MONTHLY REPORT

September, 1959

FUELS PREPARATION DEPARTMENT

GENERAL ELECTRIC

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FUELS PREPARATION DEPARTMENT

MONTHLY REPORT - SEPTEMBER, 1959

Compiled by Fuels Preparation Department

October 23, 1959 Richland, Washington

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

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12  E. Hilgeman
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A-2
PRODUCTION

Five hundred sixty tons of acceptable uranium fuel elements were produced. This is 100% of forecast production for the month.

At month end there were 669 tons of bare uranium cores in storage compared to 613 tons at the end of August. Finished fuel element inventories in combined 100–300 Area storage totaled 704 tons versus 674 tons last month.

ENGINEERING

Two natural uranium I & F fuel element failures were reported. This is the lowest number of regular production ruptures in any month during the calendar year.

A partial shipment (1600 cores) of alloyed dingot material was received. Tests indicate this material is within specified limits. The balance of the 25 tons scheduled is due in October.

About 1000 self-supported and bumper fuel elements were prepared for reactor charging.

Extensive stud pulling tests have confirmed preceding indications that prolonged heat treatment is feasible without reducing the tensile strength of the AlSi' bond. Metallographic studies show that a continuous aluminum nickel diffusion layer can be achieved at conditions not deleterious to the AlSi uranium bond. Results from the electrolytic-hydrogen test for the adherence of nickel plate also continue to indicate the beneficial effects of heat treatment.
NPR fuel element development programs continue on schedule and with generally satisfactory results. The needs of NPR and KER coextruded fuel tubing for Hanford Laboratories' and Fuels Preparation Department's components have been determined and plans laid by this Department for the extrusion of 500 feet each of NPR and KER sizes, and 170 feet of KER enriched, during the balance of FY-1960.

A contract has been let with the Ajax Magnethermics Corporation to further develop induction heat treatment methods for the NPR fuel process. This work continues on the basis of satisfactory test development work carried out by this corporation.

Approval has been received to conduct work with the G. E. Metallurgical Products Department in the development of welding closures by powder metallurgy techniques.

The NPR nondestructive testing station is nearing completion. Ultrasonic and X-ray methods are being used successfully for other NPR testing work.

Experimental studies of eddy current methods for measuring metal temperature has been extended to the measurement of transient temperature in thin plates on a laboratory scale.

GENERAL

Manufacturing yield for 8" I & E fuel elements dropped slightly to 83.4% from 85.3% last month. The 8" solid fuel element yield improved to 88.7% compared to 87.9% last month. Tests are being conducted with 0.3 cm, 0.5 cm and 0.75 cm standard settings on the internal bond testers to determine yield effect. Operating efficiency was 94% as forecast.

Three autoclave failures occurred in September.

Two new size fuel elements were added to the product line this month, CIVN and 6" O size I & E normal for water mixes.

Laboratory tests confirmed that iron and silicon additives in ingot uranium fuel cores produce grain size uniformity comparable to ingot metal.
A system is being devised whereby data processing methods will be used in advising customers of the Maintenance & Power Operation when calibration of various instruments should be made. It is expected that this system will greatly improve the regularity with which instruments are calibrated which will in turn guarantee a more precise measurement by these instruments.

PERSONNEL STATISTICS

| Number of employees August 31, 1959 | 730 |
| Number of employees September 30, 1959 | 730 |

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<thead>
<tr>
<th>Department</th>
<th>Exempt</th>
<th>Non-Exempt</th>
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</tr>
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<td>Manufacturing</td>
<td>53</td>
<td>284</td>
<td>337</td>
</tr>
<tr>
<td>Engineering</td>
<td>50</td>
<td>28</td>
<td>78</td>
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<tr>
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<td>11</td>
<td>7</td>
<td>18</td>
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<tr>
<td>Maintenance &amp; Power</td>
<td>31</td>
<td>252</td>
<td>283</td>
</tr>
<tr>
<td>Relations Practices</td>
<td>5</td>
<td>6</td>
<td>11</td>
</tr>
</tbody>
</table>

**TOTAL** 151 578 729

STAFF

General Manager, Fuels Preparation Department  L. L. German
Manager, Manufacturing Operation            W. M. Mathis
Manager, Engineering Operation             J. W. Talbott
Manager, Financial Operation              W. S. Roe
Manager, Maintenance & Power Operation     E. Hilgeman
Manager, Relations Practices Operation     W. A. Shanks

PATENT SUMMARY - SEPTEMBER, 1959

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 September, 1959. 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.

General Manager
Fuels Preparation Department

L.L.German/jm
CURRENT OPERATIONS

Production and Productivity

Statistics

<table>
<thead>
<tr>
<th></th>
<th>8&quot;</th>
<th>8&quot; I &amp; E Rev.</th>
<th>6&quot; Water</th>
<th>ENRICHED 6&quot; I &amp; E</th>
<th>6&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Solid</td>
<td>C</td>
<td>K</td>
<td>K</td>
<td>O</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current Month's Production</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acceptable Fuel Elements Produced (Tons)</td>
<td>81.6</td>
<td>52.2</td>
<td>100.8</td>
<td>71.6</td>
<td>199.1</td>
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<tr>
<td>As % of Forecast</td>
<td>102</td>
<td>109</td>
<td>146</td>
<td>102</td>
<td>85</td>
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<tr>
<td>Production</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>As % of Past 3 Month's</td>
<td>119</td>
<td>120</td>
<td>99</td>
<td>103</td>
<td>100</td>
</tr>
<tr>
<td>1/4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Production</td>
<td>154</td>
<td>105</td>
<td>152</td>
<td>95</td>
<td>33</td>
</tr>
<tr>
<td>As % of Past 12 Month's</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1/2</td>
<td>95</td>
<td>73</td>
<td>102</td>
<td>101</td>
<td>106</td>
</tr>
<tr>
<td>% of Forecast Achieved</td>
<td>109</td>
<td>107</td>
<td>75</td>
<td>107</td>
<td>152</td>
</tr>
<tr>
<td>Last Fiscal Quarter</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% of Forecast Achieved</td>
<td>106</td>
<td>107</td>
<td>75</td>
<td>107</td>
<td>152</td>
</tr>
<tr>
<td>Last 4 Fiscal Qtrs.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Operating Efficiency

|                         |        |             |          |                    |        |
| Current Month (%)       |        |             |          |                    |        |
| Forecast (%)            |        |             |          |                    |        |
| Previous Month (%)      |        |             |          |                    |        |

Manufacturing Yield

|                         | 89     | 85           | 84       | 79                 | 85     |
| Current Month (%)       |        |             |          |                    |        |
| Forecast (%)            | 82     | 82           | 82       | 82                 | 82     |
| Previous Month (%)      | 88     | 85           | 87       | 86                 | 83     |

Bare Uranium Available for Processing (Tons)

|                         | 118    | 45           | -        | 203                | 180    |
| Finished Products in Storage (Tons)
Special Products Finished (Pieces) Poison Uranium Utilization
Production

Finished production for the month of September was 560.9 tons, 100% of forecast. Production was achieved through the use of eight canning lines during one-half of the month and nine canning lines during the remainder of the month. Emphasis was placed on reducing the in-process inventory by recovering weld reject material.

Production of KIIN material was completed on September 15 with all available aluminum components being consumed. Most of the few KIIN uranium cores that remain have been processed through recovery and may be returned to NLO for rework.

