves
	Alaskan Copper and Brass, Seattle	W. Rosen	8-23-62	Discuss copper- silicon end plates
	General Metals Heat Treating, Inc. Cleveland, Ohio	E. Johnson D. Petruccio	8-27-62	Discuss heat treat- ing operation and specifications
	Brush Beryllium Corp. Cleveland, Ohio	K.G. Wickle L.D. Alspach H.G. Piper	8-28-62	Discuss problem areas and quality aspects
	Kinzig Tool Co. Cleveland, Ohio	C.H. Kinzig H.P. Stanley	8-29-62	Discuss tooling
	Winslow Mfg. Co. Cleveland, Ohio	M.A. Price	8-29-62	Discuss tooling

Visits (Continued)

<u>Name</u>	<u>Company</u>	<u>Contact</u>	<u>Date</u>	<u>Reason</u>
D.W. Darsow	Nuclear Metals, Inc. Concord, Mass.	H. Sawyer P. Loewenstein	8-30-62	Delivery require- ments
	Bridgeport Brass Bridgeport, Conn.	R.A. Quadt C.E. Sperry	8-31-62	Discuss Zircaloy II cladding shells and end caps

Visitors

L.L. Becker	Bridgeport Brass Riverside, Calif.	H.P. Kraemer	8-27-62 thru 8-28-62	Discuss Caps and Cans
J. Foss	Bridgeport Brass Bridgeport Conn.	D.W. Darsow	8-23-62	Discuss Zircaloy cladding

Training

Electronics training and instruction continued during August with 141 instruction hours being completed for concerned craft personnel.

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 August.

WN Mobley
Manager - Manufacturing

WN Mobley:HFT:mfj

8" NORMAL

	MAR	APR	MAY	JUNE	JULY	AUG
100	92.2	91.8	92.1	91.4	92.1	92.1
90						
80						
70						
60						
CUR MO.						
100	90.2	90.6	92.5	92.2	92.3	91.9
90						
80						
70						
60						
3 MO.						
100	90.2	90.6	91.2	91.2	91.3	91.5
90						
80						
70						
60						
CY						
100	90.1	90.2	90.5	90.6	92.1	92.1
90						
80						
70						
60						
FY						

8" BUMPERS

	MAR	APR	MAY	JUNE	JULY	AUG
100						
90	84.6	82.6	83.1	83.0	83.2	83.0
80						
70						
60						
CUR MO.						
100						
90	85.3	83.9	84.0	82.7	83.1	83.1
80						
70						
60						
3 MO.						
100						
90	85.3	85.0	84.9	84.7	84.5	84.2
80						
70						
60						
CY						
100						
90	85.3	85.1	85.1	85.0	83.2	83.1
80						
70						
60						
FY						

6" ENRICHED

	MAR	APR	MAY	JUNE	JULY	AUG
100	91.5	91.6	91.7	89.1	88.1	90.6
90						
80						
70						
60						
CUR MO.						
100	92.3	92.1	91.5	90.8	90.0	89.9
90						
80						
70						
60						
3 MO.						
100	92.3	92.1	91.5	91.6	91.4	91.3
90						
80						
70						
60						
CY						
100	91.9	91.8	91.9	91.6	88.1	90.3
90						
80						
70						
60						
FY						

6" BUMPERS

	MAR	APR	MAY	JUNE	JULY	AUG
100						
90		83.4	81.9	86.8		
80	75.6				79.8	80.9
70						
60						
CUR MO.						
100						
90	85.0	82.2	81.7	84.0	83.4	83.4
80						
70						
60						
3 MO.						
100						
90	85.0	82.2	81.7	84.3	83.9	83.5
80						
70						
60						
CY						
100						
90	84.8	84.6	84.1	84.5	79.8	80.9
80						
70						
60						
FY

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ENGINEERING OPERATIONAUGUST, 1962VISITORS

<u>Name</u>	<u>Company</u>	<u>Contact</u>	<u>Date</u>	<u>Purpose</u>
LE Goodwin JD Ross	E. I. duPont Savannah River Project Aiken, South Carolina	DC Worlton	8-24	Nondestructive testing.
J Setinsky	Carborundum Metals Akron, New York	GW Riedeman	8-3	Routine visit
RL Klein	Nuclear Metals, Inc. Concord, Mass.	WK Alexander	8-6/10 8-20/24	Auditing
RA Graham	Wah Chang Inc. Albany, Oregon	GW Riedeman	8-14	N fuel fabrication
RE Fisher	E. I. duPont Wilmington, Del.	CH Shaw	8-18	PO AX-2485
PN McCreery L Cooper	National Lead Co. of Ohio, Cincinnati, Ohio	LT Hagie KW Norwood	8-1/2	Data processing and accountability and quality control
JA Fellows	Mallinckrodt Chemical Works, St. Louis, Mo.	JT Stringer	8-13/14	Dingot problems and program
E Noe'	National Lead Co. of Ohio, Cincinnati, Ohio	JT Stringer	8-6	Uranium technology
NF Neumann	Mallinckrodt Chemical Works, St. Louis, Mo.	EA Weakley	8-21/24	Dingot uranium
N Rankin	E. I. duPont Savannah River	JT Stringer	8-12	Nickel plating
WEL Smith	E. I. duPont Savannah River	CA Burgess	8-14/17	Nickel plating
D Kelley DH Tuel	Wyandott Corporation Wyandott, Michigan	JD Schaffer	8-13	Technical assistance
A Stankus	KH Ruppert Co. Chicago, Illinois	GM Schweikhardt	8-6/7	Technical information

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TRIPS

<u>Name</u>	<u>Company</u>	<u>Contact</u>	<u>Date</u>	<u>Purpose</u>
GW Riedeman	Wah Chang Inc. Albany, Oregon	RA Graham	8-6/7	N fuel components
	Rem, Inc. Portland, Oregon	CA Brown	8-8	N fuel components
TR Groupman	Linde Company Newark, New Jersey	W Helmbrecht	8-20	Investigate and witness demonstrations of plasma arc spraying
	Precision Welding Co. Cincinnati, Ohio	AW Schueler	8-21	Discuss equipment problems
	National Welding Co. Bay City, Michigan	HJ Lange	8-22	Resistance welding
	Resistance Welder Co. Bay City, Michigan	W Beavais	8-22	Resistance welding
	United Welder Co. Bay City, Michigan	RE Groening	8-23	
	Sciaky Brothers, Inc. Chicago, Illinois	R Gasser	8-24	Equipment for NPR processes
NC Davis	Rem, Inc. Portland, Oregon	CA Brown	8-27	Special fabrication tests of N fuel supports
JT Stringer	Mallinckrodt Chemical Works, St. Louis, Mo.	JA Fellows	8-18	Feed Site technical programs and scheduling
	National Lead Co. of Ohio, Cincinnati, Ohio	S Marshall	8-22	Feed Site technical programs and scheduling
LM Loeb	Research Lab., G. E. Schenectady, N. Y.	WE Tragert	8-16	Discuss services of Res. Lab. and consulting contract
	Mallinckrodt Chemical Works, St. Louis, Mo.	JA Fellows	8-20	Feed Site technical programs and scheduling
	National Lead Co. of Ohio, Cincinnati, Ohio	S Marshall	8-21/22	Feed Site technical programs and scheduling

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PERSONNEL

Additions

E. D. Sayre, Principal Engineer-Fuels Programs, joined the Engineering Operation on August 6, 1962 from the Flight Propulsion Department, Cincinnati, Ohio.

Removals

D. R. Stenquist, Senior Engineer, transferred to the Financial Operation, FPD, effective August 1, 1962.

P. K. Hoffman, Tech. Grad., went on a two-year military leave-of-absence, effective August 31, 1962.

INVENTIONS

All Engineering Operation personnel engaged in work that might reasonably be expected to result in inventions or discoveries advised that to the best of their knowledge and belief, no inventions or discoveries were made in the course of their work during August, 1962. Such persons further advise that for the period therein covered by this report, notebook records, if any, kept in the course of their work have been examined for possible inventions or discoveries.

