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CHEMICAL PROCESSING DEPARTMENT
MONTHLY REPORT
FOR

JANUARY, 1960

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By TL Phillips 5/4/92

DJ Krieger 8/4/92

Compiled By
OPERATION MANAGERS

February 22, 1960

HANFORD ATOMIC PRODUCTS OPERATION
RICHLAND, WASHINGTON

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

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CHEMICAL PROCESSING DEPARTMENT
MONTHLY REPORT

JANUARY, 1960

I. SUMMARY

A. RESPONSIBILITY

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

B. PRODUCTION

Production of plutonium nitrate from the separations plants during January exceeded the Official Forecast.

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

A new production record for unfabricated plutonium metal was achieved in January when the output exceeded that of any previous month by three per cent. Shape production conformed to the current requirements and shipments of both items were on schedule.

C. ENGINEERING

The decontamination performance of the Purex process during January continued to be below standard. After adjusting the flowsheet to retain the neptunium, waste rework was started about the end of December. The Zr-Nb decontamination improved during this period but ruthenium build-up occurred throughout the system. After completion of rework, ruthenium levels returned to normal but the solvent extraction first cycle Zr-Nb decontamination deteriorated. Intensive efforts to resolve these problems are continuing

A preliminary information issue of the engineering flow diagrams for the Plutonium Reclamation Facility was completed on January 25. Four basic design philosophies are being considered. A directive was issued by the AEC on January 18, approving \$100,000 for Title I design and associated project engineering services; Work Authority No. 1 for \$100,000 was received by General Electric on January 25.

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Field work at the site of the 234-5 Building Inspection Facility started on January 8. As a result of this activity, temporary re-location of the present radiographic inspection equipment was necessary.

Detail design and fabrication drawings were completed for the "powered ferret," which is an electric motor and gear box mounted on a small carriage. The primary purpose of this device is to drive a scintillation counter several hundred feet through a 4-inch diameter conduit to monitor ground activity beneath self-boiling radioactive waste storage tanks. An experimental probe design is essentially complete.

The shipping cask to be constructed for the shipment of semi-refined Cerium-144 to Oak Ridge is being completely redesigned to satisfy the stringent restrictions imposed by the Bureau of Explosives.

Consideration is being given to altering the NPF scope of work to a two-phase program; Phase I - storage, and Phase II - fuel element reprocessing. A storage-only activity at HAPO is feasible but not attractive from a contribution point of view. A decision to install a reprocessing facility at HAPO will probably be delayed at least six months. Studies are under way to determine the minimum facility required, consistent with good production practices and currently assigned fuel.

D. GENERAL

An increase in the cost of living index for the fourth quarter of CY 1959 resulted in a 0.59% upward adjustment of all nonexempt employee wages and the isolation pay for the exempt employees. This 0.59% increase amounts to an annual increase in Chemical Processing Department cost of approximately \$31,000.

On January 11, the Department experienced a disabling injury which terminated a record of 702 injury-free days, totalling 5,300,000 man-hours.

W. K. MacReady

General Manager
Chemical Processing Department

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CHEMICAL PROCESSING DEPARTMENT
MONTHLY REPORT

JANUARY, 1960

II. ACHIEVEMENTS

1. PRODUCTION OPERATION

1. Production Statistics

	<u>January</u>	<u>December</u>
a. <u>Purex</u>		
Tons uranium processed	600.87	443.9
Average production rate during operation (T/D)	19.4	23.7
Total waste loss (%) Uranium	0.08	0.18
Average cooling time (days)	93	104
Minimum cooling time (days)	90	91
On-line efficiency (%)	100.0	60.3
b. <u>Redox</u>		
Tons uranium processed	(11.1 N 73.1 E	125.2 N 9.8 E
Average production rate during operation (T/D)	6.2	8.2
Total waste loss (%) Uranium	(0.18 E (0.21 N	0.12
Average cooling time (days)	166	(111 N 260 E
Minimum cooling time (days)	124	(97 N 217 E
On-line efficiency (%)	67.4	75
c. <u>234-5</u>		
Batches input to Task I	265	256
Runs completed through Task III	219	211
Batches through Product Recovery	20	34
Reduction yield (%)	96.6	97.4
Buttons produced (% of schedule)	107	95

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c. 234-5 (Continued)

	<u>January</u>	<u>December</u>
Buttons shipped (% of schedule)	102	100
Shapes produced (% of schedule)	100	100
Shapes shipped (% of schedule)	107	111
Recovery output (% of schedule)	112	148
Pu recovery backlog (units)	106.9	89.5
Waste disposal (units)	663	847

d. UO₃

	<u>January</u>	<u>December</u>	<u>To Date</u>
UO ₃ loaded (tons)	(54.6 E	(52.9 E	
	498.4 N	523.1 N	
UO ₃ approved for shipment (tons)	(49.2 E	(48.2	(762.8 E
	402.3 N	553.2 N	36 725.9 N
UO ₃ shipped (tons)	(0 E	(143.4 E	(664.9 E
	403.2 N	452.5 N	36 474.3 N
UNH backlog (tons)	(23 E*	(10 E	
	240 N**	196 N	

*Includes 11 tons with high gamma.
 **Includes 18 tons to be reworked.

e. Power

	<u>200 East</u>	<u>200 West</u>
Raw water pumped (gpm)	7 785	3 952
Filtered water pumped (gpm)	1 140	755
Maximum steam generated (lbs/hr)	263 000	188 000
Average steam generated (lbs/hr)	235 805	143 707
Total steam generated (M lbs.)	175 439	106 918
Coal consumed, est. (tons)	10 309	6 419

f. Waste Storage

	<u>Equivalent Tons U</u>	
	<u>January</u>	<u>December</u>
Salt waste reserve storage capacity-Redox	2 994	3 077
Salt waste reserve storage capacity-Purex	28 462	29 057
Coating waste reserve storage capacity-Redox	24 046	24 129
Coating waste reserve storage capacity-Purex	33 945	34 540

J. H. Warner
 Manager - Production

CHEMICAL PROCESSING DEPARTMENT
MONTHLY REPORT

JANUARY, 1960

II. ACHIEVEMENTS (Continued)

B. PUREX OPERATION

1. Operating Continuity

Processing was continuous at a nominal 2.4 CF throughout the month. The uranium production exceeded the schedule by 101 tons.

2. Processing Operations

Process performance for the first half of the month was adequate although the uranium required silica gel treatment. Activity levels started to climb at mid-month with the plutonium eventually going out of specification. Plutonium waste losses in the pre-cycle extraction column (HA) markedly increased for unexplained reasons. The uranium saturation in the organic was reduced to help control waste losses; however, this change adversely affected the decontamination performance of the plant. The high gamma plutonium produced during this period was combined with decontaminated uranium and successfully reworked through the process.

Rework of first cycle (IWW) waste early in the month appeared to improve the decontamination performance of the precycle (HA) column. An increase in the ruthenium activity of all streams, including the organic, halted this program temporarily. The substitution of synthetic (cold) IWW waste for regular IWW waste failed to improve decontamination. Later in the month small quantities of actual IWW were again reworked but without duplication of the apparent beneficial effects.

As the result of failure of a nitric acid flow controller in the final uranium cycle four batches of uranium were contaminated with plutonium. This material and approximately 90 tons of out-of-specification uranium from the December run period were reworked through the final uranium cycle.

The plutonium ion exchange equipment was shut down on four different occasions. Three outages were caused by mechanical failures and the fourth by failure of resin movement.

The silica gel facility processed 511 tons of uranium during the month.

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3. Mechanical Experience

A portion of the plutonium concentrator loop and the feed pump inlet check valve in the ion exchange facility were replaced because of leakage. A flange on the concentrator continued to leak after the change and it was regasketed on two additional outages.

The agitator in the neutralized waste tank (F-16) failed and was replaced. There have been only five agitator failures since plant startup.

4. Radiation Experience

There were three Radiation Occurrences.

An employee punctured his right thumb while preparing waste for disposal. A sharp object in the contaminated waste pierced two plastic bags and two pair of surgical gloves which the employee was wearing. The plutonium contamination (10,000 d/m) detected at the puncture site was readily reduced to less than 500 d/m. An additional survey was also accomplished, utilizing the Whole Body Monitor facility.

There were five cases of skin contamination during the month with a maximum of 10,000 d/m plutonium and 1,000 c/m of fission products.

5. Analytical Performance

Assistance to diagnostic efforts to determine causes of reduced decontamination performance in the process increased the number of determinations to 6466 for the month compared to a monthly average of 5004 during 1959.

High first cycle plutonium waste losses were investigated. A non-extractable form of plutonium was found in some samples.

An investigation was made to determine the cause of ruthenium in the uranium final product. The 3WB back-cycle stream proved to be the contributor and the condition was corrected by the addition of sodium nitrite.

6. Events Influencing Costs

The large scale reworking of high gamma plutonium through the process resulted in increased manufacturing costs during the period.

Two failed canyon-type pumps, valued at \$14,000, were decontaminated and repaired at a cost of \$6,300.

P. H. Murray
Manager-Purex

FR McMurray:BAF:gt

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**CHEMICAL PROCESSING DEPARTMENT
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II. ACHIEVEMENTS (Continued)

C. SPECIAL SEPARATION PROCESSING & AUXILIARIES OPERATION

1. Operating Continuity

Processing operations were conducted as scheduled throughout the month and the production commitment was exceeded by 28%. The mechanical efficiency for the month was 100%, there being no downtime chargeable to failed or malfunctioning equipment.

