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FUELS PREPARATION
DEPARTMENT

MONTHLY REPORT

APRIL

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HANFORD ATOMIC PRODUCTS
OPERATION

[REDACTED]

GENERAL ELECTRIC

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**HANFORD ATOMIC PRODUCTS OPERATION
RICHLAND, WASHINGTON**

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FUELS PREPARATION DEPARTMENT

MONTHLY REPORT - APRIL 1961

78580

Compiled by Fuels Preparation Department

May 7, 1961 - Richland, Washington

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

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PRODUCTION

The operation of six canning lines for the major part of April resulted in a new record high output of 12,721 fuel elements on April 14.

A new record high manufacturing yield of 89.7 per cent was established during the month.

Finished inventories at month end reflect a 1.6 month supply, of which 20 per cent is bumper fuel elements.

Bare uranium inventories at month end reflect a 1.7 month supply.

ENGINEERING

Present Reactor Fuels

Eleven natural uranium fuel elements (ten I&E and one solid) and one enriched I&E fuel element failed in the reactors during April. A lower incidence of enriched fuel element failures was offset by an increase in natural fuel failures. The total number of ruptures was the same as last month and one more than occurred in April, 1960. Severity of service continues to be over twice that of one year ago. Three internal failures and potentially two "side other" natural I&E failures were fuel quality oriented.

Post irradiation measurement of "Quality Certification Program" monitor charges shows a gradual increase in natural I&E fuel diameter of four to six mils over an 18-month irradiation period through December, 1960. The gradual increase in diameter correlates with increased irradiation severity and an observed upward trend in uranium texture coefficients which may contribute to uranium growth.

One fringe column of oversize, self-supported fuel elements (CVIN) in C Reactor was discharged at 400 MWD/T and replaced. Preliminary examination shows no evidence of hot spots or accelerated corrosion. Four additional columns of oversize fuel elements were charged in C Reactor overbored channels, completing the initial 20 tube loading. Of the total charged, four short columns (16 pieces) in Zircaloy ribless tubes are located in the near upper central zone. The remaining 16 columns are standard length columns (32 pieces) located in the lower and upper fringe of the reactor. These include two ribbed aluminum, 8 ribless aluminum and six ribless Zircaloy tubes. Central columns operate at maximum specific tube power of about 110 kw/ft and the fringe columns at about 75 kw/ft. All columns will be exposed to 800 MWD/T.

Approximately 258 tons of dingot uranium are being irradiated and 370 tons have been discharged by mid-April. The failure rate of dingot uranium has not been significantly different from ingot uranium and full acceptance is expected by June, 1961.

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Fifty completely recrystallized dingot cores and 70 control cores have been received. Alpha recrystallization produces an equiaxial structure and it is believed that recrystallization contributes to stress relief which may reduce the tendency of the cores to warp during irradiation. Further evaluation of recrystallized cores is contingent on the development of fabrication techniques which produce uranium of the desired texture.

Approximately 1,550 oil quenched OIIN cores were received from National Lead Company of Ohio. UT-2, SORT, X-ray diffraction and complete metallographic evaluations are being carried out to see if these cores differ appreciably from standard water-quenched cores. The oil-quenched cores will be reactor charged if the pre-irradiation testing is favorable.

An initial shipment of 1,000 alloyed dingot fuel cores for the assembly of diffusion bonded fuel elements was received. Hanford Laboratories nickel plating line has been used for a period of two weeks. During this period, 189 fuel cores have been plated for pressure bonding at Savannah River Laboratories. These fuel elements will be assembled by six assembly techniques to determine which method provides fuel elements of maximum quality. In addition, the test fuel elements will be pressure bonded at Savannah River Laboratories under three different temperatures, times and pressure to help define the autoclave cycle which will ultimately be used to prepare fuel elements for irradiation.

The Sylcor Division of Sylvania-Corning Nuclear Corporation has a contract to produce 1,000 HAPO CV size, diffusion bonded fuel elements, prepared by the Sylcor hot die process. Progress on this program will be delayed because of the very low machining yield for these larger diameter cores at Mallinckrodt Chemical Works.

Chemical nickel plating of C-64 alloy aluminum jacketed OIIN fuel elements for a forthcoming irradiation test was begun at two commercial plating shops. Two thousand fuel elements had been plated by month's end and examinations indicated satisfactory plate quality.

In order to probe the limitations, if any, of AlSi-bonded fuel elements under future reactor-operating conditions (PT-344-A), fuel elements (CV) of three enrichment levels (600 natural, 533 of 0.94 per cent, and 300 of 1.47 per cent U-235) previously canned have been finished and tested for the attachment of self-support rails. An additional 250 natural uranium pieces are being canned in the pilot plant, since insufficient cores were available for the initial canning. Half of the fuel elements for the test are being assembled by the standard process and the remainder with process innovations to achieve maximum AlSi bond quality.

An automatic control unit for the ultrasonic production welder developed by Testing Methods Engineering is being evaluated. Through measurement of each welding head during welding, the unit determines the weld time necessary to produce a satisfactory weld and adjusts the weld cycle accordingly. Use of the unit thus far indicates the number of pieces requiring re-welding can be reduced over 50 per cent.

An automatic bare core test station (UT-2) and a manual UT-2 test station were shipped to National Lead Company of Ohio and an automatic UT-2 station was shipped to Mallinckrodt Chemical Works in St. Louis. This completes the major portion of a program undertaken to assist off-site feed plants in obtaining and putting into place full core inspection equipment.

N Reactor Fuel Development

Four natural uranium N inner tube fuel elements at an exposure of 985 MWD/T and one enriched uranium inner tube fuel element at an exposure of 270 MWD/T were discharged from KER loops because of a suspected rupture. Visual examination in the viewing basin did not reveal any sign of jacket failure. Special tests are under way, however, to determine whether any of these fuels are releasing fission products. If these tests are successful it will no longer be necessary to examine each suspected fuel element failure in the Radiometallurgy facility.

Ten N natural uranium inner tube fuel elements were discharged after a goal exposure of 1,000 MWD/T. The loop was recharged with a special UO₂ fuel element and two KER size enriched, single tube fuel elements. This loop had to be discharged shortly after startup due to a piping leak and it will remain empty until adequate repairs can be made.

Four KER single tube enriched fuel elements in Loop #3 and five N natural uranium inner tube fuel elements in Loop #2 are operating satisfactorily.

The following fuel elements await testing space: Four KER natural uranium single tubes; seven natural uranium N inner tubes; and four enriched uranium N inner tubes. An additional group of test elements, containing iron and silicon additives in the uranium, will be available for testing during the next shutdown.

Twenty zirconium clad coextruded tubes were made to provide 726 I&E pieces for processing. One hundred and four pieces passed final inspection to give an over-all yield of 15 per cent.

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NPR fuel elements are also being produced for use in various N charging machine tests. Total requirements for these tests are seventy-two 23.13 inch assemblies and thirty-six 11.53 inch assemblies. In addition, 42 assemblies of nominal 23", 20", 17", and 12" length are being fabricated for use in the testing of the fuel segregation system.

All coextruded fuel elements are now being brazed using the "wide braze" techniques. It appears that the number of voids has increased since the use of the wide braze was started. A true estimate of rejects of this nature cannot be made at this time because of the relatively small amount of material processed.

Chemical milling of the uranium in the coextruded tube ends to provide the end cap recess is proceeding satisfactorily with no apparent difficulty when uranium containing added iron and silicon was used.

Nine coextrusions were made, using uranium billets containing iron and silicon additives in the range of 100-200 ppm iron, and 75-140 ppm silicon. All were satisfactory with respect to surface smoothness and the use of iron-silicon additives to enriched uranium has been adopted as a standard practice. Specifications have been revised to reflect this change and future production orders for uranium will contain these additions.

A requisition for 15,000 pounds of Zircaloy-2 cladding shells for N reactor fuels was released for quotation. This included 350 feet of outer tube material and 100 feet of inner tube material. Part of this material will be used for production startup inventory and the balance for continuation of vendor development and research and development activities. Allegheny Ludlum, Bridgeport Brass, and Harvey Aluminum companies are involved in these bids.

Requisitions for the other components to cover the start of production period, July through September, have been, or will be placed by May 12. This includes copper, end caps, supports, locking clips, welding wire, cap braze materials, etc.

The following extrusions were made during April: 26 coextrusions, 13 Zircaloy billets, 9 uranium billets, and 4 copper billets. These utilized 6.0", 7.6", and 11.1" tooling to give a range of sizes and types for testing and development.

Work was continued in an effort to improve the cleanliness of the zirconium-uranium interface of coextruded tubes. Minor improvements were made with the use of trichlorethylene degrease and hot water rinses. Additional work is needed to define the reasons for this problem and a series of tests have been designed, using small test billets and uranium wafers. This will allow a maximum number of experiments in a minimum of time.

Spot welding of supports for NPR tubes produces a heat affected zone which sometimes penetrates to the uranium interface. Development work is directed to the limitation of this effect in order to prevent damage to the bonding and/or alteration of the uranium grain size. An order has been placed for a spike welder. Preliminary evaluations of spike welding indicate that this type of welder will not produce harmful heat penetrations.

The second shipment of NPF fuel specimens autoclaved at 600 C and 650 C at Battelle Memorial Institute has been received. Bonding of the Zircaloy cap to the uranium was of good quality and complete. It has been determined that what was thought to be impurities in the bonding layer are actually pits produced by the cathodic etching. Tests are planned to develop cathodic etching cycles which do not produce excessive pitting. This work is part of the program to develop an alternate end closure method for N reactor fuel elements. In fabricating the test pieces, the uranium end face is first cleaned by cathodic etching and a Zircaloy ring is then welded into place by electron beam techniques. Following this the piece is subjected to pneumatic pressure at elevated temperatures in a gas pressure autoclave.

Check out of the NPR testing equipment scheduled for the 333 N fuel plant is progressing on schedule. Recent tests indicate that an ultrasonic attenuation measurement will provide a sensitive check on the beta heat treating process in spite of variations in grain structure that may exist along the coextruded tube.

GENERAL

The operation of six canning lines during the major portion of the month reduced plant operating efficiency slightly below forecast to 92 per cent.

Four autoclave failures occurred during April, bringing the total for the year to nine.

The first shipment of recycle uranium cores was received during the month.

