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**FUELS PREPARATION
DEPARTMENT**

MONTHLY REPORT

AUGUST

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Received by OSTI

DEC 0 1 1962

**HANFORD ATOMIC PRODUCTS
OPERATION**

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FUELS PREPARATION DEPARTMENT

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MONTHLY REPORT - AUGUST 1961

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J Tang 8-21-92 Compiled by Fuels Preparation Department

September 7, 1961 - Richland, Washington

Work performed under Contract No. AT(45-1) - 1350 between the Atomic
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PRODUCTION

As a result of high finished fuels inventories, the production schedule was reduced and the August output of fuel elements was 94 per cent of forecast.

The first production grade material in the Coextrusion Shop was processed through the extrusion press late in the month.

Finished AlSi fuel element inventories at month end reflect a 2.0 month supply.

Bare uranium inventories reflect a 1.4 month supply.

ENGINEERING

Present Reactor Fuels

Two (2) natural uranium and three (3) enriched I&E fuel elements failed in-reactor during August. Fuel performance was adversely affected by an increase in fuel quality oriented "hole" failures. Total ruptures were four (4) more than last month and three (3) less than the same period of last year. Severity of service is about twice that of a year ago.

Methods of reducing the severity of the uranium quench from the beta to alpha phase are being evaluated in an effort to reduce stress risers which may cause core cracking during irradiation. These include heat treating the uranium in hollow blank form and quenching in oil rather than water.

A uranium core surface tester, modified to detect quench cracks, has been operating successfully for several weeks. Similar modification of the remaining UT-2 testers is planned. The average daily downtime charged to UT-2 stations has been reduced to 3.5 hours per day or about one-half of the June rate.

A minimum specification of iron plus silicon in uranium cores of 100 PPM is being studied as a means of control grain size and to improve further basic uranium quality.

Seven hundred and thirty-two overbore fuel elements were canned in the Pilot Plant during August. Higher yields for overbore fuels indicate that scheduled reactor deliveries, which have been increased from the original 10 test columns to 62 columns, can be made in spite of a tight uranium supply situation.

Two central columns of overbore fuels exposed to 770 and 828 MWD/T respectively and six fringe columns exposed between 616 and 776 MWD/T were discharged and examined in C Basin. Projection rail height for overbore fuels is being increased 3 mils as a result of these examinations. This should improve fuel centering and minimize temperature gradients, which could cause non-uniform corrosion and "hot spots."

Yields of 70% are being achieved in the preparation of overbore fuel elements. This is a 15 to 20% improvement over earlier experience. Further improvements in the process and handling methods are expected to give additional yield increases.

Twenty-three tons of alpha extruded, Fe-Si additive, dingot cores for the overbore program were shipped to HAPC. Two tons were fabricated from low hydrogen dingot metal and the remainder from hollow core blanks which were vacuum out-gassed after beta heat treatment.

Approximately 324 tons of additive dingot, transitional test uranium are being irradiated and 694 tons had been discharged by mid-August. Twelve (12) ruptures have occurred in dingot fuels as compared with nine (9) in the ingot control material. Analysis of Quality Certification data indicates that dingot uranium is slightly less stable than ingot metal and had a tendency for greater diameter growth during irradiation. About 36,000 dingot test cores, vacuum-outgassed-after-beta-heat-treatment, and 21,500 control dingot cores vacuum-outgassed-before-heat-treatment have been canned. The cores outgassed after heat treatment appear to have less porosity than the control cores.

Approximately 36,000 "bumper" (solid rail) fuel elements were produced on the Pilot Plant ultrasonic rail welder and the over-all welding yield was 96.7%. Operating techniques have been developed, which allow effective welder operation during critical warm-up periods. Two automatic ultrasonic rail welders have been put into limited service in the 313 manufacturing facility. Dies have been fabricated to produce elliptical solid bumper rails. Production test fuel elements with elliptical rails will be fabricated in September.

Seventy tubes of nickel plated fuel elements have been shipped to 105-DR Reactor for irradiation testing, planned for twice normal goal exposure. Charging is scheduled for September 7.

Five hundred fuel elements were canned in nickel plated aluminum components. Testing is under way to determine their suitability for irradiation.

Corrosion testing results continue to be highly encouraging for fuel elements canned in nickel-plated components. Test elements showed no visible pitting or other accelerated corrosion after 91 days in 175 C, 300 Area process water.

One hundred C-64 alloy aluminum cans and spires plated with low-phosphorous chemically deposited nickel have been obtained. Preliminary testing indicates that plate ductility is increased significantly. Planned testing includes adhesion, ductility, phosphorous content and canning behavior.

The hot pressing of 1,000 HAPC CV size diffusion bonded fuel elements by the Sylcor Division of Sylvania Electric Products Company (Sylcor Hot Die Process) is under way. Shipment of these fuel elements to EAPC for evaluation is expected in September.

During May, 160 fuel element assemblies were shipped to the Savannah River Laboratory for fluid pressure bonding. Shutdown of their autoclave pressurizing system for repairs has delayed this work and only about 50 assemblies have been bonded to date.

During August, 348 fuel elements were assembled in the EAPC hot pressing facility. Destructive and nondestructive testing indicates that these fuel elements are of uniformly high quality.

Procurement of components and uranium for hot die sizing development work at EAPC has been initiated.

Conversion to a pressurized fuel assembly quench was completed on all production canning lines during the first week of August. Experience indicates the average external bond rejects have been reduced from 1% to 0.4%. Base and braze voids have been reduced by 50%.

Direct current welding tests indicate that current ripple has a marked effect on the weld quality of AlSi bonded fuels. It was found that temperature fluctuations and changes in braze mixing occur as certain changes in current ripple are made. Work to define the optimum per cent of ripple in DC welding current is being carried out.

About 3,200 fuel elements were canned in the AlSi Pilot Plant. Approximately one-third of these were for reactor use. Tests were run to further optimize the canning process. Use of lead plugs in the cores to accelerate core preheat and improve the characteristics of the internal compound layer is being evaluated in conjunction with these studies.

Modifications to the bond and penetration testers have provided marked improvement in the operation of ME-1 stations. The downtime charged to these stations during August was an average of 18 station-hours per day as compared to 34 station-hours per day during the first two weeks of June.

The ALSi Fuel Element Closure Tester (UT-4) scheduled for 306 Pilot Plant Operation is 95% complete. The UT-4 project for production testers is proceeding on schedule.

A twelve hundred watt ultrasonic cleaner has been modified to provide ultrasonic agitation during the quench of ALSi fuels with the objective of improving the ALSi bond.

N Reactor Development

Five N inner tube, 17", 0.94% enriched fuel elements (NIE-1) are at an exposure of 1470 MWD/T in KER Loop #1 and two NIE-1 elements are at an exposure of 485 MWD/T. KER Loop #2 was discharged early this month due to the failure of the coolant deionizer. At the time of discharge it contained five inner tube, 23", natural fuel elements (NIN-1), at an exposure of 2100 MWD/T and two 23" NIE-1 fuel elements at substantially lower exposures. Examination in the C Basin indicates that these fuel elements operated satisfactorily. KER Loops #3 and #4 are shut down for modifications. Prototypic back-up charges are available for each loop.

The KSE-3 fuel elements discharged from KER Loop #3 in April, after 3600 MWD/T exposure, showed gross bumping of the inner clad. Free irradiation and radiometallurgy data are being evaluated for further explanation as to the cause of this bumping.

The initial two monitor tubes of coextruded, zirconium clad, U&E fuel elements were discharged at a goal exposure of 680 MWD/T. Visual examination in the C Basin indicated satisfactory operation of these fuels. Six additional tubes have been charged and an additional 10 to 12 tubes are presently in process.

The amount of primary reduction of the uranium ingot by alpha extrusion is a key factor influencing clad uniformity during coextrusion. In order to provide insight into metal flow characteristics and their effect upon coextruded fuels, a series of experiments have been planned to yield empirical data regarding optimum casting size, tool design and reduction ratios for each coextrusion billet geometry. Special uranium metal has been ordered from National Lead Company of Ohio for the first of these experiments.

New designs for the inner tube supports were obtained from the Hanford Laboratories Operation and the Irradiation Processing Department. Two weeks will be required to complete the necessary tools. Fabrication

should not require more than a week after proof parts have been accepted. Improved designs for locking clips are not available. First shipment of new locking clips will require about six weeks after receipt of the new design.

Development work on extrusion of bare uranium tubing at 12 to 1 reduction ratios was carried out to determine extrusion constants. Eight copper clad test billets were extruded to determine the lower temperature range at which satisfactory extrusions could be made. This was found to be about 650 F.

Several inner tube extrusions for 333 Building startup had severe dimpling of the outer cladding. The cause is not known but improper lubrication or copper inclusions are suspected.

Significant progress has been made in the welding of the copper coextrusion can to assure that welds around the end plate do not leak. A new fabrication process for producing outer sleeves by precision extrusion has been developed and proof parts from the vendor should be available in two weeks. Current methods for the large thin wall sleeves used in the coextrusion process require the rolling and welding of copper sheet to produce the tube.

One of the three end closure brazing stations in the N Fuel Production Facility was put into operation and about 75 each inner and outer tubes were brazed. Results appear good on the basis of limited evaluation.

Samples of chemical milling solutions are being evaluated by Chemical Research personnel, Hanford Laboratories Operation, to determine whether solvent extraction could be used for the in-process removal of uranium from chemical milling solutions. Solution uniformity would be improved by this means and savings in sulphuric acid and copper sulphate would be possible.

A laboratory investigation is being made on electrolytic methods of copper removal from the copper strip solution. The objective is to remove copper in a form which would be commercially salable. The large volume of nitric acid required for the present process would also be reduced.

Four each N outer tube and N inner tube sections with flat closure rings pressure bonded into chemically milled, cathodically etched recesses in the tube ends, have been shipped from Battelle Memorial Institute to EAPC for evaluation.

Tensile tests have been made on uranium-zircaloy specimens previously bonded by BMI. The material tested included specimens prepared in the following manner: As-bonded, as-bonded plus one beta heat treatment, and as-bonded plus two beta heat treatments. Bond strengths ranged from a mean of 68,000 psi for the as-bonded specimen to a mean of 78,000 psi for the as-bonded plus two beta heat treatments specimen.

Both bond and cladding testers (UE-2B) and one closure testing station have been installed in the N Fuel Production Facility and made operational. The second UT-9 station is being debugged. The feasibility of the N Fuel Cap Thickness Test was demonstrated and a prototype tester (ET-6) was designed and built in the Laboratory.

GENERAL

Operating efficiency of the ALSi Shop was 94.6 per cent, the highest attained during this calendar year, compared to a forecasted 91.0 per cent.

No failures of ALSi fuels in the autoclaves occurred during the month.