Yield Control

The September 8" I & E yield was 83.4% compared to 85.3% last month. The September 8" solid yield was 88.7% compared to 87.9% last month. Relatively slight increases in several reject categories were responsible for the lower I & E yield. None of these changes appeared to be significant. The improvement in the 8" solid yield is attributed to a significant reduction in the number of component preparation rejects.

The assembly reject category, AlSi slopover and non-seats, continued to be the largest single reject category this month. New reduced diameter sleeves are being placed in service to alleviate the AlSi reject problem, but the improvement to date has not been significant. The long preheat cycle that appeared to alleviate the AlSi problem was utilized only about one week during the month due to other process difficulties. The non-seat condition seemed to occur sporadically but was generally associated with low canning bath metal temperatures. It was not possible to entirely eliminate the non-seating situation by merely increasing bath temperatures since the hotter metal tended to erode the aluminum components and thus increase the thin wall reject category. These conditions are currently being studied.

Three autoclave failures occurred during September compared to one last month. All three failures appeared to be caused by a pinhole in the weld bead in close proximity to a void that ultimately permitted water contact with the uranium core.

A production test was conducted during September that involved processing aluminum components through a twice normal strength Diversey solution utilizing regular production component cleaning equipment. It had been found earlier through pilot plant testing that the use of this strength solution appreciatively aided aluminum component wetting. The tests to date appear to demonstrate that there are no significant adverse side effects caused by the double strength Diversey. Plans call for the continuation of the tests to further verify these observations and to definitely establish that component wetting is improved.
Radiography of the male weld by the xerography process has proven satisfactory for void detection. However, it has not been possible as yet to differentiate as to the degree of seriousness of the voids. To date a twenty-four percent void rate has been experienced on production material and preliminary testing indicates that only about half of these could be recovered by rewelding. This inspection technique will continue to be explored.

A recent shipment of dingot uranium fuel cores containing grain refining additives was sampled and evaluated in the laboratory this month. This shipment is a continuation of a program started in June of this year to improve the quality of dingot uranium. At that time, it was decided that the addition of 150 ppm iron and 100 ppm silicon to the dingot metal resulted in metal approaching ingot metal in grain size and grain uniformity.

Twenty samples of dingot uranium fuel cores were examined and all confirmed the original finding that these additives result in grain size uniformity comparable to ingot metal. The difference noted was that the higher hydrogen content (2-5 ppm) associated with dingot metal still remained. It was anticipated that this material would have a hydrogen content of less than 2 ppm, which is the level that Mallinckrodt Chemical Works is striving to obtain.

Destructive examination of several internal ruptures by Radiometallurgy has indicated that the causes were probably inadequate closure integrity coupled with water paths down the internal tube braze area. These water paths appear to be a result of both porosity and inadequate compound layer.

Since the internal water paths seem to pass through areas of small porosity and poor compound layer, one internal bond tester has been adjusted to reject on a 0.3 cm internal bond standard vice the normal .75 cm standard. Samples of the rejects on this test are being selected for retest at different test levels and for destructive examination to determine the degree of porosity and brittle bonding which can be expected to pass at three test levels, 0.3 cm standard, 0.5 cm standard, and 0.75 cm standard. Percent defective information to date indicates that an overall increase in this reject category of approximately 2.0 percent can be expected if the 0.3 cm standard is adopted.

Other Activities

The Special Products crew successfully machined, rewelded and tested 13,992 fuel elements during September.

150 I & E "N" pieces were sized by the Special Products crew for Process Engineering during September.

Development efforts in the 306 AlSi Pilot Plant were devoted primarily to the improvement of aluminum component cleaning solutions and techniques. A shortage of fuel cores for destructive testing in the Pilot Plant has continued to hamper development work somewhat.
The following pieces were processed through the Fuel Recovery Operation.

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>8&quot; Solid</td>
<td>2,988</td>
</tr>
<tr>
<td>8&quot; I &amp; E</td>
<td>24,478</td>
</tr>
<tr>
<td>6&quot; Water Mix</td>
<td>103</td>
</tr>
<tr>
<td>6&quot; Enriched</td>
<td>9,773</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>37,342</strong></td>
</tr>
</tbody>
</table>

**PLANT CONDITIONS, INCIDENTS AND IMPROVEMENTS**

**General**

Operating efficiency improved again this month to 94% as was forecast. No single significant incident contributed to operating downtime.

The inventory of bare uranium cores increased to 669 tons at month end compared to 613 tons on hand at the end of August. Uranium receipts were about 100 tons below NLO's adjusted schedule for September although they did exceed minimum requirements and thus permitted a slight build-up in the inventory.

The initial shipment of 8" solid uranium cores from the Mallinckrodt Chemical Works was made near the end of September. It is expected that this facility will continue to manufacture 8" solid material and they should supply a major portion of our bare core needs for this size in subsequent months.

Inventory of finished fuel elements increased to 70½ tons compared to 67½ tons on hand last month. Department production slightly exceeded reactor usage of finished fuel. Currently supplies of all product types are adequate.

**Long Preheat Cycle**

The long preheat cycle was again used on a limited basis this month. In total about 5,000 pieces were processed on this cycle. To avoid thin-wall rejects it has generally been necessary to operate the canning bath at relatively low temperatures which in turn causes metal freeze out in the bath and subsequent operating problems. This problem did not occur to any significant degree during development tests in the 306 Pilot Plant. The advisability of conducting further development tests on this cycle in the Pilot Plant is being studied.

**Noise Level in Automatic Weld Booth**

Corrective measures are being taken to reduce the noise level in the automatic weld booth. Earlier studies revealed that some impact noises were near the upper level of the HAPO standards for mandatory noise control. It was learned that the impact noises originated from stops on the inserter cylinders, improper air cushion adjustment on the ejector, unload elevator cylinders and electrical relays. All of these noises were amplified by the booth’s metal ceiling and walls. A follow-up study is planned after improvements have been completed.
Automatic Lathe Unloader

A prototype automatic lathe unloader with a length check attachment has been installed on one Acme Gridley Lathe and fuel elements are being conveyord to a second lathe for final facing. With the unloading device and connecting conveyor a pair of lathes operate as a single unit. The mechanical system eliminates operator handling of fuel elements and thus can be expected to improve the marred surface reject category somewhat.

OPERATING PLANS

Initial deliveries of CIVN and 6" "O" size I & E normal uranium cores were received during the month, adding two new sizes to the product line. The CIVN material is scheduled for use initially in ribless zirconium process tubes in C reactor. The finished fuel elements will have the self-supporting feature. The 6" "O" I & E cores will be utilized for water mixing fuel elements for the older reactors. The initial production run of this size is scheduled for early October with routine production thereafter.

A revised schedule of finished fuel element requirements has been received from IPD. Although it has not been possible to complete a revised Department production schedule based on these requirements, it does appear that a tenth canning line will be necessary beginning in November.

An order for 40 tons of reject 8" I & E uranium cores was placed with NLO during the month. This is scrap material rejected for striations to be used solely in the 306 Pilot Plant. Nearly all the process development work carried out in this facility requires virgin uranium cores. In the past, Pilot Plant needs exceeded the amounts of virgin pickle rejects available from the 313 production process, so it was necessary to supplement these virgin rejects with acceptable virgin cores. This was costly, in that part of the acceptable uranium was later rejected and scrapped after it had been through the recovery process.

