HW 66271 DEL

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CHEMICAL PROCESSING DEPARTMENT
MONTHLY REPORT
FOR

JULY, 1960

HW--66271-Del.

Compiled By
 OPERATION MANAGERS

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August 22, 1960

HANFORD ATOMIC PRODUCTS OPERATION
 RICHLAND, WASHINGTON

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CHEMICAL PROCESSING DEPARTMENT
MONTHLY REPORT

JULY, 1960

I. SUMMARY

A. RESPONSIBILITIES

There were no changes in the responsibilities of the Chemical Processing Department during July.

B. PRODUCTION

The production of plutonium nitrate from the separations plants during the month was below that forecasted.

The production and shipments of UO_3 conformed to the operating and shipping schedules.

Although unfabricated plutonium metal production was below that forecasted for July, all shipments were made on schedule.

C. ENGINEERING

Purex processing was continuous until July 25 when plant operations were suspended to replace the final waste concentrator (F-11) which had developed a leak. Two plutonium-uranium partition failures were experienced early in the month and were attributed to the presence of foreign organic material in nitric acid received from the vendor. Although solvent quality simultaneously degraded to a condition ultimately requiring discard, the plutonium product was kept within specifications by the addition of sodium fluoride and ANN to the ion exchange feed stream. This treatment increased the decontamination efficiency of the plutonium ion exchange unit by as much as seven-fold.

After processing normal uranium until mid-July, a neptunium recovery run was started in the Redox plant. Concurrent with the neptunium processing, dissolution was started of twelve special two-ton test batches of normal uranium fuel elements, irradiated in the Hanford reactors to provide information on plutonium formation rates. At the end of July, both programs were nearing completion.

The damaged B-2 E-metal dissolver was removed from the Redox canyon and replacement with a conventional dissolver was started.

A four month test of a new sieve plate cartridge in the Recuplex H-1 extraction column was terminated and a cartridge of original design will be installed. The test cartridge (more plates and more free area, 23 percent versus 13 percent) permitted local flooding, resulting in lower capacity and efficiency.

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A new semi-continuous product concentrator-stripper, designed to minimize metallic corrosion product impurities in recovered plutonium, was fabricated to replace the present Recuplex batch concentrator (J-3).

Conversion of the Purex prototype anion exchange to a manufacturing unit was completed with the exception of one pump installation. This item is scheduled for completion during August.

Detail design was completed on the new Redox E-metal Dissolver, a replacement for the damaged E-metal dissolver, which incorporated eight changes resulting from design analysis of the failed unit. Also, the design is intended to accommodate NPR and PRTR fuels, insofar as current information on the fuels remains firm.

Process feed was introduced into the RMC Button Line in the 234-5 Building on July 21. By July 26, three buttons had been made, thus demonstrating capability.

Revision No. 3 of the project proposal for NPF Reprocessing (Project CGC-830) was transmitted to the Atomic Energy Commission on July 18, 1960. This revision updates scope of work in accordance with AEC communications, and requests design authorization only.

General Manager
Chemical Processing Department

CHEMICAL PROCESSING DEPARTMENT
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II. ACHIEVEMENTS

A. PRODUCTION OPERATION

1. Production Statistics

a. Purex

	<u>July</u>	<u>June</u>
Plutonium nitrate produced (Kgs)	253.7	142.5
Uranium nitrate produced (tons)	423.3	251.9
Average production rate during operation (T/D)	22.5	24.9
Total waste loss (%)		
Plutonium	0.96	1.83
Uranium	0.10	0.28
On-line efficiency	60.7	32.6

b. Redox

Plutonium nitrate produced (Kgs)	34.8	72.1
Uranium nitrate produced (tons)	79.0	(36.9 E 115.1 N
Average production rate during operation (T/D)	7.7	8.0
Total waste loss (%)		
Plutonium	0.56	0.32
Uranium	0.15	0.13
On-line efficiency	41.1	75.0

c. Uranium Reduction

Normal UO ₃ loaded (tons)	428.9	292.7
Enriched UO ₃ loaded (tons)	0	43.6
Normal UO ₃ approved for shipment (tons)	398.7	297.0
Enriched UO ₃ approved for shipment (tons)	0	97.1
Normal UO ₃ shipped (tons)	449.6	396.4
Enriched UO ₃ shipped (tons)	0	99.6
Normal UNH backlog (tons U)	160.2	117.4
Enriched UNH backlog (tons U)	4.5	4.3

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d. Plutonium Metal Processing

	<u>July</u>	<u>June</u>
Input to Task I (batches)	190	199
Reduction yield (%)	95.2	96.7
Plutonium metal buttons produced (% of commitment)	67.7	46.2
Plutonium metal buttons shipped (% of commitment)	101.2	35.3
Product recovery output (% of schedule)	95.7	144.8
Product recovery backlog (Kgs)	195.7	190.2
Waste disposal (grams)	591	394

f. Waste Storage

Redox salt waste reserve (tons U)	2 792	2 870
Purex salt waste reserve (tons U)	26 065	26 490
Redox coating waste reserve (tons U)	22 457	22 535
Purex coating waste reserve (tons U)	32 807	33 232

g. Power

	<u>200 East</u>	<u>200 West</u>
Raw water pumped (gpm)	10 131	5 114
Filtered water pumped (gpm)	1 052	1 011
Maximum steam generated (lbs./hr.)	220	100
Average steam generated (lbs./hr.)	158 114	69 844
Total steam generated (M lbs.)	117 637	48 244
Coal consumed (est. tons)	6 027	2 537

J. L. Warner
Manager - Production

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II. ACHIEVEMENTS (Continued)B. PUREX OPERATION1. Operating Continuity

The plant was started up on June 30 and ran continuously until July 25 at a nominal 2.4 CF. A leak in the final waste concentrator (F-11) caused an unscheduled shutdown on July 25, which extended until August 2. The operating period was marred by two partitioning failures when it was necessary to recycle the uranium which was out of specification in respect to plutonium content. Approximately five days were spent in recycling uranium. Both occasions of partitioning failure were accompanied by excessive solvent gamma activity.

2. Processing Operation

The solvent quality was very poor during the entire run period with its gamma activity averaging about 8,000 uc/gal. instead of a normal 1500 uc/gal. At the end of the run period the organic in the #1 system was discarded to the A-2 crib. The used organic, which had been stored in the P-2 tank since March, was brought back into the building and made ready for use.

A process test was conducted at the start of the period, using fresh acid only throughout the plant. During the test, the Fulflo filter in the acid line to the Ion Exchange Facilities plugged repeatedly with a black greasy substance. It is believed that this material was responsible for the poor organic quality.

The plutonium product was kept in specification during the period of high gamma activity by the addition of sodium fluoride and ANN to the plutonium ion exchange feed stream (XAF). Decontamination performance of this facility was increased by as much as seven-fold by this treatment.

All of the uranium product which was out of specification during the month was reworked through the final uranium cycle by increasing the processing rate to a 2.88 CF. With the exception of seven cans all out-of-specification plutonium produced in June and July was either blended with current production or recycled to meet specifications.

Uranium waste losses were comparable to the CY 1959 average. Plutonium waste losses were higher than normal due primarily to the poor organic quality and the need to operate the HA column to give maximum decontamination performance.

The silica gel facility processed 315 tons of uranium during the period to produce specification material for shipment. Fifty tons of UNM were shipped to Redox for silica gel treatment.

3. Mechanical Experience

The plutonium concentrator in the ion exchange facility developed a leak at the thermowell. The entire loop of the concentrator was replaced with a titanium unit.

The process was shut down when a leak of approximately 10 gpm near the bottom of the #1 waste concentrator (F-11) occurred on July 25. Replacement of the concentrator was completed in seven days. This is the first failure of a canyon concentrator since startup of the plant. (Purex)

The R-4 centrifuge drive-head bearing failed during the pre-startup checkout at the end of the month. The drive head is to be replaced and the old unit repaired.

A bearing and shaft were replaced in the #2, 291-A exhaust fan.

The PK-6 canyon pump was replaced with a reconditioned spare unit after upper seal leakage became excessive.

Reactivation of the control house and vault equipment at 241-CR tank farm was begun. These facilities will be used in fission product recovery work.

4. Radiation Experience

The total radio-iodine 131 emission for the month was 21.0 curies, with a daily average of 1.32 curies. There were nine Radiation Occurrences during the period.

A total of eight cases of skin contamination and four cases of contaminated personal effects occurred during the month. The maximum skin contaminations were 6,000 c/m fission products and 5,000 d/m plutonium. All skin contamination was readily reduced to less than detectable.