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PERSONNEL STATISTICS

Number of employees as of March 31, 1961 864
Number of employees as of April 30, 1961 878

	<u>Exempt</u>	<u>Nonexempt</u>	<u>Total</u>
General	1	1	2
Manufacturing	84	368	452
Engineering	41	27	68
Financial	12	6	18
Plant Facilities	43	286	329
Relations Practices	5	4	9
	<hr/>		
TOTAL	186	692	878

STAFF

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

PATENT SUMMARY - APRIL 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 April. 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.

R L Dickeman

General Manager
Fuels Preparation Department

RL Dickeman:mkm

MANUFACTURING OPERATION

April, 1961

CURRENT OPERATIONS

Production and Productivity

Statistics

	NORMAL					ENRICHED				
	8"	O				O				Total
	Solid	C	K	Reg.	Bumper	C	K	Reg.	Bumper	
<u>Current Month's Production</u>										
Acceptable Fuel Elements Produced (Tons)	0	91.4	279.7	209.3	35.8	.04	28.1	44.7	26.4	715.8
As % of Forecast Production	-	158	116	126	87	2	72	248	82	117
Cum. % of Forecast for Current Quarter	-	158	116	126	87	2	72	248	82	117
As % of Past 3 Month's Average Production	-	172	137	100	87	2	68	106	88	112
% of Past 12 Month's Average Production	-	183	133	89	239	3	72	149	264	113
% of Forecast Achieved Last Fiscal Quarter	-	92	100	109	96	132	94	90	81	100
% of Forecast Achieved Last 4 Fiscal Quarters	-	105	101	108	73	98	100	78	92	101

Operating Efficiency

Current Month (%)	91.7
Forecast (%)	93.0
Previous Month (%)	94.4

Manufacturing Yield

Current Month (%)	-	89	89	88	82	-	88	90	-
Forecast (%)	-	87	87	87	78	87	87	87	78
Previous Month (%)	-	86	87	90	83	92	86	87	-

Bare Uranium Available for Processing (Tons)	1097
Finished Products in Storage (Tons)	1052
Special Products Finished (Pieces) Boll	210
Uranium Utilization	98.5

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Plant Operation - AlSi

Increased production was scheduled during April to improve the finished inventory level and was obtained by utilizing the sixth canning line on both shifts during the first three weeks in April. Twelve (12) canning lines per day were operated during the first three weeks, and the AlSi Shop resumed ten (10) canning lines per day operation for the last week in April, for a total of 230 canning line shifts worked. This is the first time that the full plant capacity on two shifts has been utilized, one line previously having been kept in reserve in case of furnace or furnace control failures. Preventive maintenance was deferred in some areas while operating at full capacity.

The time operated efficiency and product yields remained high during the period of twelve line operation, and the morale of the work force was excellent. Two new daily canning records were established. The first, 12,717 pieces, was achieved on 4-4-61 while the AlSi Shop was processing one model. The previous record of 10,896 pieces was established in February, 1960, while operating ten canning lines per day. The second and standing record of 12,721 pieces was set on 4-14-61 while processing both six and eight-inch models. This represents a time operated efficiency of 97.4 percent. It is also significant to note that a record average six-inch I&E yield was established during April. This month's 89.7 percent yield was 0.2 percent higher than the previous record set in November, 1959.

The prototype ultrasonic welder was operated on a two shift basis all month to produce a total of 62 tons of bumper fuel elements, 34 tons of eight-inch and 26 tons of six-inch fuel elements.

Three tons of four-inch I&E fuel elements were fabricated in the 306 Pilot Plant this month, making a total of 12 tons on this month's finished inventory. Little, if any, of this size has been charged in the reactors so no more of this material is scheduled to be fabricated until the present inventory has been partially depleted.

Special products processed 13,921 fuel elements through weld reclamation this month with an average yield of 88 percent. Water mixing spools were also attached to 5,100 OIIIW elements, approximately 1,300 of which had bumper rails attached. Approximately 3,000 lead cadmium "poison" pieces were also jacketed in the Special Products operation during April.

Manufacturing yields for eight-inch and six-inch fuel elements for April were 88.9 percent and 89.9 percent respectively. The corresponding March yields were 87.3 percent and 87.8 percent.

Some increase in the external thinwall reject rate on KIVN fuel was caused by higher than normal variation in the as-received aluminum canwall thickness, while excessive upset metal on the CIIN can grooves resulted in poor fit between the can and the sleeve causing assembly rejects. Forcing the can into the sleeve caused damage to the can mouth and AlSi grooves with a subsequent increase in the AlSi reject rate.

Conversion from the OIIE to the OIIIE model resulted in a significant yield improvement for the enriched product. The OIIIE contour base can experienced yield improvements in the braze layer integrity and thinwall categories.

There were four autoclave failures during April, bringing the total failures for the year to nine.

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

8" I&E	23,919
6" Enriched	9,517
6" Water Mix	11
Total	<u>33,447</u>

Finished fuel element inventories at month end reflect a 1.6 month supply, of which 20% is bumper fuels. Bare core inventories at the end of the month reflect a 1.7 month supply. The lower than normal inventory of bare cores was due in part to the fact that four freight cars scheduled for arrival in April had not arrived.

Two enriched uranium scrap shipments were made during the month totaling 9,717 pounds. Normal uranium scrap will be shipped in May and small amounts of enriched scrap will be returned along with empty box shipments as nuclear safety standards allow. The normal uranium scrap shipment was deferred this month due to the volume of car traffic at the 313 Building dock. Car receipts increased as "special recycle material" deliveries are in small amounts in Railway Express cars.

In addition to four-inch fuel element production and attachment of bumper rails to six and eight-inch models, five development tests were conducted in the 306 Pilot Plant this month. Included in the development schedule were fuel elements for UT-2 tester evaluation, aluminum component wetting tests, fabrication of alpha recrystallized cores, pressurized quench, and canning of 635 CVIN (oversize) fuel elements.

Routine production testing continued on one shift in the 305 Test Reactor with a backlog of approximately seven days reactor time. Approximately 20 percent of the reactor operating time was devoted to testing of EGCR and NPR graphite.

Plant Operation - Coextrusion

Operating personnel assigned to the Coextrusion Shop continued to work on the I&E enriched program with Coextruded Products Engineering personnel.

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During April, five (5) tubes of I&E enriched material was extruded. Of these, four had Fe-Si additions to the billets. I&E enriched production through the other work stations was:

Cutoff	267 elements
Chemical Milling	554 elements
Braze	471 elements
Heat Treat	302 elements
Vapor Blast	250 elements
Machining	226
Welding	130
Autoclave	0

There were 31 elements charged into the autoclave on April 28th.

The major causes for rejects have been rough surface, unbonded braze, wall thickness, and weld over-hang. Additions of iron and silicon is apparently not a cure-all for the clad wrinkling problem since some clad wrinkling has been encountered with alloyed billets.

Production of I&E enriched fuel elements was adversely affected by equipment difficulties, process problems, and the scheduling of development work on NPR material. An apparent problem with interface cleanliness has prompted delay in the extrusion of additional I&E material in order to devote added efforts in solving the interface cleanliness problem.

Facilities Engineering

Design and Projects

CAF-847 - New Fuel Cladding Facility

	<u>Scheduled</u>	<u>Actual</u>
Design	100	100
Construction	45	52 (1)

Floor tiling on the East mezzanine has been completed. The main sub-station transformer and switch gear are being installed. The floor drains and furnace pit in the press room have been completed. Installation of the billet assembly equipment has started.

Bid package information for completion of the exterior work (painting and paving) has been transmitted to the AEC.

Requisitions have been issued or purchase orders placed for preliminary quantities of most baskets, gages, pallets, carts, stands, etc.

(1) Reflects equipment placement. Overall work is on schedule.

CAF-894 - Increased Compressed Air Capacity

	<u>Scheduled</u>	<u>Actual</u>
Design	100	100
Construction	45	42

Erection of the building addition and exterior piping has been completed.

CGF-903 - Projection Fuel Element Modifications - Phase I

	<u>Scheduled</u>	<u>Actual</u>
Design	100	100
Construction	29	27

Conveyor relocation has been completed. Autoclave baskets, soap tank, and soap tank conveyor are on order. Phase II approval is being delayed until resolution of charging this material in IPD is made.

CAF-915 - Increased Storage Space - 303 Area

	<u>Scheduled</u>	<u>Actual</u>
Design	NS	70
Construction	NS	-

Comments on the final design have been forwarded to the AEC.

Drafting and Files

Drafting work was performed on the following equipment:

306 Pilot Plant	ALSi Fuel Closure Tester UT-4 Fuel Core Tester UT-2B
ALSi Shop	Equipment Arrgt. as of 1-1-61 Acme-Gridley Lathe - Misc. Fuel Element Welding Machine-TW-7
Coextrusion Shop	Billet Assembly Fixtures Self-Support Spot Welder Extrusion Press Tooling Revolving Baskets Chemical Milling Tank Be Exhaust Filter

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REF ID: A66121

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The following drafting work was completed:

New Drawings	85
Revised Drawings	95
Small Charts	13
Large Charts	6
Miscellaneous	13

PLANT CONDITIONS, INCIDENTS, AND IMPROVEMENTS

AlSi Shop

Operating efficiency of the AlSi Shop was influenced by the operation of twelve (12) canning lines per day for most of the month. As a result, the efficiency was 1 percent below that forecasted.

Of the total outage time, equipment failures were responsible for 63 percent and operational outages caused the remaining 37 percent. The bond and penetration testers, furnace controls and jacks and agitators were responsible for a major portion of the equipment time losses.

A detailed report containing recommendations for standardizing of cartons and pallets was sent to Alcoa, Harvey Aluminum and Bridgeport Brass companies for their comments. Upon receipt of these comments, the carton and pallet size specifications will be included in purchase requisitions for aluminum components.

Considerable difficulty was experienced again this month in obtaining satisfactory welds on bumper rails. Further, an "aging process" is apparently taking place in the welding heads or transducers, requiring an extension of the weld times. This phenomenon has reduced the welding capacity by approximately twenty percent. The concentration of soap solutions used in preparation of the pieces for welding has a considerable effect on weld strengths. The nickel-alloy rail is being welded satisfactorily by increasing the soap concentration by one percent and extending the weld time.

During the latter part of April, a prototype electronic welding time mechanism was installed on the ultrasonic welder which permits a variable weld time from weld to weld as the need arises. This device has a phonographic pick-up which transmits vibrations from the welder tip. When the weld "makes" the amplitude of these vibrations decreases and the welder automatically moves to the next portion of the cycle.