SIGNIFICANT REPORTS ISSUED

- HW-74597 "The Feasibility of Ultrasonic Inspection of Thick Wall Steel Pipe for Weld Defects," CL Frederick and GL Waldkoetter, June, 1962.
- HW-74625 "UT-4 - An Automatic Ultrasonic Tester for Closures of Hanford I&E Fuels," DO Hunter and MF Zeutschel, August 14, 1962.
- HW-74651 "Foreign Travel Report," TB Correy, August 16, 1962.
- HW-74134 "Fuels Preparation Department Sponsored O2 Metallurgy Research and Development Program - FY 1963," IM Loeb, August 31, 1962.
- HW-74594 "Chemistry Test Design - Evaluation of Carbon, Iron and Silicon on Irradiation and Mechanical Properties of Uranium," GL Hammons, August 7, 1962.
- HW-74596 "Machine Programming of the NPR Data System," LT Hagie, August 8, 1962.
- HW-74672 "Fuel Element Development Committee Annual Report from the General Electric Company, Hanford," JT Stringer, August 16, 1962.
- HW-74380 "Need for a Cracked Core Tester," EA Weakley, July 20, 1962.

SECURITY

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

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ADVANCE FUEL ENGINEERING

Fuel Performance

Five regular production I&E fuel elements and one test (CVI-Overbore) fuel element failed in the reactors during August. No unusual trends are evidenced in this normal production experience. The overbore rupture was the fifth fuel element (third column) to fail under this program.

<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	3868-B	404	Side Hot Spot	8-13-62	5-24-62
Bumper	2583-D	902	Hole	8-27-62	2-13-62
Enriched					
Non-Bumper	0359-H	1193	Hole	8-15-62	1-20-61
Bumper	1285-DR	948	Hole	8-17-62	3-22-62
Bumper	0989-B	1090	Unclassified	8-22-62	3-28-62
Natural					
Overbore	3162-C	640	Core Split (Transverse)	8-29-62	10-4-61

Characterization of Windscale Elements

Fuels Preparation Department recently received six (6) Windscale fuel elements from the group of twenty-four (24) which was received by National Lead Company of Ohio from the United Kingdom Atomic Energy Agency as a part of a Fuel Element Development Committee project on "British" uranium. The program to be carried out on these elements by the four Atomic Energy Commission sites involved (National Lead Company of Ohio, Mallinckrodt Chemical Works, Savannah River Plant, Hanford Atomic Products Operation) is to be scoped at the September meeting of the Working Committee of the Fuel Element Development Committee. In advance of this session, Advance Fuel Engineering is completing a short program of chemical, physical, metallurgical and x-ray analyses of two (2) of these elements to provide a first-hand basis for HAP0's recommendations on the scope of the four-site program.

ALSI PRODUCT ENGINEERING

Uranium Technology

As of September 1, the irradiation status of natural alloyed dingot uranium in the "old" and "K" reactors was as follows:

	Tons of Alloyed Dingot Uranium		
	<u>In-Reactor</u>	<u>Discharged at Goal*</u>	<u>Total Ruptures</u>
Old Reactors	43	1455	29
K Reactors	21	278	0

*Average goal exposure: Old Reactors - 675
K Reactors - 650

There were no dingot failures this month; however, a non-bumpered and a bumpered ingot control failure were sustained at exposures of 404 and 902 MWD/T, respectively. The non-bumpered ingot rupture was classified as a side hot spot and the other as an internal failure. As previously reported, alloyed dingot uranium canning and reactor charging has been temporarily discontinued since mid-May to more precisely define and alleviate quality deficiencies which have caused dingot fuel elements to be more rupture prone than ingot material. The status of programs at the feed sites and HAPO to improve dingot core quality and ALSi bonding characteristics is reported elsewhere in this report.

Test quantities of dingot cores heat treated in hollow (rather than solid) core blank form, oil quenched and vacuum annealed prior to machining were received for etching and canning studies. Mallinckrodt Chemical Works has found that this procedure eliminates quench cracks previously observed in dingot cores, reduces surface hydrogen to less than 1 ppm, and provides a more chemically reactive core surface for ALSi bonding through the precipitation of U_2Fe as an intermetallic compound. Evaluation of this material is scheduled for completion by mid-September.

Informal agreement has been reached with IPD to irradiate a major part of the canned OIIN dingot fuel elements (99 tons) in inventory after subjecting the pieces to specific tests to upgrade bond quality and closure integrity. An experimental "crack" tester is being used to examine core samples from the 302 tons of bare dingot cores in storage for transverse O.D. and I.D. cracks. If the tester performs satisfactorily, it is planned to test all of the dingot cores for possible transverse cracks before arrangements are made for processing the material under optimized canning conditions. Thus far, only one dingot core with transverse cracks on outer surface has been found.

Approximately 9.4 tons of hollow core blank, oil quenched ingot fuel elements have been discharged at goal exposure and 6.4 tons are under irradiation. Post-irradiation examination of fifteen (15) monitor columns, consisting of alternate

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oil and water quenched ingot cores exposed to about 800 MWD/T, is in progress. The reactor charging rate of evaluating this material will be increased from 5 to 25 tons per month in September.

Further investigation has indicated only about one-half of the forty-eight (48) tons of oil quenched ingot test cores in storage was heat treated at MLO in May during a sludge buildup in the salt bath, which resulted in erratic temperature control and some partially untransformed cores. Since the heat treatment of uranium in the low beta phase (668-685°C) may produce areas of preferentially oriented large grains that cannot be detected by existing non-destructive tests, all questionable material is being returned to MLO for remelt.

ALSI Process Development

Projection Fuel

Irradiation experience continues to demonstrate that bumper fuel will effectively minimize gross fuel misalignment in ribbed process tubes and associated fuel cladding corrosion (hot spot) ruptures. About 1665 tons of bumper fuel elements have been charged to date in the old reactors and 1082 tons discharged at variable goal exposure, incurring thirty-eight (38) ruptures. None of these ruptures have been of the "hot spot" type. Three of four bumper fuel ruptures (3 enriched and 1 natural) sustained this period were classified as fuel quality oriented "hole" failures and the other was unclassified. The overall performance of bumper fuel is a factor of two better than non-bumper fuel.

Production transition from the present rectangular bumper rail to an elliptical rail, offering lower hydraulic resistance, is contingent on satisfactory demonstration of a suitable rail feeder. Testing and debugging of a prototype automatic feeder, designed to feed elliptical rails in pre-stamped roll or strip form into the ultrasonic welders, is progressing in the pilot plant. The results thus far indicate revision of the feeder tips and rail positioning slides is required to achieve trouble-free operation. An order placed for 2,000 pounds (approximately 750,000 rails) of elliptical rails in 100 foot rolls is being expedited to facilitate continuous demonstration of the feeder and to prepare production quantities of fuel elements with elliptical rails for irradiation. Delivery of this material is expected in October. In the meantime, short strips of rail stock fabricated on site are being used for development. The cost of the elliptical rails on order is about 0.075 cents/rail. Since this figure includes vendor tooling costs, the cost per rail is expected to more nearly approach that of the present bumper rail (0.045 cents/rail) on future orders.

Although the current bumper fuel yield loss of about 4 percent resulting from inferior rail welds, rail misalignment and smashed rail tabs may be reduced through further control of equipment and process variables, recovery of the rejects for rewelding appears to offer the most expedient

gain. A study has been initiated to determine the feasibility of removing and replacing rails without damaging the fuel cladding or underlying bond layer.

Approximately 3,024 natural self-supported overbore (CVINS) fuel elements and 12,970 regular CIVNS fuel elements have been discharged to date from the C reactor test facilities. One cladding groove corrosion failure, caused by broken and damaged rails, was sustained in each fuel type prior to increasing rail thickness from 40 to 45 mils and strengthening the bridge-tab junctures of the rails. In addition, four split core failures have occurred in overbore fuel. One transverse dingot core failure was experienced this period and three previous longitudinal ingot core failures sustained in a single column were associated with a reactor temperature cycling incident.

Static load tests on a new channel-type rail, designed by HLO for the K reactor self-supported fuel models, showed the strength of this rail was less than that of the present collapsible bridge rail. The channel-type rails completely collapsed under a load of 500-700 pounds, as compared to 800-1000 pounds for the collapsible bridge rails. Other potentially more optimum rail designs are being fabricated for evaluation. This will include rails with "T" and modified columnar dimple bridge sections.

In order to meet K reactor self-supported fuel requirements in conjunction with a retubing program starting late this year, the thickness of the present KVN collapsible bridge rail has been increased from 45 to 50 mils for use on an interim basis until a more optimum rail design can be developed and evaluated. Because of the minimum longitudinal spacing (3-9/16") between ultrasonic welder heads, it is necessary to reduce the length of enriched (KVE) fuel element rails from a nominal 2-5/16" to 1-7/8". In order to make this change without sacrificing rail strength, a rail with equivalent upset metal in a shorter bridge section has been designed and is being fabricated for evaluation.