2. Processing Operations

The first week of the month was used to process the balance of the normal depleted uranium which remained in the process tanks following the December production run. E-Metal processing, which started in the dissolvers on 12-31-59, reached the extraction columns on 1-6-60 and continued as scheduled to the end of the month. To provide the metal necessary for the month's production, the dissolvers were operated continuously, including week-ends, when the building is normally scheduled for shutdown.

The quality of both product streams was maintained under shipping specifications throughout the month. As previously experienced with E-Metal processing, a slight increase in the iron content of the final plutonium solution was noted. This has been attributed to the longer residence time in the process vessels resulting from the slower production rates.

Product waste losses on both product streams were under satisfactory control throughout the month, averaging 0.18% and for uranium and plutonium respectively. In addition to using the D-9 waste in the head-end batch makeups, the 1S column was utilized as available to reprocess high salt waste batches and product bearing sump wastes. Three batches of D-9 waste were reworked due to the high Palm content which resulted from a temporary loss of acid control in the acid precycle flow sheet.

Approximately 90 units of UNH, with a gamma ratio of approximately 5.00, was received from the Purex Plant for processing through the silica gel system to bring it within shipping specifications. Processing of this material was underway at the end of the month.

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3. Mechanical Experience

The D-14 backcycle concentrator pump was replaced on 1-9-60, because of erratic flow rate operation. The failed pump was installed on 2-8-59 and had operated 3,280 hours over the eleven month period. The eleven month operation of this particular pump is significant in that it was one which had been decontaminated and repaired in the Redox Equipment Reclamation Facility at a savings of approximately \$6,000 over the cost of a new pump. The replacement pump is also one which had been decontaminated and repaired.

The charging wrench reelite for the electrical cable on the 60-Ton canyon crane failed this month and had to be replaced. The new unit is equipped with a quick-change device which should expedite future replacements in this high radiation area.

The weight factor and specific gravity instruments on the 2DW waste concentrator were returned to service this month after the successful repair of the inconcrete piping. This was accomplished by threading quarter inch stainless steel tubing through the failed inconcrete line.

4. Waste Handling and Decontamination

A total of 124,510 gallons of stored salt waste was pumped from the 112-TX tank to the 111-TX tank for in-farm concentration. No difficulty was experienced with this operation.

Using sheet lead and concrete barriers approximately two feet thick, sufficient shielding was obtained to allow replacement of a leaking diversion valve in the SX Tank Farm condensate valve pit located near the 112-SX boiling waste tank. Dose rates were reduced from a maximum of 20 r/hr to a working field of 500 mr/hr.

Supplemental ditching and diking, approximately a half mile long around the Redox Cooling Water Swamp was completed this month. Enlargement of the swamp area was necessary due to low percolation rates and weakening of the existing dike walls.

A total of 196 man-hours was charged to the decontamination of automotive, railroad, and heavy equipment this month. The following is a breakdown of the decontamination work:

<u>Item</u>	<u>Operation Charged</u>
Panel Truck 1D 458	HLO
Regulated Dump Truck	P&GM
Fork Lift Truck	FPO
D-7 Cat	P&GM
Locomotive #29	RR

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<u>Item</u>	<u>Operation Charged</u>
Locomotive #32	RR
Well Car #37	RR
Whiting Crane Wheels	WH&DO
Crane Hooks (Lorraine)	P&GM
(2) Electric Pumps	HLO

Some of the decontamination work on the above equipment was accomplished using high pressure water rather than steam. Although all equipment details and techniques have not been worked out for the high pressure water system, indications are that it will improve and speed up the decontamination work.

Minor Construction work in the 221-T Canyon Building was completed this month and relocation of the Redox Waste Handling and Decontamination Operation from the 221-U to the 221-T Canyon Building is continuing as manpower is made available.

5. Radiation Experience

A fission product emission from the 291-S stack occurred on 1-7-60 when the dissolver vent jets were temporarily placed on steam while repairs were being made on the cooling water supply system to the air compressors. A survey of the area around the stack revealed contaminated spots of greater than 100,000 c/m. Subsequent water flushing of the walkways and general area reduced the smearable fission product contamination to less than 300 c/m. The spread of contamination was confined to the previously zoned 291 radiation areas. This occurrence quite conclusively indicates that the dissolver vent jet lines are holding up ammonium nitrate and fission products. Piping changes are therefore being investigated which will route all dissolver off-gases through the 293-S Building scrubber or absorber. Presently the coating removal gases go directly to the 291-S stack.

Two extensive decontamination assaults were made on the 202-S Building canyon crane during the month and levels of contamination were reduced by approximately 50%. Dose rates from the crane are still above the levels of a year ago, however, routine maintenance can now be performed without excessive radiation exposure to personnel.

6. Analytical Experience

Evaluation of the analytical requirements of the UO₃ Plant was completed this month. As a result of the study a new sampling schedule is being issued, the sample load will be reduced, and the timing changed sufficiently to allow all process control analytical work to be handled on the day shift in the 222-S Laboratory. The new sample schedule goes into effect 2-1-60.

A study of high gamma ratios occurring in depleted UO_3 powder was investigated during the month. Results positively identified I-131 as the present contributor to this increased activity.

Considerable analytical support was given to the Redox Radiation Monitoring Operation in their study of the 291-S stack emission problem. 127 samples were analyzed on the 256 channel analyzer. Evaluation of the complex 4, 5, and 6 component systems, which were involved, required many man-hours of calculating effort.

7. Events Influencing Costs

The Redox Plant was shutdown on January 1, 1960 for the New Year holiday. Only standby personnel were scheduled to work.

A reduction of \$26,000 was made in the spare equipment inventory with the excessing of the D-4 condensate evaporator condenser which is no longer required.

Chas. S. Grosz

Manager - Special Separation
Processing and Auxiliaries

CT Grosz:sws

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CHEMICAL PROCESSING DEPARTMENT
MONTHLY REPORT

JANUARY 1960

II. ACHIEVEMENTS (Continued)

D. FINISHED PRODUCTS OPERATION

1. Operating Continuity

Schedules and commitments for weapons parts, unfabricated plutonium, recovered plutonium and uranium oxide were all met or exceeded.

2. Processing Operations

a. Plutonium Fabrication

Model 65 assemblies were fabricated during the month. Production progress was below par during the first half of the month due to substandard metal quality and also due to a higher-than-normal number of machining rejects. The use of tantalum metal cups and the old type resistance furnaces for melting during the latter half resulted in such significant improvement in metal quality that it was possible to complete the scheduled production before month end.

b. Plutonium Processing

The production of unfabricated plutonium was excellent during the month. A new production record was achieved when the January output exceeded by more than 3% that of any previous month in the history of the plant.

Continued processing of marginal quality feed material has created a serious personnel exposure problem with ever increasing, but still within specification, radiation levels on the finished product.

The Recovery Operation met schedules although it did not perform as well as in previous months. The processing of a large volume of cutting oil from the Fabrication Operation resulted in abnormal amounts of plutonium in the organic and waste streams,

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requiring considerable reworking prior to disposal. The processing of off-standard plutonium nitrate has created a personnel exposure problem in the Recuplex facility also.

Two potentially serious incidents occurred in the Recuplex facility during the month. One occurred when a dissolver pressurized as a result of the inadvertent loss of the inert gas blanket. The other involved the failure of three valves which allowed material from a critically safe extraction column to back up into a critically unsafe vessel. Neither of these incidents resulted in any over-batch-size conditions, caused any significant lost time, or resulted in any injury, or spread of contamination. Both have been investigated and are reported separately. Steps have been taken to prevent recurrence.

c. Uranium Reduction

The Uranium Reduction Operation performed routinely throughout the month. Production schedules were completed by January 26, and the plant was shut down for preventive maintenance. During this shutdown the UNH receiver tank (C-1) was recalibrated using an ultra-high-precision manometer and the latest techniques to insure a more accurate accountability of uranium.

3. Mechanical Experience

All mechanical equipment in the U and Z plants operated during the month with no unscheduled shutdowns due to equipment failures. Maintenance activities were limited to repairs or replacements of a minor nature.

4. Radiation Experience

<u>Statistics</u>	<u>January</u>	<u>December</u>
Radiation Occurrences	11	6
Skin Contamination Cases	22	15
Injury in CIZ	0	3
Clothing Contamination	6	0
Positive Nasal Smears	5	5
Stack Emission, Z Plant	10.7 μ c Pu/day	71.2 μ c Pu/day
Stack Emission, U Plant	4.6 μ c U/day	12.4 μ c U/day

High gamma exposure rates in the plutonium processing work areas and in Recuplex have built up as a result of processing marginal quality plutonium nitrate feed. In order to conserve on manpower exposure, the hoods in both these areas are being cleaned, and Purex is taking steps to improve decontamination.

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5. Analytical and Final Inspection Experience

<u>Statistics</u>	<u>January</u>	<u>December</u>
Number of Samples	1268	1003
Number of Determinations	11419*	6133
Average Impurity Content - Buttons	1130 ppm	1080 ppm
Purity - Shapes	99.868%	99.869%
Gauging Acceptance - Shapes		

*Increased number of determinations due to additional spectrographic work resulting from high production of plutonium buttons.