Shipments of recycle uranium cores began arriving from NLO this month in railroad refrigeration cars. Existing unloading methods are not adaptable for unloading these express cars. Carpenters were required to remove the wood shoring and steel strapping from the cars, and riggers were used to operate a hydrocrane to remove the boxes from the cars, which are normally unloaded using an electric hi-lift. The large number of cars received and delay in unloading caused a tie-up of dock space for other receipts and shipments. The solution to this problem lies either in changing the method of shipping to standard D.F. loader cars

or changing of unloading techniques. Equipment needs and modifications to dock equipment are being determined while the AEC was requested to determine whether continuation of the courier escorted shipments in railway express cars will be required for security reasons.

Processing of the recycle enriched uranium cores was delayed this month awaiting a set of "ground rules" from HOO-AEC, to permit reasonable operating procedures while this material is in the fabrication process. Procedures were received late in the month which allow processing without violation of classification controls. The over-all change from regular to "recycle" enriched uranium is causing much more work and expense than was originally anticipated.

A routine metallographic examination of Vendor "H" cans revealed large grains extending from the can base into one-half inch of the canwall. Some of the largest grains extended across one-half of the canwall. This condition apparently resulted from a change in the sizing operation used to achieve the required dimensions. A total of 50,000 cans are affected.

The bare core surface test for core cracking due to high iron content has been discontinued because of improved iron control in the feed metal. Realignment of the test to detect surface cracking showed that it is not reliable for detecting cracks and that tester non-reproducibility precludes control of the process. The surface test has been removed until it can be refined for production use.

Incomplete segregation of bare cores from lots containing high iron cracks required retesting of the canned fuel elements on a modified surface test. Because bumper elements were included, it was necessary to make the test highly sensitive to minor core surface defects. Retesting of the fuel elements resulted in an overall defective rate of six percent, with less than two percent of the rejects due to high iron core cracks.

Revisions have been made in sampling procedures and solution life standards for the spire etch process. Process tests completed on the Aluminux and nitric acid etch solutions indicated that solution life could be increased and sampling frequency reduced with no loss in process quality. A "double sample" system was initiated for the Aluminux solutions with the sampling frequency reduced from two samples to one per day whenever the chemical analysis results show good solution control. Solution life for the nitric etch has been increased from four shifts to 10-12 shifts, depending on acid concentration. Nitric acid sampling has been reduced from once a day to once a week.

Braze closure welding through the canwall was investigated. It was felt that welding through the canwall into the side of the cap would result in a better test for braze defects. Canwall welding on non-wet areas resulted in fusion through the non-wet. Blowout of braze voids was not easily detected; often the void was simply displaced or reshaped, resulting in a thin residual canwall over the void. Thus canwall welding did not result in an improved braze test, and the fusion zone obtained was of poorer quality than the present closure process.

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All external bond testers have been converted to the twenty-five megacycle tests. The test provides a more reliable sorting process for rejectable defects, and performance reproducibility between testers has been improved. One benefit of this conversion has been elimination of the requirement for retesting non-wet material. There have been no instances where sampling of non-wet material previously tested on the twenty-five megacycle test has indicated a significant amount of non-wetting in the acceptable material. Because this test requires refined maintenance techniques, a program to measure tester reproducibility routinely has been initiated.

Percent defective control charts for the UE-1 testers have been initiated. The defective rates for the external and internal braze layer integrity and thinwall categories is plotted by tester on a two-hour basis. These charts provide a visual comparison of the screening efficiency of each tester, thus permitting more timely and accurate control of tester performance.

Several modifications to the UT-2 Bare Core Testers were completed during April. Circuit changes were made to provide more reliable readout panel operation. An externally mounted centrifugal pump was installed to replace the submerged pump on the water deaerator.

During the past month several short canning line outages were encountered due to erratic or unstable recorder - controller operation on the Ajax Furnaces. The trouble was traced to the thermocouple, and in every case, the trouble was eliminated by installing a new thermocouple. A prototype thermocouple and break detector assembly, utilizing a smaller gauge wire is being fabricated for evaluation.

A rough draft document entitled "Economics of Lead-Dip and Solid State Diffusion Bonding Processes" has been prepared as the result of a study of solid state diffusion bonding. The study makes unit cost comparisons of lead-dip versus hot die sizing, gas bonding, and hot press die processes. Also included in the report are estimates of the capital expenditures required for each of the three solid state diffusion bonding processes. A section devoted to maintaining operating continuity during the changeover period is being compiled after which the report will be published.

A study of the distribution of engineering work in the Department has been initiated. The first two phases consisting of (a) compiling a list of brief phrases which defined most engineering work, (b) coding the phrases for card punching, (c) preparation of survey forms with accompanying instructions, and (d) distribution of the material to engineering personnel was completed during April.

Coextrusion Shop

The chemical milling operation was down the first week of the month awaiting the fabrication of a rotating basket. Braze was down three days during the installation of a 3,000 cycle motor generator set. The heating elements in one of the heat treating furnaces in the 313 Building burned out on April 20th. Repairs were not completed until May 1st. Final etch was out of service three days while the steam coil was being replaced.

The lathe used for end cap facing is being moved from the 333 Press Room to the 306 Pilot Plant. A second lathe was acquired and is being installed in the 333 Building. This will provide one lathe for uranium length facing and one for end cap machining. A reduction of setup time is expected to improve throughput rates.

The process inspection gages and equipment for the I&E enriched program are in use. Gage and equipment requirements for "N" fuels production have been determined and the necessary standard gaging equipment has been ordered. Special gages are being designed for diameter, warp and length and for routine pre-irradiation measurements.

The maintenance foreman and engineer have been following the installation of the high pressure autoclave system in the Coextrusion Shop. Information and data is to be obtained that will be of unlimited value when responsibility for operation and maintenance of this system is assumed by the Manufacturing Operation.

Operating Plans

Uranium core requirements, plant yields and efficiencies, uranium utilization, and inventory levels were reviewed and altered as required, to reflect the Fuels Preparation Department quarterly production plan and commitment schedule.

Fuel element requirements during the fourth quarter, FY 1961, remained about the same as shown on the January forecast and then increased by approximately two percent during FY 1962. Production during these periods, however, was increased about 3.6 percent over amounts shown on the January forecast in order to provide an adequate finished inventory to meet charging fluctuations as they occur during the forecast period.

Plans for production of bumper fuel elements were altered substantially during the current review. On this review, the following reactor conversion schedule was shown:

D	Conversion in process
H	May, 1961
KE	January, 1962
KW	March, 1962
F	May, 1962
B	July, 1962
DR	September, 1962

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This schedule excludes the C Reactor conversion and reflects a three-month delay in converting the "K" reactors.

EMPLOYEE RELATIONS

Safety

A complete safety review of all operating facilities was made during April. Necessary corrections have been made. In addition, all job hazard breakdowns and safety rules have been reviewed and up-dated.

A violation of nuclear safety procedures which occurred on March 28 was investigated during April. The violation involved the improper storage and lack of identification of enriched material. Receiving and handling procedures have been revised to prevent a recurrence of this incident.

Members of the Manufacturing Operation sustained 26 medical treatment injuries during April, a frequency rate of 3.71.

Radiation Control

For the four week badge period ending March 24, 1961, Manufacturing personnel received a combined total of 10,056 mrad of exposure. Five individual exposures in excess of 300 mrad were recorded.

Security

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

Training

Four classes were conducted on the 25 mc bond tester during the month. The classes, which were attended by 15 employees, covered general theory of the bond test.

The UT-2 electronic maintenance manual was completed and issued to responsible maintenance personnel.

Reports of 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 April.

Manager - Manufacturing

WN MOBLEY:HFT:mrh

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ENGINEERING OPERATION

April, 1961

VISITORS

<u>Name</u>	<u>Company</u>	<u>Contact</u>	<u>Date</u>	<u>Reason</u>
DC Atkins, Jr.	U.S. Chemical Milling Corp. Manhattan Beach, California	SM Gill WG Hudson WA Hendricksen	4/21/61	Discuss contract.

TRIPS

<u>Name</u>	<u>Company</u>	<u>Contact</u>	<u>Date</u>	<u>Reason</u>
CJ Denton	Portland, Oregon	---	4/6/61	Instrument Auto- mation Conference.
TB Correy	International Inst. of Welding New York City	---	4/11-15	Attend sessions.
	American Welding Society, N.Y.C.	---	4/16-17- 18 & 20	Attend sessions.
	AIEE, N.Y.C.	---	4/20	Attend sessions
	GE, Light Military Electronics, Utica, N.Y.	TE Harr	4/19	Discuss cathodic etching.
	Battelle Memorial Inst., Columbus, O.	C. Boyer	4/22	Discuss diffusion bonding.
SM Gill GW Riedeman	Wah Chang Corp. Albany, Oregon	RA Graham	4/12	Zircaloy procure- ment.
WK Alexander	Nuclear Metals, Inc. Concord, Mass.	P. Loewenstein	4/17-18	Discuss progress of DDR-75.
	General Astrometals Yonkers, N.Y.	SB Roboff	4/19	Discuss fabrica- tion of brazing alloy.

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DECLASSIFIEDTRIPS (Continued)

<u>Name</u>	<u>Company</u>	<u>Contact</u>	<u>Date</u>	<u>Reason</u>
DO Hunter	U.S. Navy Nonde- structive Testing Rocket Symposium, Concord, Calif.	---	4/17/61	Attend Conference.
GF Jacky	Industrial Plating Inc., Seattle, Wash.	J. Werner	4/16 - 4/19/61	To observe nickel plating of jacketed fuel elements.
	Heath Plating, Inc. Kent, Wash.	F. Bradford		
EN Wells	Turco Products Seattle, Wash.	F. Morris	4/25-26	To witness equip- ment demonstration.
LH McEwen	GE - ANP Cincinnati, Ohio	---	4/17	Interview employ- ment candidates.
	Nuclear Metals, Inc. Concord, Mass.	P. Loewenstein	4/18	Discuss progress of DDR-75.
	General Astrometals Yonkers, N.Y.	SB Roboff	4/19	Discuss fabrica- tion of brazing alloy.
	Bridgeport Brass Adrian, Mich.	DR Jefferson	4/20	Discuss procurement of uranium and Zr.
	National Lead Co. Cincinnati, Ohio	FL Cuthbert	4/21	Review progress of uranium supply program.