Process capability for controlling the maximum projected diameter and minimum rail height of KVNS fuel elements within the desired dimensions for irradiation has been successfully demonstrated using a 1.702" +0.001", -0.002" slotted sizing die. Over 99 percent conformance to the specified maximum projected diameter (1.710") and minimum rail height (0.092") has been obtained on statistically significant quantities of these fuel elements at a 95 percent confidence level. Four sized replacement charges of KVNS fuel elements have been shipped for irradiation in two ribless zircaloy tubes currently installed in KW reactor. Die dimensions for sizing KVES fuel elements and other self-supported fuel models will be developed as soon as assembled fuel elements are available. It is proposed to incorporate the sizing step in the discharge station on the ultrasonic welders, utilizing the air cylinder at this location to force the fuel elements through the sizing die.

AlSi Bond Studies

The development of optimized duplex canning bath conditions to improve the bond quality of alpha rolled, alloyed dingot cores has been completed. A comparison of present and revised duplex bath process limits for dingot uranium based on metallographic examination of assembled dingot fuel elements is shown below:

	Process Limits	
	Present	Revised
Lead Temperature (°C)	616 ± 7	625 ± 7
Core Lead Preheat (Sec.)	34 - 40	30 - 36
Core AlSi Braze (Sec.)	3 ± 1.5	3 ± 1.5
AlSi Silicon Content (w/o)	9 ± 0.5	7.5 ± 0.5

Two large scale tests were run this period to verify that the revised duplex bath conditions would produce dingot fuel elements at least equivalent to ingot fuel quality. Initially, 3000 dingot fuel elements were assembled in the pilot plant to determine the effect of varying the silicon content in the duplex bath AlSi layer within the revised range and to pinpoint any problem areas that might develop in applying the various duplex bath process changes. A second test was run in the AlSi Shop to compare ingot-dingot fuel quality on production run equivalent of two canning line shifts or about 2000 pieces of each fuel type. Major conclusions derived from these tests were as follows:

1. Metallographic examination of the bond structure showed dingot was equivalent to ingot. The percentage of UAl_3 -type compound layer on the internal and external surfaces of the dingot cores was nearly identical on both tests; 94 percent on the I.D. as compared to 98.7 percent on the O.D. This was partially attributed to etching the dingot cores for five minutes in the nitric acid pickle bath (normal time 2-4 minutes) to obtain an etch comparable to ingot uranium.
2. Internal and external total count data on a representative sample of test and control pieces showed no difference between dingot and ingot fuel elements.
3. There was no significant difference in internal or external bond count or percentages of UAl_3 -type compound layer formed on corresponding surfaces of the dingot fuel elements for 7.0, 7.5, 8.0 percent silicon content in the duplex bath AlSi layer.
4. Significantly less UAl_3 -type compound layer was formed at the center of the internal surface of both dingot and ingot cores than at the ends. This may result from less washing action and a lower heating rate at this point during preheat in the duplex bath.

5. Close control of canning furnace temperatures is necessary to maintain uniform canwall thickness when using the revised canning process for dingot cores.

Based on the above results, it has been recommended that approximately 300 tons of alpha rolled dingot cores in inventory at HAP0 and the feed sites be released for canning under optimized process conditions.

Bond count data has been taken on fuel elements before and after baking at 200, 300, 400, and 500°C for periods of 1, 2, 3, 4, 6, 25, 50, 75, and 100 hours, followed by water quenching to determine the effect on AlSi bond layers. Data has also been obtained for a series at 500°C followed by an air quench. The data clearly indicates a deterioration of the AlSi-uranium bond after baking one hour at 500°C and after 25 hours at 400°C. Baking for 100 hours at 300 and 200°C had no effect on the bond which could be detected by differences in total count. All fuel elements baked at 500°C for 25 hours or more and then water quenched rattle when shaken, indicating complete destruction of the bond. No pieces baked at 500°C followed by air quenching exhibited this phenomenon. In addition, the external bond of the air quenched fuel elements deteriorated before the internal bond. The converse was true for the fuel elements which were water quenched.

A test designed to investigate the effects of gun travel distance, surface preparation, gun pressure, and gun restore pressure upon the quality of welds obtained from the stud welder has been completed. Utilization of the resulting data is expected to improve the stud pulling test for external bond strength. Investigations were continued in an effort to develop a test to determine internal bond shear strength. Use of the "zyglo" process has revealed that the bond is partially broken when fuel elements are cut into wafers.

An autoclave failure occurred in lot KF422A on August 20, 1962, after a total cycle time of over 60 hours. The failure resulted from water entry through a hole in the base weld and a large gap in the braze layer between the can base and the spire. Approximately one-half of the fuel core had been destroyed by oxidation, partially masking the cause of failure.

Component Cleaning

Past work has indicated that a chromate conversion coating on the aluminum component surface is highly beneficial in promoting AlSi wetting. A bath designed expressly to lay down a chromate coating on aluminum was obtained and tested in the pilot plant. Cans were removed from the component preparation line at various stages and the bath applied a varying number of times to determine the effect of coating thickness. Surprisingly, all of the cans processed through the coating solution showed absolute non-wetting using a standard wettability test. A survey was then conducted of cleaners and deoxidizers used in past tests to determine what constituents may be present

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(or absent) in compounds producing desirable results. The results of this survey strongly indicate that the coating which is being sought is a phosphate-chromate conversion coating rather than just a chromate coating.

AlSi Pilot Plant Activities

During the period from July 26 - August 24, 1962, a total of 2,661 pieces were canned in the 306 Pilot Plant. Of these, 1,786 were for reactor use and the remainder for process development. In addition, 1,706 fuel elements were rewelded and 320 cans were processed for wetting tests.

Alternate Process Development

Hot Press

An irradiation test (IP-450-A-FP) comparing Sylcor hot press, HAP0 hot press and HAP0 Al-Si bonded fuel elements has proceeded without incident. The current level of exposure is about 425 MWD/T or one-half goal.

Enriched uranium (0.94%) to produce 1000 CIVE I&E fuel elements by the Sylcor hot press process is currently being machined at NLO. Delivery of this material to Sylcor for fuel assembly is expected by October 1.

Fluid Pressure Bonding

Negotiations were completed and a contract signed to develop optimum process parameters for fluid pressure bonding HAP0 assembled fuel elements in Battelle Memorial Institute's facilities.

Hot-Die Sizing

A total of 210 fuel assemblies have been pressed since the installation of the sizing press. Initial effort has been concerned with eliminating a cap mushrooming problem and developing operating conditions to produce strong uniform bonds. Cap mushrooming was eliminated by:

- 1) Determining the cap wafer diameter required to prevent expanding and seizing either the inner or outer flash while filling the gap between the cap wafer and the inner and outer canwall.
- 2) Reducing pressure on the lower ram.
- 3) Water cooling the upper ram tip to room temperature.

Fuel element bonds having tensile strengths of 30,000 psi have been produced. Improvements in bond strength have resulted from increasing the fuel assembly preheat temperature from 600°C to 700°C and reducing the preheat time to ten minutes. As experienced at Savannah River, nickel

plate integrity has proven to be a function of preheat time. Reducing the preheat time has markedly decreased the uranium oxide observed on the internal and external flash of the fuel elements after sizing. Further improvements in nickel plate quality have eliminated the oxide on most pieces.

When it became apparent that short preheat times were necessary, use of a heat shield was discontinued because an additional two minutes could be cut from the preheat time. Later, the thermocouple cores were preheated and the resulting data indicated that a much more uniform temperature could be maintained within the core and that the piece did not cool off immediately after removal from the furnace if the heat shield was used. The heat shield was also observed to act as a heat source during transfer from the preheat furnace to the press, thus providing a higher and more uniform temperature during pressing.

A vacuum dryer to be used for drying and storing cleaned components and plated cores before sizing was installed during the month. Due to a leak in the refrigeration system, it was necessary to dismantle and repair the condenser. The temporary replacement of valves and gages damaged during repair of the condenser will prevent full use of the vacuum dryer until replacement parts are received. Installation of the end bonding press is 75 percent complete.