Determination of the ratio of gamma activity to plutonium alpha content (G/AT) was initiated in January on all Purex and Redox nitrate as well as all Recuplex product. Comparisons indicate a variance in measurement of gamma activity of Purex material between laboratories. An investigation of the analytical methods has been initiated.

All equipment from the radiographic area of the Final Inspection facility has been moved out to make way for construction activity. Essential dark room, X-ray and Co⁶⁰ radiographic service has been set up temporarily in the 234-5 Building Analytical Laboratory.

6. Events Influencing Cost

A review of analytical requirements for the Uranium Reduction plant has resulted in the approval to composite many of the samples and thus minimize repetitive analyses. This, when coupled with more accurate process instrumentation, and some improvements to time consuming analytical procedures has allowed the work to be done on straight days, and has eliminated the need for two shift employees in the 222-S Laboratory. Cost to the Uranium Reduction plant should be reduced by approximately \$12,000 per year.

7. Miscellaneous

The Finished Products Operation Manager's Annual Information Meetings were held this month. Three sessions were conducted and essentially all of the employees attended.

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W. M. Mohler
Manager - Finished Products

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CHEMICAL PROCESSING DEPARTMENT
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January 1960

II. ACHIEVEMENTS (Continued)

E. POWER AND GENERAL MAINTENANCE OPERATION

1. Operating Continuity

There were no outages of steam, water, or emergency electrical services that affected continuity of operation of the prime production facilities.

2. Inspection, Maintenance and Repair

Fabrication of the Multipurpose Dissolver (Project CG-772), for the Redox Facility, was an estimated 90 per cent complete at month end, with total completion scheduled for February 15. Immediately thereafter, a complete mock-up, including installation of all cell pipe jumpers, will be done in the cold cell at 277-W Shop, to assure the correct fit of all related components prior to hot cell installation.

A new concentrator was withdrawn from Spare Parts and made ready for installation in the D-12 position at the Redox Facility, as a replacement for a leaking in-service unit. Accompanying the new unit to the job site was a set of carbon steel cover plates for installation on the failed unit, for containing contamination during its removal and subsequent burial. A precast concrete burial box was constructed as a further precaution against the spread of contamination during the planned removal and burial of the failed unit.

Progress on the fabrication of a Prototype F-F6 Demister for the Purex Facility remains at 50 per cent of completion, and further action is deferred pending procurement of an acceptable deentrainment filter cartridge. A tantalum deentrainment filter cartridge was delivered to the job site January 27, however it was returned to the vendor because of uneven density distribution which could have caused channeling and loss of efficiency. Completion will follow within three weeks of receipt of a satisfactory cartridge.

Modification work has been completed on a spare F-6 Condenser, as required by the Purex Facility for installation in the F-11 position as a replacement for the existing unit which is leaking at the head gasket.

Completed at the Purex Facility was the installation of special piping required in connection with preparatory work on the Fission Product Load-Out Facilities (Project CGC-873).

Being machined at month end was a spare set of crucible cutter blades for the Task III RMA Line at the Finished Products Operation. The blades are similar to those produced by the Shops Operation on an experimental basis in November 1959, and which have given satisfactory service since that time.

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2. Inspection, Maintenance and Repair (Continued)

The new-type blades are of a simplified design that requires less machining, and provides better machineability than the original equipment, which was of Hastelloy "C" material. The new blades are made of hardened type 4140 steel.

Modifications to the 125-ton extrusion press in Hanford Laboratories Operation's 231-Z Facility have been completed as required to provide for the production of larger fuel elements. The existing billet heaters and container were replaced with larger units, and hydraulic mechanism was installed to provide means for lifting the heavier units.

The original inert gas system for the Mold Out-gas Hood in room 32 of the 231-Z Building was replaced with an improved automatic control system. The new system provides automatic closure of the argon supply at a predetermined positive pressure, and automatic stop on vacuum pumps at a predetermined negative pressure, as insurance against explosion or implosion of the hood.

The machining of a prototypal forging punch-and-die set, for use by Hanford Laboratories Operation, was 60 per cent complete at month end, with final completion scheduled for mid-February. The tooling will be used in development of a process for forging plutonium shapes, in an effort to eliminate production problems currently associated with casting processes.

Completed was the fabrication and assembly of a dual-type Dry Box Vacuum Hood for experimental use by Hanford Laboratories Operation in the 300 Area. The unit is equipped with air locks, vacuum pumps, gas circulation system, drying chambers and electrical services. In the absence of firm design, the work was carried out under the direction of a development engineer.

The Redox waste water swamp, which appeared to have reached its maximum saturation point, was increased in ground area by approximately 20 acres. The additional area embraces a trench 6' in depth and 20' wide, properly diked, with two 16" pipes to permit movement of water from the old swamp area to the new. Enlarging the swamp area precludes the possibility of a break or overflow of the dike, which would permit the uncontrolled flow of contaminated water over a large ground area.

High levels of radiation, emitting from the earth floor of the 112 valve pit, 241-SX Tank Farm, were reduced by 75 per cent through the use of magnetite ore. In making preparation for a valve repair job, an 8" layer of magnetite ore was spread over the floor of the valve pit, reducing radiation levels from 20 r/hr to 4.5 r/hr. A 12" layer of concrete over the magnetite further reduced readings to 2 r/hr.

Assistance rendered the Irradiation Processing Department consisted of conducting humidity tests on high efficiency air filters, in connection with the "Reactor Exhaust Air Decontamination Program" (Project CG-191), and making adjustments to the ventilation systems in the 105-B, D, F and H Buildings.

2. Inspection, Maintenance and Repair (Continued)

Fabrication of cell pipe jumpers required for the process canyons was as follows:

Redox -	13
Purex -	<u>7</u>
Total	20

3. Events Influencing Costs

The last 1959 quarterly inventory of the Department's precious metals indicates a reduction during the calendar year 1959 of 19,224.1 grams of gold, 57.7 grams of silver and 9,340.2 grams of platinum, having a combined total dollar value of \$47,592.35.

Manager-Power & General Maintenance

TGL:JFL:ap

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CHEMICAL PROCESSING DEPARTMENT
MONTHLY REPORT

January 1960

II. ACHIEVEMENTS (Continued)

F. FACILITIES ENGINEERING OPERATION

1. Purex

a. Process Design and Development Engineering

In-Line Pu Monitor, LBXP Stream

Jumper fabrication for the prototype neutron counter installation is 60 per cent complete, and electronic fabrication work is 20 per cent complete. The probe is being modified for this specialized use.

Waste Carton Monitor for Pu

On the basis of sensitivity and geometry data obtained in the instrument laboratories, detail design work has been started on a waste carton monitor for plutonium. The equipment will consist of a moderator box into which the waste cartons are placed, neutron detector tubes in the moderator, and read-out instrumentation.

F-F6 Demister

Fabrication of the demister vessel was essentially completed with the delivery and installation of the tantalum demister pad. The jumpers needed for the demister installation were also completed. The vendor was provided information with which to prepare a proposal for the Brink demister cartridges being considered for the spare demister unit.

Continuous Palm Recovery

Feasibility has been established that critically-safe equipment and interconnecting piping can be fitted into a remotable L-Cell package-type rack installed in the J-2 Canyon position. Major vessels within the rack would not be individually remotable. With the exception of samplers, sufficient wall services are available from the P&O Gallery for minimum extraction column control characteristics.

Waste Concentration

Preliminary engineering work has been completed on routings needed for conversion of Purex to single-stage waste concentration. Selection of the preferred alternate, expected within two weeks, will permit completion of definitive process design work covering the conversion of the plant to single-stage waste concentration. Demonstration of demister performance will, of course, be needed before these changes will be placed into effect.

b. Project Engineering

CGC-850 - 216-A Crib Replacement, Purex

Work by the fixed-price contractor has been essentially completed. The Commission is negotiating a contract for the drilling of two test wells, the only remaining work.

CGC-854 - Conversion of Purex Anion Exchange Prototype to a Manufacturing Unit

Field progress is estimated to be 75 per cent complete. An engineering study was initiated during the month to evaluate the need for several additional alterations and changes that may be required to achieve a fully satisfactory manufacturing facility.

DO-51208 - Purex 216-A-6 Replacement Crib

Approval action was started on a project proposal to replace the 216-A-6 crib which is failing. The total project cost is estimated to be about \$150,000.

c. Manufacturing Engineering

Titanium Reboiler

The contract with Griscom-Russell Company for the fabrication of the titanium reboiler for the Purex H-4 concentrator is now in force. By terms of the contract, the reboiler is to be completed by October 24, 1960.

Construction of a stainless steel reboiler of design similar to the titanium unit is still under study.

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2. Special Separation Processing

a. Process Design and Development Engineering

Off-Gas Iodine Monitor

The experimental installation has continued in operation in the 293-S Building during the month, and it was recalibrated with an ^{131}I source. Some improved calibration equipment has been assembled in the laboratory, for some minor modifications and calibration tests on the ranges which have been found to be required.