PERSONNEL

<u>Name</u>	<u>Title</u>	<u>Code</u>	<u>Reason</u>	<u>Date</u>
R. W. Gilmore	Engr., Process & Dev.	4450	Transfer from IPD	4/1/61
K. W. Norwood	Manager, Advance Fuel Engineering	4410	Transfer from IPD	4/1/61

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 April, 1961. 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.

ALSI PRODUCT ENGINEERINGFuel Performance & Requirements

Eleven (11) natural uranium fuel elements (ten I&E and one solid) and one enriched I&E fuel element failed in the reactors during April. A summary of these ruptures is as follows:

<u>Fuel Element Type</u>	<u>Reactor</u>	<u>Exposure (MWD/T)</u>	<u>Rupture Classification</u>	<u>Canning Date</u>	<u>Cladding Alloy</u>
I&E Natural*	B	623	Side Hot Spot	12/7/60	X-8001
	B	639	Side Hot Spot	12/8/60	X-8001
	C	382	Side Other	11/20/59	C-64
	C		**		
***	D	745	Unclassified	9/1/60	X-8001
***	D	760	Internal	9/1/60	X-8001
	H	386	Internal	11/8/60	X-8001
	H	542	Side Hot Spot	12/12/60	X-8001
	H	536	Unclassified	10/27/60	X-8001
	KW	744	Internal	10/26/60	X-8001
Solid Natural	KE	622	Split Core	10/10/60	X-8001
I&E Enriched	KE	422	Side Hot Spot	12/23/60	X-8001

* Clad in new vendor (H) components.

** Not examined.

*** Dingot uranium.

A lower incidence of enriched fuel element ruptures during this period was offset by an increase in natural fuel ruptures. Total ruptures experienced was the same as for last month and one more than sustained in April 1960. Severity of service for both natural and enriched fuel elements continues to be over twice that of one year ago. Three internal and potentially two "side-other" natural I&E ruptures were fuel-quality oriented.

A fifth rupture ("side-hot-spot") was incurred by natural fuel clad in new vendor (H) aluminum components undergoing production transition testing. About 37,000 or 25 percent of the fuel elements authorized for testing in this vendor's components have been reactor charged and approximately 20,000 have been irradiated to goal. Four ruptures have been sustained to date by the control material. Based on the sequential test design established for comparing the relative rupture resistance of the test and control components, further irradiation is required to demonstrate equivalence or differences in performance.

The fifth and sixth ruptures (internal and unclassified) were experienced in natural alloyed dingot uranium fuel elements being evaluated for unrestricted

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use None of the dingot ruptures (three "side-hot-spot", one "internal", and two "unclassified") to date have been associated with the uranium quality. Rupture rates for natural dingot and ingot control fuel elements are comparable, approximating 44 ruptures/ 10^6 pieces discharged at goal exposure

Post-irradiation measurement of "Quality Certification Program" monitor charges shows a gradual increase in natural I&E fuel OD of four to six mils over an 18 months irradiation period through December 1960. Subsequent data is not yet available. Average OD change measured at the center of the fuel elements increased from one to two mils to five to six mils. Average OD measured at the ends of the fuel elements increased from a minus four mils to 0-1 mils, continuing to indicate the pieces become slightly barrel-shaped during irradiation. The gradual increase in diameter correlates with increased irradiation severity and an observed upward trend in uranium texture coefficients that may contribute to diameter growth. Average warp for the same monitor charges shows an unexplained cyclic trend, ranging from about five mils to peaks of nine to ten mils at 100-180 day intervals. Average tube-filling capacity was influenced by the cyclic trend of warp and the general increase in OD, ranging from eight to 16 mils.

Radiometallurgy examination of high-weight loss, natural I&E collapsible bumper fuel elements, exposed to 1100 MWD/T in D Reactor, indicates there was essentially no difference in the depth of corrosion along the length of the pieces. Average corrosion was about 11 mils, suggesting that most of the OD increase observed after irradiation is contributed by the core. Examination of two three-rail, solid-bumper, natural I&E fuel elements, which failed in D Reactor at an exposure of 950 MWD/T during January, is in progress. Extreme corrosion of both the bumper rails and fuel cladding is evident opposite the process tube rib marks. Corrosion near the point of jacket penetration on each rupture appears to be a combination of uniform and intergranular attack (normally at about 360 C), confirming abnormally high surface temperatures contributed to failure. Only slight corrosion of the uranium occurred.

One fringe column of oversize self-supported fuel elements (CVIN) in C Reactor was discharged at 400 MWD/T and replaced. Preliminary examination of the irradiated pieces shows no evidence of hot spots or hot areas. Extremely light corrosion was noted around the ends of some of the supports, including slight pitting of the cladding and abrasion of the support rail bearing surfaces similar to that observed earlier on pieces discharged at 200 MWD/T.

Four additional columns of oversize fuel elements were charged in C Reactor overbored channels, completing the initial 20-tube installation. Of the total charged, four short columns (18 pieces each) in zircaloy ribless tubes are located in the near upper central zone. The remainder (16) are standard length columns (32 pieces each) located in the lower and upper fringe of the reactor. Two of these columns are in ribbed aluminum tubes, eight in ribless aluminum tubes, and six in ribless zircaloy tubes. The central columns are operating at maximum specific powers approximating 110 KW/ft., and the fringe columns at about 75 KW/ft. All columns will be exposed to 800 MWD/T.

Uranium Technology

Approximately 258 tons of dingot uranium were being irradiated and 370 tons had been discharged by mid-April. Two ruptures (internal and unclassified) occurred this month in vacuum-outgassed dingot uranium, making a total of six failures to date in dingot uranium. About 45, 30, and nine tons of regular, vacuum-outgassed-before-heat-treatment, and large-grain virgin dingot cores were canned this month. A comparison of ten tubes of dingot uranium fuel elements with 190 tubes of ingot uranium fuel elements measured after irradiation under the "Quality Certification Program" indicates that there is no difference in warp, but growth in diameter at the center of the pieces is about five mils greater for dingot uranium. Additional measurements of dingot fuel elements are necessary, however, to determine if there is a significant difference in OD growth of dingot uranium.

The segregation of large-grained cores in OIIIIN and KIVN models is continuing. At a setting of 0.3 minimum voltage, 10.4 percent of the ingot and 6.3 percent of the dingot cores were segregated this month into large-grain lots. When the large-grain lots were re-tested at a setting of 0.1 minimum voltage, 0.02 percent of the ingot cores and none of the dingot cores were rejected for extremely large grains.

Cores (OIIIINB) for the UT-2 grain size production test were canned in the pilot plant this month, and will be charged in D Reactor as soon as possible. Both ingot and dingot cores were selected for this test, representing specific ranges of large-grain, small-grain, and grain-size variation. Complete UT-2 and SORT data was recorded for each core. Post-irradiation data from this test will be used to establish rejection limits for the UT-2 testers.

Fifty (50) completely alpha-recrystallized dingot cores and 70 control cores from the same rods received from MCW have been examined. Alpha recrystallization produces an equiaxed grain structure, and it is believed that recrystallization contributes to stress relief which may reduce the tendency for cores to warp during irradiation. X-ray diffraction data for this group of alpha-recrystallized cores was less favorable than for the control cores. The growth index values (G_3) were higher and most of the texture coefficient values of the crystallographic planes show a wider range from randomness than the control cores. Uranium cores with a random grain orientation have growth index (G_3) values approaching zero and texture coefficients of the crystallographic planes approaching one. Further evaluation of recrystallized cores is contingent on the development of fabrication techniques that produce uranium of the desired texture.

Post-irradiation measurements of "Quality Certification" monitor charges have shown a gradual increase of four to six mils in the OD of natural I&E fuel elements processed with ingot cores received from NLO between June 1959 and July 1960. This increase in OD appears to correlate with x-ray diffraction data on quality-control samples from natural ingot lots received during the same period. X-ray data in the longitudinal direction of the cores shows a gradual upward trend in 200-plane texture coefficients and a slight downward trend in growth index (G_3) values to essentially zero in July 1960. Uranium

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cores with a predominant 200 texture in the longitudinal direction are known to shrink in length and may result in a diameter growth. To determine if this change in OD is caused by an increase in the 200 texture or some other effect such as fission-gas swelling, post-irradiation data is needed on bare core length, ID and OD. Factors contributing to a gradual change in x-ray diffraction data on the incoming uranium cores from NLO and MCW are being investigated.

Approximately 1550 oil-quenched, OIIN cores (heat treated similar to the SRP Mark VB-Inner cores) were received from NLO in late March. Only SORT and limited metallographic examination have been completed to date on these cores. UT-2 testing, x-ray diffraction, and complete metallography are currently being carried out. SORT values do not differ appreciably from those for standard water-quenched cores. The oil-quenched cores will be reactor charged if pre-irradiation testing is favorable.

Process Development

A total of 680 acceptable overbore (CVIN) fuel elements have been prepared to date for reactor loading. An additional 650 pieces are being finished and tested for replacement charges. Use of a 25-megacycle external bond tester in the pilot plant has resulted in the detection of small fractures or cracks in the compound layer that have not been previously observed in this fuel model. The extent and cause of these defects are being investigated to eliminate the problem in subsequent canning runs.

An initial shipment of 1000 alloyed dingot fuel cores for the assembly of diffusion-bonded fuel elements was received. These cores met dimensional specifications and the factor weight was 8.44 pounds, as compared to 7.75 pounds for standard CV cores. An unusually high incidence of surface seams observed in the dingot metal apparently resulted from machining the larger diameter (1.432 inch) cores from standard CV core (1.406 inch) rod stock, allowing for less cleanup of surface imperfections.

The laboratory electro-nickel plating line has been used for a period of two weeks. During this period, 189 fuel cores have been plated to prepare fuel elements for pressure bonding at the Savannah River Laboratory. These fuel elements are being assembled by six assembly techniques to determine which assembly scheme will provide fuel elements of maximum quality. In addition, the test fuel elements will be pressure bonded at SRL under three different temperatures, times, and pressures. This should define the autoclave cycle that will ultimately be used to prepare fuel elements for irradiation. An improved and automated de-mineralized water supply system is required for the sustained operation of the nickel-plating line. Bids for a demineralized water supply unit have been reviewed and procurement initiated. Delivery is expected by June 15.

No additional work was done on the production of HAPU hot-pressed fuel elements. The initial assemblies will be prepared during May.