The failed waste concentrator (F-11) was placed behind the water-filled door in the Purex railroad tunnel extension at a maximum personnel dose rate of 3 rads/hr., including 1 r/hr. An equipment burial box containing a process pulse column (HA) was also placed in permanent storage behind the water-filled door.

5. Analytical Experience

Laboratory tests were made to determine the effects of filterable solids found in the nitric acid system on solvent quality. Although inconclusive the results indicate that the presence of solids lowers solvent quality. The nitrite ion content of the solvent also increased when solids were present in the nitric acid.

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The effects of refluxing Purex recovered nitric acid on zirconium-niobium distribution ratios were studied. It was found that refluxing of the acid under vacuum conditions lowered the distribution ratios, whereas refluxing under atmospheric conditions had no effect on distribution ratios.

Experiments were run to confirm the effect of temperature and nitric acid concentration on silica gel bed performance when processing final uranium product solution. The information obtained verified previous information reported in the literature.

Three analytical methods for the determination of fluoride ion in the plutonium anion exchange system have been checked and found inadequate. The methods tested included fluoro-metric, colori-metric, and a titration method. Testing of a distillation method is in progress following the acquisition of new equipment.

A new controlled potential coulometer was received on July 27. Calibration of the new coulometer is in progress.

6. Events Influencing Costs

Costs continued to be abnormally high in July due to failures of expensive process equipment and abnormal activities to regain decontamination performance of the process.

PR Mc Murray
Manager-Purex

PR McMurray:EAF:gt

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II. ACHIEVEMENTS (Continued)

C. SPECIAL SEPARATION PROCESSING AND AUXILIARIES OPERATION

1. Operating Continuity

The Redox Plant remained on normal uranium production through July 14, 1960.

dissolution of twelve special two-ton test batches of normal uranium fuel elements, irradiated in the Hanford reactors to provide information on plutonium formation rates, was started. At the end of the month dissolution of this material was nearing completion.

2. Processing Operation

Processing of normal uranium metal continued through July 14, 1960, the last batch of metal being charged to the dissolvers on July 10, 1960. The plant returned to a three-shift five day week operation on July 11, 1960. The switch both to and from the four-shift seven day week operation (June 13 through July 10, 1960 inclusive) was made very smoothly, and effective utilization of the personnel borrowed from the Purex and Finished Products Operations was accomplished in a relatively short time.

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At month end processing was being delayed until the material lost to the uranium cycles could be recovered and recombined with that in the plutonium cycle vessels for fission product decontamination.

dissolution of twelve two-ton test batches of depleted uranium, which was irradiated at specific reactor power levels, was started. The test was initiated to provide additional information on plutonium formation rates. At month end the dissolving was nearing completion.

Enriched uranium from a fourth E-N loading test batch was also dissolved and sampled during the month. Poor samples and/or inadequate samples on some of the original test batches, processed during June, necessitated securing another set of samples of this special material.

Approximately 38 tons of UNH, with a high gamma ratio, were received from the Purex Plant and reprocessed through the silica get system to reduce the gamma content to within shipping specifications.

3. Mechanical Experience

The failed B-2 multipurpose dissolver was removed from the Redox canyon on July 15, 1960 and transferred to the 221-T Decontamination and Equipment Reclamation Facility for further decontamination and inspection. TV inspection and photographing prior to its removal from the Redox canyon revealed extensive erosion holes in the steel cylinder which forms the inside wall of the dissolver annulus. Considerable corrosion to the I-beam on the dunnage was apparent and the steel staves of the crib wall, which form the outer wall of the annulus, also appeared to be damaged.

A replacement conventional dissolver was obtained from the 221-T Decontamination and Equipment Reclamation Facility and the unit is now positioned in the cell ready for jumper installation. Procurement of a B-4 off-gas filter will be the determining factor in completing the installation.

4. Waste Handling and Decontamination

Equipment valued at \$110,281 was received from the processing plants for decontamination, repair or inspection during the month. Equipment valued at \$89,916 was returned to customers after decontamination and repair, and represents a savings of approximately \$60,000 over the cost of new replacement equipment.

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A total of 414 man-hours was charged to the decontamination and/or repair of railroad, automotive, and heavy equipment. The following is a breakdown of the major items decontaminated:

<u>Item</u>	<u>Operation Charged</u>
Flat Cars No. 19030, 3627, 3618	Purex
Well Cars No. 37, 39, 40, 44, 98, 99	Purex
Gondola Cars No. 3652, 4611	Purex
Locomotive No. 29	Purex
Sedan No. 1A-5837	Transportation
Welding Rig	WH&DO
Power Wagon	Transportation
Panel Truck No. 1D-463	HLO
UNH Tractors No. 68E-8950 & 8930	Purex
Pulser Cylinder and Piston	Purex
Column Sieve Plates (100)	Purex
Republic Transmitter	IPD

5. Radiation Experience

Total iodine 131 emission to the 291-S stack for the month was 60.6 curies. The major portion of this total emission occurred during the period July 3 through July 11, when a breakthrough of 50.5 curies of I-131 was observed during the dissolution of 98-125 day-cooled normal uranium metal. Regeneration of the A-3 and C-3 silver reactors failed to restore the Redox Plant's normal over-all I-131 removal efficiency. However, the decision to begin dissolving the special two-ton test batches for plutonium formation rates eliminated the immediate need for a second regeneration or replacement of the silver reactors since this material had negligible I-131 content. In the meantime investigations are continuing in an effort to determine the cause of the increased emission rate.

On 7-11-60, the batch size control limit in the L-16 recycle tank was exceeded. This occurred during the transfer of recycle solution to the L-16 tank, and was caused by an incorrect piping installation and improper valving which permitted some of the plutonium in the L-6 tank (Concentrated Product Sampler Tank) to be transferred to the L-16 tank along with the recycle solution. The transfer was immediately stopped when the neutron monitor on the non-critically safe L-16 tank alarmed. Although a nuclear incident was not involved, the solution was immediately diluted to a lower concentration and half of it removed to another vessel for subsequent rework. Replacement of the L-16 tank, with a critically safe unit, is now proceeding on an expedited basis. The replacement had been planned prior to the over batch size occurrence.

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6. Analytical Experience

Problems were encountered in the 222-S Analytical Laboratory in providing and maintaining sufficient doorstep samplers for the twelve two-ton test batches of depleted uranium which were dissolved in the Redox Plant this month. The processing procedure called for numerous samples and more than twenty doorstep samplers were required on some of the batches before consistency was assured. All the unused stainless steel doorstep samplers were taken from storage and placed in service. Since the samplers had to be held for disposal approval there were times when supply was critical. It was necessary for radiation protection purposes to use personnel from all laboratory groups in disposing of the samples and getting the samplers ready for use. Radiation from many of the samples was higher than usual and personnel monitoring by the radiation monitors was required during analyses.

CT Grosz
for CT Grosz
Manager - Special Separation
Processing and Auxiliaries

CT Grosz:HWM:sws

CHEMICAL PROCESSING DEPARTMENT
MONTHLY REPORT

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II. ACHIEVEMENTS (Continued)

D. FINISHED PRODUCTS OPERATION

1. Operating Continuity

All Finished Products' shipping commitments were met.

The gross production of unfabricated plutonium was fifteen percent below schedule because of shortages of feed until mid-month and because of mechanical difficulties. Net production was approximately twenty percent less because of rejections due to metal impurities. Plutonium recovery was held to 97 percent of schedule because of mechanical difficulties. Uranium Oxide production met schedule.

2. Processing Operations

a. Plutonium Fabrication

Only twelve percent of the pieces produced this month were acceptable. Almost half of the production was rejected because of defects detected by radiographic examination, and over a third because of failure to meet dimensional specifications. Improvement in the number of radiographic rejects was noted at the end of the month.

Delays in the completion of the installation of melting furnaces and conveyors on Project CG-811 (Additional Fabrication Equipment) have now become critical because of the August shipping commitments for the new weapon parts. All concerned are working to expedite the remaining work.

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b. Plutonium Processing

Operation of the RMA Button Line was erratic during the month. Almost fifty percent of the available processing time was lost because of mechanical failures. Approximately twenty percent of the metal produced failed to meet purity specifications because of excessive iron content. The investigation to determine the source of the iron continues.

The RMC Button Line was placed in operation during the month, but failed to attain sustained operation because of mechanical failures in the conversion (nitrate to fluoride) equipment. Repairs are in progress.

The recovery operation achieved 97 percent of schedule in spite of numerous major mechanical difficulties.

c. Uranium Reduction

The Uranium Reduction plant resumed operation on July 11 following the scheduled vacation outage. Performance was satisfactory and schedules for the production of uranium oxide powder were met.