The procedure is being used to conserve the machining capacity at NLO during this period of labor uncertainty. After these scrap pieces have been canned in the Pilot Plant, they will be recovered and shipped back to NLO for remelt. Care will be taken to assure that none of this material gets into the production stream.

EMPLOYEE RELATIONS

Safety Performance

Members of the Manufacturing Section were treated for 25 medical treatment injuries. This is equivalent to a frequency rate of 4.75.
One serious accident (FPD 59-5) occurred on August 29 but was not reported in last month's report. A Machinist Journeyman, Manufacturing Maintenance, sustained second degree burns to the fingers and palm of his right hand when a small accumulation of zirconium chips ignited while he was removing the scrap from a lathe chip pan. The employee was on loan to HLO Technical Shops for the day. After treatment the employee was able to return to his regular assignment.

Radiation Control

Radiation exposure of operation personnel, as measured by film badge results, was at the lowest level since March and was the second lowest month this year.

<table>
<thead>
<tr>
<th>Greater than 300 mrads</th>
<th>August</th>
<th>September</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>2 badges</td>
<td>None</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Combined Manufacturing Section Exposure</th>
<th>August</th>
<th>September</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>5,316</td>
<td>4,240</td>
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</table>

Security Violations

None

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 September.

[Signature]

Manager - Manufacturing

WM Mathis:RWM:gl
VISITORS

<table>
<thead>
<tr>
<th>Name</th>
<th>Company</th>
<th>Contact</th>
<th>Date</th>
<th>Reason</th>
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<tr>
<td>C. Konecnl</td>
<td>APED</td>
<td>D. C. Worlton</td>
<td>9/3</td>
<td>Discuss nondestructive testing of zirconium tubing</td>
</tr>
<tr>
<td>A. L. Hobson</td>
<td>Carl Hermann</td>
<td>Worldon</td>
<td>9/21</td>
<td>Present educational series on Vacuum Engineering and Maint. Techniques</td>
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<tr>
<td>F. F. Davis</td>
<td>&quot;</td>
<td></td>
<td>9/25</td>
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PERSONNEL

<table>
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<th>Title</th>
<th>Operation</th>
<th>Nature of Change</th>
<th>Date</th>
</tr>
</thead>
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<tr>
<td>L. E. Kusler</td>
<td>Engineer</td>
<td>4420</td>
<td>Transferred to 4430</td>
<td>9/1</td>
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</table>

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 September, 1959 except as listed below. Such persons further advise that for the period therein covered by this report, notebook records, if any, in the course of their work have been examined for possible inventions or discoveries.

NONE
PROCESS ENGINEERING

Regular Production Rupture Experience

Two natural uranium I & E fuel element ruptures occurred in the reactors during September. These ruptures are summarized as follows:

<table>
<thead>
<tr>
<th>Reactor</th>
<th>Exposure (MWD/T)</th>
<th>Rupture Classification</th>
<th>Jacket Alloy</th>
</tr>
</thead>
<tbody>
<tr>
<td>KE</td>
<td>845</td>
<td>Internal</td>
<td>X-8001</td>
</tr>
<tr>
<td>DR</td>
<td>632</td>
<td>Side Other</td>
<td>X-8001</td>
</tr>
</tbody>
</table>

The number of regular production ruptures experienced this period is the lowest reported for any month during the calendar year.

In addition to the regular production ruptures, two ruptures were sustained in production test material. One was an unclassified I & E depleted rupture, which had been exposed to 1151 MWD/T or approximately ten months in C Reactor. The other was a zircaloy clad enriched (1.44% U-235) uranium tube-in-tube fuel element, which had been exposed to 310 MWD/T in a KER loop. This rupture has not been classified.

Production Tests

Eight tubes of I & E depleted uranium fuel elements being irradiated to rupture or for a maximum exposure period of twelve months in C Reactor were discharged because of the aforementioned rupture. This material was prepared using a caustic etchant on the caps to minimize non-wetting problems and associated closure failures experienced earlier during an I & E depleted loading. Since the appearance of the rupture was similar to previous ruptures, it is evident that non-wetting was not the single cause of the earlier failures, but braze porosity may have been an equal or greater factor. One of the eight charges was reluctant to back-seating in the process tube prior to discharge, further confirming a dimensional stability problem.

An analysis of post-irradiation data for I & E fuel elements, fabricated from natural uranium heat treated in rod form, shows a slight improvement in dimensional stability. The average warp of measured I & E fuel elements discharged from the C and K Reactors during CY 1958 was 7.7 mils versus 7.4 mils for CY 1959. Data for the current year also indicate a significant reduction in so-called "sports", which warp in excess of 30 mils. Although an analysis of preliminary data on blank heat treated I & E fuel elements is incomplete, a further improvement in warp is indicated.

Uranium Technology

A partial shipment (1600 cores) of alloyed ingot uranium was received this month. Tests indicate that this material is within the limits specified for...
the initial 25 tons per month scheduled for reactor charging. The grain size tester (UAT) shows a slightly greater variation in grain size for alloyed ingot uranium than for standard ingot. Chemical composition of the metal is suspected as being the cause of this variation, and further testing is in progress to determine if a correlation exists.

Table I compares chemical composition, reactivity and grain size for the present ingot, alloyed ingot and the unalloyed ingot material canned a year ago.

Table I

<table>
<thead>
<tr>
<th>Chemical Analysis (ppm)</th>
<th>Dingot Specifications 25 T/Mo.</th>
<th>Original Dingot (1958)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrogen</td>
<td>1.5-2.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Iron</td>
<td>100.0</td>
<td>150.0</td>
</tr>
<tr>
<td>Manganese</td>
<td>10.0</td>
<td>25.0</td>
</tr>
<tr>
<td>Magnesium</td>
<td>5.0</td>
<td>25.0</td>
</tr>
<tr>
<td>Nickel</td>
<td>30.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Silicon</td>
<td>15.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Carbon</td>
<td>500.0</td>
<td>750</td>
</tr>
<tr>
<td>Reactivity-dih &quot;O&quot; Size I &amp; E</td>
<td>-0.365</td>
<td>-0.319</td>
</tr>
<tr>
<td>Grain Size Heyn Intercept</td>
<td>0.28-0.30 mm</td>
<td>0.29-0.40 mm</td>
</tr>
</tbody>
</table>

The remainder of the first 25 tons of alloyed ingot cores is being shipped and should be ready for canning the later part of October.

Uranium machining has started at Mallinckrodt and the first shipment of 8-inch solid cores has been received at HAPO. Until sufficient acceptable alloyed ingot material is produced at MCW, NLO is supplying rolled ingot rods for final machining at MCW. Dimensional inspection of this material indicates it is comparable to the standard production material received from NLO.

Numerous tests have been made to determine the difference in uranium cores that have been quenched in 100°F versus 130°F water following beta-heat treatment. Results from X-ray diffraction, the sonic orientation test, and the grain size test indicate no difference. Warp measurements made on pieces after alpha annealing, as well as after slug recovery also show no difference. Irradiation experience is expected to further confirm that the quenching temperature has no adverse effect on uranium quality.
Three thousand I & E cores have been tested with the grain-size tester (UAT) to determine if core position during heat treating had any effect on grain size. Cores normally are heat treated in lots of 250 pieces. Test results indicate that core position does not have any appreciable effect on grain size.