The Sylcor Division of Sylvania Electric Products has a contract to produce 1000 HAPU, CV-size, diffusion-bonded fuel elements, prepared by the Sylcor hot-

die process. The uranium for these fuel elements has been rolled at the Fernald Plant and is currently being machined and beta-heat treated at MCW. Completion of this program, as scheduled, is in doubt because of a very low machining yield (eight to ten percent) at MCW. A minimum of 252 acceptable fuel elements is required for irradiation and the MCW bare-core yield is not expected to exceed 500 cores out of an initial 5000 core blanks.

A program to prepare diffusion-bonded fuel elements by the hot-die-sizing process has been initiated. The program scope calls for the SRL operation to prepare 200 CV fuel assemblies for HAP0 evaluation. These fuel elements are to be completed by SRL during August 1961. If the fuel elements are of sufficiently high quality, the present reactor test will be revised to include this fuel element assembly concept.

Chemical nickel plating of C-64 alloy, aluminum-jacketed, CIIN fuel elements for a forthcoming irradiation test was begun at two commercial plating shops in the Seattle area. At month end, approximately 2000 fuel elements were plated, 35 percent of the anticipated needs for the test. Preliminary examination of the plate indicates satisfactory quality is being maintained.

Development of optimum AlSi process cycle for canning fuel elements in nickel-plated aluminum components was continued. At present, the quality of the material produced this period has not been evaluated; no assembly problems were encountered over a wide range of duplex cycle conditions. Closure-welding studies included further experiments with the electron-beam welding equipment, employing a slow-speed, low-power, three-pass cycle. Preliminary results indicate a homogenous weld bead providing at least 30 mils coverage over the braze layer can be produced by first machining a 50-mil wide step on the surface to be welded, essentially removing the braze layer and the adjacent can wall for a depth of 100 mils. The electron-beam is then directed to flow metal from the thick sections of the cap or base, replacing the metal removed by step cutting. Ten fuel elements are being prepared for corrosion testing of the weld bead.

Limited efforts in the 304 Building chemical nickel-plating facility failed to produce a plate having satisfactory adhesion. Aluminum treatment procedures were employed which improved the cleanliness, uniformity, and reactivity of the surface.

In order to explore a potential method for reducing friction between aluminum fuel element support rails and the reactor process tube, several rails were nickel plated on the load bearing surface, and successfully attached to fuel elements by the standard ultrasonic welding technique. By masking during the plating operation, the rail surface contacting the fuel element was not plated. It is planned to plate approximately 1000 rails in the near future which will be used to further expand experience in ultrasonic welding, and for charge-discharge tests in a process tube mockup.

Exploratory corrosion testing of nickel-plated, C-64 aluminum alloy in a 360 C, pH 10 refreshed autoclave continued. Five cans with 1/2-mil thick plate are substantially intact after a total time of 1260 hours, including 760 hours

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with visible macro-cracks in the plate. FPD Engineering-sponsored studies by HLO Coatings & Corrosion to develop a corrosion-resistant, chromic-acid autoclave film are encouraging. Pitting attack of aluminum during the autoclave cycle can be eliminated by several methods, including increasing the pH of the 1 weight percent chromic acid from 1.0 to the 2.5-3 range. Corrosion tests in 130 C flowing reactor process water have been initiated to determine the effects of autoclaving process variables including pH, time, and chromic-acid concentration.

Corrosion testing of nickel-plated fuel elements in 120 C and 165 C reactor process water flow tubes was discontinued after approximately nine months' exposure at each of the above temperatures. Visual examination revealed little or no change during the past two months. No corrosion undercutting or sloughing of the nickel has been observed, and aluminum corrosion at discontinuities in the plate appears to be about the same or less than for unplated aluminum. Also, it appears (visual examination) that the aluminum corroded more slowly at 165 C than at 120 C. It is planned to measure the depth of aluminum corrosion for comparison with unplated material.

Process Technology

In order to probe the limitations, if any, of AlSi-bonded fuel elements under future reactor-operating conditions (PT-344-A), fuel elements (CV) of three enrichment levels (600 natural, 533 of 0.94 percent, and 300 of 1.47 percent U-235) previously canned have been finished and tested for the attachment of self-support rails. An additional 250 natural uranium pieces are being canned in the pilot plant, since insufficient cores were available for the initial canning. Half of the fuel elements for the test are being assembled by the standard process and the remainder with process innovations to achieve maximum AlSi bond quality.

During the month a total of 26,400 bumper fuel elements (OIIIIN, OIIIE, and OIIIE) was produced on the automatic ultrasonic welder. The yield was 88.2 percent, as compared to 91.2 percent for March and 90.7 percent for February. About 9.8 percent of the fuel elements required re-welding. Major reject categories were rail alignment (3.7 percent) and rail tab deformation (4.0 percent).

Minor adjustments to the welder thus far have not reduced alignment rejects appreciably. Rail deformation rejects are primarily attributed to extreme tip displacement on the No. 2 welder head. This head produces the outer weld on bumpers attached to the cap end of the fuel elements. The greater tip displacement is caused by the mode of fuel element vibration during the weld cycle. Rubber O rings included in new chucks recently installed on the welder must either be adjusted or modified to dampen fuel element vibration and alleviate the incidence of tab deformation rejects.

Investigation has shown that approximately the first 100 fuel elements welded on the automatic ultrasonic welder have a low average rail tensile-peel strength. Tests are in progress to determine if the lower weld strength

results from the electronic system, mechanical system, hydraulic system or transducer welding array. Tip displacement is less upon startup and stabilizes after a "warmup" period.

An automatic control unit for the ultrasonic production welder developed by Testing Methods Engineering is being evaluated. Through measurement of each sonotrode displacement, the unit determines the weld time necessary to produce a satisfactory weld and adjusts the weld cycle accordingly. Use of the unit thus far indicates the number of pieces requiring re-welding can be reduced over 50 percent. Most of the rejects occurred during startup periods when the resonant frequency of the welder is affected by temperature change. Further investigations will include the incorporation of an automatic frequency control to minimize startup problems.

A test is underway to determine the relative effectiveness of visual inspection, radiography, ultrasonic testing, and autoclaving for determining closure integrity. All of these tests have been performed on 600 fuel elements selected for this evaluation, and destructive examination of the closures is about 50 percent complete. The elements were autoclaved twice, once under normal conditions for 50 hours and once after the outer welds were removed from the elements. Only one autoclave failure was sustained in this group of fuel elements and this occurred during the second autoclaving period. The element which failed originally had a pinhole in the outer weld, but the pinhole was not continuous through the weld. With the weld cover removed, however, there was a continuous water path to the uranium core during the second autoclave cycle.

Autoclaving testing before welding may facilitate autoclave failures of fuel elements having defective closures. To determine what problems would be encountered in welding autoclaved elements, 400 production fuel elements were procured from the production stream and were autoclaved for 40 hours. No failures were encountered in this test and the pieces are now being prepared for welding.

AlSi Pilot Plant

A total of 4569 fuel elements was canned in the pilot plant this month, of which 4244 were for reactor charging. A summary of the pieces canned is as follows:

<u>Pieces Canned</u>		<u>Purpose</u>
<u>No.</u>	<u>Type</u>	
306	CVIN	Production commitment.
115	OIIIN	Evaluate alpha re-crystallized uranium cores.
642	OIIIN	Evaluate pressurized quench.
2850	OVN	Production commitment.
325	ONP	Weld test nickel-plated components.
275	OIIN	Test nickel plating.
56	Rae	HLO corrosion and crud-film tests in 1706KE.

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COEXTRUDED PRODUCT ENGINEERING

DECLASSIFIEDReactor Fuel DevelopmentKER Loop Testing

Four NIN-1* fuel elements at an exposure of 985 MWD/T and one NIE-1* fuel element at 270 MWD/T were discharged from Loop 4 with a suspected rupture due to a high delayed neutron monitor trip which shutdown KE reactor. Visual examination in the viewing basin has not revealed any sign of jacketing failure. Tests are under way to determine if any of the fuel elements are releasing fission products. If these tests are successful, it will eliminate the need of examining each individual fuel element in the Radio-metallurgy facilities. The loop was recharged with five NIN-1 fuel elements which will be discharged the latter part of May when modification work begins on this particular loop.

Loop 3 containing four KSE-3* fuel elements and Loop 2 containing five NIN-1 fuel elements are operating satisfactorily.

Ten NIN-1 fuel elements, 15 inches in length, were discharged from Loop 1 after having attained a goal exposure of 1000 MWD/T. The loop was recharged with a special UO₂ fuel element and two KSE-3 fuel elements but had to be discharged after startup due to a leak in the piping. Adequate repairs have not yet been made and the loop will remain empty until the next shutdown.

Fuel elements awaiting testing include four KSN-1*, three NIN-1 (23 inches long), four NIN-1 (17 inches long) and four NIE-1 (23 inches long). An additional group of test elements containing iron and silicon additives in the uranium are in process and should be available by the next shutdown.

I&E Program

Processing of I&E fuel elements has continued the past month with minor delays due to equipment breakdown and a shortage of operators. Twenty-two I&E coextruded tubes, or 726 pieces, have entered the process this past month. 104 pieces have passed final inspection with the overall yield of the tubes required to fabricate these elements being 15%.

- *NIN - N inner, natural
- NIE - N inner, enriched
- KSE - KER loop, single tube, enriched
- KSN - KER loop, single tube, natural

Other Pilot Plant Production

NPR fuel elements are currently being produced for IPD for use in various N-charging machine tests. Five 23 inch prototypic NPR fuel assemblies will be required by May 15. These assemblies will be used for hydraulic flow tests prior to their use in the charging machine tests. The total requirements for the charging machine tests are seventy-two 23.13 inch assemblies and thirty-six 11.53 inch assemblies. At the present time there are the following, either completed in storage or in processing, in the FPD Pilot Plant:

a. 125 - 23 inch NPR outers	d. 5 - 17 inch NPR outers
b. 239 - 23 inch NPR inners	e. 21 - 17 inch NPR inners
c. 1 - 20 inch NPR outer	f. 4 - 12 inch NPR outers

In addition to the charging machine tests, the following NPR fuel assemblies will be required by June 15 for the testing of the fuel segregation system.