3. Mechanical Experience

Plutonium fabrication equipment operated satisfactorily during the period, requiring only minor maintenance. Plutonium preparation equipment required numerous major repairs and replacements. Principal difficulties involved the reactor agitator, heating elements in the calciner and fluorinator, and the off-gas scrubber, all in the RMA equipment, and platinum liner of the fluorinator on the RMC Line. Recovery equipment also required major maintenance efforts including the replacement of a solvent catch tank (K-9), a column feed pump (H-9), a solvent recirculation pump (K-2), and three pulser bellows for the solvent extraction columns. Uranium reduction equipment functioned well, with only routine repairs required.

The use of normal Maintenance manpower to assist the Facilities Engineering Operation toward the completion of Projects CG-734 (RMC Button Line) and CG-811 (Additional Fabrication Equipment) is in excess of that forecast. As a result, normal maintenance capability has been reduced temporarily.

The methods used by Finished Products Maintenance for the scheduling and control of maintenance work in U and Z Plants are described in an illustrated article entitled "Maintenance Problems Increase When Working Around Radioactive Equipment". The article which was authored by Max G. Petersen, Maintenance Planner and Scheduler, appears in the current (August, 1960) issue of Mill and Factory Magazine.

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4. Radiation Experience

Radiation and contamination control statistics show an upward trend for the month, but control is still in the satisfactory range.

A potentially serious injury occurred when a fabrication operator cut his finger on a plutonium part rotating in a lathe. An evaluation of the case was completed during the month, with plutonium deposition of five to ten percent of the maximum permissible limit indicated. The man has been returned to his regular duties.

5. Analytical and Final Inspection Experience

	<u>June</u>	<u>July</u>
Number of Samples Received	1,049	1,542*
Number of Determinations	8,510	12,669*
Average Impurity, Buttons	2,255 ppm	3,945 ppm*
Buttons Rejected	14.2%	19.0%*
Average Purity, Model 85 Parts	98.78%	98.73%
Model 85 Parts Accepted	6%	12%

* Increases resulted from iron impurity problems

Manager - Finished Products

CHEMICAL PROCESSING DEPARTMENT
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II. ACHIEVEMENTS (continued)

E. POWER AND GENERAL MAINTENANCE OPERATION

1. Operating Continuity

There were no outages of Power services that affected operating continuity. A partial interruption of electrical service occurred on July 12, however, caused by difficulties experienced at 251 Substation. Pumps at the West Area Reservoir Pump House and at the Filter Plant dropped their loads, as did the pumps at the East Area Filter Plant. The West Area emergency generator automatically came into service, as did the turbine-driven pumps in both areas. Fluctuation in the raw water pressure was cause for some concern at 231-Z, but there were no serious complications. All affected equipment was restored to normal operation within a 20-minute period.

2. Inspection, Maintenance and Repair

A spare F-11 High Activity Waste Concentrator was tested and made ready on an urgent basis, and delivered to Purex July 30. The heavy equipment group of the General Maintenance Operation assisted in the permanent burial of the failed unit in the Purex burial tunnel.

A similar concentrator is being prepared on a round-the-clock schedule, to be available if difficulties arise in the H-4 position at Purex.

A spare Plutonium Decontamination Pulse Column (2-A) is undergoing design revisions, in preparation for installation at the Purex Facility. Failure of the in-service unit is attributed to the break-up under radiation of the fluorothene raschig rings.

Preliminary work is approximately 10 per cent complete on reactivation and revision of equipment and facilities at 244-CR Vault Area, which is to be used in part of the process for isolation of Strontium 90 from Purex waste stream.

A total of 20 process jumpers, 16 for installation at Redox and 4 for Purex, were completed.

Shop fabrication of the spare Ruthenium Oxidizer Vessel (H-4) was totally completed, and the unit is available for service.

A revised L-16 Recycle Tank was fabricated on a crash basis for immediate installation in the final plutonium concentration cycle at the Redox Facility. This new vessel is a cluster-type, with three separated tanks instead of one larger tank, and the geometry provides a much higher degree of safety from critical mass incident possibilities.

Five standard open-face laboratory hoods were fabricated of stainless steel and installed in 222-S Building, Redox plant.

Work progressed to 85 per cent completion on installation of the Sheffield Rotary Contour Gauge and related equipment in the addition to the 234-5 Building. Due to necessary modifications, final completion has been delayed until next month.

Installation of the one-million electron volt hood and associated equipment in the addition to the Finished Products Operation's 234-5 Building is 95 per cent complete. This unit will be used for X-ray examination of finished plutonium shapes, and will be a phase of the final inspection cycle.

Efforts of the Tool and Die Shop were concentrated on the machining of precision tooling and fixtures for the new RMC line and inspection facilities at 234-5 Building.

Fabrication of 36 additional shipping containers was completed this month, making a total of 96 completed of the 140 required to ship a full reactor loading of experimental rod-type plutonium-aluminum alloy fuel elements from Hanford Laboratories Operation's 231-Z Facility to Savannah River.

Complete at month's end was the installation at the 231-Z Building of the 1,000-ton press, hood and associated equipment which is to be used in experimental and developmental press forming of plutonium into shapes for subsequent machining.

Further decontamination of F and G cells in the 224-T Building is underway to permit use of the F-10 room, F cell and B cell for prototype work.

Installation of an additional fire hydrant for 2719-WA (West Area First Aid) Building and vicinity was complete at month's end.

With two minor exceptions, reroofing the high- and low-level roofs and the installation of eight ventilators on the 272-E Building are complete.

Building 271-CR and Building 241-C-601, with installed equipment, were transferred to Purex in connection with initial Fission Product Recovery effort. The existing HLO tenant working on waste disposal will not have to be relocated.

Due to water seepage into the 101-B tank, 241-B Tank Farm, a suspect blow-off valve in the raw water line to the farm was removed and blanked.

Sanitary water service was restored to the Hot Semiworks Change House, and raw water service to the Semiworks Hot Shop, during the month.

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Air-balance activity included assisting construction forces at 234-5 in the removal and installation of hood systems and ventilation balancing.

Recommended modifications and rebalancing of supply units serving the office section in the 202-S Building resulted in increased air supply and improved efficiency.

T. S. LaFollette

Manager
Power & General Maintenance

HFS:ap

CHEMICAL PROCESSING DEPARTMENT
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JULY, 1960

II. ACHIEVEMENTS (continued)

F. FACILITIES ENGINEERING OPERATION

1. Purex

a. Process Design and Development Engineering

Instrumentation on Jumpers

Activities aimed at placing Purex instrumentation on jumpers have reached final design phases. A shop fabrication order was placed for a flexible jumper which will place pH electrodes in the E-3 blending tank. This jumper probe includes a temperature compensator which was not used on the earlier experimental model. With the recent changing out of the HS column, design of the prototype gamma monitor now mounted on the jumper is being revised. The revised design permits more lead shielding for the instrument probe than was possible on the earlier HS column. Also, the additional shielding allows development work on a jumper-mounted scintillation counter for gamma energy analysis as well as gross gamma measurements by means of an ion chamber.

New Purex Tank Farm

Preliminary design criteria for the new Purex tank farm were revised and are now being reviewed. The new criteria deleted the requirement of secondary containment and instituted positive leak detection with means of recovery. Two design concepts are being considered; both have nine tanks each placed in a common vault. One concept employs the vertical cylindrical design, the other the horizontal cylindrical on two supports.

Purex Demister

After three months of operation, the tantalum demister in the F-F6 position, has demonstrated promising results. However, present data are not sufficient to permit a conclusive decision for conversion of the plant to a single-stage waste concentration. Volatile ruthenium carryover from E-F6 does not appear to be a problem.

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DECLASSIFIEDb. Project EngineeringCGC-854 - Conversion of Purex Anion Exchange Prototype
to a Manufacturing Unit

All work on this project was completed on July 24, 1960, with the exception of the installation of the XAF feed pump. This feed pump is scheduled for delivery and installation during August. A physical completion notice (with exceptions) will be issued as of August 1, the directive completion date.

CGC-895 - Purex Expansion

Process design work on the Purex expansion project was virtually completed with the comment issue of twenty scope design drawings and preparation of the cost estimate. Among the major equipment items currently believed to be limiting below the capacity factor of 4.0, are tube bundles for two large concentrators and three concentrator condensers. The scope is being reviewed to determine possible flowsheet changes which would permit retention of existing condensers mentioned above. The total cost of the project is estimated at about \$1,500,000, assuming that proposed flowsheet modifications in the final uranium concentrator and the F5-F6 acid recovery system are attainable.

c. Manufacturing EngineeringPurex Burial Tunnel and Burial Containers

At the request of Purex Operation, evaluation was initiated on alternate types of construction and locations for an additional equipment burial tunnel. Included in this evaluation will be alternate methods of disposing of equipment currently stored in "light frame" construction boxes in the Purex railway tunnel. Also, burial containers were designed for the Purex L-1 tower and for concentrator tube bundles. These containers are designed to withstand complete backfilling without collapse.