Process Development

Three hundred twenty-two OIIN self-supported and 733 OIIN bumper fuel elements were prepared for reactor charging using the resistance spot welder. In addition, four charges of prototypical CIVN self-supported elements were fabricated for flow laboratory and preliminary in-reactor tests.

A production test to evaluate ultrasonic techniques for attaching rails to self-supported elements has been expanded from three to nine charges for irradiation. No significant difference in the shear strength of ultrasonic welds was apparent after 60, 80, and 100 hours of water autoclaving. Weld quality specifications have been developed for a prototypical ultrasonic production welder.

About 700 four-inch solid enriched Li-Al target elements were fabricated for Production Test IP-255-A-9-FF. These pieces are about 99 per cent "black" or 50 per cent blacker than natural Li-Al pieces. A total of 264 I & E enriched Li-Al target elements were also produced with an overall yield of 70.2 per cent.

The larger scale testing of the long-preheat cycle (73 sec. nominal) for I & E canning in 313 Building resulted in a slight reduction in overall braze porosity and a slight increase in the Al-Si penetration reject rate. However, xeroradiographic studies of male welds revealed that there was a significant reduction in male-end braze porosity when using the longer preheat cycle.

A comparison of one and two-step fuel element quenching methods after canning revealed statistically that a single step quench tends to produce more braze layer porosity between the cap wafer and can wall. The one-step method (currently being used) consists of submerging the fuel element assembly below the Al-Si reservoir before the Al-Si has frozen. In the two-step method (used prior to 1958) the assembly is lowered to a level about one inch below the Al-Si reservoir, delayed several seconds until the Al-Si freezes, and is then submerged below the Al-Si reservoir. Manufacturing is now converting all their quench machines to a two-step method.

The present aluminum cleaning process was compared to the following cleaning methods and found to be superior in all cases:

1) Use of GMC 114 A alkaline cleaner in place of Altrex.
2) Use of Wyandotte 2487 de-oxidizer in place of Diversey 514.
3) The use of a Zincate and nitric acid etch between the Altrex and Diversey 514 steps.

Process Technology

1. Production use of 32 oz/gal diversey for aluminum component cleaning was started during September with favorable results toward improving can wetting.
2. Eighteen hundred (1800) fuel elements that had passed final inspection were closely examined for pinholes in the welds. A defective rate of 4.9 per cent was observed. It has been demonstrated that buffing of the welds, particularly after final etch, makes visual inspection of the welds for pinholes much easier.

3. Specifications for a prototype ultrasonic welder to attach rails to self-supported fuel elements were completed and routed for bids.

4. A rail-weld-strength tester has been designed to destructively measure the strength of welds used to attach supporting rails to fuel elements. Fabrication is in progress.

5. Fabrication of a peel test fixture was completed and is ready for installation in the Instron Tensile Test Machine, parts of which have been received. This equipment will be used to measure bond strength.

Nickel Plated Fuel Elements

Extensive stud-pulling tests have confirmed preceding indications that prolonged heat treatment of nickel-plated canned fuel elements is feasible without reducing the tensile strength of the Al-Si-uranium bond. Baking at 300° C up to 6 hours and at 400° up to one hour has no effect on the bond-tensile strength. Twelve (12) hours at 300° C, and 3 hours at 400° C resulted in a definite decrease, and this trend continued with longer times. Metallographic studies indicate a continuous Al-Ni diffusion layer can be achieved at conditions not deleterious to the Al-Si uranium bond, but reproducibility has not been established.

Results from the electrolytic-hydrogen test for adherence of nickel plate continue to indicate the beneficial effect of heat treatment. However, the testing method appeared to be deficient in the following respects:

   (1) The small amount of blistering achieved makes rapid comparative evaluation difficult.
   (2) Surface conditioning of the samples appeared to have a significant effect on results, even though all surfaces were visually clean.
   (3) Electrolytes giving good pH control (phosphates) appeared to retard blistering, possibly due to formation of an insoluble nickel-phosphate film.

The amount of blistering achieved in a given period of time has been markedly increased by increasing the current density five fold to approximately 5 amp/sq. ft. Employing a high current density also achieves nickel blistering in the pH-4 to pH-6 range, which is ideal for control using buffers which will not coat the nickel with an insoluble salt; earlier data indicated little or no blistering could be achieved in the pH range at low current densities (.8 - 1.0) amp/sq. ft. and gross discoloration of the samples resulted at higher current densities. Addition of sodium chloride to the electrolyte appeared to minimize this discoloration. A few more tests with various electrolyte compositions are planned. Equipment has been fabricated which will increase the sample capacity by four-fold and simplify operation. The equipment is set up in the Manufacturing Quality Control Laboratory, and arrangements have been made for assistance from Quality Control Laboratory personnel in conducting the tests.
Radion metallurgy examination of irradiated nickel plated fuel elements was confined largely to detection of hydrogen in the gas present at possible void spaces at the Al-Ni interface. Preliminary results indicate the nickel plate getters hydrogen while in-reactor. Gas pumped from two fuel elements having one mil thick coatings of chemical nickel, was two percent (vol.) and 9 percent (vol.) hydrogen, while a single unplated irradiated element had less than .01 percent when pumped for the same period of time. Prolonged pumping resulted in less than .01 percent additional hydrogen on the nickel plated elements, but 32 percent on the unplated control. A possible cause for the anomalous behavior of the single control element is thermal decomposition of organic material on the surface as the element heats up during a period of several hours in a vacuum. Two additional nickel plated pieces and three unplated controls will be run to firm up the existing information.

AlSi Pilot Plant Activities

About 2700 uranium cores were canned in the AlSi Pilot Plant for process development purposes and 101 six-inch solid Doe cores were dip-canned for high temperature corrosion tests in the KER Loops. The major items of process development were:

1. Comparison of two step and quick submerge quenching methods.
2. Aluminum cleaning and wettability tests in molten AlSi to:
   a. Evaluate effect of increased chromic acid concentrations in Diversey 514.
   b. Determine effect of ultrasonics in the Diversey 514 solution on aluminum wetting.
   c. Test effect of hexachoroethane additions to methanol rinse on aluminum wetting.
   d. Evaluate effect of sulfuric acid additions to Diversey 514 solutions.
3. Test of effect of a vibrating-abrading well on bubble removal under the spire wafer and on spire wetting.
4. Evaluation of treating cores in a boiling NaOH-NaNO₃ solution on core bonding and braze porosity.
5. Determination of mechanical agitation on spire-heating rate.
6. Preparation of spires for a large scale canning test in 313 Building to compare spires dried after spire etching by chemical drying with methanol-warm air dried spires.
7. Tests using spire-can components to:
   a. Determine if internal porosity can be reduced by a longer submerge time.
   b. Determine the location of voids in a can immediately after submersion.
8. Evaluation of a high nickel concentration (about 1.2 percent) in the canning baths on fuel element quality.
9. Normal canning of fuel elements to provide:
   a. I & E fuel elements with X-8001 cans and C-64 spires for autoclave and corrosion studies.
   b. Seven-inch 1.47 percent enriched pieces for comparison fuel elements in PT-IP-247-A-8-FP.
MATERIALS ENGINEERING

NPR Fuel Element Development

Coextrusion Program

The needs for NPR and KER coextruded fuel tubing for HLO and FPD components for FY 1960 have been estimated and plans laid for Materials Engineering to coextrude these as follows:

a) Requirement: about 500' each, of NPR and KER sizes, natural uranium, and about 170' of KER enriched.

b) All KER stock will be extruded between now and the end of CY '59 in four extrusions, two at NMI and two at Bridgeport Brass.

c) NPR stock will be extruded during the 3rd and 4th quarters, FY '60.

d) Plans for the enriched are indefinite.