- 21 assemblies of the 23.13 inch size
- 7 assemblies of the 20.53 inch size
- 7 assemblies of the 17.34 inch size
- 7 assemblies of the 11.53 inch size

Materials Development and Procurement

Uranium Billets

During the month, eight I&E² coextrusions and one NIE coextrusion were made with billets containing iron and silicon additions in the ranges 100-200 ppm iron and 75-140 ppm silicon. The problem existing had been that of clad wrinkling during the coextrusion. All of these nine extrusions were satisfactory with respect to surface smoothness except nose piece effects as discussed in last month's report. It is believed the function of the iron:silicon additives is to produce a finer grained and more randomly oriented structure following working and beta heat treating processes and apparently provides a slightly increased extrusion constant for the uranium, thereby more closely matching the uranium and zircaloy extrusion constants which have been shown in the past to produce smoother cladding. The use of the iron:silicon additives has been adopted as standard practice.

The following items have been converted to iron:silicon additive uranium:

- All deliveries of I&E² billets (35/month) for the months of June and July.
- All regular production for future deliveries for the N-fuel program.
- All R&D production orders with Fernald, with a few exceptions where non-additive metal is specifically desired.

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The formal HAPO specifications to Fernald for the production of N-fuel element billets has been revised to incorporate the iron:silicon additions. This document is HW-67575 Rev. 1, "Specifications for Uranium Metal Billets for the NPR Fuel Element", April 6, 1961.

Zircaloy-2 Cladding Shells - Vendor Development

As a continuation of the Vendor Development Program for developing sources of supply for zircaloy-2 components for N-reactor fuels and as a start for production inventory, a requisition for 15,000#, 350 each of outer tube - 160 each of inner tube components was released for quotation. Three vendors are involved, Allegheny Ludlum, Bridgeport Brass Company, and Harvey Aluminum. Bids are due May 8, 1961.

Both Allegheny Ludlum and Harvey have delivered some material under the current Vendor Development Program.

- a. Allegheny Ludlum - 28 tubes, 7-1/2", 69 tubes 2-3/4" and 77 tubes 1-3/8". No 6-inch successfully made yet. A-L plans to extrude fill-in material the week of May 8.
- b. Harvey Aluminum - Harvey has delivered six of the 6-inch size tubes. The remaining batch is now at Harvey inspection. Harvey has some fill-in material to remake because of machining rejects.
- c. Bridgeport Brass - Bridgeport Brass has most of the material being final machined. Many parts are actually finished. G.E. inspection has passed some material but none has been shipped.

Other End Fuel Essential Materials

The preliminary process specifications for all of the components used in the N-fuel Fabrication Program have been completed and issued. In addition, an Essential Materials Handbook*, which incorporates all Engineering specifications for the procurement of essential materials has been compiled and issued.

Requisitions for all components (other than cladding shells previously discussed) have either been placed, or will be placed, not later than May 12. The quantities involved in most cases are to cover the start of production period of July, August and September 1961. These include the following:

- a. Copper tubing components for the outer and inner tubing of the NOT co-extrusion can. Quantities are in excess of 650 feet, equivalent, of each.
- b. Copper tubing for the outer and inner components of the NIT billet design. Quantities here are in excess of 400 feet of each size.

*HW-69224, "Essential Materials Handbook, N-Fuel Element Process, Engineering Specifications, Fuels Preparation Department", April 1960

- c. Copper front and rear end plates and front and rear preshaped cones for both the NOT and NIT designs. About 325 of each of the four items have been ordered for the NOT design and about 240 each of the four components for the NIT design.
- d. Zircaloy-2 end caps of each the NOT and NIT designs; 12,000 each.
- e. Zircaloy-2 outer tube supports and steel shoes; 43,000 each.
- f. Zircaloy-2 inner tube end supports and center supports; 32,000 and 15,000 each, respectively.
- g. Zircaloy-2 locking clips; 14,000.
- h. Zircaloy-2 welding wire for heat treating supports; 150 pounds.
- i. Graphite follower blocks of 7-1/2" and 6" diameters; 325 and 240 each, respectively.

Extrusion Process

The following coextrusions and extrusions were made during the month:

1. 6.0 Inch Tooling

20 composites - T-185 through T-196 and T-203 through T-210

T-185 through 188 and	
T-193 through 196	I&E .94 enriched (Fe-Si)
T-192	NIT .94 enriched (Fe-Si)
T-189 through 191 and	
T-203 through 207	NIT normal
T-208	I&E .94 enriched (Brine)
T-209 and 210	NIT normal, for HLO

7 Zircaloy Billets - Zr-80 through Zr-86

Zr-80 and 81	NIT end caps
Zr-82 through 85	I&E end caps
Zr-86	NIT shroud tube

2 Uranium Billets - U-52 and 53

U-52	2" rod for development billets
U-53	NIT size tubing for HLO

1 Copper Billet

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2. 7.6 Inch Tooling

6 Composites - T-197 through T-202

T-197 through 199	NOT .94 enriched
T-198 through 202	NOT normal

6 Zircaloy Billets - Zr-74 through Zr-79

Zr-74 through 77	4-1/2 & 2-1/2" OD tubing, for HLO
Zr-78	NOT end caps
Zr-79	NOT inner clad

3 Copper Billets

3. 11.1 Inch Tooling

7 Uranium Extrusions - U-45 through U-51

U-45 through U-50	Primary and I&E billet size
U-51	4" rod, for HLO

Interface Cleanliness

The cleanliness problem still exists with only token improvement on some extrusions. The average cleanliness rating has been improved approximately 1 point this month. This improvement was brought about primarily by using trichlorethylene degrease and hot water rinses. It has not been possible, however, to reproduce ratings on all material.

A series of tests have been designed using small test billets and uranium wafers which should allow a maximum amount of experiments in a minimum of time.

The following statements are based on interface cleanliness rating of 60 coextrusions between tubes No. 150-196.

1. Average interface rating at front and back of tubes is the same.
2. Interface cleanliness rating on outside diameter of center sample is higher than on inside diameter of center sample.
3. Interface cleanliness rating on outside diameter of front and rear sample is about the same as the inside diameter.
4. Interface rating at front and back of coextrusion is 1-1/2 rating units lower than at center of coextrusion.

Peel tests have been made on samples from 11 tubes after heat treating. The results show that the bond strength is much less now than it was six months ago, and the bond in the braze-heat-effected zone is weaker than in the center of the fuel element.

Chemical Milling

Zircaloy Oxidation

The modification performed on the chemical milling basket has eliminated the oxidation problem. The modification consisted of reboring the side plate holes and inserting a Teflon bushing, thus eliminating the physical contact of zircaloy with the stainless steel basket. About 20 tubes have been milled in this fashion with no evidence of oxidation.

Iron:Silicon Material

Three tubes of I&E geometry with Fe (110 ppm) and Si (80 ppm) have been milled successfully. The etching characteristics are the same as the regular material. A slight increase of the SO_4^{2-} will minimize the pitting. A slight amount of pitting was present but it is believed that it is not severe enough to produce difficulties. If the SO_4^{2-} is permitted to go below 4.80 lbs/gallon, the pitting becomes severe.

End Closure Brazing

All fuel elements are now being brazed with the "wide braze" technique. Insufficient data are available to quote rejection rates from faulty closures, but it would appear to be somewhere around 10%. This is due largely to the use of the wide braze. The occurrence of voids under the caps on non-wets seems to be quite rare.

Nuclear Metals Inc. has completed fabrication of the first order of rings which called for 1,000 each of outer and inner NPR sizes and 3,500 I&E size. They are now fabricating an additional 5,000 I&E rings for the balance of the I&E program.

Arrangements are being made to procure the first three month's supply of NPR rings from NMI. This will be 12,000 each of the outer and inner sizes. The order calls for delivery by July 1, but it is very unlikely that this can be accomplished.

Another vendor is interested in trying to make some samples of braze alloy by powder metallurgy techniques. A proposal will be submitted for a small-scale program to do some preliminary exploration into the use of powders.

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Heat Treating NPR Fuels

No NPR fuel pieces have been beta heat treated during the past month.

A further compilation of the warp data on the N-inner geometry has been made. The previous compilation of 24-inch lengths showed that 45 of 102 pieces met a warp specification of 30 mils double throw, i.e. 44 per cent acceptance. The latest compilation is based on 149 pieces and the number of acceptable pieces after a single beta heat treatment is 81, i.e. 54 per cent.

J. L. Jaech, HLO, has made a statistical analysis wherein he has differentiated the warp characteristics of V-trough cooled vs table-roll cooled tubes. Accordingly, there is justification in separating the V-trough cooled pieces (37) from the others (112). The warp yield on the 112 other pieces has been 64.3 per cent. A final separation of variables can be made on the basis that 19 lengths had an outer clad thickness of only 25 mils. Thus, there are 93 fuels derived from table-roll cooled tubes having 40 mil outer clads and 64 of these met specification, i.e. 69 per cent.

Tests are under way to determine if hot warp measurements (say at 300°C) will have vectors related to heat treating vectors. Hot warp measurements will be made under oil.

The outer clad thickness variation on five tubes has been measured by the autoradiography technique used by Quality Control. The relation of these measurements with warp vectors is under way.

Equipment in the 313 Building used for heat treating I&E² fuel elements operated well until April 20. On that day, both sets of elements burned out. When the furnace was cool and was disassembled on April 24, the element failure was attributed to a short-circuit caused by loose scale from the crucible.

Analysis of the scale was made and Fe, Cr and Mn confirm a heat resistant alloy casting. However, analyzed traces of Na (1 w/o) and Cl-(0.7 w/o) indicate a failure of the pot. A new pot of 304 SS is being made; the equipment should be operative on May 2, 1961.

End Closure Machining

Arrangements have been completed for moving the Warner and Swasey No. 5 turret lathe into the 306 Building. Installation of the lathe in the 306 Building will commence May 1, 1961.

Vapor Blasting

Some 100 mesh aluminum oxide abrasive was tested. The results of the test showed no apparent increase in the rate of oxide removal. The test also showed that the 100 mesh abrasive gave a rougher surface finish than 220 mesh abrasive.

Brazed Closure Welding

A preliminary trial of helium shielding gas for welding of the wide braze shows no significant difference in the grain size of the weld metal compared to welds produced with argon shielding gas. Additional tests are planned.

Side Support and Locking Device Attachment

Work to date indicates that if the heat affected zone penetrates two-thirds or more through the cladding that the uranium grain size will be affected.

Development of the attaching technique is progressing. It has developed to the point that satisfactory mechanical strength has been achieved. Additional work is required to limit penetration to the point that the interface and uranium grain size are not affected.

The controls for operating the main ram and the movement of the electrode on the Sciaky spot welder are located in such a manner as to require both hands for the down operation. This prevents the operator from any injury by placing a hand on the tooling and then operating the ram. One hand will not operate the Sciaky spot welder.