Alpha and Beta Gamma Air Monitors

Three beta-gamma air monitors were completed in the shops, and calibrated in HLO. They are under further test observation for an occasional instability fault which has been observed. Five alpha monitors have been fabricated and are being tested in HLO.

b. Project Engineering

CAC-843 - Disposal Facilities for UO_3 Condensates

A low bid of \$14,279 was submitted January 27 by Triangle Construction Company, Kennewick, for the fixed price construction contract for the crib. Bid package information for the test well drilling contract has been started.

c. Manufacturing Engineering

E-13 Ozone Contactor

Design was completed and drawings issued for modifications of an E-10 spare to an E-13 vessel. The modifications will simplify fabrication and improve future decontamination of this vessel. The outer coil was eliminated. The coil supports were redesigned for removal of the coils and upper head as a unit. A feasible method of coil insertion through the bottom of the vessel was proposed to the shops.

3. Finished Products Operation

a. Process Design and Development Engineering

Plutonium Reclamation Facility

A preliminary information issue of the engineering flow diagrams for the Plutonium Reclamation Facility, was made on January 25.

Four basic design philosophies are being considered. The first of these four approaches that will be evaluated utilizes a semi-remote maintenance philosophy in which the major equipment pieces are located in a Zone IV area with access by crane only, and all valves, flowmeters, and interconnecting lines requiring routine maintenance installed in glove boxes located in the Zone III area below Zone IV area. A directive was issued by the AEC on January 18, approving \$100,000 for Title I design and associated project engineering services; Work Authority No. 1 for \$100,000 was received by General Electric on January 25.

Transfer Can

A new design has been evolved using gaskets at the junction of the four corners to eliminate the need for extremely close machining tolerances and finishes. Positive locking devices are also used in place of the springs used on earlier designs.

Button Line Sander-Holder Hoods

A design sketch was made for a new crucible holder for use with the new RS-6 crucible on Button Line "A". Also, design was completed on a new type crucible holder for use on Button Line "C", and to replace the collapsible rubber ring holder now being used. This prototype crucible holder has been fabricated and installed on the "C" Line for testing.

b. Project Engineering

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

Pressure and vacuum testing of all hoods except Hood 9-B has been completed. The purchase order for lead shielding glass has been placed with Penberthy. Revised drawings and templates of all lead glass panels have been sent to the vendor for his use in cutting glove port holes in the glass.

Job 0095 - Inspection Facility

Field work at the site started January 8. Excavation work was hampered by the cold weather but is proceeding, and tunnel footings have been poured. The structural steel which was procured by

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General Electric purchase order has been shipped from Spokane. The radiographic inspection facilities were relocated in temporary facilities in the southeast portion of the 234-5 Building and an adjacent temporary structure.

CGC-826 - Vacuum System Improvements, 234-5 Building

The tie-in of the 4-inch vacuum lines between the 234-5 Building and 291-Z Building was made January 23. The project was closed as of January 31, 1960.

c. Manufacturing Engineering

Plutonium Recovery

Simplified procedures for generation of nuclear material source data and improved techniques for process control were installed in the Recuplex Operation. Unit cost variations were determined for both present and proposed plutonium reclamation facilities involving different combinations of feed and operational cost.

Recuplex Dissolver

Design and specifications were completed to permit purchasing of an all-cast dissolver vessel to replace a fabricated unit now in use.

4. General

a. Process Design and Development Engineering

Amplifier Development

Complete drawings have been prepared for a transistorized pre-amplifier for neutron counter tubes. It is applicable principally for well probes into process tanks for Pu monitoring and for neutron absorptiometers. Evaluation tests have been in progress some weeks on several "Transpac" power supplies, which are small commercial units particularly applicable for use in transistorized equipment.

Critical Incident Alarms

General discussions have been held with Irradiation Processing Department personnel on critical incident instrumentation, and the Chemical Processing Department spare unit has been used there in test work. A commercial alarm unit made by Nuclear Measurements

Corporation has been purchased for evaluation. It features a log scale readout, both locally and at a remote indicator.

Hood Construction

By applying techniques used in hood cell construction, jigs were designed and fabricated for making hood framework. A demonstration model of a box hood two feet in each direction has been prepared. The preliminary hood cell covering has been completed.

Radiological Inspection Equipment

Detail design and fabrication drawings were completed for the "powered ferret" which is an electric motor and gear box mounted on a small carriage. The primary purpose of this device is to drive a scintillation counter several hundred feet through a 4-inch diameter conduit beneath self-boiling radioactive waste storage tanks. An experimental probe design is essentially complete, and work is continuing to obtain satisfactory cable, reel, and associated equipment. Bids and further correspondence from liquid level instrument vendors were reviewed. Equipment has been selected that is recommended for evaluation testing.

Fabrication of the remotely-operated, pan and tilt optical prism for closed-circuit television inspection of waste storage tanks was completed. A remotely-operated light bar to provide light inside of the tank was completed. Comment drawings have been distributed for the TV camera housing, approximately 10-inch in diameter and 3 feet long, and shielding plug.

Fission Products Shipping Cask

A new fission product shipping cask concept was derived and a complete redesign of the cask to be used for shipment of semi-refined Cerium-144 to Oak Ridge has been initiated in order to satisfy more stringent restrictions imposed by the Bureau of Explosives. To design for containment of the gaseous products of decomposition would be prohibitive costwise, if not impossible. The primary design change proposed is to change the thermal bond material from mercury to a low-melt, high-boiling metal alloy such as "woods metal". To aid in meeting the new design restrictions, it is planned to further purify the semi-refined Cerium-144 and to ship only 1/2 megacurie shipments since ORNL has indicated a preference for the small size shipment.

b. Project Engineering

Project cost information as of January 17, 1960:

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Total authorized funds - 15 active projects	\$ 9,353,000
Total cost-to-date	3,597,000
Commitments and Open Work Releases	2,026,000
Unencumbered balances	3,730,000
Costs charged to above projects 12-20-59 to 1-17-60	236,843

CGC-830 - NPF Reprocessing

Engineering flow diagrams on dissolution, centrifugation, solution storage, waste concentration and neutralization have been completed and are essentially ready for the comment issue. Preliminary reports from the vendor indicate good results from centrifugation tests on two of the three stand-in solutions. The test centrifuge did not give satisfactory separation of the stand-in material representative of over-reacted uranium-molybdenum dissolving solution. Bird is preparing a report which will predict the performance of an 8-inch machine.

NPF Program Review

Consideration is being given to altering the NPF scope of work to a two-phase program; Phase I - storage, and Phase II - fuel element reprocessing. A storage-only activity at HAPO is feasible but not attractive from a contribution point of view. Consideration is being given to delaying the decision to install a reprocessing facility at HAPO, and studies are under way to determine the minimum facility required consistent with good production practices and currently assigned fuel.

CGC-872 - Palmolive Processing

Palm engineering studies are being expanded to include evaluation of shipping schemes for the various production forms in accordance with a request from AEC. Definite notification was received from the Commission that the Hot Semiworks Palmolive Facility scope Project CGC-872, will not be needed to meet anticipated Olive requirements. Consequently, the Palmolive Program at Hanford now includes only recovery of Palm at both Redox and Purex together with additional processing of virgin Palm to the production form, as yet undetermined, most acceptable to the Commission.

Manager
Facilities Engineering

HP Shaw:WWC:al

CHEMICAL PROCESSING DEPARTMENT
MONTHLY REPORT

JANUARY, 1960

II. ACHIEVEMENTS (Continued)G. RESEARCH AND ENGINEERING OPERATION1. Purex Process Technology -a. Solvent Extraction

Solvent extraction performance in the Purex Plant deteriorated during the month as both decontamination and recovery performances declined. Although the final plutonium product met the 3.5×10^{-11} G/AT specification during the first half of the month, at month end decontaminated uranium product from the solvent extraction columns was being recycled to permit reprocessing out-of-specification plutonium which was produced the latter part of the month. All product uranium exceeded the ≤ 2.0 gamma ratio specification but the Zr-Nb content was reduced to an acceptable level by silica gel treatment.

Despite improved Zr-Nb decontamination at the start of waste rework, ruthenium gamma activity continued to build up throughout the plant and in the final uranium product until the normal 30 per cent ruthenium had reached 70 per cent. Unsuccessful attempts to improve ruthenium decontamination of the uranium product included the following process changes: (a) a 2DW acidity increase from 0.60 to 1.3 M nitric acid, (b) the addition of 0.0028 M sodium nitrite to the ICU Concentrator bottoms and (c) the addition of 0.01 M sodium nitrite in the 3WB and HAF. Continued operation upon completion of waste rework returned the ruthenium activity levels throughout the plant to normal.

When cessation of waste rework reduced the First Cycle Zr-Nb decontamination, various chemical additions were made to the HAF in an attempt to restore the decontamination performance. The following components were added in the concentrations indicated.

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<u>Component</u>	<u>HAF Concentration, M</u>
1. H_2SO_4	0.030
2. Na_2SO_4	0.030
3. $NaNO_3$	0.030
4. $NaNO_3$	0.075
5. $NaNO_3$ Na_2SO_4	0.075 0.030
6. $NaNO_3$ Na_2SO_4	0.110 0.045

While all appeared to improve first cycle decontamination slightly, none had a significant beneficial effect. Two tests of temporarily stopping the 3WB flow indicated the current 3WB had no effect on HA Column decontamination.