Uranium Extrusion Billets

About 6000 pounds of ingot stock has been gamma extruded and pierced to 9" x 2-5/8". This material is being alpha extruded to KER billet sizes and will provide the uranium for the next coextrusion run. No other uranium is currently being processed for the coextrusion program although substantial orders have been placed and large quantities will be in process shortly.

The development of casting of large ingots (11-1/8" x 20") by NLO for the NPR program has started and several ingots have been cast. By November four large ingots should be available for alpha extrusion to billets.

A new route for producing uranium extrusion billets that holds promise of producing coextruded products with smoother uranium-zircaloy interfaces and more uniform clad thickness, has been developed by Nuclear Metals and Bridgeport Brass Companies. Basically, the intent of the new route is to control uranium structure during billet preheating for coextrusion. Billet preheat conditions cause alpha recrystallization in uranium, and without sufficient internal stress, recrystallization may be haphazard. Normally, the uranium core is preheated in a beta quenched condition which, though giving some internal stress, does not recrystallize in a controlled manner. To correct this situation, a small amount of alpha working subsequent to a randomizing beta heat treatment has been included in the process design for a series of uranium billets for coextrusion later this year.

Zircaloy Components

At the present time, there is on hand a small stock of zircaloy tubing and finished billet shells. A conversion of two ingots to four sizes is being
accomplished currently for delivery in October. In addition, an order of 350' of zircaloy tubing of four sizes, with Allegheny-Ludlum, is on the books. This material has been tied up in the steel strike and delivery date is questionable.

One additional item of zircaloy tubing is needed to provide sufficient stock for FY '60. This is about 25' of a 7-1/2" size. Except for this item all stock for FY '60 is on hand or on order.

Evaluation of Tube Extrusions

NPR Size

Samples of the NPR tubes extruded at BBCo. (Adrian) on 8/29/59 are being evaluated. To date, the following data is complete:

A. Bonding

One hundred thirty-four O.D. bond fracture tests and one hundred thirty-two I.D. bond fracture tests have been evaluated for eight tubes of the 27-35 series (tube #33 not included). Considerable variability in bonding was encountered.

Tubes 28 and 32 show good bonding on both O.D. and I.D. Tube 32 had the best and most consistent bonds which have been seen on NPR tube extrusions.

Tubes 30 and 35 show poor bonding on O.D. and I.D. There are areas in each of these tubes where the interface fractures readily on the standard test. In some of these areas the clad can be peeled with a cold chisel.

The remainder of the tubes are bonded to varying degrees. All of this material is satisfactory for development work. On subsequent extrusions the assembly operations will be closely scrutinized to insure billet cleanliness. No redesign is contemplated since this billet design will be eliminated when pilot plant operation begins.

B. Dimensions

Due to tool breakage and tooling experiments, five dies and three mandrels were used to produce this material. With this tool changeover, the dimensional control was greatly affected.

Based on the as-extruded measurements (with copper on) the following evaluation can be made.

1) O.D.

Tubes 27, 28, and 29 were extruded using the same tooling. For these three extrusions the total variation in O.D. (maximum) was .013"
(± .0065”). Maximum variation in one tube (#27) was ± .0035”; minimum variation in one tube (#28) was ± .0035”.

The maximum variation in any tube was ± .008”. This was caused by the die breaking during extrusion. The best tube extruded was tube #35. Total variation was ± .0025” over the tube length.

2) I.D.

The I.D. variations measured are considerably higher than for tubes #16-19, in the previous NPR outer tube extrusion. Maximum variation was ± .0095” for tube #31; minimum variation was ± .004” for tube #34. The rest of the extrusions varied from ± .0045 to ± .0055”.

3) Wall Thickness

One tube (#27), was found to be badly eccentric. Total wall thickness variation was .073” (± .0365 or ± 11.48%). This was the first extrusion of the series and due to lubrication and/or liner condition, problems it showed abnormally high shift. On the remaining seven tubes the wall thickness variation ranged from a high of ± .012” (± 3.76%) for tube #28 to a low of ± .008” (± 2.48%) for tube #31.

4) Yield

The measurements described in the preceding section are taken over the entire length of good tube cut from each extrusion. In the interest of conserving material, each tube is cropped as closely as possible to the end defect region. Based on the calculated good length available from the core, the following yields were recorded:

- Maximum - tube #28 - 83.95%
- Minimum - tube #31 - 79.63%
- Average of eight tubes - 81.4%

KER Size

Samples of the eight KER inner tubes extruded at NMI on 3/3/59 are being evaluated. To date the following data is complete:

A. Dimensions

Three dies and five mandrels were used in this extrusion run. One new mandrel system (free mandrel) was tried.

Based on the as-extruded (copper on) measurements, the following evaluation can be made:

1) O.D.

Control of diameter was good. Maximum variation of all recorded
measurements for all tubes was .005" (± .0025"). Maximum variation for a single extrusion was ± .002"; minimum variation for a single tube was ± .001".

2) I.D.

Control was good. Maximum variation of all recorded measurements for all tubes was .005" (± .0025"). Maximum variation for a single tube was ± .001"; minimum variation for a single tube was ± .0005".

3) Wall Thickness

Control of wall thickness was poor. The poorest tube produced showed a total variation of ± .022" (± 7.77%). The best tube produced was tube #39, using the free mandrel technique. Its measurements were ± .009" (± 3.16%). In comparison to the other tubes of the series, the free mandrel technique indicates an improvement but it is not as significant as indicated by the above figures.

4) Yields

Due to changes in billet length to diameter ratio, the yield varies greatly between tubes. For the short billets the yield was about 75%. On the longest billets yield increased to 88.5%.

Induction Beta Heat Treating

The Ajax Magnethermic Corporation has submitted a satisfactory bid for conducting the development program outlined in the test program.

The start of the contract was scheduled for October 17, 1959. This date can not be met for reason that additional examination of security requires that AMC be set up as an accountability station.

The drilling of thermocouple holes has been a task. Each of the 27 one foot long set-up piece required 15 holes for thermocouples, plus 2 holes for holding in a top clamp. Each of the 74 static test samples and the 10 scanning samples 3 feet long have required 2 thermocouple holes; the latter have also required 2 holes for the top clamp. The total number of holes is 647.

The material is ready for shipment when the contract is signed and the accountability station is secured.

Chemical Milling - Tube Ends

Chemical etching of counterbores for end closure caps on NPR tubing is presently being performed prior to welding. Etching removes adhering uranium on the zircaloy tube walls and uranium oxide from core surfaces. Chemical milling to replace machining is being investigated in the Manufacturing Analytical Laboratory.
A combination of machining and chemical milling presently provides the best means of providing end closure recesses for welding experiments. In this process, as much uranium is machined out as possible, without contacting zircaloy cladding. The depth of the recess is machined to within about 20 mils, so that dissolution of the uranium adhering to the side walls is complete before recess depth tolerance is exceeded.

Contacts have been made with chemical research personnel, HLO, to establish the feasibility of chemical milling for this purpose and develop a satisfactory process.