A large number of .030 supports were spot welded on reject pieces and then torn off to check the size and penetration of the welded section.

The settings on the welder have been pretty well established. However, the thickness of the new style support was changed from .030 to .040 and the shape has been changed somewhat.

In welding the .040 supports, it was only necessary to increase the current and time to compensate for the increased thickness.

It will be necessary to section and polish a number of pieces yet before a definite procedure can be established. However, what we have done looks good and consistent.

Tooling should be complete by 5/5/61 to start welding the locking devices in the outer tubes. The first tool will have a rubber die shaped to fit the locking device and will be held in place by vacuum while the electrode is being positioned in the tube.

Spike Welding

An order has been placed with Weldex for a spike welder with delivery at Weldex not later than 5/5/61. Drawings to permit design of the tooling have been received.

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Solid State Diffusion Bonding

The second shipment of NPR fuel tubes autoclaved at higher temperature and shorter time have been examined with the following results:

1. There is complete uranium core to cap bonding.
2. Bonding of the zircaloy-2 cladding to the zircaloy-2 cap is virtually the same as in the first shipment.
3. It has been established that what was thought to be impurities from the cathodic etching are actually voids produced by the cathodic etching. The bonding pressure was not great enough to force the surfaces together.
4. Double beta heat treating of the cap to core bond shows uniform widening of the interface with each heat treatment.
5. The cap to core interface width is the same as the coextruded bond after bonding and also after beta heat treatment.
6. Beta heat treating does not affect the cap to cladding bond.

Tests are being planned to use a lower argon pressure with the cathodic etching to produce satisfactory cleaning without the excessive pitting.

In addition, similar tests are being planned at higher gas bonding pressures to produce more intimate contact of the zircaloy-2 surfaces.

Reproducibility of uranium to zircaloy-2 bonds of a very high quality below the allowable maximum temperature has been established.

A modified NPR closure using a "V" groove in the uranium into which the closure ring fits is being prepared in hope of eliminating the unbonded corner area between the cap, cladding and core. This is being followed by a short length complete fuel element assembly.

Testing and Inspection

Process specifications for inspection operations have been completed. Detailed instructions for finishing inspections have been completed and a copy put at the inspection station.

Data sheets for each of the assembly, coextrusion and finishing operations have been made out by the engineer responsible for each operation. The new data sheets will be used starting during the first week of May. They will be out in duplicate and one copy from each operation will be sent to Quality Control.

A different system of classifying rejects was started on April 24 1961. This system will reduce the number of reject categories to a number small enough to work with. Rejects for all enriched I&E coextrusions made to date have been reclassified using the new system. A letter will be issued explaining the new system within the next two weeks.

The number of large voids in the braze has increased since the use of the wide braze was started. An estimate of the reject rate cannot be made yet because only a small amount of the wide braze material has been tested.

The cutoff length of I&E fuel elements has been increased by 0.020" to 7.650" because the length change during heat treating has been smaller than originally predicted.

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TESTING METHODS

Process Fuel Element Testing

Bare Core Testing

Special emphasis is being given the UT-2 surface quality test which has been temporarily removed from the production line while improved operating procedures are developed. A simple re-calibration of the equipment and changes in test head alignment have given marked improved results. These are now being thoroughly evaluated. A recent test in which one test set-up was left entirely untouched for a period of ten days has shown a maximum drift in instrument response of about fifteen percent. The adequacy of these particular instrument settings in terms of elimination of visual inspection is being determined by extensive destructive examination of select fuel cores.

Bond and Penetration Stations

The internal Bond test has been the cause of increased operating difficulty over the past month. In large measure these troubles are related to electrical interference generated by the welding equipment.

New Methods Development

UT-4 Project

Project activity is being primed and made ready to go immediately upon approval of the UT-4 project proposal. In the meantime, development work is continuing to refine and make more reliable the electric test and control circuits. Particular attention is presently being paid to the read-out circuits. Methods have been developed which provide data in such a way as to measure to a degree the "leak" potential of each closure. The need for digital voltmeters - which have been the cause of considerable difficulty in the UT-2 equipment - has been eliminated.

The prototype equipment located in 313 Building continues to be used for special tests. A test of some two-hundred elements designed to evaluate the effectiveness of new canning techniques revealed no cap-end defects. Defect indications observed on the base end of these pieces have not correlated with destructive examination.

Automatic Data Logging

One of the two automatic data loggers purchased for use in the 313 Building has been made operational. Tentative plans have been made to test controlled groups of uranium cores made up entirely from a single ingot.

As the data logger permits core identification numbers to be recorded with the test data, limited attempts will be made to record data with individual core identification. This will require maintaining sequential order of fuel cores through the canning process. Data loggers will also be routinely used to characterize fuel cores by lot numbers.

Cap Thickness Test

A recently developed prototype eddy-current device which measures the cap thickness of Alsifuel elements is undergoing evaluation. The development provides a rapid, reliable method of insuring adequate cap thickness.

Ultrasonic Weld Monitor

The past few weeks have seen substantial progress with the ultrasonic weld monitor. The prototype unit is now successfully controlling the operation of the four welding heads simultaneously. The results appear very favorable.

In principle, the device monitors the displacement of the welding probe at a point about one inch from the tip. The magnitude of this displacement - which undergoes a characteristic change as the weld is formed - is sensed to feed back a signal which controls the time duration of the welding process. Thus, the welding transducer is energized long enough to insure formation of good welds, but automatically de-energized before deterioration of the weld can occur. Although incomplete data are available to completely evaluate the effectiveness of the instrument, a recent day's operation completed nine-hundred and sixteen good pieces with the weld monitor in use, compared to the previous day's output of five-hundred good pieces without the use of the weld monitor.

Off-site UT-2 Project

One complete automatic UT-2 test station and one manual station were shipped to National Lead Company of Ohio the first week in April, at the same time one automatic station was shipped to Mallinckrodt Chemical Works in St. Louis. This completes the major portions of a program undertaken to assist off-site feed plants in obtaining and putting into place fuel core inspection equipment. Engineering assistance in making this equipment operational at the customer's location will also be provided.

NPR Testing

Check-out of NPR fuel testing equipment scheduled for the 333 facility is progressing on schedule in the laboratory. Recent tests indicate that an ultrasonic attenuation measurement will provide a sensitive check on the Beta heat treating process, in spite of the variation in grain structure that exists along the length of as-extruded fuel tubes.

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Investigations into the metallurgical properties of as-received zirconium extrusion components are continuing on a moderate scale. Metallographic examinations strongly suggest the nonuniformity of material revealed by the eddy-current test is due to variations in the degree of cold working present in the zirconium. The metallographs also show marked evidence of preferred crystal orientation.

Ultrasonic Lamb Wave Testing

Study of the behavior of Lamb waves in ultrasonic reflection testing of small diameter tubing continued during the month. Experiments to compare the response of low frequency or first mode signals with higher frequencies containing several modes are planned as soon as the fabrication of various sizes of defects in the tubing is completed by Technical Shops.

One of the problems in a defect test is to get equal response from internal and external defects. Experiments to date appear to show improved response to small internal defects at the low frequencies compared to external defect response where only one mode is present. The wider beam width at low frequencies would also help in making optimum transducer adjustments but would be more of a problem in determining depth due to the effect of defect length. Varying length as well as varying depth causes amplitude changes so that the smaller the beam diameter the more accurate the depth information will be. By recording the defect signals on chart paper the length of defect can be determined, which by comparing with the amplitude can help in depth determination.

Manager, Engineering

LH McEwen:d1

FINANCIAL OPERATIONAPRIL, 1961

Development of cost accounting procedures and measurement criteria for use in the coextrusion shop is nearing completion. Close liaison with operating management and supervisory personnel is being maintained in the development of these procedures and details are being provided them as they are finalized.

The annual physical inventory of 300 Area steam coal was taken this month. Documentation and reports applicable to the inventory will be issued during the latter part of May.

Assistance was rendered to the Engineering Section in making a complete review and internal reallocation of budgeted funds for the remainder of FY 1961. This was made necessary in view of increased process technology in connection with the coextrusion process.

A detailed presentation on production costing procedures and unit cost determination will be made to the AlSi Shop and Quality Control supervision in early May. It is planned to make this presentation for all Manufacturing level 4 components in the coming weeks. In addition to conveying general information on these subjects improved efficiency and cost reductions are expected to result from these contacts.

Travel for April amounted to \$5,500. FY to date travel costs now stand at \$45,800 as compared to \$48,800 for the same period of FY 1960. Of the 94 days spent in travel status for the month, 77 related to vendor contacts and contract work, 14 to attendance at professional and trade society meetings, and three to recruiting and interviewing activities.

Five department organization and policy guides were revised and issued during the month. A procedural change in the approval level and allocation of funds for attendance at off-site educational courses necessitated a further revision of the OPG on this subject. The organization guides for the Engineering and Manufacturing Sections are near completion and are being review by the administrative specialists of those sections.

An additional \$11,000 miscellaneous capital work order money has been allocated to the Department. Funds have been made available specifically for the security fence lighting along the east side of the 300 Area. The additional funds increase the Department's allocation to \$131,000.

Approximately \$28,000 of prototype equipment has been found acceptable for continued use and will be capitalized. The equipment, to be used in support of the coextrusion product development, is located in the 306 Pilot Plant and the 3706 Quality Control Lab.

Three spot audits of property custodial records and procedures were made during the month. Several minor deficiencies were uncovered and readily corrected. The custodians generally appear to be well aware of their responsibilities regarding property management and are conscientious in maintaining controls.

Feasibility study of establishing an integrated data processing system for certain manufacturing activities is proceeding satisfactorily. That portion of the study pertaining to the AISI process and supporting functions has been completed. Study of the coextrusion process is currently underway.

Reply to the CE&UO Level of Service Study has been completed and transmitted to that organization. Eleven recommendations for cost improvement were submitted.

The C&AO Level of Service Study has been received and is currently under review.

The third Records Management Workshop to be held in the 300 Area was arranged and conducted April 26, 1961, in cooperation with C&AO Procedures Operation and the HLO Procedures Specialist. Eleven FPD personnel were in attendance.

Manager - Finance

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PLANT FACILITIES OPERATION

APRIL 1961

I. RESPONSIBILITY CHANGES

None.