PERSONNEL STATISTICS

Number of employees as of July 31, 1961 912
 Number of employees as of Aug. 31, 1961 908

	<u>Exempt</u>	<u>Nonexempt</u>	<u>Total</u>
General	2	1	3
Manufacturing	91	374	465
Engineering	48	27	75
Financial	13	7	20
Plant Facilities	48	290	338
Relations Practices	4	3	7
TOTAL	206	702	908

STAFF

General Manager, Fuels Preparation Department	R. L. Dickman
Manager, Manufacturing Operation	W. N. Mobley
Manager, Engineering Operation	L. E. McEwen
Manager, Financial Operation	W. S. Roe
Manager, Plant Facilities Operation	E. Hilgeman
Acting Manager, Relations Practices Operation	G. D. Barr
Special Studies Assignment	J. W. Talbott

PATENT SUMMARY - AUGUST 1961

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

"Application of Lubrication to And In Ultrasonic Welding."
 E. V. Padgett

RL Dickman

General Manager
 Fuels Preparation Department

RL Dickman:mkm

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MANUFACTURING OPERATION

AUGUST 1961

CURRENT OPERATIONS

Production

Statistics

	NORMAL					ENRICHED				
	8"	C	K	O		C	K	O		Total
	Solid			Reg.	Bumper			Reg.	Bumper	
<u>Current Month's Production</u>										
Acceptable Fuel Elements Produced (Tons)	-	62.9	217.5	216.7	22.8	10.1	58.5	19.9	81.0	689.4
As % of Forecast Production	-	110	75	99	41	112	101	249	208	94
Cum. % of Forecast for Current Quarter	-	126	90	99	82	103	95	125	115	99
As % of Past 3 Month's Average Production	-	108	81	129	84	63	117	117	188	107
As % of Past 12 Month's Average Production	-	114	94	102	91	67	137	74	368	107
% of Forecast Achieved Last Fiscal Quarter	-	116	114	116	115	49	111	108	88	111
% of Forecast Achieved Last 4 Fiscal Quarters	-	101	106	110	84	81	101	86	90	102

Operating Efficiency

Current Month (%)	94.6
Forecast (%)	91.0
Previous Month (%)	91.8

Manufacturing Yield

Current Month (%)	-	86	88	89	-	86	88	93	84
Forecast (%)	-	86	86	86	82	86	86	86	82
Previous Month (%)	-	91	91	90	79	87	92	93	84

Bare Uranium Available for Processing (Tons)	915
Finished Products in Storage (Tons)	1360
Special Products Finished (Pieces) Boll	125
Uranium Utilization	98.5

Plant Operations - ALSi

The reduced production output during August is attributed to a revision in the production schedule which was planned because of a favorable finished inventory position. Instead of staffing the additional (eleventh) canning line shift planned for August, the ALSi Shop remained on ten canning line shifts per day for a total of 230 canning line shifts operated.

The August yields of both the six-inch and eight-inch elements approximated the relatively high yields which have been experienced in recent months. A recurring problem of ALSi penetration into the sleeve-can annulus, core non-seating and assembly rejects caused a slight reduction in production yield from the July experience. The problems were due to sleeve and can mating tolerances. One condition results from cans wherein there is a combination of a large outside diameter and a high upset metal of the ALSi rings to the extent that a force fit between the can and sleeve is produced at the ALSi ring location. This causes core non-seating and assembly rejects due to the cans popping up out of the sleeve during the preheat of assembly. The other undesirable condition results from cans which have the minimum acceptable can O.D. and ALSi ring upset metal. This produces an excessively large can-sleeve annulus at the ALSi ring location causing ALSi penetration into the can-sleeve annulus during the canning operation. A procedure is being negotiated with the component vendors whereby the present upset metal specification will be replaced with a specification on diameter of the can plus upset metal at the ALSi ring location which would then prevent the full accumulation of the can O.D. and upset metal tolerances.

Projection welding operations were continued on a two-shift basis on the 306 prototype welder during August, while both new production machines were given operational runs in the 313 Building. Several modifications are being made on the production machines and supporting equipment. Early in September, the operating crews are scheduled to be transferred from the prototype welder to the ALSi Shop. Although some time will be required before in-line processing is possible on these production machines, immediate advantage in material handling is anticipated and accountability problems will be lessened.

The August production of bumper fuel elements has increased finished inventories to exceed requirements for the second central zone E-N loading scheduled for September and October, 1961. An approximate two-month supply of six-inch enriched bumpers and one-month supply of eight-inch bumper fuel elements is on hand at month-end.

A total of 1120 four-inch I&E lithium-aluminum pieces were fabricated in the Special Products room during August to make a total of 4500 finished pieces available for the second central zone E-N loading. Also, 1094 bismuth pieces were produced to supplement reactor requirements until the end of this calendar year. A total of 1990 pieces were reclaimed during the month with a yield of 81 percent.

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There were no autoclave failures of AlSi Process Fuels during August. Total for the year remains at ten.

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

8" I&E	16,701
6" Enriched	11,113
6" Water Mix	135
Total	27,949

Finished fuel element inventories at the end of August reflected a 2.0 month supply based upon projected reactor usage. This is higher than normal because over the past three months reactor charging has been below forecast; FPD yields and efficiencies have been high, and approximately 130 tons of OIIIIE bumpers have been pre-produced for the second central zone E-N loading.

The month-end inventory of bare cores reflected a 1.4 month supply. Approximately half of the shortage in deliveries experienced during July was regained during August.

One scrap shipment was made during the month which contained 25,658 pounds of normal uranium and 16,777 pounds of enriched uranium.

Plant Operation - Coextrusion

The month of August was spent debugging the equipment and getting acquainted with the process specification. Final draft of the process specifications was completed at month-end.

A total of 23 billets were extruded for practice material during the first part of the month. This material has been processed in part up through the end cap welders without beta heat treating.

The first production grade material began processing on August 30th when four billets of this type were extruded.

The following is a total through put for each work station during the month of August.

Billet Assembly	23
Extrusion (29 for Engineering)	56
Cut Up	344
Chemical Milling	245
Braze	237
Vacu Blast	48
Machining	143
Beta Heat Treat	0
Welding (End Cap)	0
Support Welding	0

Facilities Engineering

Design and Projects

CAF-847 New Fuel Cladding Facility

	<u>Scheduled</u>	<u>Actual</u>
Design	100	100
Construction	92	92

Autoradiograph film developing equipment has been requisitioned.

Installation of the second vacu-blast machine and the second end cap welder is complete. Material has been run through all stations except billet pre-heat and beta heat treat.

CAF-894 Increased Compressed Air Capacity

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

Modifications have been completed and the compressor was placed in operation on August 10, 1961.

CAF-903 Projection Fuel Element Modifications - 313 Building

	<u>Scheduled</u>	<u>Actual</u>
Design	100	100
Construction	95	95

The ultrasonic welders have both been placed in service.

CAF-915 Increased Storage Space - 303 Area

	<u>Scheduled</u>	<u>Actual</u>
Design	100	100
Construction	27	25

The retaining wall has been completed. Main excavation work has been completed and work on the building footings has been started.

CAF-934 UT-4 Testers

	<u>Scheduled</u>	<u>Actual</u>
Design	34	34
Construction	2	3

Demolition required to obtain space for the testers within the 313 Building has been completed.

Drafting and Files

Drafting work was performed on the following facilities:

306 Building	AlSi Fuel Closure Tester UT-4
313 Building	UE-1 Tester Modifications Pressurized Quench Modifications
333 Building	Agitator Shear Tester Extrusion Press Tooling Manual Ultrasonic Welder Abrasive Cutoff Saw
Miscellaneous:	300 Area Steam Lines Miscellaneous Map As-Builts

The following drafting work was completed:

New Drawings	97
Revised Drawings	71
Small Charts	115
Large Charts	4
Miscellaneous	15

PLANT CONDITIONS, INCIDENTS, AND IMPROVEMENTS

AlSi Shop

General

The operating efficiency averaged 94.6 percent during August, 3.6 percent above forecast and the highest efficiency achieved during this calendar year. Since it was not necessary to start up the additional canning line, losses anticipated for the increased throughput rate were not experienced. Approximately 40 percent of the outage time was reported for operational reasons, and 60 percent was for equipment failures. Canning jacks, agitators and quench machines were responsible for a major portion of this month's equipment outages.

The vendor evaluation program is progressing and its status in percent complete, as of August 1, 1961, was as follows:

	<u>Received</u>	<u>Canned</u>	<u>Charged</u>	<u>Discharged</u>
"H" Vendor	83	40	36	28
"B" Vendor	100	85	52	24

Deliveries of "H" Vendor material will be completed in September and fabrication finished by October, 1961.

The irradiation performance of vendor evaluation material is judged satisfactory. When all of this material has been evaluated in the reactors, the establishment of new vendor acceptability will be based primarily on the as-received component quality, promptness in deliveries, and the fuel element manufacturing performance. Both vendors have shown improvement in each of these areas.

Daily yields and efficiencies at the projection welder continue to fluctuate over a wide range. Engineering studies have shown that the energy put into the weld varies during periods of the day. It appears to increase gradually as the machine operates continuously. And, after the welder is down for more than 15 to 30 minutes, the strength drops off. This condition can be compensated for, in part, by adjusting the weld frequency. These adjustments must be made frequently, therefore, frequency ranges are being established by engineering personnel, and operating crews are being trained to make the necessary adjustments.

Ultrasonic welder 2-C was first placed in service in the 313 Building on August 7, 1961. Welder quality to date has been marginal. This appears primarily due to soaping techniques and lack of an automatic monitor to control the weld time. These are both problem areas which have also been experienced in the 306 welders and development work is continuing to establish an optimum process cycle.

During the period of May 22, 1961 to August 3, 1961 pressure quench machines were placed in operation on production canning lines in the 313 Building. The function of the pressure quench machine is to apply air pressure to the molten braze metal prior to and during the water quenching of the assembled fuel element. The effect of the pressure is to compress any gas voids formed in the braze metal and, therefore, produce a fuel element relatively free of braze porosity. The production test was conducted during the transition period of standard quench to pressure quench to determine the effect of pressure quench on fuel element quality and production yield. The results of this test are as follows:

1. A significant decrease in external layer integrity rejects for pressure quench material by a factor of 2.5. No significant effect on internal bond layer integrity rejects was shown.
2. A significant decrease in average external total braze porosity (measured by total bond count) for pressure quenched material by a factor of 2.3. Less variance in total bond count was found with pressure quenched material.