Jumper Cutter

Design was completed on a rack for storage of the jumper cutter in the Purex Canyon. Fabrication of this rack, as well as final check-out of the cutter, is planned to be performed early

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in August, as work load permits. The new design eliminated 1,400 pounds of counterweights and structural members.

2. Special Separation Processing

a. Process Design and Development Engineering

1

Redox Mark V Dissolver

Detail design work was completed on the Redox Mark V dissolver, a replacement for the failed multi-purpose dissolver. This design incorporates eight changes resulting from design analysis after the multi-purpose dissolver incident and from other studies aimed at safe processing of "E" metal and normal uranium. Also, the Mark V Dissolver design is intended to accommodate NPR and FRTR fuels as far as current information on these fuels will permit.

All plate materials required for fabrication have been received.

Redox Recycle Tank Replacement

Scope design was completed for a geometrically-safe recycle receiver tank L-15, for installation in the Redox 233-S Building. Of the two design concepts, the multi-barrelled tank design was accepted; and the tank is being fabricated. The need for this tank was emphasized recently by a near-critical incident during transfer of plutonium from an RC can to the L-16 tank. The neutron monitor gave the alarm,

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and the operator responded in time to avert the possible overload. Eventual replacement of the L-16 tank will eliminate the last non-safe vessel in Redox.

c. Manufacturing Engineering

Multi-Purpose Dissolver

A television camera was suspended from the crane and lowered into the annulus of this dissolver prior to removal. Photographs were taken of interior damage. A few days later, the same technique was employed to view external sections and the support members.

Methods Analysis by Motion Pictures

As another step in using motion pictures for methods analysis, the removal of the L-16 vessel from 233-S Building, will be photographed. Primary interest centers on methods to prevent spread of contamination.

3. Finished Products Operation

a. Process Design and Development Engineering

Gorton Lathe

A preliminary training course on the Gorton Lathe control system has been given to four instrument maintenance men. The instruction was condensed from all currently available information and was presented in seven 2-hour sessions. This course provides a basis for working with the Gorton field representative when he arrives to place the first machine in operation.

Continuous Centrifuge

The modified mounting system has permitted increasing the speed from 4000 to 6000 RPM, thereby obtaining a satisfactory cake using cerium nitrate stand-in material. The vendor states that spare part delivery may extend into October. Demonstration of the machine will be scheduled after the spare parts are available.

DECLASSIFIEDAir Tube Material Transfer System

Several air tube system manufacturers have been furnished data pertaining to requirements for solids feed to the new reclamation facility. It is anticipated that sufficient information from these manufacturers will be obtained and form the basis for the preparation of a competitive bid specification.

A study indicates that about \$51,000 can be economically justified for an automatic handling system.

Fluid Bed Reactor

A specification and four detail design drawings for a bed reactor were prepared and transmitted to R & E Development Laboratory.

b. Project Engineering

CG-734 - RMC Button Line - 234-5 Building

The physical completion notice was issued as of July 15, 1960, with exceptions, including completion of the installation of lead shielding glass. Process feed was introduced into the RMC line on July 21; and as of July 26, three buttons had been made demonstrating the line's capability to perform satisfactorily. Two minor operating deficiencies were disclosed in this hot startup test and they are being corrected.

CG-789 - Additional Fire Protection - 234-5 Building

Work of installing fire detectors in the process hoods was started during the month.

CGC-813 - Rev. #3 - Plutonium Recovery from Contaminated Materials - 234-5 Building

A project proposal revision requesting a ten-month extension of schedule and an increase in authorized funds from \$470,000 to \$570,000 was transmitted to HOO-AEC on July 18, 1960.

4. General

a. Process Design and Development Engineering

High Level Radiation Alarms

An evaluation has started of logarithmic circuit scintillation detectors for high level radiation alarms and area monitoring. The test work is still in a very preliminary stage.

b. Project Engineering

Project Cost Information as of July 17, 1960:

Total Authorized Funds-13 active projects	\$ 7,950,000
Total Cost-to-date	5,189,000
Commitments and Open Work Releases	699,000
Unencumbered Balance	2,062,000
Costs charged to above projects - 6/19/60 to 7/17/60	713,946

Project CGC-872 was abandoned during this period:

Authorized Funds \$72,000 - Total Cost \$25,283,000

CGC-830 - NPT Reprocessing

Scope design work covering the remaining U-Plant items, dissolution, centrifugation, and associated services facilities, was completed and approved by the working representatives. Scope design of the cross-country line for transportation of dissolver solution between 221-U and 202-S Buildings, has been completed and approved. The Vitro Engineering Company completed their scope assistance work on July 15, 1960.

Revision #3 of the project proposal was transmitted to the Commission July 18, 1960. It is scheduled for the Review Board agenda for August 4. This revision updates the scope of work in line with AEC communications and requests design authorization only.

H. P. Shaw, Manager
Facilities Engineering Operation
CHEMICAL PROCESSING DEPARTMENT

HPS/WWC/alr

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II. ACHIEVEMENTS (Continued)

G. RESEARCH AND ENGINEERING OPERATION

1. Purex Process Technology

a. Solvent Extraction

Initial decontamination performance after startup, following the June shutdown, appeared improved based on the declining gamma activity in the final products. However, two partitioning failures occurred in rapid succession and resulted in excessive plutonium in the uranium product. Each failure required recycle of the decontaminated uranium product back to head end in order to restore proper plant operation. A subsequent investigation has failed to reveal any definite reason for the partitioning failures; however, a study of available data points to a foreign organic impurity discovered in the fresh nitric acid as received from the vendor. Laboratory tests on this impurity show that nitrite was generated in the solvent after the segregated impurity was added to concentrated nitric acid and a solvent contact made of the solution.

From startup on June 30 until July 9, fresh nitric acid had been used for all process acid requirements, but the presence of the foreign material was discovered in the acid only after several days of operation. During the second period of recycling uranium to recover from a partitioning failure, the acid supply was changed from fresh to Purex recovered acid, after which no difficulty was encountered with partitioning.

Concurrent with each partitioning failure, bursts of gamma activity were experienced throughout the plant and especially in the solvent. Both the acid impurity and the process upsets caused by switching from "hot" to "cold" feed contributed to these bursts. Continued processing slowly restored the plant to smooth operation, although the gamma activity of the solvent and the final products from solvent extraction remained a factor of two to three high. Despite the high solvent activity, the uranium product gamma ratio had dropped to the suitable silica gel treatment range (3.5 to 4.5) prior to an emergency shutdown on July 25 which occurred as a

result of a waste concentrator shell failure. The gamma activity of the solvent extraction plutonium product did not decrease to a value as low as normal, but specification product (2×10^{-11} G/AT) was still produced by ion exchange processing.

Other items of interest to solvent extraction included:

- (1) A fifty-five per cent reduction in the solvent addition to the HA Column scrub section (HAO) failed to improve decontamination but did decrease neptunium recovery.
- (2) A three-fold decrease in the gamma activity of the feed to the Final Uranium Cycle was accomplished by reducing the following:
 - (a) the IC Column extractant (ICX) temperature from 60 to 45° C,
 - (b) the ICX flow by fifteen per cent, and (c) the ICX nitric acid concentration by forty per cent (to 0.14 M).
- (3) The addition of refluxed miscellaneous rework solution to the HA Column feed (HAF) in a 1:20 ratio appeared to reduce a gamma activity of the organic overflow from the HS Column (HSP), but affected very little the activity in the feeds to the Final Plutonium and Final Uranium Cycles.

b. Neptunium Recovery

Neptunium recovery was somewhat subnormal because of two periods of high losses via the HA Column effluent (HAW). The first was due to oversaturation of the organic phase with uranium while the second resulted from a test involving the solvent addition to the HA Column scrub section (HAO stream). A fifty-five per cent reduction in the HAO flow caused an excessive reflux of neptunium in the HA and HS Columns which in turn produced neptunium losses of a factor of six above normal.

c. Plutonium Concentration

When laboratory tests indicated a significant improvement in the Plutonium Ion Exchange decontamination could be attained by the addition of fluoride ion to the ion exchange feed (XAF), the XAF was made 0.01 M in sodium fluoride and 0.02 M in aluminum nitrate. The latter is used to reduce the corrosion effect of the fluoride ion through later processing steps, namely waste concentration. Preliminary data has indicated the normal decontamination factor of three was increased up to seven-fold depending upon the gamma activity of the XAF.

d. Solvent Treatment

- During each partitioning loss, the gamma activity of the No. 1 System solvent rose to extremely high values. The gamma activity which first peaked at 22,000 microcuries per gallon was lowered to

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2,500 while the uranium product was being recycled only to rise again to 26,000 microcuries per gallon during the second partitioning failure. Unlike the first operation on recycled uranium, the second decreased the gamma activity of the solvent very slowly which indicated the probable presence of a foreign impurity such as the organic material found in the fresh nitric acid. Changes such as increased potassium permanganate flow to the Batch Wash Tank (TK-G1), more rapid rate of change for the TK-G1 sodium carbonate solution, a complete change of sodium carbonate solution in the Turbomixer (TK-G7) every twenty-four hours and higher acidity in the IO Column Scrub (IOS) all failed to have the normal effect of accelerating the reduction of gamma activity in the solvent. However, the gamma activity in the solvent had dropped to 6,000 - 10,000 microcuries per gallon rate range by shutdown.