II. ACHIEVEMENTS

A. Statistics

1. Duplicating

<u>Process</u>	<u>No. of Impressions</u>
Multilith	600,717
Verifax	10,725
Ozalid	9,088
Total	620,530

2. Utilities

	<u>April</u>	<u>March</u>
Average steam generated (M lbs/hr)	64	76
Maximum steam generated (M lbs/hr)	92	106
Total steam generated (M lbs)	46,038	56,409
Coal consumed (Tons)	2,159.45	2,683.44
Evaporation rate (steam/#coal)	10.66	10.51
Efficiency - Actual	68.0	68.5
Efficiency - Theoretical	69.0	73.2
No. of Boilers on: 3		
Sanitary water from 3000 Area (M Gals.)	139.99	130.37
Total water from 3000 Area (Avg. rate GPM)	3,240	2,920
Total water from #3 and #4 Wells (M Gals.)	13.37	13.43
Total water from #2 well (M Gals.)	.30	.30
Peak water consumption for 24 hours (M Gals.)	5.3	4.9

B. Operating Experience

Sanitary water demands continued to increase during the month. The bearings of the motor driver of the No. 5 Pump were replaced and the pump has been performing very well under almost continuous service. Revisions are being made to the gasoline engine driver to eliminate the clutch overheating problem experienced in the past.

Compressed air demands have required the use of all four existing compressors on numerous occasions. On April 29, the demand was so great that the pressure dropped from the normal 100 psi to 40 psi.

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Investigation revealed that construction forces in the 333 Building were blowing out a 4-inch line. Restrictions were imposed on this activity in order that near normal pressure could be maintained. No incidents of water in the compressed air lines have been reported to date.

Twenty-four hour coverage continued in PRTR to complete modifications and check-out of equipment in readiness for the reactor to go critical early in May. Primary Pump No. 3 had a complete seal change which substantially reduced the vibration of this unit. Instrument sensing lines were raised and remounted to permit future pump lifting and removal. Noisy operation of Boiler Feed Pump No. 4 required complete disassembly of the pump in order to locate the cause of the noise -- bearing failure, which appeared to have been caused by over-lubrication. Modifications in the helium system have completely eliminated some valves that caused leakage. The intermediate and high pressure helium storage tanks were back-welded at the inlet and outlet screwed connections. Experience gained earlier on the rewiring of the shim rods helped expedite getting the rods repaired and back into the reactor. Activity on maintenance procedure manuals has been limited due to direct assistance of craft instructors and manual writers with the work at PRTR.

The 314 Building crane was overhauled after failure apparently caused by lack of lubrication. Lubrication is now scheduled to be performed once a week.

C. Equipment Experience

A Strontium 90 test filter was fabricated from stainless steel including a real fine mesh screen, which was special-ordered. Due to the delay in the delivery of this material, some overtime was required to complete the job by the required date.

Lead shielding of various types has been fabricated for the Hot Semiworks. These shields have ranged from small plugs and cylinders to one weighing about 2,000 pounds. Due to the shape of the shields, a special melting pot, using induction heating, was devised to permit continuous pouring of the lead.

The Ease computer scanner, located in the 3707-C Building, was completely overhauled to permit the scanning through all points. The new computer equipment room overtemperature control was installed and has already demonstrated its usefulness. Two new transistorized DC amplifiers were received to replace the existing ones in the river monitor station. However, the wrong circuit diagrams were furnished and the use of the new amplifiers

will be delayed until proper diagrams are received. HLO will not permit our opening the instruments to trace out the connector wiring as it would void the guarantee.

A very near serious situation was corrected in the 325-A Building when it was discovered that a lighting transformer had created a hot terminal, which had been caused by a loose and bad connection. This was apparently a factory blunder.

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 April 1961.

E. Costs and Savings

Annual savings of \$7,620 were attained through suggestions approved during April. A large backlog of suggestions is still pending evaluation. One cost improvement proposal was submitted and is currently awaiting financial approval.

F. Status of Projects and Major Jobs

3717 Building Sheetmetal Shop Addition - No change. Still awaiting shipment of the proper type of fire alarm box for contractor to complete the job.

303 Area Grounds Improvement - Work progressed during the month and is expected to be complete by June 1.

Project CAF-894, Increased Compressed Air Capacity, 384 Building - The structural work for the building addition was completed and the new compressor is scheduled for delivery early in May. August 1 still appears to be a realistic "use" date. Several extended compressed air outages are anticipated when tie-ins for new equipment are made.

PRTR Parking Lot Access Road - Construction is 60 per cent complete and on schedule. Contract completion date is May 7, 1961.

3717 Building Ventilation - J. A. Jones Construction Company is 35 per cent complete, which is somewhat behind schedule. Priority has been given to the 303-J Building job.

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303-J Building Heating and Ventilation - J. A. Jones is 70 per cent complete with completion scheduled early in May.

Additional Sand Separator and Import Line Modifications, 382 Bldg. - Construction and fabrication work has been started and is 30 per cent complete. The major water line tie-in is scheduled for May 6, concurrent with PRTR outage. The work is on schedule.

Corrosion Control and Roof Repair, 313 Building - A contract has been negotiated with J. A. Jones to repair the autoclave roof damage and to clean and apply protective coatings in four bays above the penetration etch facilities. Work is scheduled to start about May 8.

303-J Building Renovation, North Section - Contracted work by the J. A. Jones Construction Company is 65 per cent complete. Occupancy is scheduled for May 5, with construction completion by June 1.

No. 6 Boiler Repair - Actual work on the boiler overhaul was started by J. A. Jones on April 11 and progress has been good. Overhaul of the grates is expected to start about May 15. Final preparations are being made to bring Dow Industrial Service into the 300 Area to chemically clean 3, 4, 5 and 6 Boilers. Inspections have indicated excessive sludge and scale deposit in the tubes.

No. 4 Sanitary Water Pump Replacement, -382 Building - Preparatory electrical work has been performed by J. A. Jones. The equipment is scheduled for delivery early in May, with completion of the work by July 1961.

Perimeter Fence Lighting Modifications - This security fence lighting modification in the area immediately east of the 306 Building will be subcontracted by J. A. Jones.

3701-L Building - Two time clocks and patrol station were re-located to permit one-man operation of the badge house and south vehicle gate on night shifts and week-ends. Modification of the second floor for additional office space was also completed.

Major Studies

Maintenance Shop, 384 Building - Studies are under way to evaluate the feasibility of constructing a maintenance shop on the north side of the 384 Building.

Automotive Equipment Level of Service, 300 Area - A Task Force has been organized and preliminary data is being compiled.

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G. Special Reports Issued

The manuscript, "Productive Maintenance Through Vibration Analysis," by W. F. Emery was completed and has been forwarded for publication.

An article on the 384 Building Hydrovac System by R. G. James was printed in the April issue of Combustion.

Steam Plant Study, HW-68396, by R. G. James was issued.

III. PERSONNELA. Safety, Security and Radiation Experience

Medical Treatment Injuries	31
Frequency Rate	5.74
Disabling Injuries	0
Serious Accidents	0
Security Violations	0
Radiation Incidents	0

B. Meetings

Round Table-Staff	22
Safety and Security	41
Information	1

Manager
Plant Facilities Operation

E Hilgeman:RTM:mkm

RELATIONS PRACTICES OPERATION
APRIL, 1961

STATISTICSEMPLOYMENT

		<u>April</u>	<u>March</u>
Additions:	Exempt	5	4
	Nonexempt	18	14
		<u>23</u>	<u>18</u>
Reductions:	Exempt	2	1
	Nonexempt	7	6
		<u>9</u>	<u>7</u>

HEALTH AND SAFETY

Disabling Injuries	0	1
Serious Accidents	0	0
Medical Treatment Injuries	57	57
Medical Treatment Frequency	4.07	3.50

SECURITY

Violations - FPD	0	1
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SUGGESTION PLAN PARTICIPATION

Eligible employees	691	682
FPD suggestions received	54	65
Annualized rate per 1000 eligible employees	938	1,144
No. of suggestions adopted	35	31
Net annual savings	\$10,711	\$5,553
Amount of awards	\$ 1,433	\$ 660
Per cent of total awards to savings	13.3	11.9
Average amount of awards	\$40.93	\$20.34

Employment

Recruiting of journeyman instrument technicians was essentially completed in April. Due to the cancellation of the aircraft nuclear propulsion business at Idaho Falls, some thirty-five instrument technicians were made available. Following interviews with them, fifteen offers were extended and eight acceptances received. Most of these men are expected to report to HAPO during the first two weeks of May. In addition, through earlier recruiting efforts, three journeyman instrument technicians were added to the rolls in April. Two of these men had previously been employed in California and the third at Camp Hanford.

date. no Department offers have been extended to monthly salaried personnel stationed at Idaho Falls. Invitations to visit HAPO for interviews have been extended to six monthly salaried personnel, Aircraft Nuclear Propulsion, Cincinnati, Ohio. It is expected that these men will visit HAPO early in May.

Health and Safety

The April medical treatment frequency rate is 4.07. The calendar year to date frequency rate is 3.65, which equals the Department goal.

Thorough safety reviews requested by the General Manager to be made within each section of the Department have recently been completed. Job hazard breakdowns have been updated, materials handling procedures have been improved, operating methods have been changed where necessary for added safety, and work orders are in process for needed revisions to equipment.

The off-the-job first aid program sponsored by the Health and Safety Program Council was started on April 26 and will be completed May 15. Approximately twenty-seven employees and adult family members are taking the course.

Further study is being made of emergency signal systems HAPO-wide. The FPD Specialist - Health & Safety is the Department representative on the standards technical group making the study.

New members have been appointed to the Department's Health and Safety Program Council. Assignments have been made covering activities to be sponsored later in the year. These include traffic safety, hand injury reduction, safety suggestions, and fire prevention.

A new welding and burning permit has been introduced for Department use. The forms are available from the Health and Safety Office and will be used by all components requiring this type of service to assure safety in work involving flame or arc.

Special bio-assay examinations are being conducted for forty Department employees who have worked with or may have been exposed to mercury in their work during the past two years.

Security

No security violations have been reported this month. The number of violations calendar year to date remains at two.

Salary and Wage

Position guides, evaluations and structural functional charts were completed this month to accommodate the establishment of a new maintenance subsection in the Plant Facilities Section. The new subsection will provide for around-the-clock maintenance support of the Hanford Laboratory's plutonium recycle test reactor. Formation of the subsection is to be effective May 1, 1961.

R W McCullugh
Manager - Relations Practices

McCullugh:mfj

END

**DATE
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12 / 9 / 92