Nickel Plating

Development efforts were largely directed toward the elimination of discontinuities or other imperfections in nickel plate which result in minor to gross oxidation of the uranium after a residence time of 30 minutes in a 600°C air-atmosphere furnace. A significant improvement has been achieved by removing the six wheels from the plating rack, which contacted the uranium core on the external cylindrical surface and maintained the core in a vertical position. Notwithstanding virtual elimination of visible tracks from these wheels by a number of techniques, oxidation of the uranium frequently occurred in the vicinity of the contact. In addition, the internal core surface developed oxide-filled blisters in an erratic fashion on 0 to 25% of the surface, even though the as-plated condition appeared excellent. Presumably the internal plate was affected by the proximity of the internal anode to the plated surface which was observed to vary from 1/32 inch to 1/4 inch, depending on the condition of the rack and the internal anode. By removing the external alignment wheels and using plastic insulators on the internal anode (a 1/8 diameter rod), the area of defective nickel has been confined to the contact point of the insulators, varying from a band 1/8 inch wide around the core I.D. to only 4 points approximately 30 mils in diameter. Tests of techniques to consistently produce the small point defects (or hopefully eliminate them) are underway at present. Reduced bath surface tension, careful positioning of the core in the rack, and turning the core at various time intervals appear promising.

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The nickel plating line was converted from a modified Thompson bath to a Watt's bath. The pretreatment cycle was changed to the process currently used by the Savannah River Laboratory. This change was made to take advantage of extensive experience with the Watt's bath at both Sylcor and SRL.

COEXTRUDED PRODUCT ENGINEERING

N-Reactor Fuel Development

KER Loop Testing

Loops 1 and 2

Loops 1 and 2 are shut down for modifications. It is expected they will not be back on the line until after October 1, 1962.

Loop 3

The average tube exposure on the eleven NAE-1 fuels in Loop 3 is about 650 MWD/T. Approximately 60% of this exposure has been on single pass water. Because of pump failures, Loop 3 will be discharged during the next reactor outage. This loop will be recharged after the pumps have been repaired. Recharging is tentatively scheduled for 10/1/62.

Loop 4

The fourteen NAE-1 fuels in Loop 4 are operating satisfactorily. The current average tube exposure is about 1050 MWD/T. Approximately 24% of this exposure has been on single pass water. The average tube exposure goal for this charge is 1400 MWD/T (peak exposure is 2000 MWD/T). Goal exposure should be reached about October 1, 1962. If completed, this test will be the first prototypic exposure of prototypic N fuel assemblies.

KER Test Fuel Fabrication

Loops 1 and 2

Throw-away fuels for testing Loop 1 and 2 modifications are at various stages of processing in the 306 Building Pilot Plant. These fuels will be needed on October 1, 1962 and will be available by then.

Fabrication of the 1.6% enriched KSE-5 fuel elements will commence during September.

Loops 3 and 4

A charge of fourteen prototypic NAE-1 fuel elements is now available at the K East reactor for loop charging. These fuels have the most recent support hardware.

Arrangements are now being made to procure two charges of fourteen NAE-1 fuels from Manufacturing. It is planned to have these fuels ready for shipment to the K East reactor on about October 1, 1962.

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Post-Irradiation Warp in the "NIE Warp Test"

Rough measurements of the warp in five NIE pieces have been completed in the KW examination basin. From these measurements, the change in warp during irradiation has been calculated. The change in warp during irradiation (the vector of change) does not appear to be in any way related to any of the vectors measured before irradiation.

One must conclude that the period of irradiation (about one-third of the total exposure) in cold water (single-pass water) may have invalidated the results. Therefore, a repeat of this test irradiation should be made to accumulate an irradiation record under conditions to be expected in the N reactor.

Materials Development

Uranium Billets

Quality Improvement

National Lead Company of Ohio has not yet officially accepted Revision 2 of HW-67575, "Specifications for Uranium Metal Billets for NPR Fuel Elements". However, the NLO technical people are working to resolve the technical problems associated with implementing the various new or modified processing and quality control requirements specified in Revision 2 (see the May Monthly Report).

The largest single technical problem is direct temperature-time control of the melting and casting cycle. During June, July, and August, the NLO technical people have made developmental melts, both in the pilot plant and in the production facility in Plant 9, using direct temperature control. Results have been generally satisfactory although some problems still remain. Some modifications have been made to production furnaces in order to institute direct temperature control.

In February a four-category feed site test was designed (see February Monthly Report) to evaluate the effect of various uranium processing parameters upon the control of clad thickness during coextrusion. The categories were (1) large I.D. upset during primary extrusion with minimal stock removal during machining, (2) single-beta treatment of as-extruded billet blanks, (3) single-beta treatment of rough-machined billet blanks, and (4) a "standard" control category, i.e., a regular primary reduction with no beta treatment of the billet.

Nearly all of the billets in the four-category test have been coextruded and tested. The analysis of the data is incomplete. Apparent reject rates for the various categories vary from roughly 10 to 20 per cent indicating that none of the test conditions have eliminated the problem. It has not been determined whether there is really any significant difference between the clad control behaviour of the billets from the various test conditions.

The material for a six-category, feed site test (authorized in March) of solid-cast and drilled ingots was ordered from NLO in August. The use of solid-cast and drilled ingots, rather than the present hollow-cast ingots, promises to improve both metal quality and reduce costs. Briefly, the six test categories are as follows:

Category One	- N outer, solid-cast, triple-beta treated, and drilled ingots.
Category Two	- N outer, solid-cast, drilled, and triple-beta treated ingots.
Category Three	- N outer, hollow-cast, and triple-beta treated ingots (Control Category).
Category Four	- N inner, solid-cast, triple-beta treated, and drilled ingots.
Category Five	- N inner, solid-cast, drilled and triple-beta treated ingots.
Category Six	- N inner, hollow-cast, and triple-beta treated ingots (Control Category).

The coextrusion behaviour of the billets from the solid-cast and drilled N outer ingots will be analyzed carefully to determine if such treatment improves the clad thickness control.

Development

There is a possibility that an increased reduction ratio during the primary extrusion of the N outer ingot will improve inner clad control. During July and August, the production capabilities of NLO (casting and heat treatment) and Bridgeport Brass Company (extrusion) were studied in order to determine the maximum possible primary reduction in N outer ingots. BBC is limited by press capacity to extruding from a 13-3/4" diameter liner (this would be a 13-3/8" diameter ingot). However, NLO cannot make an ingot in excess of 13 inches without a major modification of the crucible supports in their production furnaces. This 13 inch ingot would be extruded from a 13-3/8" liner to give approximately a 3.6:1 reduction ratio (vs the 2.63:1 reduction ratio using 11-3/8" liners). Therefore, the billet yield from eight, 13 inch, special N outer ingots was ordered in August. These billets will be coextruded and evaluated to determine if they improve the control of inner clad thickness.

Several high Fe-Al (400 and 700 ppm, respectively) alloy billets have been coextruded. A cursory evaluation indicates that the control of the clad thickness and wall thickness on the coextrusions was good.

Fuel Element Support Fabrication

Outer

Adequate quantities of satisfactory quality outer supports for production are on hand. These are the standard "suitcase handle" supports formed from .040 inch zircaloy-2 strip. These cover a loop height size range from about .117 "to .126" because of the selective sizing required to meet dimensional requirements. There are no problems of consequence in manufacturing supports of this design of suitable metal quality.

Inner

Fabrication of the inner "buggy spring" supports in .035 inch zircaloy-2 strip stock has not been satisfactorily accomplished, and no supports are currently on hand for production. Concentrated development activity by both FPD and HLO is under way trying to determine methods of fabricating these supports without developing cracking in the outer bends of this design. To date, the approach has been one trying variations of an orthodox approach to the fabrication of strip. The zircaloy-2 has been forged to about two inch thickness, followed by hot rolling and cold rolling, evaluating various reduction ratios, stress reliefs, and anneals, and subsequently employing various die designs, with forming both warm and at room temperature. There has been no combination of these processes which would produce this buggy spring support with .035 inch stock. Analysis of experience to date with many variations of the rolling fabrication routes discussed above, indicates the following apparent limits of fabricability:

- A. This design of buggy spring can be fabricated with about 100% yield at room temperature with .030 inch stock; with .032 inch stock, the yield is essentially 0%, i.e., all pieces have cracks in the bends.
- B. Heating the parts to several hundred degrees Fahrenheit increases the fabricability limit by about .002 inches. Thus, .032 inch stock can be fabricated with close to 100% yield, whereas .034 inch stock will have essentially 100% rejection.

Development effort is being carried out on unorthodox approaches to fabricate strip for buggy springs. Very preliminary information indicates that strip fabricated by coextruding with copper, followed by slitting and flattening, will produce good supports. However, the load deflection and other characteristics of supports manufactured by this technique have not yet been tested. The mode of metal flow at the bend appears entirely different from that made with the more orthodox technology of strip fabrication. Additional supports will be made by the coextrusion technology to determine whether they can be made consistently by this technique.