Laboratory studies, made to determine means of cleaning up the solvent, showed none of the normal solvent treatment procedures were effective. When a ten per cent caustic wash removed the gamma activity, it was then revealed that the plutonium retention characteristics of the solvent had been permanently damaged. Accordingly, the entire solvent inventory was discarded to an underground crib, and the solvent that previously had been used in the plant from startup until March 1960 (when it was stored) was added to the system. Reconditioning of this solvent was in progress at month end by recycling it through the solvent treatment facilities.

e. Waste Handling

In an attempt to help characterize the sludge layer in the bottom of the waste tank, TK-241-A-103, a series of sludge depth measurements were taken with weighted discs weighing from 1.5 to 10 pounds. The sludge depth changed from 34-1/2 to 26-5/8 inches as the loading increased from 36 to 231 pounds per square foot. No significant change occurred as the loading was increased from 186 to 231 pounds per square foot.

2. Redox Process Technology -

a. Dissolving

Inspection of the failed B-2 multipurpose dissolver in situ, using a television camera, disclosed a fairly large hole (possibly two to three feet in diameter) as expected, in the steel cylinder which forms the inside wall of the dissolver annulus. This hole was estimated to be about four feet below the top of the cone. A second, and much smaller, hole is known to exist about 2 to 3 feet above the base of the dissolver, but was not located during the TV inspection. The steel staves of the crib wall, which form the outer wall of the annulus, also appeared to be damaged, but the full extent of the damage could not be determined during this inspection.

The failed unit was removed from B-Cell and shipped to the decontamination facility at the 221-T Building without incident despite damage to the dunnage also visible with the TV camera. After removal from the concrete shipping container to the 221-T canyon deck, further inspection showed no visible damage to the outside shell of the vessel.

A radiation reading of 4 r/hr at 15 feet from the unshielded vessel, indicated that the uranium removal and preliminary decontamination performed at Redox were very successful.

The failed B-2 multipurpose dissolver has been replaced with a standard Redox dissolver which will be used until a new multipurpose unit is fabricated. Only minor modifications to the existing multipurpose dissolver design are considered necessary for the new unit, and these have been reviewed and concurred upon by RFO.

At some future time it may be necessary to add a soluble neutron poison, such as boron, to the dissolver or other vessels as a secondary critical mass control, when processing enriched uranium. Since the soluble neutron poison obviously is not effective if not present, a monitor is required to determine that it has been added. The prototype boron monitor installed in the chemical addition line to the A-2 dissolver was tested during the report period. The unit responded properly to concentrations of 1 g/l and 2 g/l boron in aqueous 50 percent sodium hydroxide, 60 percent nitric acid, and 42 percent sodium nitrate solutions. Concentrations of 1 g/l and 2 g/l boron in water gave readings 10 and 25 percent higher than previous calibrations. The instrument will be recalibrated for water-boron solutions. Additions of water or chemicals containing boron can be readily distinguished from those which have no boron.

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Dissolution of twelve special 2-ton test batches of normal uranium fuel elements, irradiated in the Hanford reactors for the purpose of defining the cause for consistent IPD-CPD plutonium accountability differences, was near completion at month end. Dissolution procedures which assure complete dissolution of each charge and the special sampling program for each charge have increased dissolver time cycles approximately three-fold.

A breakthrough of I-131 was observed during the dissolution of 98-125-day cooled, normal uranium metal early in the month. Regeneration of the A-3 and C-3 silver reactors failed to restore the Redox plant's normal over-all I-131 removal efficiency prior to the end of dissolving on July 8. The A-3 reactor is a three-stage prototype which can be flushed and regenerated in place, and whose stages can be evaluated individually by means of gas samples in and out. In the course of the iodine breakthrough, the first two stages were determined to be ineffective (arithmetic DF about 5); the final stage was performing well (DF about 1000).

Since the metal dissolved during the remainder of the month had negligible I-131 content, the apparent efficiency of the silver reactors will be redetermined when dissolution of 100-125-day cooled uranium metal is resumed. The standard silver reactors will be regenerated or replaced as necessary, and the interrupted testing program for the A-3 prototype will be resumed.

b. Solvent Extraction

Decontamination across the third uranium cycle during the month decreased from the normal log dF of 1.8 to 1.5. Attempts to improve the performance of the 3D Column by varying the organic flow and by changing the location of the organic-aqueous interface were unsuccessful.

During the shutdown of the solvent extraction columns, prior to starting the neptunium recovery run, it was discovered that the 3D Column static pressure instrument reading was considerably higher than normal. This erroneously high reading would have positioned the organic-aqueous interface so low in the column that there would have been no scrub section and may have resulted in the poor decontamination experienced. This will be investigated when operation is resumed by a study of decontamination as a function of interface location.

c. Tail-End Treatment

Poor decontamination across the third uranium cycle resulted in 50 tons of out-of-specification final uranium product (18 gamma ratio, more than 95 percent ruthenium) after the normal tail-end periodic acid-ozone treatment. Reprocessing of this material through the ozone sparger vessel (E-13) gave an arithmetic decontamination factor of about 2, considerably less than expected and not enough to bring the solution within specifications. Failure of the E-13 agitator prior to, or during the reprocessing of this material prevented efficient ozone treatment of this material. Blending or further ozone treatment will be needed for additional decontamination of this material.

d. Neptunium Recovery

Requirements for continuous neptunium recovery at Redox were documented in HW-65562 by R. G. Barnes. This document to serve as the basis for scope design, outlines the technology, the technical criteria and equipment requirements to permit the accumulation, decontamination, and load-out of neptunium without interfering with normal Redox production.

Recovery of the 700 grams of neptunium accumulated since the last recovery run in March, was begun during the latter half of the month. Poor acid control during the separation and recovery passes, together with an operating error which "lost" 40 percent of the available neptunium to the waste cell, made it necessary to rework the waste and recombine the entire neptunium inventory for a second try at separation and removal.

During the second attempt, approximately 20 percent of the uranium and plutonium initially present remained with the neptunium after the acid-deficient separation step. This was followed by pump failure which put almost 20 percent of the neptunium into the cell sump. Instrument trouble on the partitioning column (1B) during the acid cycle for the neptunium recovery step, allowed operation of the 1B Column with a low interface. This resulted in poor stripping of the neptunium and permitted approximately half of that still available to be carried over to the third cycle uranium concentrator rather than into the plutonium cycle vessels. At month end further neptunium processing was being held up until that "lost" to the uranium cycles could be recovered and recombined with that in the plutonium cycles for fission product decontamination.

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e. Waste Storage

The Redox neutralized salt waste stream was diverted from the 115-SX underground storage tank to the 112-SX underground storage tank on July 8, 1960, at which time the 112-SX tank contained a 241,000-gallon heel.

The 112-SX tank was made available for its second filling with neutralized salt waste as a result of the program for using boiling waste to concentrate non-boiling waste reported in November, 1959, Monthly Report. Approximately 426,000 gallons of non-boiling waste were pumped from the 112-SX tank to the 111-SX tank whose contents were boiling and concentrated by a factor of 2.18 during the period from November, 1959, through March, 1960. An additional 169,000 gallons were pumped from 112-SX to 110-SX during April and May, 1960.