In addition to the rising gamma activity in the plant, the HAW plutonium losses were very erratic. At times the increased loss appeared to be associated with rework plutonium; however, some high losses (up to 0.8 per cent) were sustained while processing HAF containing waste rework, which normally does not affect the HAW plutonium loss. Tentative laboratory results show the following distribution coefficients for some plutonium rework solutions found in the plant.

<u>Source of Plutonium</u>	<u>Pu EQ in 3 M HNO_3</u>
L Cell Sump	~ 10
L Cell Package	~ 1.2
N Cell Sump	~ 0.4
Normal PuIV	> 10

Although some batches of the rework solutions responded to treatment by sodium nitrite, others did not. Investigation into this problem is continuing.

Other items of interest to solvent extraction included:

- (1) Increasing the IBX nitric acid concentration from 0.30 to 0.57 M improved but did not completely eliminate instability in the IC Column.
- (2) No significant change was noted in the First Cycle decontamination performance when the HS Column pulse frequency was varied from 40 to 82 cycles per minute.

- (3) High nitric acid concentration in the 2DF (probably up to 2.2 M vs. 1.4 M normal), produced by a flow controller failure, raised the plutonium concentration in the uranium product 100 fold.
- (4) A slight reduction in the 2AF gamma activity resulted from a 27 per cent increase in IBS flow.
- (5) The operating stability of the 2E Column was improved by increasing the 2EX nitric acid concentration from 0.015 to 0.030 M.
- (6) The IBX sulfamate concentration was increased from 0.06 to 0.10 M to prevent a partitioning failure when sodium nitrite was added to the IOO for neptunium recovery.

b. Neptunium Recovery

Neptunium accumulation in the plant started when 0.0005 M nitrous acid was added to the IOO. In addition, the HSR nitric acid concentration was increased from 2.3 to 3.2 M to prevent neptunium reflux in the HA Column, although it had no direct effect on neptunium recovery in the column. Both the HAW and 2DU neptunium losses remained near or below the lower analytical limit of detection during the month despite operational and process changes made to improve over-all plant decontamination performance.

c. Plutonium Concentration

Diversion of the 2BP from the Plutonium Ion Exchange into the L Cell Package was required temporarily on each of the following occasions: (1) repair of a leak in the Plutonium Ion Exchange concentrator loop, (2) replacement of a check valve on the XAF pump, and (3) loss of adequate resin movement.

- Reduced resin movement, which was temporarily overcome by increased push pressure and time was later relieved by incrementally removing and replacing a portion of the resin. New resin, equivalent to 70 per cent of the inventory in the system, was added to the unit.

Two batches of plutonium were reworked through the Ion Exchange Unit after valence adjustment with sodium nitrite. The first batch processed without incident, but the second batch produced a high plutonium recycle via the XAW, thus indicating incomplete valence adjustment. Normal plutonium recycle from the Ion Exchange Unit was from 0.5 to 1.0 per cent.

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d. Solvent Treatment

A gamma activity increase in the No. 1 System solvent from 3000 to 7000 uc/gal, which was produced exclusively by additional ruthenium, coincided with a general increase in ruthenium activity throughout the plant. Reducing the aqueous volume in the batch wash tank from 1000 to 500 gallons, increasing the frequency change from every 8 to every 4 hours and reducing the solvent inventory in the tank improved the Zr-Nb decontamination factor 16 per cent (up to $DF = 8$), but the ruthenium decontamination remained the same ($DF = 2$). As the ruthenium activity level of the intercycle and product streams returned to normal throughout the plant, the ruthenium content of the solvent did likewise. The potassium permanganate addition rate to the batch wash tank and the caustic wash addition to the Turbomixer, TK-G7, remained a factor of two above flowsheet during the entire month.

An increased rate of carbonate wash solution changes in the No. 2 System failed to reduce the gamma activity of the solvent, which remained a factor of three high during the month.

e. Waste Treatment and Acid Recovery

Additional salts from process tests and waste rework plus off-standard operation of the plant produced an IWW flow that averaged two to three-fold higher than flowsheet. Some flooding occurred in the Acid Absorber Tower when additional dilution water was added to the HAW, prior to concentration, after the acidity and flow of the HAW was increased and produced 35 per cent more acid for recovery.

Waste volumes transferred to underground storage tanks averaged 188, 524 and 193 gallons per ton of uranium processed for neutralized IWW, solvent washes and cell drainage, respectively. Over-all plutonium and uranium waste losses for the month were 0.35 and 0.09 per cent, respectively, which reflect the high HAW and head end plutonium losses. Coating waste and centrifuge cleanout losses amounted to 22 and 47 per cent, respectively, of the overall plutonium and uranium losses.

Adoption of new loading criteria for the underground storage tanks (16,000 lbs/sq.in. stress in the tank steel) has permitted an increase in the operating liquid level of the tanks up to 275 inches. Consequently, the two high level recirculators, which extend 228 inches from the floor of the tank, have been put into service for the first time supplementing tank mixing by the two low level recirculators (120 inches from the tank floor).

Elimination of caustic addition to the Vacuum Fractionator tail water, which now goes to the swamp via the chemical sewer, will save \$3000 annually.

2. Redox Process Technology - M

a. Dissolving and Feed Preparation

Metal was dissolved under conditions carefully controlled to avoid a repetition of last month's experience with acid-deficient raw metal solution and consequent plutonium polymerization. Thus it was possible to eliminate the 3-hour oxidation cycle temporarily adopted in December and to return to the standard 10-minute feed oxidation boil-up period. A 2-hour digestion step at 70 C was also added to insure complete oxidation of neptunium in the column feed solution.

The amount of new sodium dichromate added in the feed oxidation procedure was reduced from 129 to 115 pounds per ton of uranium processed for a saving of \$2.10 per ton. This change did not reduce the sodium dichromate concentration in the feed solution below 0.1 M, but merely took advantage of the sodium dichromate in the recycled salt waste added to each feed oxidation batch.

The nitric acid concentration of the adjusted feed solution was increased from 0.4 M to 0.55 M in an attempt to simplify the acid control problems experienced in the solvent extraction battery.

b. Solvent Extraction

It has been difficult to maintain uniform acid control since the adoption of the acid precycle flowsheet for the internal recycle accumulation of neptunium. In general, the intermediate feed and backcycled waste streams have been too acid-deficient. This improves fission product decontamination across the extraction battery but at the same time creates a solids problem when subsequent neutralization produces excess sodium nitrate that crystallizes from solution. This causes solution transfer and flow control problems which, in turn, make uniform acid control still more difficult. Therefore during the month, the HAF nitric acid concentration was increased from 0.4 M to 0.55 M and that in the concentrated waste backcycled to the HA Column as scrub (HAIS) was decreased from 0.0 M to -0.35 M. This shifted the major acid addition in the aqueous streams for the HA Column from the continuously flowing HAIS stream to the batch-controlled HAF stream. A more nearly constant amount of acid thus enters the HA Column, is extracted into the HAF stream, stripped in the EC Column and carried into the LAFS concentrator to be neutralized with sodium hydroxide. The preliminary results available following the flowsheet change indicated substantial improvement in acid control.

c. Neptunium Recovery

The technical feasibility of the above-described change was tentatively established by in-plant experiment during the last week of October, 1959, at the start of neptunium recovery operation on the acid precycle flowsheet. However, following the change in mid-January approximately one-third

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of the salt-waste batches (EAW) produced during the remainder of the month showed significant neptunium loss to the first cycle raffinate as indicated in the following table.

NEPTUNIUM LOSSES TO HAW STREAM

<u>Period of Loss</u>	<u>Rate of Instantaneous Loss, Percent*</u>	<u>Total Accumulation in System at Time of Loss, Grams</u>	<u>Quantity Lost to Salt Waste Receiver, Grams</u>	<u>Reason for Loss</u>
Weekend Shut-down Operation	4	425	18	Unknown
3 Hours	100	425	42	No acid in HAX
16 Hours	4	450	17	Neutral EAW

* The percent stated is that of the total recycle inventory plus virgin neptunium in the feed during the period of loss.

These represent the first real losses of neptunium from the "closed" cycle positively detected and identified since the internal recycle flowsheet was adopted in late October, 1959. In prior months the acidities of the raffinate stream (HAW) from the first cycle extraction were temporarily in the same range without producing detectable neptunium losses. However, the total quantities of neptunium concerned were much smaller than and equivalent percentage losses would have been below the limit of detection. After the last loss listed in the table, the acidity of the organic extractant (HAX) was increased from 0.2 M to 0.3 M to halt further losses; this technique was apparently successful.

Since two of the losses were considered adequately explained (and all were apparently recovered), and since the remainder of the waste batches were reported to be free of neptunium, no true adverse effect was suspected. However, due to instrument difficulties beyond the control of the Analytical Laboratory Operation, the analyses of samples taken from the neptunium accumulation and process inventory vessels during the last half of the month were not available until the first of February. When these data were finally examined it was found that approximately one-half of the total inventory of neptunium (450 grams) had been irretrievably lost to underground waste storage during the previous 10 to 12 days. The previous flowsheet conditions have been reinstated. Meanwhile, during a scheduled production shut-down early in February, waste analysis techniques and methods will be carefully re-examined to determine how the neptunium escaped undetected in discarded salt waste.