Coextrusion Process

Extrusion

The following Coextruded Product Engineering extrusions were made during this month:

11.1 Inch Tooling

Four Primary Extrusions - PU-76 Through PU-79

All primary extrusions to intermediate billet dimensions for extrusion of du Pont V-B uranium tubing on du Pont purchase order AX-2485.

One Copper Billet

To 7-1/2 inch diameter stock

7.5 Inch Tooling

Ten Composites - X-30 through X-38; and L-3

X-30 & 31 - NOE size extruded at low temperatures to determine billet temperature effects on extruded dimensions.

X-32, 33, & 34 - NOE size for evaluation of billet heat treatment on clad thickness uniformity.

X-35, 36, 37, & 38 - NOE size for evaluation of primary extrusion variables on clad thickness uniformity.

L-3 - Special single tube design for HLO.

Three Zircaloy Billets - Z-138 through Z-140

Z-138 - End cap stock for special single tube design.

Z-139 & 140 - Thin wall (.040 inch) 2-3/4 inch O.D. tubing for zircaloy support fabrication studies.

Fourteen Uranium Billets - U-101 through U-114

All billets extruded to Mark V-B tubing for du Pont on purchase order AX-2485.

Two Copper Billets

To evaluate tooling for Mark V-B uranium extrusion.

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Extrusion Process Evaluation

The billet assembly and coextrusion processes were monitored on a 100% basis during the past six weeks. During this period a total of 130 outer tube billets were extruded.

The billet assembly operation was observed in an attempt to evaluate the effectiveness of standard operating procedures in producing clean, uniform assemblies. Some attempt was also made to evaluate surface quality of the uranium billets prior to assembly. In general, the billet assembly operation appeared to be in good control with only minor problems noted on the assembly cleanliness.

The coextrusion process was monitored to evaluate the uniformity of lubrication, billet temperatures, transfer times, tool performance, etc. The control of operating conditions and techniques are considered excellent in this area.

The above monitoring procedure will be performed in the process during the extrusion of some 80 to 90 inner tube billets during the following two weeks, after which the data obtained and observations made for both geometries will be summarized in report form.

NOE Inner Clad Thickness Variation

Extrusion of outer tube billets included in the Four Category Test (PWR-CX 24) has been completed. The results of this designed test should dictate the fabrication routing required for outer tube uranium billets to minimize inner clad variation.

An additional nondestructive clad thickness test on outer tube fuel elements immediately following copper removal was initiated during late July in an attempt to: (1) eliminate finishing operation costs on reject fuel elements, and (2) provide faster feed back of clad thickness performance. Initial testing performed was unsatisfactory due to a lack of tester standards with the clad thickness present at this stage of the process. However, with the development of required tester standards during the month, this test is now operating within the accuracy limits obtained at the final clad thickness test. Material is now being rejected at this station based on a 0.009 inch circumferential variation limit.

Mark V-B Uranium Tube Extrusions

Extrusions to fulfill the requirements of E. I. du Pont purchase order No. AX-2485 were carried out during the month. The above order required: (1) the primary extrusion of four 11 inch diameter uranium ingots to 7-1/2 inch diameter billet stock, and (2) extrusion of the primary extrusion billet stock yield plus six additional 7-1/2 inch diameter uranium castings to tubing for machining to Mark V-B fuel elements.

The primary purpose of this experiment, as defined by du Pont, is to extrude fuel material with varying extrusion reduction ratios under highly controlled conditions to determine the effect of extrusion reduction on the distribution and size of inclusions.

Warp Studies - N-Inner Pieces

An analysis of the yield of warp after beta heat treating has been completed for all NIE coextrusions made to date. It is immediately apparent that there has been a continuous trend toward lower yields since the current coextrusion process variables were chosen and fixed. Data illustrating this are shown in the following table.

TABLE 1
WARP YIELDS - BETA HEAT TREATED NIE PIECES
(1140 F Billet Temperature, 10 ipm Ram Speed)

<u>Tube Number</u>	<u>No. of Pieces</u>	<u>Percent with Warp</u>			<u>Straightening Recovery (%)</u>	<u>Total Yield (%)</u>
		<u><30</u>	<u>>30 & 75</u>	<u>>75</u>		
1076-84	118	82.2	17.8	0	86.4	98.6
1095-1103	116	69.8	30.2	0	77.1	93.1
1156-1219	927	59.8	38.5	1.7	89.6	94.3
Odd No:						
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

The fluctuation in yield makes it increasingly difficult to assume that a calculated value of yield, i.e., "process capability" is meaningful. The process capability is apparently on the down trend and the confidence limits on the mean value are large; accordingly, detection of a change in product from a change in process condition may be difficult.

The known process variables in both the coextrusion and heat treating operations seem to be under control. The only conclusion then is that some unmonitored variable or other cause is operative. Among these might be:

1. lubrication - The friction and heating therefrom may be increasing the existing temperature gradients in the billets.
2. A change in incoming raw materials - The grain structure and grain orientation in either the uranium and/or the zircaloy may be changing.

Future work must determine which of these causes could be operative.

The effect of temperature gradients in coextrusion billets vs warp has been studied. A statistically designed experiment has been completed for examination of the dependence of warp on:

1. 800 F vs 600 F liner temperatures
2. hot (1140 F) vs ambient billet loader temperatures

It can be stated that neither of these variables appears to have a measurable effect on the magnitude of either received or heat treated warp.

Chemical Processes

Copper Can Preparation

Some die pick-up of copper has occurred on the outer tube this month. Since die pick-up has been related to copper component surface condition, increased emphasis has been placed on improving the extrusion lubricant retaining power of the copper surface. Etching of copper components has been minimized to reduce the clearance between the copper end plates and shells and therefore improve weld reliability. In addition to the standard sanding of the billet surface with fine grit emery cloth prior to lubrication for preheat, different sand blasting and chemical etching techniques are being evaluated to further increase the porosity of the copper surface.

Chemical Milling - End Closure Recess

Periodically during the chemical milling operation (particularly the N inner fuse size), the zircaloy-2 clad is appreciably oxidized preventing uniform removal in the following zircaloy pickling operation. The formation of the thicker oxide film appears to be independent of extrusion tube and bath composition and yet peculiar to individual process basket loads of material. Evaluation in the 306 Pilot Plant processing indicated that galvanic currents were available between the fuel elements and the milling tank. Approximately 0.3 to 0.4 volts and 100 to 200 milliamps were measured between the un-insulated samples and tank. In effect, the zircaloy is being anodized if there is any electrical contact between the tank and fuels, or basket and fuels; making a uniform zircaloy etch after chemical milling practically impossible. Close monitoring of the production facility is being performed to try and locate the contact areas so they may be insulated.

Development work on the chemical milling process in the pilot plant to lengthen the solution life and improve the as-milled surface has continued. Present process specification limits uranium content to 0.5 pounds per gallon of solution. Work to date has shown that uranium concentration in excess of .7 pounds/gallon produces equal or superior milled surfaces at this higher level. Variation of the nitric acid concentrations with uranium content permits longer solution life. The more constant acid uranium ratio maintained also improves the milled surfaces by reducing the number and size of pits and the variation in depth.

Support Thickness Change: Final Bright Etch

A cursory examination of the N fuel outer support etch rates was made to estimate final support thickness. Supports attached to fuels and also suspended from wire hangers were processed through the production facility according to current operating procedures. An average thickness decrease of three mils was observed on both groups of supports. This means the supports are etching approximately twice as fast as the fuel element. The prior histories and the comparative bulk densities of the support and the fuel element are probable causes for the etch rate variation. Measurement of the supports removed from fuel elements in final storage (after autoclave) indicated that approximately one mil of the outer tube support thickness is being lost in pre-inspection pickle.

Autoclave and White Oxide Studies

White Oxide on Autoclaved Production Fuels

Etching and rinsing techniques to prepare N fuel for autoclave have improved considerably during the month as indicated by the low incidence of white stain on the clad surfaces. Some difficulty has been experienced with white oxide on welds at only one end of the fuel. Causes as to why this should occur on one end has not been resolved. If the cause was associated with etching or rinsing, one would expect both ends of the fuel to be similarly affected. It is likely that an incomplete hot blowdown during autoclaving may leave fluoride contaminated water in contact with the lower ends of the fuel. This was observed recently on a bottom basket of fuels that was transferred to a second autoclave because of heating problems in the autoclave in which the fuels were initially loaded. Transferring of in-cycle fuel loads has been a very common occurrence in the production facility due to failure of the heating systems.