Currently the non-boiling contents of the 109-SX tank are being pumped to the boiling 115-SX tank, according to plan. It is anticipated that the 115-SX tank has sufficient reserve capacity and heat content to concentrate 300,000 gallons of the non-boiling 109-SX tank waste by a factor of two.

f. Batch Six Incident, 233-S Building

In preparation for receiving concentrated non-specification plutonium solution for decontamination through Redox, piping revisions in the 233-S Building (Final Plutonium Concentration) were necessary to assure a critically-safe operation because the normal recycle can unloading station includes a critically-unsafe tank. It was planned to unload the concentrated product from PR cans into the critically-safe L-6 Concentrated Product Tank. Subsequently, safe batches would be loaded into PR cans and then emptied into the critically-unsafe L-16 tank with nuclear safety assured by batch control. However, prior to their inspection and authorization for use, the piping revisions which were made to permit this operation were inadvertently involved in the normal operation of unloading a recycle can into the L-16 tank. When this operation was being performed, concentrated plutonium product from L-6 tank entered the L-16 tank through an incorrectly installed pipe. The L-16 tank is provided with a neutron monitor pre-set to alarm at a plutonium concentration equal to 110 percent of the concentration of the specific material being transferred into the tank. When the monitor alarmed shortly after the transfer started, the transfer was immediately stopped, but not before the L-16 tank critical mass control limit of 790 grams was exceeded by approximately a factor of three. The solution was diluted to a lower concentration and half of it was moved into another vessel for subsequent rework.

The replacement of the non-critically safe L-16 tank with a critically-safe vessel, which was scheduled prior to the incident, will be completed before plutonium processing is resumed.

3. Finished Products Technology

a. Uranium Reduction Operation

1. Concentration and Calcination

The iron content of the depleted product stream returned to normally expected values during the month. The reduced corrosion rates are attributed to the lower free nitric acid content of Purex material (0.2 M vice 0.4 M HNO_3) and to the performance of a passivating flush of the concentration and molten UNH storage systems. The acid content was lowered and the flush was made during June, 1960.

The test Lawrence submerged centrifugal pump, with no submerged bearings or seals in contact with the process solution, was installed in the molten UNH feed tank. Operation has been satisfactory.

Relocation of the concentrator vapor lines from the mid point to the bottom of the mist separator has been completed. It is anticipated that the hot vapor will prevent freeze-ups of the separator drain line.

b. Metal Finishing Operation

1. Recuplex

Data obtained during four months of operation with the extraction column (H-1) new sieve plate cartridge (nozzle upward plates, 3/16 inch diameter holes, 23 percent free area, 2 inch plate spacing) indicate some loss of capacity and increased waste losses compared to the preceding four months of operation with the old cartridge (nozzle upward plates, 1/8 inch diameter holes, 13 percent free area, 4 inch plate spacing). The two periods of operation are compared in the following table.

Extraction Cartridge Comparison

	<u>Instantaneous Through-put Liters/Day</u>	<u>Operating Efficiency Percent</u>	<u>Extraction Waste Losses Grams/Liter</u>
Old Cartridge	2220	86.0	0.0056
New Cartridge	1940	77.5	0.0066

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b. Metal Finishing Operation (Continued)

Although the original plates had been severely corroded prior to the comparison period, better performance in all respects is indicated. The decrease in capacity was due to inadequate mixing at the feed plate resulting in local flooding, and to the relative ineffectiveness of the deemulsification agent, Mistron, with the increased hole size. The lower operating efficiency was due to more frequent flooding and to more frequent pulser bellows failures (a slight increase in pressure at the bellows resulted in an approximate two-fold increase in bellows failures). It is planned to replace the test cartridge with one of the original design.

Increasing the volume of the ferrous sulfamate-sulfuric acid semi-continuous wash from 25 liters to 40 liters per contact decreased extraction waste losses by 10 percent and extended the time between the necessity for organic carbonate washes by approximately 100 percent.

A new semi-continuous product concentrator-stripper has been fabricated as a replacement for the present batch concentrator (J-3), which has been removed from service due to low capacity and frequent coil failures. Currently, a stripper (J-26) is in use as a concentrator. This unit has stainless steel Raschig rings, a ring-type feed inlet, and no deentrainment section. Impurities in the product, predominantly iron, chromium, and nickel, average about 4000 ppm. The new concentrator incorporates a tangential feed inlet, to enhance heat transfer, and polytrifluoromonoethene (fluoroethene) Raschig rings in both the stripper and deentrainment sections, to minimize contamination of the product with metallic impurities.

2. Task I and II

The test calciner off-gas scrubber was replaced with the original condenser after seven weeks of testing. Although the scrubber plugged less frequently than the condenser, the location of the equipment in the hood caused difficulties during clean-out operations.

4. Process Chemistry -

a. Purex Process Assistance

1. Solvent Treatment

During the month, the plant solvent deteriorated to the point where satisfactory solvent quality could not be maintained by the normal plant solvent clean-up procedure. In contrast to previous experience, laboratory clean-up procedures were also unsuccessful for improving solvent quality. The solvent performed much like an ion exchange system in that the zirconium could be replaced with sodium (by contact with 10% NaOH) and the sodium in turn could be replaced by plutonium in the plutonium retention test. Although it was possible to reduce the zirconium-niobium activity of the solvent through such an exchange mechanism, laboratory contacts were not successful for removing the constituents causing the poor solvent quality.

2. Back-Cycle Waste Concentrator Crud

Recently an extremely radioactive crud was removed from the back-cycle waste (3WB) concentrator (H-4). A fission product analysis of the material showed the crud to be aged material. The fission product distribution and the americium-241 to plutonium ratio indicate that the material is probably not originally from the back-cycle waste concentrator but more likely from the first cycle waste concentrator (F-11).

Treatment with hot 10% NaOH followed by 30% HNO₃ or hot 10% NaOH - 0.02 M KMnO₄ followed by 30% HNO₃ - 5% oxalic acid did not completely dissolve the crud. However, these treatments did break up the material so that it could be slurried. Treatment with 30% HNO₃ - 5% HF or a bifluoride fusion also failed to dissolve the crud. A plutonium analysis of the bifluoride fusion mixture (a treatment known to dissolve most plutonium compounds) indicates that the crud contains very little (< 0.01%) plutonium.

b. Analytical Assistance

1. Plutonium Metal Inclusion

An inclusion in a specimen of plutonium metal was investigated using the microspark spectrographic technique. Examination showed the inclusion to consist of a grey, crystalline material extending over a region about 3/32 of an inch in diameter. Repeated analyses by the microspark technique failed to show the presence of any of the common metal elements other than plutonium. It

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appears that the inclusion is made up of a non-metal plutonium compound (or compounds), perhaps plutonium carbide.

2. Special Measurement Metal Batches

As part of a program to provide a firmer experimental basis for predicting plutonium formation as a function of irradiation time and power level, the dissolution, sampling, and analysis of twelve two-ton test batches is currently in progress at Redox. The program provides for the accurate measurement of the Pu/U ratio, the Np-237/U ratio, and the determination of the plutonium and uranium isotopic mass concentrations. Plutonium to uranium ratios are to be determined by two independent analytical methods - the conventional control laboratory method and the non-routine controlled potential coulometric method.

5. 234-5 Developmenta. Continuous Direct Calcination Of Plutonium Nitrate

Three runs were completed in the three-inch diameter calciner. Throughput was approximately 4 kg P1. During the last run, oxide product was continuously removed from the calciner via the product overflow line. This is the first run in which product exceeded the entrained material.

Run conditions were bed temperature, 275 C; agitator speed, 150 rpm; and feed rate, one liter per hour. Feed material was plutonium nitrate solution, 200 g/l Pu in 4 M HNO₃. Considerable down-time was experienced due to repairs on the calciner packing gland, the feed pump, and a frozen pipe fitting on the off-gas cyclone separator.

A sieve analysis was made of the oxide bed. The analysis tabulation is included.

<u>Screen Size</u>	<u>Wt. % On Screen</u>
1000 micron	0.2
500 micron	0.9
250 micron	1.3
105 micron	82.0
49 micron	15.1
Fines	0.5

The median particle size was determined to be 170 microns. A sample of the bed material was collected for halogenation reactivity measurements.

b. Continuous Electrolytic Reduction Of Plutonium Trichloride

Two successful runs were made this month in nickel-jacketed magnesia-titania cells. This type of cell satisfies material of construction requirements for runs of current duration. Run #35 gave a yield of 88 grams and an efficiency of 25 percent.

Both runs were complicated by the shorting of the electrodes, which caused melting of the plastic seals. Both runs were terminated because of difficulties with the powder feed mechanism. Improved powder feed techniques have resulted in improved viewing through the envelope, however, and observation of the hydrogen-chlorine reaction above the anode.

c. PVC-Coated Glove Test

The particular type of glove tested has red forearm and hand, black upper arm, and a plastic section on the upper arm which fits the glove port. On one of the two gloves under test, the seal be-

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between the plastic and glove body came apart in use. The negative pressure of the hood was sufficient to widen the rupture to approximately a 6" slit. It has been recommended that all gloves of this type now in use be replaced immediately.