**Vapor Blast**

Installation and shakedown of the vapor blast machine in the 306 Bldg. is completed.

**Autoclave**

The high pressure autoclave installation has been completed and testing is in progress. The vessel was water pressured to 3500 psi to check leakage in piping and gasket seals. Following this a temperature and pressure test at 400°C and 1750 psi was performed. Leakage at the water inlet and blowdown connections at the bottom of the vessel developed. Testing will continue until satisfactory performance is attained.

**Powder Metal Closure**

A request has been processed to the AEC requesting that closure work planned at General Electric Metallurgical Products Department be performed on an unclassified basis. An official approval was received on 10/5/59 to proceed with the powder metal closure development, on an unclassified basis.

**Explosion Welding Closure**

Explosion welding tests have indicated that zircaloy-2 can be welded to zircaloy-2 and zircaloy-2 can be welded to uranium, by this process. Welds produced do not have uniform temperature distribution, varying from vaporization at the center of force to no bonding at the outer edge. Areas bonded would be adequate for tubing if a uniform weld could be produced.

An alteration has been made to the contract to study the feasibility of making a tubular type closure by using stainless steel replicas of the required dimensions.

**Heliarc Welder**

The chamber and all essential material are on site. Installation will be made as soon as present electron beam welding commitments are completed.
Electron Beam Welder

It has been shut down for approximately one week for overhauling the diffusion pump and changing the diffusion pump oil. Operation is planned for 10/7/59.

A technique has been established for making satisfactory unbonded closures.

Present effort is on developing the thickness of a closure ring that will permit an adequate fusion welded closure without melting the uranium. This will be followed by developing a method of bonding the end closure to the uranium after the fusion closure.

Heliarc and electron beam welding are to be tried for bonding the end closure to the uranium.
TESTING METHODS

Process Fuel Element Tester

External Bond Test

The quartz transducers used on the external bond testers are being replaced with lithium sulphate crystals. By virtue of their greater bandwidth, it is expected that the new crystals will make test results less dependent upon residual can wall thickness and, consequently, more reliable and uniform.

Internal Bond Test

Attempts to construct a 20 megacycle internal probe incorporating barium titanate crystals have been unsuccessful due to the difficulty in grinding the crystals to the required thickness (0.005 inches). These attempts will be repeated in order to evaluate their suitability of these crystals for use in internal probes.

A trial test with the instruments set to reject on a .3 cm unbond rather than the customary .75 cm resulted in a one percent increase in number of pieces rejected.

General

An oscilloscope unit has been designed, constructed, and installed in a production test console for evaluation. The new unit replaces commercial oscilloscopes which have proven to be unsatisfactory. Replacement of all the commercial oscilloscopes with the new design is now being considered.

NPP and Category II

NPR testing station equipment is nearing completion. The electronic components are now being checked out in the laboratory. The mechanical equipment is essentially finished.

Recent emphasis has been to refine methods of determining integrity of zirconium tubes and coextruded rods. Metallographic examinations have shown that internal cracks are readily detected ultrasonically. Inside surface cracks approximately 0.001 inch deep have been detected ultrasonically. In some instances surface cracks were revealed by ultrasonic tests which had been missed by previous "zyglo" tests.

The use of X-rays as a means of inspecting zirconium welds on prototype NPR fuel elements appears promising. 0.020 inch diameter holes drilled into the inside and outside welds of tubular elements were clearly revealed by a test in which the film was placed on the inside of the tube.
New Development Tests

Bare Core Station

Use of the prototype bare core station for special tests has revealed additive ingot material to have generally the same range of grain size as production ingot material. One difference noted in the two types of material, however, was that the instrument characteristically grouped the ingot material into two rather distinct ranges of grain size. It is postulated that this effect may be the result of different amounts of impurities added to the ingot material.

Advantage of the new equipment over that which it will replace was revealed by a test in which a group of transformation rejects were retested at the bare core station. Only forty percent of this material was rejected by the second test.

Preliminary tests indicate that all types of I & E material may be tested at a single transducer setting. Tests of ingot material are continuing in order to obtain distribution curves for determination of rejection limits. Testing of 25 tons of ingot material is planned for October.

Construction of the production models is proceeding on schedule with delivery of the first unit scheduled for early December. Training of maintenance people has been initiated. Plans are to discuss in depth the entire station in about eight sessions.

End Integrity Tests

Preliminary attempts to evaluate the weld bead test under production conditions have not been encouraging. The equipment's sensitivity to electrical transients necessitated the development of special techniques in order to distinguish defect signals. A more fundamental problem is the apparent inability of the test to inspect more than a small region of the weld bead with fixed transducer settings. Since defects occur over the entire surface of the bead, it has not been possible to establish complete inspection coverage. Variations in techniques are under investigation for circumventing this difficulty.

Customer Work

Tests of PRTR Elements

Methods of inspecting zirconium tubing and zirconium clad swaged elements have been under development at the request of Ceramic Fuels Operation, HLO, in connection with the PRTR program. The results of this effort have been favorable.
Because of the urgent need for inspected fuel element components, laboratory facilities have been readied to test PRTR elements on a semi-routine basis. Plans are that this testing will be done in the laboratory by HLO personnel until similar facilities can be established by Hanford Laboratories.

Resin Level Test

Final check-out of the Resin Level Detector under development for Development Operation, HLO, is awaiting receipt of special high temperature crystals. Simulated laboratory tests in a six inch diameter plastic tube approximately ten feet long have shown the basic functions of the circuits to be performing properly.

Washington Designated Program

Electromagnetic Testing

Experimental studies of eddy-current methods of measuring metal temperatures has been extended to the measurement of transient temperatures in thin sheets. 0.001 inch and 0.002 inch thick brass sheets were positioned near a flat coil and rapidly heated with electrical currents. The rise in resistivity with increasing temperature was detected by the coil (driven at 100 kc) whose output was displayed on a cathode ray tube. The resulting time-temperature wave trace showed the rate of temperature rise, with time measured from the instant heating current was applied to the sheets. Temperature changes in the order of 100 degrees centigrade in 100 milliseconds were clearly measured. Although the experimental arrangement functioned very well in the laboratory, adapting the technique in practice presents many difficulties. An ultimate goal of this work is to measure temperature gradients in metals by the use of multiple eddy current frequencies.

HW-62028, "Inductive Thermometry", by H. L. Libby describes this work in detail.

Lamb Wave Testing

A more efficient method of generating Lamb Waves in plates has been devised in which the energy is coupled directly into the metal rather than through a liquid medium. In this case, the transducer is placed on a beveled edge of the plate. The amplitude and order of the modes excited is determined by the angle of the bevel. Since modes may be established which readily give up their energy to a medium in which the plate is in contact, the technique may be useful for certain high intensity sonic irradiation applications.
ADVANCED ENGINEERING

NPR Fuel Fabrication Costs

A semi-annual review of estimated NPR fuel fabrication costs was completed. Previously reported values remained unchanged.

Irradiation Experience of Coextruded Fuels

Inspection of the accumulated data on the irradiation of uranium which has been clad with zircaloy-2 by coextrusion indicates that:

1. The uranium to zircaloy-2 bond is apparently very strong. No evidence of bond damage due to irradiation has been observed to date.

2. Failures of irradiated zircaloy-2 support and spacer welds have been observed during reactor discharge of coextruded fuel elements. End supports have been welded to the zircaloy-2 end cap by an inert atmosphere arc welding technique. Spacers have been resistance welded to the cladding. The cause of this apparent and inconsistent weld zone embrittlement during irradiation has not been determined.