Locking Clip Corrosion

White corrosion product on the outer tube locking clip spot weld was observed during final inspection of autoclaved fuels. Visual examination of the spot welds of "as-welded" locking clips and buggy spring supports showed a light brown or gold interference color on the supports and dark blue, brown, and red interference colors on the locking clip. Subsequent etching of the supports and locking clips resulted in a clean, shiny surface on the supports and a pitted, dull surface on the locking clips. Microscopic examination of the locking clips revealed the same interference colors previously visible with the naked eye. Evidently, increased oxidation of the locking clip during welding plus insufficient cleanup in the final bright etch are contributing factors in the formation of white corrosion product. Corrective measures being taken are: (1) reduction of oxidation during welding by improving the seating of the locking clip in the electrode, and (2) removal of the oxidized spot weld surface by wire brushing prior to final bright etch. To define the effects of this minute white corrosion contamination, long term corrosion testing of the contaminated locking clips is being carried out in 360 C water and 400 C steam.

Zircaloy-2 Scratching: Assembly Operation

Metallographic examination of scratches and the white oxide produced thereby in the bore of the NPR outer fuel during assembly has been made on samples representing a 10 mil and 20 mil interference fit per support and exposed to 400 C steam at 1500 psi for 144 hours, one month, and two months. A sample representing a 30 mil interference fit per support has been exposed to the 400 C steam for one month. While there is slightly more corrosion product over the scratch area than the adjacent metal, no appreciable deterioration has been observed to date. The approximate depth of scratch produced by the 10, 20, and 30 mil interference fits are 0.3, 0.5, and 0.7 mils, respectively.

Exposure to 400 C steam and 360 C water is continuing for 10, 20, 30, and 60 mil interference fit samples.

End Closure Development

Fabrication of Brazing Alloy by Powder Metallurgy Techniques (DDR-137)

Four groups of samples made from different starting materials were received from the development contractor. The starting materials for these groups were as follows:

1. Powdered zircaloy and powdered beryllium
2. Powdered zirconium hydride and powdered beryllium
3. Powdered zirconium and powdered beryllium.
4. Powdered zirconium plus other powdered elements in the proper proportions to give zircaloy and powdered beryllium.

Rings from each of these groups were cold pressed at 40 TSI and sintered for one hour at 965 C in vacuum. After sintering, the densities averaged approximately 94% of theoretical. The rough as-sintered surfaces were ground off giving good bright finishes.

Melting tests were run on "C Station" in 333 Building with the following results:

Group I:	Contaminated with oxides and lacked fluidity. Did not make complete braze joints.
Group II:	Appeared to be less contaminated than Group I but still did not make satisfactory brazes.
Group III:	No evidence of oxide contamination. Good brazes resulted since molten alloy had satisfactory fluidity. However, alloy smoked badly after melting which would make it unfit for production use. The vendor suspects that the zirconium powder used to make these rings may be contaminated with calcium.

Group IV: Appeared to be less contaminated than Group I but still did not make satisfactory brazes.

These tests indicate that it will be very difficult to get oxide free material when zircaloy is used. The marked improvement shown when zirconium was used is encouraging if the source of the fumes can be eliminated.

Gas Pressure Bonded End Closure

Lot No. VII

Upon autoclaving in 400 C (752 F) steam, two NOT and two NIT specimens out of a lot of five NOT and six NIT had failed at the end of 73 hours. The closures were two-piece zirconium "W" type rings with approximately 0.060 inch in contact with the zircaloy-2 cladding. Metallographic examination of the diffusion zone indicated that bonding had taken place but that all of the striations in the zircaloy-2 cladding had not filled. Bond strengths of the zirconium to zircaloy-2 and zirconium to uranium were checked by chisel and fracture test and found to be exceptionally strong and would not fracture along the bond line.

Lot No. VIII

Six each NOT and NIT specimens with 0.120 inch thick titanium end closure rings have been autoclaved in 360 C (680 F) water for 37 days with no failures. Autoclaving is continuing until failure occurs. One specimen was sectioned and examined metallographically for corrosion penetration; at the point examined, corrosion had penetrated the diffusion zone on one side approximately 0.010 inch and the other 0.027 inch deep. The corrosion was uniformly 0.0008 inch wide on the titanium side.

Six each NOT and NIT specimens with 0.120 inch thick titanium end closure rings have been autoclaved in 400 C (752 F) water for 36 days with two NOT pieces failing. Examination of the diffusion zone on the titanium rings indicated that failure had occurred by corrosion of the diffusion zone. The corrosion penetration profile was very irregular, varying from narrow high peaked residual bonded areas to wide flat topped areas that were either shallow or deeply penetrated.

Lot No. IX

Niobium

Diffusion of the niobium and zircaloy niobium and titanium and niobium and the uranium occurred in very small widely separated areas. The strength of the bond was sufficient to pull metal from the niobium. Examination of the unbonded areas showed that contact between the two surfaces was not good and that increased pressure might promote bonding.

Thorium

The specimens with thorium-titanium end closure rings have not been examined for lack of adequate metallurgical facility capacity.

Lot No. X

Lot No. X was prepared for shipment on 8/23/62. It is composed of six NOT and six NIT specimens, two inches long, and two NOT and two NIT specimens, five inches long. The end closure rings are one-piece zirconium having a 0.100 inch extension and a 0.200 inch closure section. This test was prepared to see if a closure ring 0.200 inch thick would seal the striations in the zircaloy-2 cladding so that they could be autoclaved without a closure weld and not fail.

Lot No. XI

This lot will contain the same number and length of pieces as Lot No. X. The zirconium end closure rings will be the same dimensions as the previous lot. In addition, the cylindrical surfaces will have grooves with dimensions equivalent to the striations on the inside of the zircaloy-2 cladding. It is hoped that the combination of grooving and striations will produce a series of dams in the striations and prevent failure of the specimens when autoclaved without closure welds. The specimens are partially prepared with completion being dependent on the availability of machine shop time.

Additional Work

Titanium-Zircaloy Coextrusions

This method of producing titanium clad end closure rings has failed to produce bonding on the one NIT specimen extruded. It is believed that enough knowledge has been gained to produce a satisfactory extrusion.

Titanium Hydride

The Research Laboratory, Schenectady, has furnished a small specimen of titanium hydride which they use for coating ceramics and making a diffuse coating on metal. Tests of producing a diffuse coating on zircaloy-2 are dependent on the operation of the new Be-Zr brazing facility.

Vapor Deposited Titanium

The Research Laboratory indicates that titanium metal can be deposited readily on other metals but have not deposited it on zirconium or zircaloy-2. Plans are being made to study the titanium vapor coating of end closure rings.

Vapor Deposited Copper

Three out of six groups of copper vapor coated end closure rings have been examined. In all cases the exposed zircaloy-2 surfaces have been from a deep blue to a black color and most of the copper either all brown, partially brown, or have spots. So far none are suitable quality for bonding. An attempt was made to remove the discoloration on the zircaloy-2 by cathodic etching. It also removed the copper. Masking the copper coated areas did not prevent removal of the copper.

The copper coated areas are within the contract specifications. Deposited copper thickness has not been examined.

Fuel Element Support Design Attachment Testing

Outers

The zircaloy-2 supports on the N outer fuel element consist of four "suitcase handle" supports at each end of each piece. These are spaced 90 degrees apart, in line, and about three inches in from the fuel element end. Because of variability in the fuel element diameter, supports of slightly varying heights (range .117-.127) are used in an attempt to compensate for the difference in diameter of the fuel tube and the support circle diameter. Subsequent to the attachment of the supports by projection welding, soft iron shoes are crimped to the loop of the suitcase handle.

The support circle diameter range specification is .015 inches with permitted eccentricity of .005 inches. Despite attempts to selectively fit, it has been impossible to meet the support circle range in the as-welded condition, with actual ranges being in the .015 inches to .020 inches range. Subsequent autoclaving and attachment of supports increases this range. Consequently, the decision has been made to permit final sizing of the supports on an individual basis in order to meet support circle dimensional requirements.