3. A significant decrease in fuel elements containing base end braze voids, as determined by visual inspection after fuel element facing, by a factor of 3.3 for pressure quenched material. A significant decrease in fuel elements containing cap end braze voids by a factor of 1.4 for pressure quenched material.
4. Pressure quench resulted in a significant increase in fuel element maximum outside diameter by approximately 0.002 inches (data collected on KIVN product model).
5. Pressure quench resulted in a significant increase of fuel element out-of-roundness by approximately 0.001 inches (data collected on KIVN product model).
6. Pressure quench resulted in a significant increase in stuck sleeve rejects by a factor of approximately 2.0.
7. Pressure quench resulted in an average reject rate of approximately 0.6 per cent due to smashed caps caused by poor alignment during the quenching operation.

The Aluminum Vendor Liaison Engineer has anticipated a significant price increase on as-received bumper supports unless the as-received tolerances can be relaxed. Since the minimum height limits must be guaranteed to assure a minimum projected fuel diameter, this number could not be changed. However, the maximum limit is important only to assure that bumper rails will pass the slotted ring gage, which is a 100 percent inspection to remove any fuel elements whose projected diameter exceeds permissible limits. Thus, an increase in the maximum tolerance limit in bumper support height is only a manufacturing yield risk, not a quality risk. Consequently, calculations have been made which show it feasible to increase the maximum bumper height limit by 0.002 inches and thus avoid an increase in bumper support costs.

On August 7, 1961, a new quench basket was installed on one of the pressure quench machines. The new basket aligns the pieces accurately and consistently. However, it has been at least as difficult to keep clean as the original baskets. The design of this new basket has been modified to ease the cleaning problem, and a basket is being built to this new design.

In addition, one of the other quench baskets has been cycled through the autoclaves to build up a film on the surface of the basket. The experience to date with this basket indicates that this autoclave film reduces the amount of AlSi adhering to the basket substantially. Consequently, it is planned to autoclave new baskets as they are received.

Study work has been completed on the final inspection work place layout and method of operation. As the result of the study, Final Inspection started a single shift operation on August 21, 1961.

The Special Products operation was discontinued as a separate function on August 28, 1961. Since the E-N load requirements are completed and fewer Pb-Cd "poison" pieces are being used in the reactors, the Special Products work load is decreased to a level that can be accomplished with a supplementary crew. While reviewing the total work load, it was found that the 305 Test Reactor crew will be available approximately two days a week (since the NPR graphite testing program is also complete) for processing required quantities of special products. The weld reclamation program, previously handled by the Special Products crew, has been assigned to the 306 Pilot Plant operation and water mix spool welding has been transferred to an AlSi Shop function.

A comparison of uranium scrap rates show that process scrap was reduced to less than one-half of the 1960 rate during FY 1961. During the latter year, 116 tons of process scrap were generated as compared with 242 tons scrapped during FY 1960. Improved yields, more reliable bare core testing equipment, and saving of "striated" cores for canning in identified lots, have been primarily responsible for this improvement.

306 Pilot Plant

In addition to bumper welding activities, there were four development tests conducted in the 306 Pilot Plant during August. Included in these tests were elements canned for evaluation of oil quenched cores, several new aluminum component de-oxidizing solutions, welding studies and nickel plating tests. Also, approximately 320 CVIN oversize fuel elements were fabricated to support the overbored tubes in "C" reactor.

305 Test Reactor

The 305 Test Reactor was shut down for a two-week period beginning July 31, 1961, to install a new control console and improved instrumentation. Several additional days were required for calibration of the control rod, determination of the relative sensitivity of the level and differential galvanometers and other instrumentation checks. All work was completed without incident and routine testing was resumed on August 24, 1961, using the greatly improved control room facilities.

Coextrusion Shop

Materials

Difficulties were experienced in obtaining copper components which would meet specifications and Quality Control Standards. The extrusion rate of good material was governed exclusively by the availability of copper components. Preshapes received presently are of forged copper. They are covered with a thick, tenacious layer of forging lubricant, intermixed with copper and copper oxide. The film appears baked on and cannot be removed chemically. Since the present preshapes are oversize, they must be machined and then should be vacuum outgassed to remove any traces of lubricant.

It has been requested that future purchase specifications be modified to insure that the vendor removes all traces of the lubricant.

Cut Off Saw

Quality Control received their gage and started measuring the squareness of the saw cut on August 30th. At this time it was learned that the saw is not capable of producing a saw cut that will meet the Engineering specifications. More development work will be required in this area.

Chemical Milling

All material chemical milled to date has been processed one end at a time in the vertical position. Difficulty with the drive mechanism of the horizontal basket assembly has held up completion. Although production schedules may be met by vertical processing, it does require added manpower.

Vacu-Blast

One vacu-blast unit is operating with only minor problems. Installation of the second unit was completed during the month. To date there have been no inner bores of inner tubes cleaned on this equipment. The development of nozzles to permit this cleaning is now under way.

Braze

One braze unit was operating with minor problems the last week of the month. The second unit should be in service within a week.

Beta Heat Treat

Charging of the heat treating furnaces has been awaiting auxiliary tooling and a safety-alarm system. It is scheduled for charging the first week of September.

End Cap Welders

One welder is in operating condition for outer tubes. The second unit for inner tubes is being installed by Minor Construction. It should be ready to operate during the latter part of September.

Support Welders

Satisfactory welds have been produced with the use of temporary tooling. Permanent tooling is on order and should be installed in another week. The support weld tester is still in design.

Non-Destructive Testers

One line of testers is ready for operation. The second line needs some units installed and tuned up.

Autoclaves

Six autoclaves are in operating condition but only five have hydrogen-detection systems complete.

Two fuel element ruptures occurred in the autoclaves. The first rupture, on August 2 (fuel element 202-178) occurred on the rear end of the outer element near the support area. The second rupture on August 3 (outer element 202-61) occurred on the outer element of the assembly near the center of the piece.

The fuel elements were not autoradiographed or non-destructively tested for clad thickness before going to the autoclave. This material was known to be of poor quality and was to be used for flow material tests and charging machine tests. The material was inspected visually before autoclaving and there were no defects or areas of questionable integrity. A visual examination of the ruptured elements suggested the ruptures probably started in the inner clad. Autoradiograph results showed the inner clad was below minimum clad specifications in all cases. The inner film showed wanderlust characteristics with a minimum thickness below 0.010 inches.

Operating Plans

AlSi Shop

Based upon production levels and reactor requirements shown for uranium fuel elements on the current production forecast, the AlSi Shop was scheduled for eleven-line operation for the remainder of this fiscal year. However, as was previously indicated, the eleventh line was not required during August to maintain adequate finished inventories. Actually, there are 285 tons more in finished inventories than forecasted for the end of this month. If this amount is not made up in subsequent months charging rates, the eleventh canning line shift per day would not be required for approximately four more months. Scheduled charging for the remaining four months of this year is above planned production rates, which should reduce the finished inventories from their present two-month supply to a nominal 1.5 month's supply.

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HW 70920

Significant Reports Issued

HW 70586	AG Blasewitz	Monthly Report, Quality Control Operation, FPD, July, 1961	8/1/61
HW 70650	WG Tews	Uranium Quality Control Analytical Results	8/8/61
HW 70835	HE Berg	Uranium Delivery Schedule, FPD, H.A.P.O.	8/24/61
HW 70868	WG Tews	Uranium Quality Control Analytical Results	8/28/61
	RD Ellingson	Uranium Scrap Generation Fiscal Years 1960 and 1961	8/31/61

EMPLOYEE RELATIONS

Safety

Members of the Manufacturing Operation sustained 27 medical treatment injuries during August, a frequency of 4.02.

Security

There were no security violations in the Manufacturing Operation during August.

Radiation Experience

The total exposure received by Manufacturing personnel for the four week badge period ending July 14, 1961 was 3400 mrad and there were no individual exposures over 300 mrad. The low exposure reflects continued good performance in the handling of bare cores.

Training

A total of seven classroom sessions for craft personnel were conducted on the following subjects: ultrasonics and the bond tester, bond and pen tester set-up procedures, and the bond and penetration tester control panel.

The craft instructor is still spending a portion of his time following the development of the UT-4 testers and is assisting with the development of a manual to be used for instruction purposes.

Reports in Invention

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.

W. N. Mobley
Manager - Manufacturing

WNM:HFT:mr'b

FUELS ATTRIBUTE DATA

1961

8" NORMAL

8" BUMPER

6" NORMAL

6" BUMPER

FUELS ATTRIBUTE DATA

8"

6"

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ENGINEERING OPERATION

August, 1961

VISITORS

<u>Name</u>	<u>Company</u>	<u>Contact</u>	<u>Date</u>	<u>Reason</u>
E. Moody	Minneapolis-Honeywell Richland, Washington	GR Hanson	8/1/61	Replaced defective equipment in 313 Welding Laboratory.
S. Paprochi S. Porembka	Battelle Memorial Institute Columbus, Ohio	TB Correy	8/21/61	Discuss diffusion bonding.
PE Tade	Sciaky Brothers, Inc. Los Angeles, Calif.	TB Correy	8/29/61	Discuss welding.
P. Chambliss	Vacu-Blast Company Belmont, Calif.	JL Guthrie	8/25/61	Assist in making Vacu-Blast machine functional.

TRIPS

<u>Name</u>	<u>Company</u>	<u>Contact</u>	<u>Date</u>	<u>Reason</u>
GF Jacky	General American Transportation Corp. Chicago, Ill.	WG Lee	7/28/61	Discuss plating of fuel element components.
	Grunwald Plating Co. Chicago, Ill.	M. Mitchell	7/28/61	" "
GW Riedeman	Wah Chang Corp. Albany, Oregon	R. Graham	8/22- 8/23/61	Conference and inspection of Zircaloy tubing.
CH Shaw	Loewy Hydropress Philadelphia, Pa.	R. Strauss	8/9/61	Press modification.
	B&W Precision Products Detroit, Michigan	V. Whitzel	8/11/61	Extrusion tooling.
	Moczik Tool & Die Detroit, Michigan	C. DeBaigne	8/14/61	" "
	Ajax Steel & Forge Detroit, Michigan	E. Laing	8/15/61	Extrusion container-liner assemblies.

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PERSONNEL

Addition

<u>Name</u>	<u>Title</u>	<u>Reason</u>	<u>Date</u>
F. W. Knight	Sr. Engr., Proc. & Dev. Advance Fuel Engineering	New hire	8/29/61

Removal

R. G. Post	Sr. Engr., Proc. & Dev.	Temporary employee (Summer Professor Program)	8/31/61
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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, 1961, except as listed below. Such persons further advise that, for the period therein covered by this report, notebook records, if any, kept in the course of their work have been examined for possible inventions or discoveries.