The PVC-coated gloves are somewhat more stiff than black Neoprene, but appear to be particularly adaptable to organic and aqueous-type work where the Neoprene is attacked by the solutions. An adequate method of attachment to glove ports must still be proven.

d. Plutonium Oxide Dissolution

The final oxide dissolution tests made in conjunction with the steam oxidation of plutonium skulls have been completed. The table below gives a brief resume of results obtained over the past months.

TABLE I

DISSOLUTION OF PuO₂ FROM STEAM-TREATED SKULLS

Run No.	Batch Size As Pu	g Dissolved After			% Dissolved After			Conc. Soln. g/l
		20 min	1 hr	2 hrs	20 min	1 hr	2 hrs	1 hr
1	217	199	198	217	92	91	100	141
2	215	215	215	215	100	100	100	152
3	212	208	210	212	98	99	100	152
4	216	182	191	216	84	88	100	132
5	251	215	248	251	86	99	100	183
6	255	172	203	255	67	80	100	195
7	402	322	320	378	80	80	94	222
8	406	335	355	372	83	89	92	245

All dissolutions were made by refluxing the PuO₂ in 1.5 liters of 16 M HNO₃ - 0.2 M or 0.25 M HF. The rates represent a considerable improvement over those experienced in present plant methods.

e. Recuplex Studies

Rate studies were performed on the batch stripping of plutonium from used solvent with hydrofluoric acid. As little as three minutes' contact time was found adequate for obtaining a decontamination factor of 10 - 200 with 1 M HF. A second contact gave factors up to 65. Disengaging was excellent.

Solvent treated as above was used to study the extraction of plutonium from the Recuplex aqueous waste stream, CAW. Satisfactory distribution coefficients were demonstrated. Whether the solvent was also washed with carbonate or with aluminum nitrate, the measured distributions were higher than for synthetic solvent.

The tests were performed with solvent which after the 1 M HF washing had been treated with aluminum nitrate or with carbonate. In both cases higher distributions were observed than with synthetic solvent.

The extraction of hydrofluoric acid by 20 percent TBP-80 percent CCl_4 was studied. A series of solutions whose concentrations varied from 8 M to 0.1 M HF were contacted with cold organic for five minutes. The extraction was followed by measuring the hydrogen ion concentrations in the two phases. It was found that extraction of HF took place to some extent. At 1 M HF in the aqueous phase, the H^+ concentration in the organic was 0.075 M. It was also found that contacting the organic with five percent sodium carbonate after an extraction removed virtually all of the acid from the organic.

B. R. Irish

Acting Manager
Research and Engineering

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CHEMICAL PROCESSING DEPARTMENT
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II. ACHIEVEMENTS (continued)

H. Financial Operation

1. Production Cost

The preliminary Financial Plan for FY 1961 was received from the Commission through Contract Accounting. Funds in total were less than budgeted but were divided as best possible between the departments and operations.

The proposed allocation of funds for CPD for FY 1961 is \$888,000 less than the revised budget. Reductions are listed below:

2000 Program - Production	\$ 3 000
- R & D	34 000
- Equipment	<u>376 000</u>
Total 2000 Program	<u>413 000</u>
3000 Program - Production	49 000
- R & D	140 000
- Equipment	<u>286 000</u>
Total 3000 Program	<u>475 000</u>
Total CPD Reduction	<u>\$888 000</u>

Actually, the \$140,000 reduction in 3000 Program R & D appears to be an oversight by the AEC in failing to restore money reserved for the Pratt and Whitney gauge. Serious problems do face all of HAPO in the equipment accounts. Appeal for additional funds has been made by Contract Accounting.

A tentative pricing schedule for processing of off-site plutonium through the new Pu Reclamation Facility was released. A document is currently being prepared in conjunction with Industrial Engineering to support the price list and provide data for project write-up.

A complete history of maintenance costs for the Purex Ion Exchange was prepared to assist in determining the economics of a similar installation in Redox.

The Essential Material turnover rate was 4.2 in June and 2.6 FYTD compared to 2.0 for FY 1959.

The Spare Parts turnover rate was .52 in June and .43 FYTD compared to .32 for FY 1959.

2. Singular Cost Studies

In cooperation with Redox Technology, Finished Products Technology and Production personnel, cost estimates for processing high exposure plutonium were developed. These estimates were requested by HOO-AEC in connection with the PRTR Program.

The "Chemical Processing Department Report of Representative Economy Measures - FY 1960" was prepared and will be issued August 1, 1960.

3. Personnel Accounting

The 1.18% cost of living increase effective July 25, 1960 will result in an annual increase of \$58,675 for the Chemical Processing Department salary expense. This increase will be on the August 5 checks for weekly paid employees, and the amount applicable to the area differential for monthly paid employees on the August 31 checks.

4. General Accounting

Four Appropriation Requests were approved in July, amounting to a total of \$127,250. Equipment items to be procured were:

Shipping containers for Weapon shapes	\$100 000
Resin Replacement System "N" Cell-Purex	15 000
Rework Receiving Vessel-Purex	7 750
Electronic Particle Size Determinator-R&E	4 500
	<u>\$127 250</u>

A physical inventory of plant and equipment at buildings 271-CR and 241-C-601 was taken in connection with the transfer of custodial responsibilities from Power and General Maintenance to Purex.

5. Auditing

A formal audit report was issued covering CPD functional audit work relating to vehicle assignments and utilization during the audit year ending July 30, 1960. Department performance during this period was satisfactory. This is supported by the findings of a recent traffic survey conducted by CE&UO on a HAO-wide basis.

An audit memorandum was directed to Transportation Accounting, CE&UO, requesting updating of cost codes on the monthly vehicle liquidation report and the processing of all assignments through the department vehicle custodian.

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An analysis was made and an audit memorandum issued covering the department's purchases of Zippalope Portfolios from Stores stock. Department withdrawals of this item appeared reasonable.

6. Measurements and Procedures

In keeping with our paper work reduction program, a joint review by Procedures and Auditing was started to ascertain the need for, and utilization of, all Financial reports.

Manager - Finance

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II. ACHIEVEMENTS (continued)

I. RELATIONS PRACTICES OPERATION

1. Salary Administration

One new exempt position was established in the Financial Operation.

A revised Position Relationship Data Chart was issued. Eighteen exempt positions were deleted from the Department's list of authorized positions.

A review of all salaries of exempt personnel who were not included in the salary review conducted in February was completed and recommendations made to the appropriate managers during the month.

The Salary Administration Codes for all exempt personnel were updated for programming by data processing machines.

2. Personnel Placement

Interviews were conducted this month with two Manufacturing Training Program graduates for permanent placement in the Chemical Processing Department. Joint offers were extended in conjunction with Fuels Preparation Department and Irradiation Processing Department. Two offers were extended for direct placement in the Chemical Processing Department and one Chemist accepted assignment in the Finished Products Operation.

Requisitions for thirteen Utility Operators are on hand with the Finished Products Operation requiring ten and the other three for the Purex Operation. Qualification tests have been given to a number of people as Utility Operators and interviews will be conducted in order that the most qualified may be selected to fill the open positions.

The names of three exempt personnel from the Chemical Processing Department were submitted to the Relations Operation for participation in the Manufacturing Studies Program which is scheduled to begin in September.

3. Wage and Benefits

One new position classified as Chemical Technologist - High Level Facility, was evaluated and established in the Purex Analytical Laboratory.

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On April 11, 1960, the new Non-Unit Weekly Salary Plan was installed. At that time it was to the advantage of a few individuals to leave them on the old plan. As a result of personnel changes made during the month all Non-Unit employees in the Chemical Processing Department have now been integrated into the new Weekly Salary Plan.

Suggestion Plan Activity

	July	June
Received	32	29
Adopted	18	14
Awards	\$445	\$220
Savings	\$2560	\$751

4. Health, Safety, and Radiation

Four AEC Radiological Physics Fellows reported to the Redox Plant in the Chemical Processing Department on July 26 for field assignments in the Radiation Monitoring Operation.

5. Communication

Information related to negotiations with the Hanford Atomic Metal Trades Council and the third package, Man-Manager Communications Program, was distributed to Section and Sub-Section Managers. A special Headliner listing the Union demands, pertinent items on GE-IUE negotiations, two talks by J. S. Parker and Philip Moore, and several news bulletins were distributed to all employees on the monthly salary roll.

Other communications during the month included seven Management News Bulletins, five Headliners, two priority messages, one Management Information Meeting, three Relations Information Meetings, and one Round Table publication.