Recent data on production supports after final autoclaving and with shoes attached indicates that load deflection characteristics are approximately as previously estimated. Previous criteria had estimated approximately .010 inches deflection for a 100 pound load. Actual results on 12 prototype finished fuel supports are as follows:

Range Load for 0.002" Deflection	- 15-45 Pounds
Range Load for 0.004" Deflection	- 42-68 Pounds
Range Load for 0.008" Deflection	- 90-115 Pounds
Range Load for 0.016" Deflection	- 130-193 Pounds

Another parameter of importance is the permanent deflection of the outer support on impact loading. Recent test data on finished fuel pieces has not been encouraging. It appears that permanent deformation is approximately linear with impact load. One-foot pound gave a permanent deflection of about .020"; one-half foot pound, about .010"; and one-quarter foot pound about .005".

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TESTING METHODS ENGINEERING

N Fuel Testing

The importance of billet grain structure to the quality of extruded N fuel has been further established by recent investigations. Comparisons of nondestructive test data obtained from approximately twenty outer "X" billets to eddy current test data obtained from the corresponding extruded elements revealed that billets exhibiting large ultrasonic attenuation extruded into fuel with excessive roughness at the inner uranium-zirconium interface. Of some two hundred and fifty elements inspected by the cladding thickness tester, in fact, approximately twenty-two percent were rejected because of this defect. Analysis of the data showed that this number would have been reduced to five percent had the billets been pre-selected on the basis of the ultrasonic test. Further testing is being done to more completely evaluate the possibility of establishing billet acceptance standards based upon the ultrasonic billet test.

Measurement of N fuel uranium surface contamination is continuing on a routine basis, although some difficulty is being experienced in maintaining the stability of the alpha counting equipment within acceptable limits. Data from recent extrusions shows contamination levels to be running about thirty-two micrograms uranium per closure at the fuel element ends, with no measurable contamination detected on cladding surfaces. Present equipment, which is limited to inner fuel geometries only, will be soon augmented by a second station designed for outer tubes. Shop fabrication of this equipment is nearing completion and laboratory check out is expected within a week or two.

Equipment for measurement of enrichment level in N billets is on hand and about seventy-five percent assembled. This equipment employs a sodium-iodide crystal detector to determine the ratio of U-235 to U-238 uranium in samples by measurement of the 185 KEV gamma energy radiated. Test equipment for both the N fuel and AlSi processes is being provided.

Encouraging results are being obtained in the evaluation of a simple photo-tube device for the detection of white oxide on the surfaces of autoclaved N fuel. Continuing tests are being made with signal amplifiers and other refinements incorporated in the circuitry.

AlSi Fuel Testing

External bond tester modifications which lowered the test frequency from 25 to 15 MC have been completed on all units. This change, in addition to minor circuit alterations and improved set-up procedures, has apparently succeeded in making the equipment insensitive to "brittle" bonds and more reliable in the detection and rejection of bonafide unbond defects. Variables data supplied by the new frequency appears to be better than the old variables data by a factor of two as measured by total bond count. Although this is an encouraging step, further improvements are needed to supply data with the accuracy and reproducibility desired.

A major contributor to inconsistencies of the internal bond test is the difficulty of obtaining uniform Lamb wave test probes. At the time this test was developed the Lamb wave principle was the only known method capable of resolving unbond defects on the internal bore; however, new transducer materials have more recently proven capable of detecting these defects with the pulse-echo technique employed on the external test. Since this pulse-echo method employs one instead of two transducer elements, it offers the advantage of more simple and easier to calibrate probes. Special experimental probes for this purpose are now being fabricated by an off-site vendor and will be evaluated in the near future.

One UT-2 station has been operating the past two months under modifications intended to stabilize amplification and gating circuits, provide a large grain readout, and better discriminate uniformity of fuel core grain size. Its performance has proven to be definitely improved, and recommendations have been made to similarly modify the other three testers. A disadvantage of the modified unit, however, is that it has caused increased downtime because of more difficult set-up and calibration procedures. Present efforts are attempting to eliminate this objection before the other units are also modified.

Major emphasis is now being placed upon improving the reproducibility of the UT-4 testers. Whereas these testers are believed to be removing seriously defective closures from the process stream with reasonable confidence, the variables data show gross inconsistencies. Two developments now in progress are expected to reduce this error. A technique has been developed for fabricating more suitable set-up standards with which more precise instrument calibration is possible. In addition, tests have shown that the critical dependence of test results upon precise alignment of the external test head may be reduced by a smaller transducer mounted nearer the fuel element surface. To more fully evaluate this possibility, tests are being made in which the 5/8 inch diameter crystal presently mounted two inches away from the fuel surface is replaced with a 3/16 inch diameter crystal positioned about 1/4 inch from the fuel surface.

General

Detection of Zirconium Hydride

A modest effort continues to investigate ideas which may ultimately lead to the nondestructive detection of hydrogen embrittlement in zircaloy. The most promising work done to date has established what appears to be a real correlation between the quantity of hydrogen absorbed in zircaloy samples and the rate at which vibrational energy is dissipated in the samples after removal of a driving force (their "Q", or logarithmic decrement).

The logarithmic decrement of seven 2 x 1/2 x .025 inch thick samples with hydrogen contents ranging from 10 to 5000 ppm were measured by driving the pieces into their first flexural mode (around 2700 cycles per second) and measuring the number of cycles required for the amplitude of vibrations to decrease to 1/e of the initial value. The results ranged from 816 to 146, decreasing

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with increasing hydrogen content. The seven data points plot a near straight line relationship on semi-log graph. This relationship, if true, may be most significant. Additional samples are being obtained to further check its validity. In the meantime, techniques for obtaining equivalent measurements on actual process tubes are under development. Initial tests on a section of a process tube containing a one inch diameter spot of what is presumed to be 700 ppm hydrogen has given a slight but observable indication. A continuing effort is being made to refine this technique.

Hot Die Size Fuel Testing

Equipment for the inspection of nickel thickness, can wall thickness and bonding of fuel produced by the hot die sizing process is under development. Initial testing will be done in the laboratory on the original N fuel prototype tester which is being modified for this purpose. Design drawings are also in preparation for the fabrication of a complete "production line" test station.

AlSi Wettability Studies

The possibility of employing an AlSi rather than a nickel coat on uranium fuel cores prior to canning by the hot die sizing process is being investigated. Earlier work has shown that cores submerged for approximately thirty seconds in a molten and sonically agitated AlSi bath are readily and thoroughly wet by the AlSi. Four three inch long sample cores prepared in this manner have been canned by the regular hot die sizing process to evaluate the idea. Destructive and nondestructive inspection of the finished elements revealed that in each case the resulting aluminum to uranium bond was weak, but that both the core and aluminum can were thoroughly wet with AlSi. Additional tests are being made under slightly modified canning conditions in an attempt to enhance the strength of the bond.

Kurpwood
for
Manager, Engineering

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FINANCIAL OPERATION

AUGUST, 1962

Considerable effort was devoted to the many necessary payroll and cost coding changes occasioned by the transfer of certain maintenance functions to HLO. Necessary code changes were made for office equipment, vehicles, laundry, telephone and bus costs. New precodes, TME rates and standard billing rates were established. Also, where necessary, all records relating to the work order system were changed. Approximately 300 work orders have been removed from the system as a result of this effort. The few items remaining to complete changes necessitated by the new organizational structure will be accomplished in September.

Several meetings were held to discuss possible Financial applications of the data collection system in the Coextrusion Shop. Investigation of present system for time distribution reveals that one set of input data (TDR's) will suffice for both Financial records and the NPR data system, although timing changes will be necessary in the field. Financial will continue working closely with the NPR data system to obtain full utilization of the system in financial as well as operating areas.

Quality Control costs associated with the coextrusion process are being studied in cooperation with Quality Control personnel to determine feasibility and desirability of preparing functional reports which show costs of prevention, appraisal and failure.

Nine HAPO and one FPD OPG's were issued in August. The revised Position Guide for the Manager, Manufacturing, setting forth reorganization changes and nuclear safety responsibilities, has been forwarded to the Department General Manager for approval.

Procedures for the coordination of FPD Automatic Data Processing Applications have been established and disseminated through letters to Section Managers. Establishment of these procedures is expected to avoid duplication of effort, provide assignment of responsibility and assure sound budgetary control.

A revised accounting instruction covering procedures to be used in the authorization and performance for work for other Government agencies, contractors, or vendors has been prepared. Rough draft copies are now being circulated for comment. It is expected that the finished instruction will be issued during September, with incorporation, as necessary, into the Department's OPG or policy letter system.

Preliminary studies have started on the use of weekly time distribution reports (TDR's) for Manufacturing Engineering. The recording of a more detailed history of individual effort devoted to each sub-program is expected to provide assistance in scheduling work and assignment of effort, and also could provide a tool for better forecasting.