"Application of Lubrication To And In Ultrasonic Welding",
E. V. Padgett

SIGNIFICANT REPORTS ISSUED

HW-56525 D Rev	W. H. Hodgson M. A. Clinton	"Design of Supplement A to PT-IP-183-A-98-FP, Evaluation of Projection Elements in K Process Tubes", August 24, 1961.
HW-65870 A Rev	W. H. Hodgson M. A. Clinton	"Design of PT-IP-344-A-FP, Evaluation of AlSi Bond Characteristics", July 10, 1961.
HW-64419 D	W. H. Hodgson M. A. Clinton	"Supplement A to Design of PT-IP-263-A-FP, Evaluation of Chemically Nicked Plated Fuel Elements", 8/30/61.
HW-69964 A	W. H. Hodgson M. A. Clinton	"Design of PT-IP-409-A-FP, Pilot Test of Self-Supported Fuel Elements in K Side Smoothbore Zirconium Process Tubes", 7/26/61.
HW-70363	W. A. Blanton W. H. Hodgson	"Fuel Performance Highlights Report, August 1961", August 30, 1961.

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SIGNIFICANT REPORTS ISSUED (Continued)

HW-70651	G. R. Hanson	"Investigation of Autoclave Failure No. 1961-10", August 28, 1961.
HW-70695	G. R. Hanson	"Closure Inspection of AlSi Bonded Fuel Elements Recommendations for Further Work", August 15, 1961.
HW-70821	G. L. Waldkoetter	"Ultrasonic Inspection of Uranium Billets to Predict Coextrusion Performance", August 22, 1961.
HW-70852	C. H. Shaw	"Coextrusion Process for N-Fuel Components and Evaluation of Product Properties vs Input Materials and Process Variables". (For presentation at the 14th Sheath Program Meeting, October 24-25, Savannah River.)
HW-70846	W. K. Alexander	"Brazed Closures for the NFR Fuel Elements". (For presentation at the 14th Sheath Program Meeting.)

ALSI PRODUCT ENGINEERING

Fuel Performance & Requirements

Two (2) natural uranium and three (3) enriched I&E fuel elements failed in the reactors during August. A summary of these ruptures is as follows:

<u>Fuel Element Type</u>	<u>Tube & Reactor</u>	<u>Exposure (MWD/T)</u>	<u>Rupture Classification</u>	<u>Failure Date</u>	<u>Canning Date</u>
I&E Natural	*1163 D	795	Hole	8-29-61	3-22-61
	2470 DR	768	**Unknown	8-31-61	3-24-61
I&E Enriched	*2476 H	663	Hole	8-7-61	3-9-61
	1363 KW	554	Side-	8-29-61	6-6-61
	1379 H	745	Hot-Spot Hole	8-30-61	12-14-60

*"Bumper" fuel.

** Not examined.

Fuel performance this period was adversely affected by an increased incidence of fuel quality oriented "hole" failures. One "bumper" fuel rupture in the E-N demonstration loading was the second in the same production lot. Although this lot was presumably discharged after the first rupture, the second rupture was sustained in a limited number of pieces remaining in the reactor, indicating the lot may have been abnormally rupture prone. Total ruptures sustained this month were four (4) more than experienced last month and three (3) less than in the same period last year. Severity of service is about twice that of a year ago.

Examination of the first of two previous natural alloyed dingot transverse core split ruptures in Radiometallurgy has not revealed the exact failure mechanism. Both transverse and longitudinal cracks originating at the core I. D. were observed, suggesting that at least part of the cracks resulted from water-uranium reaction. It is conceivable that small cracks on the inner core surface of sufficient size to create a serious stress riser may have contributed to the initial failure. Extremely small cracks have been observed near the center of solid ingot and dingot core blanks at the producer sites following beta heat treatment. However, these cracks are normally removed by the core drilling operation. Reducing the severity of the quench from the beta to alpha phase by either heat-treating the uranium in hollow blank form or quenching in oil rather than water is expected to alleviate the cracking problem. Evaluation of these techniques is in progress. Examination of the second transverse dingot rupture is continuing in an attempt to more precisely determine the rupture mechanism. Neither of the dingot bar numbers on the ruptured cores correspond with the dingot bar number on two recovered cores previously found with "mud-flat" transgranular surface cracks. In addition, the ruptured cores showed no evidence of this type of surface cracks.

No difficulty is currently anticipated in providing sufficient quantities of overbore fuel to expand the original 20-tube C reactor test facility to 62 tubes as scheduled, in spite of delays in uranium procurement. Twenty-one (21) additional tubes were installed and charged in the central zone of C reactor

this period, and the remainder are scheduled in September. Two central columns exposed to 770 and 828 MWD/T, respectively, and six fringe columns exposed between 615 and 776 MWD/T were discharged early this month and examined in C Basin. No hot spots or hot areas were observed on pieces from the central columns, however, two light to medium hot spot patterns and 40 (21%) hot areas were observed on pieces from the fringe columns. Projection rail height is being increased from 69 mils to 72 mils to more nearly center the fuel elements in the process tubes and minimize temperature unbalance contributing to these film patterns. Light surface bumping (≤ 10 mils) noted on 16 pieces and ellipticity of less than 20 mils on 28 pieces and less than 30 mils on 2 pieces correlates with the larger and less uniform grain size of the initial alpha extruded dingot cores received for this program. Average and maximum warp for all overbore pieces measured was 6 mils and 27 mils, respectively. Average tube filling capacity was 14 mils with maximums up to 36 mils. These measurements further confirmed a tendency of the pieces to become "barrel shaped" during irradiation. The dimensional stability of overbore fuel does not vary appreciably from regular I&E production at comparable goal exposures.

Analysis of quality certification data representing 10,800 fuel elements indicate average values for warp, tube filling capacity and fuel element center O. D. for the twelve month shipping period ending November, 1960, were: 4.8 mils, 10.6 mils and 3.8 mils, respectively. Dingot uranium is slightly less stable than ingot metal. Average values of warp, TFC and fuel element center O. D. for the equivalent shipping period were:

	<u>Ave. Warp</u>	<u>Ave. TFC</u>	<u>Ave. OD₂</u>
Ingot	5.8 mils	13.4 mils	5.3 mils
Dingot	6.7 mils	16.4 mils	7.7 mils
Percent increase dingot over ingot	15.5	22.3	45

Dingot uranium has consistently shown a tendency for greater diameter growth during irradiation.

Uranium Technology

Approximately 324 tons of additive dingot uranium were being irradiated and 694 tons had been discharged by mid-August. There were no dingot failures this month, but there was one internal failure in an ingot control lot. This makes a total of nine failures to date in the ingot control uranium and twelve in additive dingot uranium.

A surface tester to detect and reject "bad-flat" and other grossly cracked cores was installed on one UT-2 tester in mid-August and operated satisfactorily for the remainder of the month. Similar surface testers for the other testers are ready for installation in early September.

The canning of the vacuum-outgassed-after-heat-treatment test dingot cores is essentially complete. About 35,800 of the test cores and 21,500 control dingot cores vacuum-outgassed-before-heat-treatment have been canned. From canning results to date, the cores vacuum outgassed after heat treatment appear to have less braze porosity than the control dingot cores. The vacuum outgassing after heat treatment is done in hollow form and appears advantageous since; (1) it requires a shorter outgassing time, (2) the hydrogen absorbed during the salt bath heat treatment is removed, and (3) the outgassing temperature is in the stress anneal range and should anneal out the residual quench stresses. About 89, 45, and 54 tons of vacuum-outgassed-after-heat-treatment, vacuum-outgassed-before-heat-treatment, and regular virgin dingot cores, respectively, were canned this month.

To aid in controlling the grain size of cores, a minimum specification of iron plus silicon content of 100 ppm is being considered for all uranium cores. Out of 368 KIVN cores rejected at 0.3 minimum voltage by the UT-2 testers in early August, 86% were from ingots having less than 100 ppm of iron plus silicon. Grain sizes of A-1 are common in 500 Series enriched cores that are fabricated from ingots that did not have iron and silicon added to the remelt charge. With this minimum specification, it is expected that all uranium cores with a grain size less than A-3 can be rejected without experiencing a prohibitively high reject rate.

Approximately 22.6 tons of CVIN alpha extruded additive dingot cores for the overbore program were shipped to HAP0 this month. About two tons were fabricated from low hydrogen dingot metal and the remainder was from vacuum-outgassed-after-heat-treatment hollow core blank material.

Process Development

Seventy tubes of nickel plated fuel elements have been shipped to 105-DR for irradiation testing to approximately two times normal goal exposure under PT-IP-263-A-FP, Supplement A. Charging is scheduled for about September 7. Welding of aluminum water-mix spools to the male-end of the nickel plated fuel elements was accomplished without difficulty, and a yield of approximately 85%, with a high proportion of the rejects due to spool eccentricity. Strength testing of the impact shear strength of the spool-slug weld, caused several of the spools to be broken off by severely striking them on a concrete floor. It was of interest that none of the welds failed at the slug-weld interface, indicating that the chemically-deposited nickel-plate is a superior surface for weld adhesion (and possibly for other aluminum braze applications) compared to bare aluminum.

Canning of 500 fuel elements in nickel-plated aluminum components was carried out without incident; whether or not these will be suitable for irradiation testing has not yet been determined. Reject categories may be summarized as follows:

Assembly - 10%

External Bond - 10% (total count on acceptable pieces ranged 0-158 with average of <50).

External Penetration - 18% (including most of the external bond rejects)

Internal Bond - 20% (confined to one box of spires)

Approximately two-thirds of the fuel elements were rejected by the internal-penetration test; however, this may be a spurious result, since the penetration tester response is markedly influenced by nickel thickness, and the pattern on the scope indicated end-to-end penetration, which would be very unusual, based on preceding metallographic studies. A fifth reject category included 121 fuel elements with droplets of AlSi inside the spire, which would not permit passage of the test mandrel. The source of these is unknown at present.

Results of corrosion testing fuel elements canned in nickel-plated aluminum components continued to be highly encouraging, with no visible pitting or other accelerated corrosion after 91 days in 175 C 300 Area process water. To minimize the effect of corrosion product build-up, the water was changed eleven times. The fuel elements included eleven with electron-beam closure welds and five without closure welds, which have been in the test for 48 days.

Activities in the 304 Building chemical nickel-plating facility included a series of runs designed to firm-up data on effect of plating bath pH and plate deposition rate on plate adhesion, plus equipment modifications and additions. Plate adhesion data were not conclusive. Based on the bend test, adhesion was generally excellent; however, under the electrolytic hydrogen test, 50 to 100% of the surface of all as-plated samples blistered, with no discrimination based on the plating bath variables tested. Part of the trouble might have been caused by wide variations in bath composition, resulting from a serious leak in the plating tank, and subsequent inaccurate chemical additions. The plating tank was replaced with an ~50 gallon vessel, suitable for the plating of fuel elements. The down time was also utilized to install a 250 lb. capacity monorail hoist over the cleaning line and plating tank. An initial run employing a freshly made up plating bath, and both fresh make-up and aged pre-treatment solution, did not reveal any improvement in plate adhesion.