3. Coextruded zircaloy-2 cladding has corroded severely (to failure) under irradiation conditions in cooling water adjusted to a pH of 4.0-4.5 with phosphoric acid, and with estimated cladding surface temperatures in the neighborhood of 290 to 300 °C. A similar exposure with a cladding surface temperature (calculated) of approximately 250 °C went to 2000 MWD/T and acquired a thick (10 to 20 mils) flaky coating, but did not fail.

Hanford Test Reactor

Routine testing continued without incident throughout the month. A special test was conducted for IPD to predict the 105 reactivity loss which would result from use of 304 L stainless steel tubing being considered for instrument cable housing.

A request by the United Kingdom Atomic Energy Authority for use of the Hanford test facilities as an umpire for beryllium absorption cross section measurements was agreed to by H.O.O. A description of the test conditions, restrictions, and capabilities was submitted by letter to the British Embassy in Washington, D.C.

Fuel Element Thermal Stresses

A study has been initiated in cooperation with HLO in an effort to determine if thermal stresses in the I & E fuel elements will result in rupture proneness at anticipated increased power levels.
DESIGN & PROJECTS

CGF-810 - 306 Pilot Plant Modification

Start up of the high pressure autoclave has been delayed by leaks which developed at several connections during pressure testing. This is normal with this type of installation, but the degree is greater than anticipated.

One of the side cylinders for the extrusion press was damaged during final machining and had to be bored out approximately 1/64" extra. The opposite cylinder was bored out an equal amount to reduce the possibility of torque on the ram.

The forming and steelwork for the press foundation is nearly complete.

CAF-820 - Additional Storage Space, 300 Area

This project is complete and the warehouse has been turned over to the customer.

CAF-847 - New Fuel Cladding Facility

The building contractor is progressing on schedule. The bid package for outside utilities has been issued to the ABC. This package also includes a tie-in with the 313 building process sewer to supplement the present marginal sewer.

Design work has started on the component preparation equipment.

Design of the run-out table for the production facility has been completed. It is planned to install the production run-out table during the initial installation of the press and thereby minimize press down time during the change to a production plant.

CGF-876 - 303 Area Maintenance Facility

The project proposal for this facility has been forwarded to Contract Accounting.

Miscellaneous Design Work

A new 306 component cleaning exhaust system was designed. The design provides complete separation from the HLO exhaust system.

Design was completed for modifications to the 313 Building caustic penetrator.
DRAFTING AND FILES

Major Jobs in Drafting

306 Building
- Ventilation Improvement

313 Building
- Facing Lathe - Automatic Unloader
- Quality Control Reporting System - Electrical As-Builts
- Water Mix Slug Welder

333 Building
- R.R. Spur and Paving
- Mezzanine - Scope Layout
- Press Foundation, Trenches, Floor, Run-out Table and Drive
- Press Room Lighting and Electrical

333 Building R.R. Spur and Paving
- Mezzanine - Scope Layout
- Press Foundation, Trenches, Floor, Run-out Table and Drive
- Press Room Lighting and Electrical

Miscellaneous
- NPR Billet Designs

Drawings Produced

New 53
Revised 68
Small Charts 35
Large Charts 8
Miscellaneous 65

Manager - Engineering
The formal report on the physical inventory of installed equipment is essentially complete and will be issued shortly. Application of identification tags to installed equipment assigned the Manufacturing Section is complete. Work is continuing with the Engineering and Plant Facilities Sections. Completion of all tagging is expected in October.

Customers of the Plant Facilities Section have requested that a system be devised to inform them of the date calibration is required on the various instruments in their charge. The feasibility of Data Processing providing such information from existing uninstalled equipment records was reviewed. It was determined that such a procedure represented a good application of this data and a proposed system was devised. The entire matter was reviewed with representatives of the Plant Accounting and Data Processing Operations of CE&UO, who concurred with the proposal. Details of procedure application are now under consideration by the Data Processing Operation.

Three buildings formally assigned to CE&UO for use by minor construction are being transferred to the custody of FPD. The buildings are 3704 and 3707-E located at the northwest corner of the 300 Area and 3711 located adjacent to the east high tank. The two former buildings measure 20' x 40' and the latter 40' x 80'. All are aluminum frame construction with aluminum roof and siding. First cost valuations to be transferred are: 3704 Building $6,465; 3707-E Building $2,865; and 3711 Building $4,203. Additional plant to plant transfer of about $10,000 covering relocation cost will be received against Building 3711 as soon as the work is complete.

New One Trip Property Passes form 54-8600-087, and Extended Property Passes form 54-8600-100 along with the revised OPG covering new HAPO pass procedure were distributed to FPD components during the month. Control and issuance of such passes will rest hereafter with the Specialist, Plant and Property Accounting.

A cash fund audit was made on September 30, 1959 by a member of the Traveling Auditors Staff.

Present planning calls for issuance of 55 HAPO-wide Relations OPG's and 20 HAPO-wide Property Management OPGs. Forty-six of the Relations OPGs have been reviewed by our Manager-Personnel Practices, 35 have been approved by the General Manager FPD, and 18 have been issued. Of the 20 proposed HAPO-wide Property Management OPGs, 2 have been issued, 5 are ready for issue and 12 have been reviewed.

A schedule of formal FPD audits for audit year 1960 was prepared for submission to the Commission. As arranged by AEC audit classifications, provision was made for coverage this year of 17 audit subjects. In addition, about an equal number of special or informal audits are usually performed.
The audit of small tools and gloves was substantially completed during the month. Eight instances were noted where controls could be improved. Appropriate corrective action is being taken. In addition, a small tools inventory form is being revised to facilitate control of hand tools and to replace four other less useful forms.

A review was made of important FPD records to determine whether or not more should be classified as vital in accordance with new AEC definitions and criteria. It was determined that the selected records currently being microfilmed include all prescribed "vital records."

Due to an apparent shortage of 2000 Program funds, a study was made to determine FY 1960 production costs based on seven different production assumptions.

Based on Document HW-61824, "PRTR High-40 Irradiation Request," two estimates were prepared covering the fabrication cost of 20 tons of I & E depleted uranium. The first estimate was based upon fabricating a seven-inch piece, and the second estimate was based on fabricating a five-inch piece. In addition, a study was made to evaluate the over-all effect the depleted uranium program will have on production cost for fiscal years 1960 and 1961.

The quarterly manpower forecast for the Department was prepared and submitted during the month. The current forecast is lower at all points than the revised FY 1960 budget.

The new weekly time distribution procedure was put into effect for the week ended October 4, 1959. The new procedure separates payroll information from cost distribution by use of a separate card, rather than use of the back of the time card. The second part of the procedure is "Cost Distribution by Exception." Only work which is performed on other than normal assignments need be submitted on the cost distribution (normal assignment is precoded in the card). The system provides for the balance of hours worked to be automatically distributed to the precode.

A revised personnel estimate was prepared for the NPR Startup Costs for fiscal years 1960, 1961 and 1962.

The quarterly inventory of precious metals and special materials was completed on September 30, 1959. Reconciliations and reports on the results of the inventory will be prepared during October.

A meeting was held with C and A Inventory Accounting representatives to assure agreement and understanding on the division of responsibilities relative to the recent realignment of responsibilities. Current procedures were discussed to insure that they provide adequate controls and facilitate timely reporting.