To provide the needed improvement in acid control which again becomes critical with the return to the previous flowsheet, the IAFS prototype pH monitor

will be removed from its present location and installed in the IAW stream where the instrument response is expected to be much greater than on the LAFS for the same acidity changes. It should provide instantaneous information on the acid condition within the LA Column thus permitting earlier adjustments, with consequent reduction in the number and magnitude of acidity variations.

After many months of fruitless effort, further development work on the prototype LAFS pH meter in its present location has been stopped because of lack of correlation with laboratory analyses. This was due partly to the fact that the instrument was forced to work on that portion of the aluminum nitrate and uranyl nitrate buffering curves where the change of pH with change in acid content was small. However, if its performance in the new location warrants, consideration will also be given to installing a similar unit on the HAW stream.

d. Gaseous Effluent Problem

On two separate occasions during the past two months, fission products discharged in the ventilation exhaust gas from the Redox plant stack, have caused low level contamination of the plant environs. An intensive gas sampling campaign to identify the source of the activity, has thus far shown the dissolver off-gas streams to be principal contributors. Sample data show that fission product activity is carried from the dissolver through in-cell fiber glass filters whose over-all efficiencies have recently been determined to be only about 90 to 95 percent, and into or around the 293-S Acid Recovery and Iodine Removal facility. (The 293-S Building is purposely by-passed by the ammonia formed during coating removal operation and occasionally by-passed unintentionally by the oxides of nitrogen when the gas diversion valves fail to seat properly.) The data further show that at any time the 293-S facility is by-passed, the fission product activity going directly to the stack increases by a factor of about 200 regardless of the nature of the operation in progress in the dissolver. In addition, it is known that ammonium nitrate contaminated with fission products is formed in these lines and contributes markedly to the environs contamination problem when dislodged and discharged through the stack to the atmosphere.

A series of possible long-range solutions to the problem is currently being studied; meanwhile immediate steps are being taken to improve the in-cell filtration of the dissolver off-gas. Redox Technology personnel have recently supplied detailed specifications for repacking the spare filter which will be installed at the time of the Multi-purpose dissolver installation in approximately 5 to 6 weeks. This filter is expected to be more than 99.99 percent efficient for particulate matter including particles of sub-micron size. Serious attention is also being given to temporary but immediate measures to provide complete separation of ammonia from the oxides of nitrogen downstream from 293-S while permanent ammonium nitrate preventives are being developed.

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3. Finished Products Technology -

a. Uranium Reduction Operation

(1) Process Performance

The gamma radioactivity of UO_3 produced from Purex feeds with gamma ratios of approximately 2.7 (50 to 70 per cent ruthenium) has averaged 90 per cent of that of aged natural uranium (ANU). Data from the 256 channel analyzer indicated that I^{131} contributed approximately 30 per cent of the fission product radioactivity and that essentially no decontamination resulted from calcination. The low energy (0.36 MEV) gamma from I^{131} is shielded out and not counted in making the U^{237} correction in the gamma radioactivity specification analysis.

(2) Process Improvement

Two test feed points failed after approximately two months service. Both appeared to be due to poor weldments at the junction of the feed tube and the outer steam jacket.

b. Metal Finishing Operation

(1) Recuplex

The flow sheet test using 1 M HNO_3 as scrub at the bottom of the extraction column, in lieu of recycled product (CAS), continued to result in total impurities of less than 10,000 ppm/Pu after product concentration.

The feasibility of a "critically safe" slag and crucible dissolver for the new plutonium reclamation facility is being evaluated. Calculations indicate that a dissolver six inches in diameter will be critically safe under the postulated dissolution conditions. Materials of construction will be examined in a program of corrosion testing.

(2) Task I - II

Investigation of the hydrofluorination off-gas system has revealed that insufficient water pressure is available at the jet to allow operation at rated capacity. Although this is not the cause of the current short filtration cycles, some improvement in filter performance can be anticipated at higher jet capacities.

(3) Task III

Process Test 59-25-T, evaluating reduction to metal without iodine, was completed. The average metal yield of the 98 test reductions was slightly higher, 97.4 per cent, than the average of 100 control reductions with iodine, 96.2 per cent. The higher yield was likely due to higher PuF_4 quality during the test period. No change in button appearance or in metallic impurities was observed. Average firing time, however, was increased to 25.4 minutes from 18.5 minutes.

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4. Process Chemistry -

a. Purex Process Assistance

During the month, laboratory work in support of the Purex Process was devoted mainly to identifying some of the causes of the poor solvent extraction performance currently experienced at Purex. The following results were obtained:

- (1) Laboratory solvent treatment tests showed that the plant solvent - KMnO_4 contactor (G-1) is only about 50% as effective as a laboratory single-batch contact. Plutonium retention tests carried out in the laboratory using a single contact with 3% Na_2CO_3 -0.01 M KMnO_4 , followed by carbonate and water washes, reduced the plutonium retention value of plant first-cycle solvent by a factor of 20-25. The plant treatment reduces the plutonium retention factor of the solvent by a factor of about 10.
- (2) Tests were carried out to measure the effect of Turco Decon 4182A, a commercial decontaminating agent occasionally used in the plant, on plutonium extraction. These showed that the presence of even trace amounts of the Turco agent in the aqueous phase greatly reduces the extractability of plutonium(IV) into Purex solvent. The plutonium(IV) extraction coefficient was reduced by factors of 1500, 6, and 2 by the presence of the Turco agent in the aqueous phase at concentrations of one part in 10^4 , 10^6 , and 10^8 parts of solution, respectively.
- (3) Laboratory disengaging studies (used to measure liquid flooding tendencies) show that an agent (or agents) which could contribute toward flooding is acquired in the uranium cycle, either in or prior to the first uranium stripping cycle (1 C column). This is evidenced by normal disengaging times for No. 1 and No. 2 recovered solvents versus synthetic feeds; in contrast to abnormal (long) disengaging times for plant 2DF (final uranium cycle feed) and ICW (first stripping cycle organic waste) versus laboratory solvent and synthetic feed, respectively. The material responsible has not been identified but initial results indicate that it is not Turco.

In other experiments with Turco, it was found that it forms a complex with plutonium(IV) which is highly extractable in xylene but inextractable in Purex solvent.

b. Redox-URO Process Assistance

Periodic acid was recently adopted as an additive (added to yield ~ 50 parts iodine per million parts uranium) in the ozonation of Redox final product uranium solutions (E-13). Iodine analyses made on Redox product uranium material going through the Uranium Reduction

Process show that the iodine is largely (>60%) retained in the UO_3 powder. All of the iodine present in the powder appears to be in an oxidized form, presumably as the iodate or periodate.

c. Neptunium Process Studies

Seventy grams of Redox neptunium which was contaminated with 180 grams of plutonium, 248 grams of uranium, and 47 grams of thorium, was purified the latter part of December. Because of the high plutonium content of this material, it was possible to load the anion exchange resin to only 10 g/l Np. Despite the use of 45 column volumes of wash to remove the co-absorbed plutonium from the resin, the eluted product contained 0.18 weight per cent plutonium (specification: 0.1 wt. per cent). Normally, 13 to 20 column volumes are sufficient. Decontamination of the neptunium from uranium, thorium, and fission products was normal.

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5. 234-5 Development -

a. Fluid Bed Halogenation

Three chlorination runs have been made in a one-inch diameter fluid bed reactor. The feed material was plutonium oxide made by direct calcination of nitrate solution. The chlorinating agent was phosgene. In the first two runs at 450 C, the reaction went to about 70 percent completion quite rapidly and then stopped. An attempt was made to further chlorinate the product batchwise in a static bed, but it went only to 75 percent conversion. Direct calcined oxide has, in the past, been completely chlorinated in a static bed.

There is a good possibility that 450 C is too hot for a fluid bed chlorination process. The reaction being exothermic, it may be that the individual oxide particles are being driven above 500 C, resulting in unreactive oxide. However, a run at around 350 C resulted in product 50 percent chlorinated and which resisted further chlorination.

b. Continuous Chlorinator

Work continued aimed at finding conditions for trouble-free operation.

The alterations to the demonstration chlorinator to admit phosgene at the upper end and to heat this section of the tube to chlorination temperature have failed to eliminate lump formation. Powder caking in this section plugged the tube twice in recent runs. Other operating conditions will be tried.

Nevertheless, the demonstration chlorinator produced high quality plutonium trichloride, as evidenced by chloride reduction to metal. Two bomb reductions, each containing 650 g of plutonium, gave high yields of good metal, as the following numbers indicate.