Plans include a re-run of the plating work described above with more frequent examination of samples during the electrolytic hydrogen test in an effort to obtain some discrimination. Normally, the samples have been tested for a 16 hour (over-night) period, with no intermittent examination.

One-hundred C-64 alloy aluminum cans and spires plated with low-phosphorous content (5-6 wt. %) chemically deposited nickel have been obtained from the General American Transportation Research and Testing Laboratory. Preliminary visual examination and bend testing indicates the plate is satisfactory, and that the plate ductility is markedly increased, compared to the normal 8-10 wt. % phosphorous material. Planned testing includes adhesion, ductility, phosphorous content, and behavior in the canning cycle.

Developments in producing a corrosion-resistant chromic acid autoclave film on X-8001 aluminum included evaluation of films produced in 1 wt. % chromic

acid preceded by steam autoclaving, water autoclaving, and no autoclaving. Accelerated corrosion tests in both acid and alkaline media indicated water autoclaving was the superior pre-treatment; in addition it was discovered that the coupon containment vessel material may have a major effect on film adhesion, since severe spalling of the film occurred in going from a stainless steel to an aluminum container. Further tests are planned to determine the optimum time and temperature for the water autoclaving--chromic acid autoclaving cycle in a stainless steel container.

The Sylicor Division of Sylvania Electric Products has a contract to produce 1000 HAPC CV-size, diffusion-bonded fuel elements, prepared by the Sylicor hot-die process. The hot-pressing of these fuel elements was initiated during August and the completion of the pilot run is expected during early September. Sylicor anticipates shipping of the completed fuel assemblies to HAPC by September 15, 1961. The evaluation of these fuel elements will begin during late September.

The HAPC hot-pressing facility was placed in operation during late May. Difficulties with the equipment caused delays of approximately two months in starting the pilot production. Most of the operating problems were solved by July 25 and routine production was initiated. During the month of August 348 fuel elements were assembled. A very limited amount of quality control work indicates that these fuel elements are of very high quality relative to an AlSi brazed fuel element. Bond strengths of 20-25,000 psi are obtained as compared with 10-12,000 psi for AlSi bonds. The process in general works very well and little difficulty has been experienced in the routine operation of the process.

During May, 1961, 160 fuel assemblies were shipped to Savannah River Laboratory for fluid pressure bonding. These fuel elements were to be bonded on various cycles to determine a satisfactory cycle for bonding pilot quantities of fuel elements. Approximately fifty assemblies were bonded during the early part of June. The gas compressor failed at this time and several attempts have been made to repair it. The last start-up was attempted on August 24 and again the compressor failed. The cause of this latest failure, or the time required to effect repairs, has not been determined.

Procurement of components and uranium for hot die sizing development work at HAPC has been initiated. A proposed program of development at Savannah River for HAPC size fuel elements has been deferred because of technical problems encountered at Savannah River in obtaining high bond strengths.

Process Technology

Yields in the order of 70 per cent are currently being achieved in the preparation of overbore fuel, which represents about a 15-20 per cent improvement over earlier experience. Major reject categories are marred surfaces, off cycle, and closure, and rail weld; each ranging from 4 to 5 per cent. Further refinement of processing and handling techniques should reduce these rejects. A total of 732 overbore (CVIN) fuel elements was canned in the pilot plant during August.

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The pieces are being finished and measured to complete the charging of the expanded C Reactor test facility as scheduled in September.

Tests are being run in the ALSi Pilot Plant to further optimize the canning process for both enriched and natural I&E fuel production. Use of lead plugs in the cores to accelerate core preheat and improve the characteristics of the internal compound layer is being evaluated in conjunction with these studies.

Conversion to a pressurized fuel assembly quench was completed on all canning lines during the first week of August. Experience thus far indicates the average external total bond count has been reduced from 5 to 2 counts and external bond rejects have been reduced from 1% to about 0.4%. In addition, base and braze voids have been reduced about 50%. Effects on internal total bond count cannot be accurately measured until more reliable equipment is available.

Process Specifications (HW-47029) were revised as follows:

- (1) Marred surface limits for ALSi bond fuel were revised to permit stamping canning line identification on the cylindrical surface of the fuel element base up to 230 mils above the base end.
- (2) Specifications were added for the assembly of solid lithium-aluminum alloy target elements, Model NIC, for evaluation in the N Reactor control rods.

Approximately 36,500 bumper fuel elements were produced on the 306 prototypical ultrasonic welder, 87 per cent were OIIIE and 13 per cent OIIIN bumper fuel elements. The yield through the inspection station was 88.2 per cent. The over-all monthly yield was 96.7 per cent compared to 94.5 per cent for July and 93.6 per cent for June. Eight per cent (8%) of the fuel elements required rewelding and about 2 per cent were rejected for mechanical malfunction and rail tab deformation.

An operating technique has been developed and demonstrated to allow operation of the 306 ultrasonic welder during the morning warm-up period without causing rewelds or smashed railwelds. The technique involves manual time and frequency adjustments.

The two ultrasonic production welders in the 313 manufacturing facility have been put into limited service on both OIIIN and OIIIE bumper fuel elements. About 6800 elements were welded with a yield of 81.9 per cent. Alignment of the fuel element and the rails has been a serious problem. Six per cent (6%) of the elements have been rejected for this cause.

The 313 facility soap tank has presented a major problem to ultrasonic welding of production elements. The steam sparge heating system was replaced by an enclosed system. Soaped elements still proved unsatisfactory. The soap tank is presently operating correctly after the system was completely cleaned of all foreign substances.

Dies have been fabricated to produce elliptical solid bumper projection rails. The Production Test fuel elements with this type of rail are scheduled to be fabricated by late September. Reactor evaluation is not expected until the end of the year.

A core-bore plug press has been designed to punch lead plugs from strip and insert them into both ends of the bare uranium core simultaneously. A prototype has been built and modifications will be complete in time for testing on the CVI run scheduled for September 12.

Single jack canning has been installed in the Pilot Plant and is being used for all CVI material. It will be used for other sizes as cycles are established and approved. Conversion from single to double jack equipment or vice-versa can be made in about one hour.

During the course of previous work with direct-current welding of Al-Si bonded fuel elements, it was noted that current ripple had an effect on weld quality. Several tests involving nearly 2000 fuel elements were conducted to determine the areas in which weld quality would be affected by current ripple. It was found that, as the ripple was increased from one to 43 per cent, weld cracking increased by 60 per cent. It is believed that the increase in cracking resulted from temperature fluctuations within the weld due to the pulsating d-c current. A 16 per cent improvement in braze mixing was found as the ripple was increased and this was attributed to increased agitation with the high-ripple current. Current ripple had no apparent effect on the elimination of braze voids. Undesirable ripple marks were produced in the weld surface from current containing more than 20 per cent of ripple. Based on these preliminary findings, it appears that, for the 360-cycle current ripple, the welding current should contain no more than five per cent of ripple for best performance in welding AlSi bonded fuel elements.

A number of production welding problems were encountered during the month. Burn-out of the wire-drive motor for the water-mixer welding machine caused a temporary shut-down of the machine. Replacement of the defective parts, however, returned the machine to normal operation. Destructive evaluation of a number of welds from I&E lithium elements revealed that oxide spikes existed in the welds. Several welds were found in which a small void existed at the peak of the spike. The problem was temporarily resolved by lowering the welding turntable speed. An examination was made of a fully automatic welding machine which was not locating fuel elements properly. It was found that the alignment of the inserter cylinder and the condition of the nylon piece which contacts the fuel element were contributing to mislocation of elements. The condition was corrected by proper alignment of the air cylinder and by replacing the nylon contact.

AlSi Pilot Plant Activities

A total of 3194 fuel elements were canned in the pilot plant this month, of which 1125 were for reactor use.

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PILOT PLANT PRODUCTION SUMMARY
AUGUST 1961

<u>Pieces</u>	<u>Type</u>	<u>Purpose</u>
613	CVIN	PT# IP-381-A-FP
1389	OIIIIN	Weld Studies
512	ONP	Weld Development
304	OIIIE	Optimization of fabrication cycles for I&E enriched.
376	CVIN	(1) Physics testing (2) Test single jack canning equipment

Total Pieces Canned 3194
Pieces for Reactor Use 1125

COEXTRUDED PRODUCT ENGINEERING

N-Reactor Fuel Development

KER Loop Testing

The NPR inner tube fuel elements in Loop 1 are operating satisfactorily. Five NIE-1 elements are at an exposure of 1470 MWD/T and two NIE-1 elements are at 465 MWD/T. Five 23-inch NPR inner fuel elements were discharged from Loop 2 early in the month at an exposure of 2100 MWD/T. The discharge was due to loop coolant difficulties. Visual examination in the viewing basin indicates the fuel elements operated satisfactorily with no signs of any defects.

The suspect rupture fuel element (NIE design) discharged from Loop 4 in April because of loop activity has been tested in the IRP facility for twenty hours and no indication of failure was noted. The next step is to examine the fuel element in Radiometallurgy for any visual indication of defects.

Pre-Irradiation Evaluation of KSE-3 Loop Charge

The KSE-3 fuel elements discharged from Loop 3 during April, after 3600 MWD/T exposure, showed gross bumping of the inner clad. Pre-irradiation data are being examined for explanation of this effect.

Possible causes of the bumping are:

- a) non-uniform inner clad
- b) clusters of large grains
- c) undesirable preferred orientation, either,
 - (1) oriented zones of large grains, or
 - (2) a tendency for growth, i.e. a contraction of the uranium in the circumferential direction by $GI_c = \text{negative}$.

The results of the study are summarized below:

- A. Uniformity of Inner Clad - The nondestructive tester traces of the inner clad show some sharp changes in clad thickness. The magnitude of the change is not gross, but the rate of change is very sharp.
- B. Grain Clusters - The grain size varies over wide limits. It is generally noted that there is some clustering in the coarser grained samples.
- C. Preferred Orientation - Growth indices (GI) are available for longitudinal, circumferential and radial directions. No unbalance that would lead to growth was noted. However, when

important crystallographic directions are examined, certain textures are noted that could lead to contraction in a circumferential direction.

In summary, it is possible that cumulative effects of inner clad thickness variability, grain clusters and preferred orientation might lead to the bumping that was found. It is stressed that these are only stated as possibilities, not conclusions.

Coextruded I&E² Program

The initial two monitor tubes of I&E fuel elements have been discharged at goal exposure of 680 MWD/T. Visual examination in the "C" basin indicates the fuel elements operated satisfactorily. Six additional tubes have been charged and an additional 10 to 12 tubes are presently in process.