WS Roe: mh

Manager - Finance

D-2
DUPLICATING

<table>
<thead>
<tr>
<th>Process</th>
<th>Number of Impressions</th>
</tr>
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<td>Multilith</td>
<td>630,228</td>
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<td>Verifax</td>
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<td>Ozalid</td>
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<td><strong>Total</strong></td>
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GENERAL

Cost Reductions totaled $17,385 during the quarter. This is 73 per cent of the quarterly budget. CYTD savings reported have been $80,339 or 64 per cent of budget.

POWER

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<th>September</th>
<th>August</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average steam generated (M lbs/hr)</td>
<td>31</td>
<td>24</td>
</tr>
<tr>
<td>Maximum steam generated (M lbs/hr)</td>
<td>53</td>
<td>35</td>
</tr>
<tr>
<td>Total steam generated (M lbs)</td>
<td>22,776</td>
<td>18,014</td>
</tr>
<tr>
<td>Coal consumed (Tons)</td>
<td>1,162.75</td>
<td>1,167.0</td>
</tr>
<tr>
<td>Evaporation rate (steam/#coal)</td>
<td>9.79</td>
<td>7.72</td>
</tr>
<tr>
<td>Efficiency - Actual</td>
<td>65.2</td>
<td>65.0</td>
</tr>
<tr>
<td>Efficiency - Theoretical</td>
<td>66.3</td>
<td>65.2</td>
</tr>
<tr>
<td>No. of Boilers on:</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Date of Change</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Sanitary water from 3000 Area (Million Gals.)</td>
<td>87.11</td>
<td>95.1</td>
</tr>
<tr>
<td>Total water from 3000 Area (Average rate GPM)</td>
<td>2,015</td>
<td>2,132</td>
</tr>
<tr>
<td>Total water from #3 and #4 wells (Million Gals.)</td>
<td>11.19</td>
<td>11.3</td>
</tr>
<tr>
<td>Total water from #2 well (M Gallons)</td>
<td>.30</td>
<td>.30</td>
</tr>
<tr>
<td>Peak water consumption for 24 hours (Million Gals.)</td>
<td>3.2</td>
<td>3.5</td>
</tr>
</tbody>
</table>

Evaporation rate for the month was high. This is the result of the increased BTU content and lower moisture in the Utah coal burned. In addition, there were no boiler changes to reduce efficiencies and there was a high load factor on the boilers operating.

The new ground storage tank was put into operation. All water supplied to the Area (exclusive of water required during fire fighting) is allowed to flow through the tank prior to delivery to the Area. This has been done to permit the settling out of sand in the incoming water.
POWER (Continued)

On September 7, 1959 an exhaust fan in the 329 Building failed. Failure was caused by corrosion of the rivets holding the inlet vanes in place. The inlet vanes and duct were of stainless steel but the rivets were of black iron. Acid fumes drawn through this system corroded the rivets. A vane was drawn into the revolving fan with resultant damage to the fan shaft, bearings and foundation bolts. Repairs were completed and the unit returned to service on 9/14/59. Other exhaust fans in the Laboratory area are scheduled for inspection to prevent similar incidents.

INVENTIONS

All personnel in the Operation engaged in work which might lead to inventions and discoveries advised that to the best of their knowledge none were made in the course of work during September 1959.

SAFETY, SECURITY AND RADIATION EXPERIENCE

<table>
<thead>
<tr>
<th>Medical Treatment Injuries</th>
<th>16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency Rate</td>
<td>3.53</td>
</tr>
<tr>
<td>Disabling Injuries</td>
<td>0</td>
</tr>
<tr>
<td>Near-Serious Accidents</td>
<td>0</td>
</tr>
</tbody>
</table>

There was one Radiation Occurrence reported (undocumented). A janitor received shoe contamination of 10,000 d/m (uranium) while mopping Laboratory floors in the 325 Building. The shoes could not be decontaminated and were confiscated.

There were no Security Violations reported.

MEETINGS

<table>
<thead>
<tr>
<th>Round Table-Staff</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety and Security</td>
<td>13</td>
</tr>
<tr>
<td>Information</td>
<td>8</td>
</tr>
</tbody>
</table>

E. Hilgeman: JPF: mkm

Manager
Maintenance and Power Operation

E-2
EMPLOYMENT

Personnel Added: 8  Removed: 17

Reduction of force by FPD: 0; by seniority bumping 2

Upgrades within FPD: 6  Transfer requests active at month end: 62

Procurement: Offers 7; Interviews 7; Requests for personnel 9; Transfers (All) 7

Perfect attendance recognition awards: 7

Service Pins: ten year 1; five year 12

HEALTH AND SAFETY

<table>
<thead>
<tr>
<th></th>
<th>September, 1959</th>
<th>August, 1959</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disabling Injuries</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Serious Accidents</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Medical Treatment Cases</td>
<td>42</td>
<td>49</td>
</tr>
<tr>
<td>Medical Treatment Frequency</td>
<td>3.57</td>
<td>4.35</td>
</tr>
</tbody>
</table>

Of the 42 injuries sustained by FPD personnel in September, 18 were to the hands. This is the lowest number of hand injuries since January, and the lowest percent of total this year.

There were two eye cases reported that were caused by windblown particles. This figure is also the lowest during 1959.

Program

Distribution of the third topic in the series on hand protection has been completed. Audit sheets returned to Program Council indicate good coverage is being made at safety meetings.

A bus has been procured from excess to be used as a disaster service vehicle for the 300 Area. Equipment and emergency tools have been selected that will enable disaster crews to handle most any emergency condition. The vehicle will be kept in readiness by the Fire Prevention component of 300 Area.
## Benefit Plans Participation

<table>
<thead>
<tr>
<th>Plan</th>
<th>Participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pension Plan</td>
<td>99.9%</td>
</tr>
<tr>
<td>Insurance Plan</td>
<td>99.9%</td>
</tr>
<tr>
<td>Stock Bonus Plan</td>
<td>45.6%</td>
</tr>
<tr>
<td>Savings and Security Plan</td>
<td>95.6%</td>
</tr>
</tbody>
</table>

## Suggestion Plan Participation

<table>
<thead>
<tr>
<th></th>
<th>September, 1959</th>
<th>Year to Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eligible employees</td>
<td>578</td>
<td>578</td>
</tr>
<tr>
<td>FPD suggestions received</td>
<td>27</td>
<td>325</td>
</tr>
<tr>
<td>Annualized rate per 1000 eligible employees</td>
<td>561</td>
<td>748</td>
</tr>
<tr>
<td>No. of suggestions adopted</td>
<td>11</td>
<td>119</td>
</tr>
<tr>
<td>Net annual saving</td>
<td>$2,050</td>
<td>$58,628</td>
</tr>
<tr>
<td>Amount of awards</td>
<td>$375</td>
<td>$4,620</td>
</tr>
<tr>
<td>Percent of total awards to savings</td>
<td>18.3</td>
<td>7.9</td>
</tr>
<tr>
<td>Average amount of awards</td>
<td>$34.00</td>
<td>$38.82</td>
</tr>
</tbody>
</table>

## GENERAL

Security Violations in the Department this month: 1

W. A. Shanks
Manager - Relations Practices

WA Shanks: mb
END

DATE FILMED

8/25/92