<u>Reduction Yield</u>	<u>Total Impurities By Spectrograph</u>	<u>Button Density</u>
99.8%	2149 ppm (1625 ppm Fe)	19.2 g/cc
100 %	923 ppm	19.4 g/cc

A ceramic filter has been operated successfully for 60 hours at 350 - 400 C in the off-gas stream. This filter is a six-inch section of "Aloxite" cut from a 28-inch cylinder obtained from the Carborundum Company. It is the primary filter used to stop plutonium dioxide and plutonium trichloride from blowing out with the exhaust gases. The effectiveness of filtering during the latest 32-hours of operation was studied by collecting dust, condensed volatile chlorides, and corrosion products from the stainless steel tubing and the trap downstream from the filter. The 9.5 grams of powder collected was found to contain 6.6

percent plutonium. The plutonium was passing through the filter at a rate of 0.02 grams per hour. New filters are known to be less effective for the first several hours of operation. The present filter shows no sign of deterioration.

c. Jamesbury Ball Valve

A one-inch, PVC, Jamesbury ball valve was successfully operated for 407,000 cycles to simulate powder transfer valve operation in a Hood 9A type continuous hydrofluorinator. Lead oxide powder was used as a standard for plutonium tetrafluoride. The powder was packed loosely in and below the valve, but was not actually transferred through the valve in this test. After the test, the valve was disassembled for inspection. The valve components were not affected by powder abrasion. A cycle was considered as one complete opening and closing of the valve.

d. Ceramic Development

A procedure was developed for slip casting magnesia containing approximately 10 percent titania. The resulting crucibles are expected to have low porosity. Variables studied were calcining temperature of the titania, percentage of titania added, sintering temperature, and oxidizing temperature. One slip cast crucible was tested for ability to contain the continuous Task III chloride eutectic at 800 C. The crucible held the melt for one and one-half hours with no clear evidence of leakage. This result shows a big improvement over the normal slip cast magnesia crucibles.

e. Plutonium Powder Preparation

Plutonium powder was prepared on a ten-gram scale by the hydriding-dehydriding method. Particle size ranged from a few microns up to a centimeter.

Purity requirements were determined for the hydriding reaction. Absolute hydrogen purity is essential for a good preparation. The surface purity of the metal used has some effect on the length of the induction period. Plutonium metal purified by casting reacts more rapidly than buttons.

Sintering of the plutonium powder was investigated as a function of the dehydriding temperature. Particle size began to increase at about 300 C. At 450 C, a sintered cake was formed. Metal beads appeared in the sintered cake at roughly 600 C. Further work will define the temperature at which dehydriding can occur without sintering.

A simple method of differentiating between plutonium powder and plutonium hydride was found and tested. The hydride decomposes at 90 C in water to form a fine, black hydroxide and liberate hydrogen gas.

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V.R. Cooper
Manager
Research & Engineering

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CHEMICAL PROCESSING DEPARTMENT
MONTHLY REPORT

JANUARY, 1960

II. ACHIEVEMENTS (Continued)

H. Financial Operation

1. Production Cost

All phases of the FY 1961-62 budget preparation work are progressing on schedule. Portions of the budget which have been completed include Office Equipment, Photographic Equipment, Audio and Visual Aid Equipment, Motorized Equipment, and Research and Development Proposal Summaries.

Personnel estimates were reviewed and approved by CPD management in late January. These will be submitted to Contract Accounting ahead of the February 19 scheduled due date.

We are currently collaborating closely with the operations in preparing funding budgets and expect to have these completed by the latter part of February.

In order to assist CPD management in gauging the adequacy of budgeted personnel, the percentage contribution of each section to department staff and end function costs was scheduled for FY 1957 through FY 1962, and individual improvement patterns over the period were established.

Studies completed and documents reviewed:

- a. We collaborated with Purex and Research and Engineering personnel in developing chemical separations operating cost estimates for processing and loading certain fission products for shipment to ORNL.
- b. Palm purification costs were segregated between Redox and Purex by a study, and January costs reflect this segregation.
- c. The Redox Palm costing method was finalized after projecting unit costs under a variety of quantity and run frequency assumptions in order to establish that Redox excess capacity costs would not be appreciably absorbed by Palm.
- d. We completed an analysis of CPD cost expenditure pattern during FY 1958, FY 1959 and the first half of FY 1960, for operations and equipment not included in construction projects. Recommendations were made for improving and leveling of the CPD expenditure pattern.

2. Personnel Accounting

An increase in the cost of living index for the fourth quarter of CY 1959 resulted in a .59% upward adjustment of all nonexempt employees wages and the isolation pay for the exempt employees. This .59% increase amounts to an annual increase in Chemical Processing Department cost of approximately \$31,000.

3. General Accounting

Five Appropriation Requests were approved in January for a total of \$58,320. The principal item was a Hot Sample Station in the Purex Laboratory for \$38,800.

The procedure for taking physical inventory of CPD uninstalled equipment has been issued. Physical count will start at 8:15 a.m. on February 24, 1960, and is scheduled for completion on March 4, 1960.

4. Auditing

An audit report was issued covering findings and recommendations relating to an audit of control of, and accountability for, frozen lunches.

Field work was started of an audit of Power and General Maintenance service activities.

Meetings were held with Facilities Engineering personnel to review a proposed HAPO OPG for Control of Material and Equipment furnished fixed price contractors. Comments were prepared and forwarded to Contract and Accounting Operation.

5. Measurements and Procedures

A new reporting system was designed and will be used for the January unit cost and production reports. This system will save approximately eight hours per month typing time, reduce documents issued from 144 per year to six and result in an issuing date of at least seven days earlier than in the past. The system has been presented to Contract and Accounting for possible application in their routine reporting.

In line with our paper work reduction program, a listing was prepared of all forms having no ordering activity for the past 12 months. The listings were sent to the originators of each form with an eye towards elimination.

A review of records covering obsolete plants and processes is in progress to determine which records still have continuing value. Approved records retention schedules are being used as the primary guide lines in this review.

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[Signature]
Manager - Finance

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CHEMICAL PROCESSING DEPARTMENT
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JANUARY - 1960

II. ACHIEVEMENTS (continued)

I. RELATIONS PRACTICES OPERATION

1. Communication

A booklet, "What We Must Know About Communism", was distributed to Sub-section managers and specialists, with extra copies for distribution within their components.

In addition to general items of information, six General Electric News articles, six Management News Bulletins, three Headliners, and a Round Table supplement discussed subjects such as working conditions, economics, new equipment and facilities, new badge procedure, and individual recognition.

The first three PEM classes for 1960 got underway during the month. Session 0 was held on January 11 and sessions started the following week. A total of 49 men are attending these three classes.

Arrangements, including scheduling of those to attend, were made for F. E. Highton, an economist from the New York office, to speak to Chemical Processing Department management about inflation and other economic matters. Approximately 110 Chemical Processing Department people heard his presentation.

Word was received from Mill and Factory that the signed article by M. G. Petersen and C. C. Hinson concerning maintenance planning in a plutonium plant had been accepted for publication. No date for publication has been scheduled by Mill and Factory.

2. Salary Administration

The study of the Maintenance Foreman positions, a program underway during the past three months, was completed, and all changes of position content, titles, levels, and staffing were placed in effect. Twenty-seven foreman positions were involved in the study.

An analysis of the results of the 1959 Appraisal Program was completed and discussed with management.

The Department organization directory was revised and issued. The quarterly Personnel Ratio and Salary Distribution Data Reports were issued.

3. Wage and Benefits

Meetings have been held with all section managers and with six section staffs to explain and discuss the proposed Wage Plan. Details of anticipated effect of the new plan have been reviewed with each section. Additional reconciliation meetings have been held to assure proper comparison of job evaluations within the Department

Suggestion Plan Activity:

	<u>Received</u>	<u>Adopted</u>	<u>Awards</u>	<u>Savings</u>
January, 1960	39	-	-	-
December, 1959	69	35	\$970	\$5,673

4. Health and Safety

Arrangements were made for display of the HAPO General Manager's Safety Trophy in Chemical Processing Department.

5. Personnel Placement

The six Utility Operators in excess of Chemical Processing Department's needs were employed as Radiation Monitors, which resulted in only one man being given an ROF notice.

Offers were extended to two Technical Graduates during the month, with one acceptance received by the end of the month. He will report to the Analytical Control Operation of Special Separation Processing and Auxiliaries Section on permanent assignment March 1.

R. B. Britton
Manager, Relations Practices

R. B. Britton

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III. PERSONNEL ACTIVITIES

A. FORCE SUMMARY

<u>Operation</u>	<u>EXEMPT</u>		<u>NONEXEMPT</u>		<u>TOTAL</u>	
	<u>12-31-59</u>	<u>1-31-60</u>	<u>12-31-59</u>	<u>1-31-60</u>	<u>12-31-59</u>	<u>1-31-60</u>
General Manager's Group	10	10	1	1	11	11
Financial	13	13	11	11	24	24
Relations Practices	5	5	6	6	11	11
Research & Engineering	60	60	25	25	85	85
Facilities Engineering	66	66	21	20	87	86
Power & General Maintenance	43	43	238	232	281	275
Production	6	6	4	4	10	10
Special Separation Processing and Auxiliaries	49	49	216	218	265	267
Purex	48	49	205	206	253	255
Finished Products	<u>54</u>	<u>54</u>	<u>219</u>	<u>212</u>	<u>273</u>	<u>266</u>
Total	<u>354</u>	<u>355</u>	<u>946</u>	<u>935</u>	<u>1 300</u>	<u>1 290</u>

CHEMICAL PROCESSING DEPARTMENT
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III. PERSONNEL ACTIVITIES (Continued)

B. PERSONNEL CHANGES

There were no personnel changes during the month of January.