Materials Development and Procurement

Uranium Billets

The amount of primary reduction of the uranium ingot by alpha extrusion has proven to be a key factor influencing clad uniformity during coextrusion. The reduction ratios currently in use are below those used commercially and very little is known about the structural behavior of metals extruded under these conditions. In order to provide some insight into the metal flow characteristics and their effect upon the coextruded fuels, a series of experiments have been planned. These experiments should yield empirical data leading to selection of optimum casting size, optimum extrusion tool design and proper reduction ratios for each coextrusion billet geometry.

Special uranium metal has been ordered from NLO for the first of these experiments.

Zircaloy Fuel Supports

New designs for the inner tube supports were obtained from NLO and IPD and the outstanding fabrication orders have been converted to the new design. A complete new set of tools are required and the vendor will commence tool fabrication as soon as the purchase order has been altered. An estimated two weeks will be required to complete the tools. Fabrication should not require more than one week to complete after proof parts have been accepted.

Designs for locking clips are not available, the purchase orders have been held up pending new drawings. First shipment of the new locking clips will require approximately six weeks tooling, debugging and production time from receipt of approved designs.

Copper Sleeves

A new fabrication process for producing outer copper sleeves is just about developed. Copper suppliers are not able to supply large diameter copper tubing with as thin wall as needed for the process. The only process found acceptable so far is to roll and weld copper sheet into tubing. To broaden our supply base, another supplier was located who was able to make precision extrusions in our required sizes but had never done so in the copper alloys we specify. Currently, this vendor's tooling is complete and proof parts should be available in approximately one week. Product prices are compatible with rolling and welding.

Zircaloy End Caps

The first shipment of several thousand of each inner tube and outer tube end caps is due immediately. The vendor's tooling and inspection techniques were proven several weeks ago, and last week, all sample parts passed corrosion test. Parts were shipped early this week.

Extrusion Process

Extrusions

The following extrusions were made during the month:

9.6 Inch Tooling

One zircaloy extrusion (Bare) #112 - 3-3/8" rod for IPD
One copper extrusion for liner break-in

7.6 Inch Tooling

Three composite billets - T-241, 242, and 243

T-241, 242 & 243 NON

One zircaloy billet - Zr-113

Zr-113 Bare to 5" OD

6.0 Inch Tooling

Eleven composite billets - T-244 thru T-254

T-244 thru 249, & 254	KIE ²
T-253	KIN
T-250	NIN
T-251	NIE
T-252	NIN (for clad standards)

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5.0 Inch Tooling

One zircaloy billet - Zr-114

Zr-114

Thin wall shroud tube-stalled

4 0 Inch Tooling

Eight uranium billets - Ur-70 thru Ur-78

Tubing to evaluate low temperature extrusion constants

Uranium Extrusions

Initial development work on extrusion of bare uranium tubing at approximately 12 to 1 reduction was carried out to determine extrusion constants.

Eight copper clad test billets were extruded to determine the lower temperature range at which satisfactory extrusions could be made. It was found that satisfactory extrusions could be made down to approximately 650 F. At this point tool stress limitations prevented further reductions in temperature.

Surface Dimpling

Several inner tube extrusions (#1005 thru #1009), extruded for 333 Building startup, had severe dimpling of the OD cladding. The cause for this dimpling is not yet known. From past experience, dimpling of this nature has been caused by lubrication techniques or copper inclusions. The dimpling patterns existing on these tubes indicate that the most probable cause is copper inclusions. The particular batch of copper used for the above extrusions is now being examined. No problems of this nature have occurred on material extruded in silicon/copper cans.

Tube Cutting

Several tests were run on the abrasive cutoff saw to evaluate various trial blades furnished by the vendor. These tests showed that with the best performing blade furnished, satisfactory cuts could be made in 43 seconds on the outer tube.

The results of the above tests were given to Manufacturing with recommendations as to the type of blade to purchase and the optimum operating conditions for usage.

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Billet Assembly - Copper Welding

Significant progress has been made on the welding of the coextrusion copper can to assure that welds do not leak during preheat and handling prior to extrusion. The improvement has primarily been the result of modifications in the weld design and techniques used. These are:

1. The end plate to can joint design has been changed from a straight joint to a V-notch joint.
2. The welding speed and current have been reduced significantly.
3. Better fitup of the end plate, and reduced tolerances on the end plate groove thickness resulted in better equalization on both sides of the weld and hence greater uniformity.

At the present time, the use of silicon:copper appears to give welds least likely to show signs of breakage on the billet loader immediately prior to extrusion. The front inner welds have been in tact at the front of the coextruded tube. At the present time, the silicon:copper is specified for production.

Improvements have been made on the welding of DHP copper and some DLF copper is being procured to determine whether it will be of improved weldability. Another modification being tried is to reduce the front end plate to 1/4 inch.

The copper can welding process and equipment is now practically ready for production. There are two items on the welding fixture being used by Manufacturing that require modification, namely, the speed control of the positioner turntable is at the present a two-button, high and low control. This will be changed to a hand rheostat, and by doing so the operator will have a more convenient and definite speed control. The second modification is on the welding head left-to-right control arm which is at present giving a very stiff and jerky action; a finer gear movement is to be installed. Billet holding fixtures have, and are, being made for centering the billet on the positioner and all indications show that these holding fixtures are satisfactorily rotating the billet about its axis.

Chemical Processing

Copper Removal

Experiments to determine the completeness of copper removal by the copper strip solution and zircaloy stick solution have been completed. Preliminary results indicate:

1. Copper is not completely removed by the standard copper strip solution,
2. Copper is reduced to the original zircaloy concentrations 1.5%, the diffusion layer is removed, by removal of a total of 0.5 mils of zircaloy,

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3. Applying an anodic electrolytic potential to the work in the copper strip removes nearly all of the copper contamination, and
4. No appreciable removal of copper in a second, fresh, copper strip solution was observed.

A formal report on the copper diffusion and contamination will be issued shortly. A procedure for evaluating minute surface copper contamination on zircaloy is being currently developed.

A laboratory investigation is being made on electrolytic methods of copper recovery for the copper removal solution. The objective of this work is to remove copper from the dissolver solution in a form which would be commercially salable. The large volume of nitric acid required for the present process would be greatly reduced.

Chemical Milling

Samples of chemical milling solutions are being evaluated by Chemical Research personnel, HLO, to determine whether solvent extraction techniques could be used for in-process removal of uranium from chemical milling solution. Uniformity of solution composition would be much improved if uranium build-up could be controlled by this means. Also, substantial savings in sulphuric acid and copper sulphate would be possible as the solution depletion rate is a function of excess uranium content. The amount of material processed through a solution could possibly be extended to four or five times, or more, than presently possible.

Copper Component Preparation

Etching of Everdur copper components in nitric acid has not produced satisfactory results in the 333 Building equipment. This has been due to the length of transfer time required by hoist transfer of cleaning baskets. When copper components are processed individually by hand using support hooks, the transfer time is quick enough to produce bright cleaning surfaces. Process specifications have been revised to permit the use of a commercial copper brightener in lieu of, or in addition, to nitric acid.

End Closure Brazing

Because of the production plant startup, very few fuel elements were brazed in the pilot plant.

One of the three brazing stations in 333 Building was put in operation and about 75 pieces each of outer and inner tubing were brazed. Results appear good although only limited evaluation has been made. Minor equipment problems still exist. Some of the controls are rather awkward and may have to be relocated for maximum ease of operation.

Warp Studies

Warp During Heat Treating of N-inner Fuels

The current explanation of the occurrence of V_1 at 225 degrees (i. e. warping takes places in the direction of 225 degrees clockwise from the top of the die as viewed from the extrusion press runout table), is by reason that this direction is that of heat flow from the billet during transfer from the soaking furnace to the liner. In standard process material, the billet loses heat by line contact at:

1. 285 degrees and 225 degrees when the billet loader is in the "out" position,
2. 225 degrees and 135 degrees when the loader is in the "in" position,
3. 180 degrees when the billet rests in the liner prior to upset.

An extrusion experiment has been run wherein billets have been delayed three minutes in both the "out" and "in" loader positions and the "out" plus 85 degrees clockwise rotation of the billet prior to upset. These billets have yielded fuel pieces that have not resulted in V_1 occurring at new predicted angles. In every case, the new angle has been 120 degrees away from the predicted position. The original hypothesis of warp being caused by temperature gradients which give variable preferred orientation in the tube must be modified.

Straightening of N-inner Fuels in the Beta Phase Temperature

Previous work has shown that an as-coextruded fuel tube section will warp more than an as-beta- heat-treated fuel when both are heated (or cooled) through 20-300 C. On this basis, it was predicted that if a fuel section was straight at 730 C, it would have less warp at room temperature than otherwise.

A controlled experiment on the product of two coextrusions incorporated:

1. half the material being heat treated by standard methods of salt bath heating and quench;
2. half the material being heated in an argon-purged muffle furnace and quenched in a 3-roll straightener (three power driven cylindrical rolls with parallel axes).

Difficulties were encountered in centering the roll-straightened pieces in the rolls so that the end caps would be unrestrained. Each piece that was successfully charged to the rolls was found to be within warp specification (8 lengths). Six pieces that were collared were all out of specification. Thus, the yield from the beta straightening was 8 out of 14 pieces.

No conclusions can be drawn on the merits of the test because 8 out of 14 pieces were acceptable from the salt bath control lot. The test will be repeated.

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Abrasive Blasting

Work has commenced on the installation of the vacu-blast unit in the 306 Building. Tests with the vacu-blast units located in the 333 Building have shown that the reliability of the machine depends on the amount of abrasive charged to the machine. Further, it has been learned that abrasive must be added to the machine periodically to compensate for abrasive losses. The losses include (1) broken-down abrasive lost through the cyclone separator, (2) abrasive remaining on pieces after blasting, and (3) abrasive loss through machine leaks.

Support Attachment

The mechanism for support attachment in 333 Building has been completed in Technical Shops. Installation can proceed upon receipt of some air cylinders which are expected to arrive early in September.

Pressure Bonding

Four each NOT and NIT tube sections with chemically milled uranium and flat closure rings (Lot #3) have been autoclaved and shipped to Hanford from BMI on 8/25/61.

Tensile test specimens of the uranium:zircaloy bond produced on the second lot of material processed by BMI have been pulled. The material tested covers as-bonded, as-bonded plus one beta heat treatment, and as-bonded plus two beta heat treatments. There is about a plus or minus 30 per cent spread between the mean and extremes of the as-bonded (mean 68,000 psi) and as-bonded plus one beta heat treatment (mean 64,000 psi), with the two extremes being well separated from the main grouping. There is about a plus or minus 20 per cent spread between the mean (78,000 psi) and extremes of the as-bonded plus two beta heat treatments with the two extremes being well separated from the main groupings. No significant difference can be seen in the fractured surfaces of any of the specimens.