RB Britton
Manager, Relations Practices

RB Britton:ecm

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III. PERSONNEL ACTIVITIES

A. FORCE SUMMARY

<u>Operation</u>	<u>Monthly Salaried</u>		<u>Weekly Salaried</u>		<u>Total</u>	
	<u>6-30-60</u>	<u>7-31-60</u>	<u>6-30-60</u>	<u>7-31-60</u>	<u>6-30-60</u>	<u>7-31-60</u>
General Manager's Group	10	10	1	1	11	11
Financial	13	12	13	14	26	26
Relations Practices	5	5	6	6	11	11
Research & Engineering	61	61	27	27	88	88
Facilities Engineering	65	65	25	24	90	89
Power & General Maintenance	41	41	231	231	272	272
Production	6	6	3	3	9	9
Special Separation Processing and Auxiliaries	47	48	214	212	261	260
Purex	47	48	207	206	254	254
Finished Products	<u>51</u>	<u>52</u>	<u>212</u>	<u>214</u>	<u>263</u>	<u>266</u>
Total	<u>347</u>	<u>348</u>	<u>939</u>	<u>938</u>	<u>1 285</u>	<u>1 286</u>

B. PERSONNEL CHANGES

There were no personnel changes during the month of July.

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C. TRIPS

<u>Visitor</u>	<u>To</u>	<u>Nature of Discussion</u>
<u>To other G.E. Components</u>		
J. H. Warren	General Electric Services Div. San Francisco, California	Cost Improvement Regional Meeting 7/6/60
K. G. Grimm	General Engineering Laboratory Schenectady, New York	Review of accounting system 7/25/60
K. G. Grimm	General Electric Company New York, New York	Review of accounting system 7/26/60
<u>To AEC and Other AEC Operational Contractors</u>		
J. H. Warren B. F. Judson	AEC, Division of Production Washington, D. C.	Fission Product Recovery Program 7/7/60
G. E. Wilbur	Dow Chemical Company Rocky Flats, Colorado	Discuss non-destructive testing problems 7/7-8/60
R. G. Geier	ANL Lemont, Illinois	Consultation on Purex problems 7/11-12/60
J. J. Courtney M. J. Szulinski	Lawrence Radiation Laboratory Livermore, California	Pu scrap recovery discussions 7/18-19/60
J. J. Courtney M. J. Szulinski	Los Alamos Scientific Lab. Los Alamos, New Mexico	Pu scrap recovery discussions 7/20-21/60
J. J. Courtney M. J. Szulinski	ANL Lemont, Illinois	Pu scrap recovery discussions 7/22/60
K. G. Grimm	du Pont (SRP) Aiken, South Carolina	Review of accounting system 7/27-29/60
<u>To General Industry</u>		
R. A. Kennedy	General Mills Minneapolis, Minnesota	Review design progress of equipment for NPF Project 7/11/60
R. A. Kennedy	Racine Hydraulic & Machine Co. Racine, Wisconsin	Review design progress of equipment for NPF Project 7/12/60
R. A. Kennedy	Birdsboro Machine Company Birdsboro, Pennsylvania	Review design progress of equipment for NPF Project 7/13/60

<u>Visitor</u>	<u>To</u>	<u>Nature of Discussion</u>
R. A. Kennedy	Vitro Engineering Corp. New York, New York	Review design progress of equipment for NPF Project 7/14-15/60

D. VISITORS

<u>Visitor</u>	<u>From</u>	<u>Nature of Discussion</u>
<u>From Other G. E. Components</u>		
R. H. Norris	General Engineering Laboratory Schenectady, New York	Heat transfer from high activity wastes 7/8/60
G. W. Dunlap A. H. Bushey B. D. Bedford	General Engineering Laboratory Schenectady, New York	Fission product usage 7/22/60
<u>From AEC and Other AEC Operational Contractors</u>		
R. A. Vandegrift	Dow Chemical Company Rocky Flats, Colorado	Discuss plutonium pro- cessing and equipment 7/18-19-20/60
Dr. S. Shoup	AEC Oak Ridge, Tennessee	Discuss equipment decon- tamination and radiation hazards 7/19/60
R. G. Jordon R. C. Baker	Union Carbide Nuclear Co. Paducah, Kentucky	Discuss equipment decon- tamination and radiation hazards 7/19/60
S. D. Lewis L. M. Howell W. B. McDonald	UCNC Oak Ridge, Tennessee	Remote Maintenance 7/21/60
W. L. Lennemann	AEC, Division of Production Washington, D.C.	Tour of the Purex Plant 7/21/60
<u>From General Industry</u>		
I. R. Higgins	Chemical Separations Corp. Oak Ridge, Tennessee	Discuss ion exchange de- velopment work 7/6/60
B. Olson	Western Chemical Products Co. Seattle, Washington	Discuss decontaminating chemicals 7/14/60
D. Eaton M. Barmat	General Instrument Corp. Newark, New Jersey	Industrial uses of radio- active waste 7/22/60

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Visitor

From

Nature of Discussion

From Other Government and Foreign Agencies

S. A. Hagsgard
A. H. Larsson

AB Atomenergi
Sweden

Criticality problems
in laboratories and
separations plants
7/5/60

From Colleges and Universities

G. W. Watt

University of Texas
Austin, Texas

Research and develop-
ment discussions -
waste disposal
7/19-20/60

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IV. SAFETY AND SECURITY

Operation	Facil. Eng.	Finan.	Fin. Prod.	P&GM	Purex	SSP&A	Prod.	Rel. Prac.	Res. & Eng.	Total CPD	Year to Date
Disabling Injuries										0	1
Serious Accidents										0	13
Medical Treatment											
Injuries											
Radiation Occur.			9	12	2	8	1		1	33	272
Contam. Wounds			7		8½	5		2½	23	23	124
Pu Depositions			1*						1	1	4
Fires											6
Security Violations			1#						1	1	10
									1	1	4

*A Finished Products operator received a contaminated puncture wound of the right index finger on July 18, 1960, while assisting maintenance in the 234-5 solvent extraction hood. Low level skin contamination was readily removed by standard decontamination methods.

#A fire occurred in 234-5 Analytical Lab on July 8, 1960, when a short piece of rubber tubing was ignited by heat from a tube furnace.

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V. REPORTS

A. PREPARED AND ISSUED

- HW-65325, Unclassified, "Project Proposal - CGC-830 - Revision #3 - Plant Modifications for Reprocessing Non-Production Reactor Fuels," dated July 11, 1960, L. W. Finch.
- HW-65564, Unclassified, "Project Proposal - CGC-813 - Revision #3 - Plutonium Recovery From Contaminated Materials - 234-5 Building," dated July 5, 1960, L. W. Finch.
- HW-65937, Unclassified, "Project CGC-830 - Plant Modifications For Reprocessing Non-Production Reactor Fuels, Design Criteria For Dissolution Systems and Associated Service Facilities," dated July 20, 1960, S. R. Bierman.
- HW-65947, Confidential, "Birch Schedule," dated July 1, 1960, W. K. MacGready.
- HW-65952 RD, Secret, "Redox Plant Production Schedule, July-August, 1960," dated July 25, 1960, D. McDonald.
- HW-65953 RD, Secret, "Purex Plant Production Schedule, July-August, 1960," dated July 25, 1960, D. McDonald.
- HW-65954 RD, Secret, "UO₃ Plant Production Schedule, July-August, 1960," dated July 25, 1960, D. McDonald.
- HW-65955 RD, Secret, "234-5 Plant Production Schedule, July-August, 1960," dated July 25, 1960, D. McDonald.
- HW-65982, Confidential, "Scheduled Shutdown - Redox Plant," dated July 6, 1960, R. E. Tomlinson.
- HW-66040, Secret, "Essential Material Consumption - Purex, CPD, June, 1960," dated July 12, 1960, J. E. Lentz.
- HW-66187, Secret, "CPD Waste Status During June, 1960," dated July 25, 1960, J. E. Lentz.
- HW-66228, Confidential, "Unscheduled Shutdown - Purex Plant," dated July 25, 1960, J. H. Warren.

B. PREPARED FOR SIGNATURE AND ISSUANCE

HW-65934, Secret, "Production - June, 1960," dated July 1, 1960,
W. E. Johnson.

HW-66052, Secret, "HAPO Production Forecast July 1, 1960 through
June 30, 1965," dated July 25, 1960, W. E. Johnson.

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VI. PATENT SUMMARY

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

INVENTOR

Gary C. Bower

TITLE

HWIR-1260 - Split-Nut Machine or
Pipe Fasteners

General Manager
Chemical Processing Department

END

**DATE
FILMED**

12 / 14 / 92