C. TRIPS

<u>Visitor</u>	<u>To</u>	<u>Nature of Discussion</u>
<u>To other G.E. Components</u>		
W. K. MacCready (1/4-8/60)	Div. Managers Meeting Roanoke, Virginia	Management Conference
<u>To A.E.C. and other A.E.C. Operational Contractors</u>		
J. H. Warren (1/21/60)	AEC Albuquerque, New Mexico	AEC-DMA Meeting
W. A. Graf (1/21/60)	Phillips Petroleum Co. Idaho Falls, Idaho	Discussion and review of plans for product handling facilities
S. J. Beard (1/26-27/60)	Union Carbide Nuclear Co. ORNL, Oak Ridge, Tennessee	Discussion of separations processing problems
G. C. Oberg (1/26-27/60)	"	"
S. J. Beard (1/28-29/60)	du Pont Company, Savannah River Plant, Aiken, So. Car.	"
G. C. Oberg (1/28-29/60)	"	"
<u>To General Industry</u>		
P. S. Kingsley (1/6/60)	Electric Steel Foundry Portland, Oregon	Discussion of casting of dissolver pots
W. H. Koontz (1/6/60)	"	"
P. S. Kingsley (1/7/60)	Northwest Copper Co. Portland, Oregon	Discussion on titanium ion exchange concentrator loop
W. H. Koontz (1/7/60)	"	

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CHEMICAL PROCESSING DEPARTMENT
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III. PERSONNEL ACTIVITIES (Continued)

C. TRIPS (continued)

<u>Visitor</u>	<u>To</u>	<u>Nature of Discussion</u>
R. C. Hollingshead (1/25-27/60)	Star Machinery Co. Seattle, Washington	Discussion on design and fabrication of equipment for CPD
<u>To Conventions and General Meetings</u>		
W. Watson (1/18/60)	San Francisco, California	Western College Placement Association meeting
C. C. Hinson (1/25-29/60)	Philadelphia, Pennsylvania	Plant Maintenance and Engineering Conference and Executive Study Group

D. VISITORS

<u>Visitor</u>	<u>From</u>	<u>Nature of Discussion</u>
<u>From other G.E. Components</u>		
H. L. Leone (1/28-29/60)	Computer Department Phoenix, Arizona	General discussion
J. L. Michaelson (1/25/60)	General Engineering Lab. Schenectady, New York	Review technical and engineering activities of G.E.L.
R. O. Fehr (1/25/60)	"	"
<u>From A.E.C. and other A.E.C. Operational Contractors</u>		
E. E. Lamb (1/14-15/60)	Union Carbide Nuclear Co. ORNL, Oak Ridge, Tenn.	Fission product recovery discussion
Capt. H. T. Uhrig (1/6/60)	Defense Atomic Support Agency	DASA-advanced course in nuclear science for medical officers. Purex process summary and general tour.
Capt. S. J. Floti	"	"
Capt. E. L. Fountain	"	"
Capt. R. M. Allman	"	"

D. VISITORS (Continued)

<u>Visitor</u>	<u>From</u>	<u>Nature of Discussion</u>
Maj. R. S. Malone (1/6/60)	Defense Atomic Support Agency	DASA-advanced course in nuclear science for medical officers. Purex process summary and general tour.
Maj. A. M. Burner	"	"
Lt. C. E. Parker	"	"
Lt. A. L. Rehme	"	"
Cdr. C. F. Climie	"	"
F. R. Dowling (1/14/60)	AEC, Div. of Production Washington, D. C.	Discussion of separation processes and CPD facilities.
D. K. MacQueen (1/18/60)	Phillips Petroleum Co. Idaho Falls, Idaho	Discuss product nitrate handling, loadout, shipping, and specifications and analytical results.
L. G. O'Connell (1/27/60)	Lawrence Radiation Lab. Livermore, California	Discussion of special device work
R. M. Mousel (1/27/60)	du Pont Co., Savannah River Plant, Aiken, So. Car.	Discussion of waste tank corrosion
<u>From General Industry</u>		
E. L. Cumir	Bechtel Corporation	Industrial Reprocessing Group - Discussion on processing spent fuel elements (1/25-26-27/60)
D. F. Mordoff	"	"
G. A. Vincent	"	"
C. V. Ellison	Davison Chemical Corporation	"
E. R. Johnson	"	"
C. W. Taylor	"	"
E. G. Wallinder	"	"
W. A. Nixon	Weinrich Associates	"
S. S. Stanton	"	"
P. N. McCreery (1/28/60)	National Lead Company Cincinnati, Ohio	Discussion on in-line monitors and flow equipment
A. P. Stahl	"	"

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D. VISITORS (Continued)

<u>Visitor</u>	<u>From</u>	<u>Nature of Discussion</u>
T. Blanckenburg	States Marine Lines	N.S. Savannah training program - General tour and discussion of waste handling and equipment facilities and procedures and techniques. (1/15/60)
G. R. DeGroote	"	"
A. J. C. Egle	"	"
J. Gregory	"	"
D. B. McMichael	"	"
W. W. Meyer	"	"

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IV. SAFETY AND SECURITY

Operation	Facil. Eng.	Finan.	Fin. Prod.	P&GM	Purex	SSP&A	Prod.	Rel. Pract.	Res. & Eng.	CPD Total
Disabling Injuries						1*				1
Serious Accidents				1						1
Medical Treatment										
Injuries	2		3	18	5	3	1		1	33
Technical Over- exposure Incld.					1					1
Radiation Occur.			11		3	3				17
Contam. Wounds					3					1
Pu Depositions					1					0
Fires										0
Security Viol.										0

* On January 11 the Department experienced a disabling injury which terminated a record of 702 injury-free days, totalling 5,300,000 man-hours. An employee slipped and fell on an icy spot after getting off a bus at the Redox badge house, resulting in a separation at the shoulder-collarbone joint. Hospitalization was required and it is estimated that the employee will be absent from work 10-14 days.

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CHEMICAL PROCESSING DEPARTMENT
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V. REPORTS

A. PREPARED AND ISSUED

- HW-62815 Rev. 2, Secret, "CPD Unit Cost and Production Goals - CY 1960", dated 1-18-60, F. A. Fieser
- HW-63148, Secret, "Accountability Factor Relationships for Fabrication Operation", dated 12-21-59, W. W. Kinney
- HW-63318 RD, Secret, "Redox Plant Production Schedule - January, 1960", dated 1-6-60, D. McDonald
- HW-63319 RD, Secret, "Purex Plant Production Schedule - January, 1960", dated 1-6-60, D. McDonald
- HW-63320 RD, Secret, "UO₃ Plant Production Schedule - January, 1960", dated 1-6-60, D. McDonald
- HW-63321 RD, Secret, "234-5 Plant Production Schedule - January, 1960", dated 1-6-60, D. McDonald
- HW-63406, Unclassified, "Quarterly Report - Technology of Non-Production Reactor Fuels Reprocessing - Budget Activity 2790", dated 1-20-60, V. R. Cooper
- HW-63423, Secret, "Essential Material Consumption - Purex, December, 1959", dated 1-8-60, J. E. Lentz
- HW-63441, Secret, "CPD Cost and Production Analysis - December, 1959", dated 1-19-60, K. G. Grimm
- HW-63442, Secret, "Special Separation Processing and Auxiliaries Operation Cost and Production Analysis - December, 1959", dated 1-18-60, F. A. Fieser
- HW-63443, Secret, "Purex Operation Cost and Production Analysis - December, 1959", dated 1-18-60, F. A. Fieser
- HW-63444, Secret, "Finished Products Operation Cost and Production Analysis - December, 1959", dated 1-18-60, F. A. Fieser

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A. PREPARED AND ISSUED (Continued)

- HW-63453, Unclassified, "Purex Two-Cycle Waste Studies", dated 11-16-59, T. R. McKenzie
- HW-63475, Secret, "Statistical Statements and Associated Data for 234-5 Bldg. Final Product Shipped During the Fourth Quarter of Calendar Year 1959", dated 1-15-60, R. E. Smith
- HW-63559, Secret, "CPD Waste Status Summary - December, 1959", dated 1-19-60, J. E. Lentz
- HW-63560, Secret, "Plutonium Reclamation", dated 1-13-60, W. K. MacCready
- HW-63610, Secret, "CPD Purex Operation Essential Material Utilization", dated 1-25-60, J. E. McDonald
- HW-63611, Secret, "CPD Special Separation Processing and Auxiliaries Operation Essential Material Utilization", dated 1-25-60, J. E. McDonald
- HW-63673, Confidential, "Salt Plug for Bottom Pour Casting Crucibles", dated 1-27-60, T. S. Soine
- HW-63754, Unclassified, "Reusable Reaction Vessel Liner", dated 1-27-60, T. S. Soine
- HWS-7441, Unclassified, Specification, "Fabrication of Titanium Vessels and Components", dated 1-21-60, G. A. Conner

B. PREPARED FOR SIGNATURE AND ISSUANCE

- HW-63312, Secret, "Production - December, 1959", dated 1-4-60, W. E. Johnson
- HW-63547, Secret, "HAPO Production Forecast - January 1, 1960 - June 30, 1965", dated 1-25-60, W. E. Johnson

CHEMICAL PROCESSING DEPARTMENT
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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.

<u>INVENTOR</u>	<u>TITLE</u>
T. S. Soine, Research & Engineering	Reusable Reaction Vessel Liner
T. S. Soine, Research & Engineering	Salt Plug For Bottom Pour Casting Crucibles

General Manager
Chemical Processing Department

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**DATE
FILMED
12/23/92**