Four each NOT and NIT, five inches long with cladding unbonded areas have been assembled and were shipped to BMI on 8/25/61. These are for non-destructive bond test standards. They were assembled from tubing components. No significant problems were encountered with the cathodic etching. Problems of assembly developed from the high friction of the etched surfaces sliding together, but all assemblies were completed.

TESTING METHODS ENGINEERINGProcess Fuel Element TestingBond-Penetration Testers

The several minor modifications made to equipment and operating procedures have collectively made a marked improvement in the operating efficiency of the UE-1 stations. The downtime charged to the stations during the middle two weeks of August was an average of eighteen hours per day compared to thirty-four hours per day during the first two weeks of June (the time that the Task Force originated). Of particular note is the improvement in the external bondtester which had an average daily downtime of one and one-half hours during the August period compared to eleven hours in the June period.

The variations amongst testers is also being kept under better control. Periodic checks of each instruments' rejection rate are made to more quickly reveal abnormal tester operation and bring it back to normal.

Fuel Core Tester

A surface tester, modified for detecting quench cracks, has been giving satisfactory results for the past several weeks while undergoing evaluation on a production line UT-2 station. Some downtime has been caused by transducers being knocked out of alignment due to jamming of the cores. Also, there has been some difficulty experienced in the testing of recovered material. The surface condition of this material gives rise to defect indications which are difficult to distinguish from actual quench crack indications.

The surface tester is currently being placed in operation on two additional stations. The remaining station will be similarly equipped immediately thereafter. The most significant equipment modification required by this test is a water jet to clean the core of minute air bubbles.

Downtime charged to the UT-2 stations has been reduced from an average of six and eight-tenths hours per day during the first two weeks of June to four and four-tenths hours per day during the middle two weeks of August. The average daily downtime for the entire month of August is three and five-tenths hours.

U Fuel Testing

Both UE2-B stations have been made operational. No difficulties are anticipated in their performance. One UT-9 station has been made operational; the other station has been debugged and installed. Fabricated defects have been easily detected; the performance capabilities of the testers, however, will not be established until new standards are available.

Experimental data indicates that an RF shielded room should not be necessary although a simple draped copper screen may be required.

The grain size test for N fuel tubes has been discontinued. Reasons for this are: (1) The test has not been found to be useful as an indication of transformation. (2) The grain structure is such that ultrasound attenuation is severe and poor signals are obtained when testing material with grain sizes much smaller than the grain size thought to be near the upper limit.

The grain size testers were converted to second uranium integrity testers giving better coverage of the regions nearer to the outer and inner surfaces in addition to some overlap.

AlSi Fuel Closure Tester

The UT-4 unit scheduled for 306 operation is about ninety-five percent fabricated. All instrument fabrication is complete. A design change has necessitated a delay in the completion of the mechanical system. It is expected that debugging and evaluation of the station will be seventy-five percent completed during September.

The UT-4 project is proceeding on schedule. The control panel fabrication job was given to J.A. Jones Company.

New Test Development and Special Tests

N Fuel Cap Thickness Measurement

The feasibility of this test was demonstrated with good results at both 1 KC and 4 KC. Accuracy limits will be determined after more standards are received. A prototype tester (ET-6) was designed and built in the laboratory. This design will be kept current with requirements to insure a basis for a 306 Building pilot model.

NPR Projection Weld Uranium Penetration

A recent failure of an NPR fuel in autoclave testing was probably started in the region of one of the projections. Uranium penetration under the weld spot is a possible cause. Autoradiographing will be performed on a number of pieces with different welder settings to determine if penetration can be detected.

Crystal Beam Patterns

A study is continuing on determining parameters of Bondtest crystals which adversely affect testing. It has been found that poor performance can be identified with (a) multiple lobe beam patterns, (b) reduced sensitivity and (c) a poorly aimed crystal; only three-tenths degree tilt caused a substantial signal reduction. Other areas are to be investigated.

Ultrasonic Agitation during Quench of AlSi Fuels

A twelve-hundred watt ultrasonic cleaner has been modified for addition to a quench tank. It is hoped this instrument will improve AlSi bonding.

Lamb Wave Testing

In the past, it has been observed that certain Lamb wave modes in a water loaded plate are attenuated more rapidly with distance than are others. The question arose as to whether this selective attenuation was due primarily to interaction between the water and the surface particles of the plate, or was due to some interaction between particles within the test piece itself. Experiments conducted this month with .030 inch aluminum plates indicate that water loading is the primary contributor to this attenuation effect. Selective attenuation was observed in unloaded plates also, but this effect was orders of magnitude less than that related to surface loading conditions.

Another study was conducted to determine the sensitivity of Lamb waves to non-wet and brittle-bond defects. Several void, non-wet, and brittle-bond fuel element samples were scanned using various Lamb wave modes at ten megacycles. Although large, distinct signals were obtained from void areas, only the largest non-wet areas were detectable. Further studies will be conducted to determine the optimum conditions under which these defects can be detected using Lamb waves.

S. M. Gile
for Manager, Engineering

LH McEwen:dl

FINANCIAL OPERATIONAUGUST, 1961

An initial FY 1962 Financial Plan was issued August 21, 1961, with Fuels Preparation Department allocated \$13,670,000, the amount of the Target Budget submission. Breakdown by end function follows:

ALSi Production	\$10 191 000
Coextrusion Production	3 102 000
Startup	<u>377 000</u>
Total	<u>\$13 670 000</u>

Work is proceeding on a breakdown of the Target Budget by subsection

HAP0 and Savannah River production and cost comparisons were prepared for Fourth Quarter and Fiscal Year 1961. Comparisons were classified in two parts: fuel fabrication cost (\$/lb.), and total plant activities on a cost-per-gram basis. Details of these comparisons are included in HW-68247, dated August 25, 1961.

In order to better acquaint management with specific items comprising indirect Manufacturing expense, a summary covering the first six months of CY 1961 was developed. Identification of specific areas should materially assist the cost improvement. Details of production costs were provided Engineering Section for the same reasons.

Unit cost estimates for fuels produced in the 306 Facility were prepared for Engineering in order that comparisons could be made with 313 Building production.

A complete review of procedures relative to the Department work order system was made during the month. Results of the review are currently being studied to determine what steps can be streamlined or eliminated and how required services in this area can be provided at lower cost.

Review of the FY 1962 General Plant Project fund requirements was completed. Expenditures including miscellaneous capital work orders, are anticipated to exceed \$400,000. Work planned includes a High Pressure Autoclave Facility and additions to the steam distribution system with expenditures during the year of \$112,000 and \$167,000 respectively. In addition, requirements for miscellaneous capital work order jobs amount to \$160,000.

The Department's Equipment Financial Plan for FY 1962 has been established at \$2.1 million. Section requirements are summarized below:

(Amounts in Thousands)

Manufacturing	\$1 187
Engineering	701
Plant Facilities	<u>212</u>
Total	<u>\$2 100</u>

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HW-70920

Two spot audits of uninstalled property records and procedures were conducted during the month. A letter recommending changes in procedure to correct minor discrepancies was sent to each custodian. No serious discrepancies were revealed during the audits.

Travel cost for August was \$10,066 and represented 102 days in travel status. This included \$6,500 for the movement of household goods of new employees. Thus far in FY 1962 \$11,500 has been expended for movement of personnel compared to \$12,900 during entire FY 1961. It is expected that this rate of expenditure will decline as staffing requirements of the Engineering and Manufacturing Sections have now been substantially met.

During August, 24 HAPO-wide Organization and Policy guides were reviewed and issued. The majority of these contained revisions of a minor nature or reflected provisions of previously published benefit plans, etc. At present five additional guides are undergoing review and will be ready for issue in a week. The FPD numerical index is being updated and will be issued in early September. OPG 55.8 on use of personal cars for Company business is being revised to reflect the standard \$.06 per mile allowance where use is for the convenience of the employee.

The Department's Cost Improvement Program is moving along steadily with 100% of CY 1961 goal realized at the close of the month. One indicator of the effectiveness of the program is the fact that this is the first summer there has not been a significant decrease in suggestion submissions. Additional means of obtaining increased results from the program are currently under study.

Manufacturing Section procedures study is progressing satisfactorily. For the present work is being concentrated in the area of production scheduling and control and accounting for essential materials.

Study of essential materials costing was commenced during August, 1961, and is currently about 50% complete. Purpose of the study is to review the adequacy and accuracy of current methods and to explore possible alternatives. Report of findings will be issued in September.

Manager - Finance

WS Roemmh

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FW-70320

PLANT FACILITIES OPERATION

AUGUST 1961

I. RESPONSIBILITY CHANGES

There were no changes in responsibilities during the month.

II. ACHIEVEMENTS

A. Statistics

1. Duplicating

<u>Process</u>	<u>No. of Impressions</u>
Multilith	657,416
Verifax	9,636
Ozalid	7,604

2. Utilities

	<u>August</u>	<u>July</u>
Average steam generated (M lbs/hr)	36	38
Maximum steam generated (M lbs/hr)	45	48
Total steam generated (M lbs)	26,700	28,082
Coal consumed (tons)	1,295.40	1,352.02
Evaporation rate (steam/#coal)	10.30	10.38
Efficiency - Actual	63.5	62.3
Efficiency - Theoretical	67.5	67.1
No. of Boilers on	2	
Date of Change	0	
Sanitary water from 3000 Area (M Gals.)	168.37	156.15
Total water from 3000 Area (Avg. Rate GPM)	3,772	3,498
Total water from #3 and #4 Wells (M Gals.)	18.42	12.14
Total water from #2 Well (M Gals.)	.30	.30
Peak water consumption for 24 hrs. (M Gals.)	5.9	5.7

The peak water consumption of 5.9 million gallons for a twenty-four hour period exceeds the previous high of 5.7, which was experienced last month. The increase was due to the increased operation of the PRTR.

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B. Operating Experience

On August 14, 1961 there was a total power outage in 30C Area for approximately thirty seconds. All under-voltage sensing equipment in the 384 Building functioned and triggered the turbine main steam valve, which failed to open due to a mechanical fault. It was necessary for the operator to start the steam valve manually. The emergency generator came on and picked up the load in approximately thirty seconds after the power failure. Investigation of the automatic steam valve led to a revised design for supporting the tripping mechanism on the trip valve. Contacts have been made with the factory representative to visit the plant and discuss this problem regarding failure of the valve to operate. It is the general opinion that the outage was caused by lightning damage.