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During August, receipt of one cost improvement proposal with estimated savings of \$1,031, and approval of suggestions with savings of \$6,431 brought year-to-date cost improvements to \$580,500, 65% of CY 1962 goal. Review of the new Department treatise on Cost Improvement has been completed and it is now being processed for publication. It will be titled, "Cost Improvement at Work in the Fuels Preparation Department." Correspondence with Elliott Service Company has resulted in availability to the Department of a modified cost improvement poster program at a cost less than first specified. This program is currently under review.

Travel expenses during August totaled \$7,360. This amount includes a \$491 adjustment resulting from modification 22 to Appendix B of the Prime Contract, which increased compensable per diem from \$12 to \$13.25, retroactive to April 20, 1962. Exclusion of that portion of the adjustment applicable to prior months leaves a net charge of \$7,052 for August. Nineteen expense accounts were processed during the month generated by three household moves and 191 travel status days. Travel status days were 120 for personnel transfers, 8 for placement interviews and 63 for business trips directly related to work performance. There have been no expenditures FY-year-to-date to attend either professional and trade society meetings or off-site courses.

No reports of unusual significance were issued during the month.

The Financial Section had two security violations during August.

Manager - Finance

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PLANT FACILITIES OPERATIONAUGUST 1962I. RESPONSIBILITY CHANGES

Effective September 1, 1962 the Plant Facilities Operation will no longer exist as such. Those portions of the maintenance and power operator coverage, which are specifically for the Hanford Laboratories Operation, will be transferred to them. The power operators will be assigned to Facilities Engineering, Financial and the maintenance to Test Reactor and Auxiliaries.

II. ACHIEVEMENTSA. Statistics

<u>Utilities</u>	<u>August</u>	<u>July</u>
Average steam generated (M lbs/hr)	35	35
Maximum steam generated (M lbs/hr)	48	61
Total steam generated (M lbs)	25,780	26,024
Coal consumed (tons)	1,445.42	1,539.07
Evaporation rate (steam/# coal)	8.92	8.45
Efficiency - Actual	55.6	58.0
Efficiency - Theoretical	67.8	67.9
No. of Boilers on: 2		
Date of change : None		
Sanitary water from 3000 Area (M Gals.)	159.34	142.56
Total water from 3000 Area (Avg. rate gpm)	3,569	3,193
Total water from #3 and #4 wells (M Gals.)	18.52	14.59
Total water from #2 well (M Gals.)	.30	.30
Peak water consumption for 24 hours (M Gals.)	5.7	5.2

B. Operating Experience

The annual overhaul and maintenance work in the powerhouse continued during the month. Overhaul of the No. 6 Boiler is progressing well. The one bad water tube was repaired and the x-rayed weld passed. The Third Party Inspection was held during this period. The coal crusher was overhauled, with worn parts replaced and others serviced. The lower section of the coal hopper was replaced. Wear plates were bolted on instead of welding so as to permit easier and quicker replacement.

Modifications were made to the sand separators by the installation of new rubber-lined grit pots, which will have a longer life and give better service than the previous unlined pots. The dumping cycle was also extended. Sample nozzles were installed in the west and north grid water lines from the 382 Building to be used in determining the efficiency of the sand separators.

Coal deliveries were resumed about the 10th of the month and it will be necessary to replace coal in the stockpile, which will increase the cost of coal handling until completed.

The overhead steam and compressed air lines from 384 to 382 Buildings were removed with the underground service now in use.

Two underground lines were repaired during the month without interruption of service. A sanitary sewer line near the 340 Building ruptured due to heavy automotive equipment driving across a valve box and the 12-inch import water line from North Richland developed a leak around a lead joint, which was also caused by the presence of heavy equipment near the 340 Building.

A special three-compartment, round cornered, polished stainless steel sink was fabricated for installation in the Special Analysis Laboratory in 3706 Building. Fabrication time for this sink was reduced to half by the use of the press brake and special forming dies instead of the previous method of using the hand brake.

A scheduled outage of the 308 Building air conditioning and exhaust system was held to allow testing of the complete system by CE&UO's Design Engineering. Seven possible operating combinations of the system were tried to collect data which will be evaluated to determine the adequacy of the system.

C. Equipment Experience

The motor on the B unit supply fan in the 325 Building was replaced due to a bad bearing.

A dual temperature control system was fabricated and installed for the Chemical Research group in the 325 Building to provide control for the heating and quenching temperatures of plutonium samples in an inert atmosphere. In the same building, an eight channel tape serial numbering device was put in service for Radiological Chemistry. This device will be used to code tapes from the counting rooms for processing by the electronic data equipment.

A breaker failure on motor control center No. 3 in the 384 Building involved the No. 3 and No. 4 compressors, air dryers, welding outlets, and lighting transformers. The failure caused a 10 to 15 minute interruption in the operation of the equipment but did not affect customer service. A study is being conducted to determine the reason for the failure of this breaker.

The 3745-B accelerator is experiencing difficulty with arcing. A new set of high voltage resistors is being installed to correct this condition.

The use of sulfamic acid was not successful in cleaning scale from the rotor wheels on Building 3707-A cooling units. The acid may have been of insufficient quantity or not left in the tank for a long enough period.

The contamination of distilled water storage tanks in the 3706 Building was caused by back flow of the drain line from the drafting room air cooler. Separation of the drain line from the storage tanks overflow line corrected the problem.

D. Inventions and Improved Methods

None.

E. Cost and Savings

One thousand nine hundred and forty-five dollars (\$1,945) in annual savings from suggestions brought the CYTD cost improvements to \$56,519 or 49.1 per cent of goal.

F. Status of Projects and Major Jobs

Auxiliary Instrument Panel, 384 Building - Drawings have been issued for the final phase of installation by Plant Forces. Over-all completion is 80 per cent.

Emergency Power System - The request for appropriation received departmental approval and is awaiting the HAPD General Manager's approval. Further engineering study is being made in evaluating the load-splitting operation and the need for an integral 480 volt, 3-phase system for the new generator to assure independent operation of the two generators.

Compressed Air Expansion - Field installation work is under way by J. A. Jones on the electrical power and control panel for the No. 6 compressor. The mechanical portion has not been started due to a delay in the delivery of the compressor. It is now scheduled for shipment August 29, 1962.

Service Piping, 382-384 Buildings - The old overhead lines have been removed and the new underground lines are in service.

Process Sewer Extension - The 15-inch process sewer has been installed and the two manholes are complete. Tie-ins to the 307 Basins are scheduled for early in September.

Outside Storage Facilities, 303 Area - All paving areas have been constructed and the new storage fence installed. The asphaltic concrete areas have failed "to set" and are not

usable for heavy traffic. Laboratory tests are being run to determine the reason for the failure to set and to evaluate corrective action. The paving was performed by a fixed-price contract under J. A. Jones.

Building Roof Repairs - A request for fixed-price contract services is being prepared to re-roof or repair roofs on Buildings 305, 313, 333 and 3703. Rough draft specifications are being reviewed.

4th Expansion Steam Generation Plant - The project proposed is currently being reviewed by the AEC. Data are being furnished as requested.

Compressed Air System, 384 Building - Financial approval has been received to install the new emergency compressed air system in the 384 Building. Detailed design is being firmed up for installation by J. A. Jones.

West Gate Patrol Station - Mechanical and architectural drawings have been completed for the construction of a new patrol station at the west gate entrance to the 300 Area. A traffic survey has indicated future heavy use of this gate and need will be in accordance with the 300 Area Master Plan.

Steam Line Pole Replacement - Financial approval has been received for steam line pole replacement and steam line modification in the southwest section of the 300 Area. Design is complete and a contract is being negotiated with J. A. Jones Construction Company.

MAJOR STUDIES

Utilization of PRTR Steam - A study is under way to evaluate the feasibility of utilizing PRTR steam for the reactor and the 300 Area grid system. A financial evaluation is in progress and detailed scope drawings are being prepared by Bovay Engineers. The study is scheduled for completion in mid-September.

G. Special Reports Issued

None.

III. PERSONNELA. Safety, Security and Radiation Experience

Medical Treatment Injuries	16
Frequency Rate	3.82
Disabling Injuries	0
Serious Accidents	0
Security Violations	0
Radiation Incidents	0

B. Meetings

Round Table-Staff	19
Safety and Security	18
Information	6

Manager
Plant Facilities Operation

E. Hilgeman:RTM:mkm

END

**DATE
FILMED**

12 / 10 / 92