There was a partial outage on August 15, 1961 caused by construction forces accidentally opening a switch in the sub-station. There was no power loss at the 384 Building and normal power was restored to the Laboratory Area Buildings within twenty-three minutes. The 328 Building was down during this period due to no emergency power in the building.

The coal feeders for the No. 4 Boiler are badly in need of overhaul. As soon as this unit can be removed from service, it is planned to accomplish the required work.

A low import sanitary water pressure was experienced for a short time on the afternoon of August 25, 1961, which was caused by the City of Richland using too high a rate of flow while filling the million gallon reservoir at the 3000 Area.

The No. 5 air compressor at the 384 Building was in service for most of the month and has performed well. Several adjustments remain to be made on the control panel and pressure switches. This unit will have to be removed from service for a few days when the revised air intake manifold is ready for installation.

The ash sluice transport line from the 384 Building failed on August 25, 1961. Large quantities of water "boiled" out of the ground in the vicinity of the north side of the 3718 Building. Excavation of the existing 8" cast iron line revealed that scouring action had worn the pipe to the point of rupture. Several sections of pipe were replaced and all but one length of the newly installed discharge end of the line were removed to reduce back pressures and prevent further rupturing of the

worn line until a new line can be installed. Approximately 550 feet of line must be replaced and study is under way to determine the method and class of material to be used in the replacement. This line must be replaced before the start of the approaching heating season.

A prototype BF_3 was built for the Calibration Operation of HLC and is now undergoing evaluation in the field. An exceptionally high number of portable instruments were repaired during the month of August.

Considerable time has been required to repair damaged pallets in the 313 Building. The need for pallets will be heavy through November.

The submerged combustion propane burner unit for the T-7 tank in the 321 Building has been reinstalled. Modifications required revising all the piping system and extending to the burner head. The Roto-blower used in connection with this combustion unit was repaired and reinstalled. The equipment was started up for a short period and operated satisfactorily except for a few minor adjustments, which are currently in process.

C. Equipment Experience

Frequent short reactor outages were experienced during the month at PRTR. Primary causes for the downtime were excessive D_2O losses, plugged chemical addition lines, and inadequate control of pressurized level and pressure. Earlier in the month a coffee can was found in the primary system. It is not specifically known how or when this may have occurred. Bits of the coffee can were found in the major share of the inlet jumpers to the process tubes having unexplained flow characteristics. The bulk of the can was picked up when the lower ring header was temporarily removed from service and back flushed.

Three separate electrical power failures were experienced during the month, requiring the operation of the emergency diesel generator. The generator and all electrical circuit switching performed as programmed. Some damage occurred to the fuel transfer mechanism when two cables broke. In order to make necessary repairs, and at the same time investigate the cause of the trouble experienced with this unit, a stop gate will be installed and the transfer pit in the storage basin will be pumped out.

Principal jobs completed were:

1. Both phosphate and sulfite chemical addition lines were unplugged and flushed on several occasions. Plugging usually occurred at the screens, pump ball check valves or orifices at entrance to the deaerator.
2. Check valves and diaphragms were replaced on both the high pressure and low pressure helium compressors. The diaphragms on the low pressure compressors had failed after about 400 hours of running time. Those on the high pressure compressors were replaced as a precautionary measure and are being given a die-penetrant test to help improve failure predictions.
3. The thermal barrier seal was replaced with one constructed of higher quality material for better service.
4. The stem, plug and seat were replaced in the E-9 valve. The gold seat was badly damaged due to severe hammering of the valve, which occurred when operations inadvertently opened the wrong valve. This valve is in a 4" line and required freezing of the line to affect repair.
5. Several helium valves were overhauled and repaired.
6. The motor bearings on Moderation Pump #3 failed and were replaced. One of the bearings "galled" on the shaft and had to be cut off and the shaft remetalized.
7. Mechanical work was completed on the manipulator and viewer in the fuel examination facility. Electrical work remains to be done with design tests to follow.

Scale formation in the Barnstead still in the 325 Building was heavy during the period of feeding raw water. All feed water to the still is now demineralized. This unit should be cleaned of scale before being returned to service. An investigation of the No. 2 exhaust fan motor revealed loose motor connection leads, which were the apparent cause of tripping out the overloads. These evidently were left this way by construction when they installed the new motors. An instrument control system was set up for corrosive studies and an analyzer-detector selector was fabricated and installed in the counting room.

Water flooded the glass shop in the 328 Building when the outside temperature became low enough to stop the shop fan. It was suggested that installation of a solenoid valve on the rear spray bank connected electrically to the motor would shut off the water whenever the shop fan stopped.

All 300 Area time clocks were converted from continental time to standard time on August 28, 1961.

A twenty second camera timer was fabricated and installed on camera equipment to be used in photographing the "C" reactor rebore job.

Overhaul of the coal bucket elevator at the 384 Building is complete and new wheels have been installed on the reciprocating feeder. Further work remains to be performed on the feeder unit.

D. Inventions and Improved Methods

All personnel in the Operation engaged in work which might lead to inventions and/or discoveries advised that, to the best of their knowledge, none were made in the course of their work during the month of August 1961.

E. Costs and Savings

Annual savings of \$45,720 were achieved during the month through one suggestion and two cost improvement items -- training on multi-channel analyzers on-site, and sand removal equipment. The total for CY-1961 now stands at \$85,154 or 73.5 per cent of goal. Proposed changes to the Hanford Standard, AC-5-40, "Identification Markers for Buried Radioactive Material," should result in savings of 50% over the present requirements. In FPD there are potential savings of approximately \$6,000.

F. Status of Projects and Major Jobs

Compressed Air Expansion, 384 Building - Project CAF-894 -
The AEC has agreed to issue a work order to J. A. Jones to cover the cost of modifying the intake air filter system for the new compressor. In order to stay within available project funds it was necessary to eliminate a spare intake roof penetration.

Perimeter Fence Lighting - All work completed and accepted from the contractor.

Replacement of Breaching Damper - Work Authorization has been issued to J. A. Jones for fabrication and installation, which is scheduled to start in September.

Corrosion Control, 313 Building - This job was completed during the month.

Ash Disposal Systems, 300 Area - Completion of this job has been held up due to late delivery of special fittings and valves. This work will be integrated with recent failure of the ash sluice line.

Modification of No. 1 I.D. Fan - Both the fan rotating assembly and the turbine were scheduled for shipment the end of August. Western Gear will mount the turbine and gear on a base plate prior to shipping to Hanford.

Water Chemistry Laboratory - Several clean-up details remain to be accomplished.

384 Building Maintenance Shop - Comments were received from the AEC on the bid package information submitted to them. Bid assemblies are expected to be issued September 15 with the bid opening October 16, 1961.

No. 6 Boiler Overhaul - Complete installation of the electromagnetic clutch between the I.D. fan and turbine speed reducer is expected before chemical cleaning of the boiler by Dow Industrial Service, which is scheduled to start September 11, 1961. The clutch has been installed and test run with satisfactory performance. Additional tests are scheduled early in September after the electric motor and solenoid valve installation is completed.

Major Studies

300 Area Decontamination Facility - The preliminary scoping for a proposed decontamination facility in the 300 Area has been completed and submitted to CERUC's Design Engineering for complete scoping.

300 Area Emergency Load - Although not complete, sufficient data have been compiled to predict that the emergency load for the balance of FY-1962 will be less than the 1000 KVA which the existing turbine generator is rated. Completion of the study will be during September.

FPD Facilities Master Plan - Revision and expansion of the preliminary report is now under way. The completed report is scheduled for issuance in December 1961.

G. Significant Reports Issued

A special report by T. D. Gibbs dated August 16, 1961 documented the details of the power outage and line fault, which occurred in the 300 Area on August 14, 1961.

A report was made of non-compliance items with respect to "Safety and Health Standards, Walsh-Healey Act."

A report was issued to HLC entitled, "Retirement of the Thyac GM Portable Radiation Monitoring Instruments," which recommends replacement of the Thyac with a transistorized model.

III. PERSONNEL

A. Safety, Security and Radiation Experience

Medical Treatment Injuries	32
Frequency Rate	6.14
Disabling Injuries	0
Serious Accidents	0
Security Violations	0
Radiation Incidents	1

One radiation incident was experienced near the MB shaker in the basement of the 325 Building. No personnel contamination resulted, but an employee's shoes had to be replaced.

B. Meetings

Round Table-Staff	26
Safety and Security	24
Information	2

FCR

Manager, Plant Facilities Operation

E. Hilgeman;GAE:RTM:mkm

RELATIONS PRACTICES OPERATION
AUGUST, 1961

STATISTICS

<u>EMPLOYMENT</u>	<u>August</u>	<u>July</u>
Additions: Exempt	3	9
Nonexempt	<u>9</u>	<u>14</u>
	12	23
Reductions: Exempt	2	2
Nonexempt	<u>13</u>	<u>7</u>
	15	9

HEALTH AND SAFETY

Disabling Injuries	0	0
Serious Accidents	0	0
Medical Treatment Injuries	61	46
Medical Treatment Frequency	4.35	3.74

SECURITY

Violations - FPD	2	0
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SUGGESTION PLAN PARTICIPATION

Eligible Employees	702	707
Suggestions Received	76	61
Annualized Rate/1000 Eligible Emp.	1,299	1,035
Number of Suggestions Adopted	18	18
Net Annual Savings	\$3,579	\$4,121
Amount of Awards	\$445	\$665
Per cent of Total Awards to Savings	12.4	16.1
Average Amounts of Awards	\$24.72	\$36.94

Employment

Two asbestos workers were removed from the payroll on ROF basis on August 25 and September 1. The reduction is due to excess in other departments and one reduction in FPD.

The two exempt reductions were R. G. Post and A. P. Burgess, both summer professors.

Health and Safety

The medical treatment frequency rate for August was 4.35. The CY to date frequency rate is 3.92.

Health and Safety (Continued)

An injury to a Department employee was classified as Disabling retroactive to June 15, 1961. This brings the Department total to two disabling injuries for the year.

Disabling Frequency rate through August is 1.73 and the Severity rate for the same period is 488. Days lost and charged for the two injuries this year total 565.

An evaluation of Department facilities has been made by components to determine compliance with the requirements of the safety and health standards of the Walsh-Healey Act.

The planning group for Fire Prevention Month held their first meeting on August 17. Chairman O. N. Dodson designated Chairmen of sub-groups and program responsibilities were assigned. The program activities include safety meeting material, central display, fire inspections, slogan contest, literature and posters, and general publicity.

Security

Two security violations were recorded in the Department in August. Violations CY to date total six.

Benefits

Revision to the Tuition Refund procedure outlined in Organization and Policy Guide has been received and is being used in processing current applications.

Significant Reports Issued

No significant reports were issued by the Relations Practices Section during August.

Acting Manager - Relations Practices

GL Barr:mfj

END

**DATE
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