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CHEMICAL PROCESSING DEPARTMENT MONTHLY REPORT

JANUARY, 1961

FEBRUARY 21, 1961

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HANFORD ATOMIC PRODUCTS OPERATION

RICHLAND. WASHINGTON

GENERAL ELECTRIC

Discontinued 2871

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CHEMICAL PROCESSING DEPARTMENT
MONTHLY REPORT
FOR

JANUARY, 1961

Compiled By
OPERATION MANAGERS

February 21, 1961

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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By *J. B. Lister 8/25/92*

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TABLE OF CONTENTS

Distribution	2
Table of Contents	3
Staff	4
I. Summary	5-6
II. Achievements	
A. Production Operation	A-1 Through A-2
B. Purex Operation	B-1 Through B-3
C. Special Separation Processing & Auxiliaries Operation	C-1 Through C-3
D. Finished Products Operation	D-1 Through D-3
E. Power & General Maintenance Operation	E-1 Through E-3
F. Facilities Engineering Operation	F-1 Through F-7
G. Research & Engineering Operation	G-1 Through G-12
H. Financial Operation	H-1 Through H-3
I. Relations Practices Operation	I-1 Through I-3
III. Personnel Activities	J-1 Through J-3
IV. Safety and Security	K-1
V. Reports Issued	L-1 Through L-3
VI. Patent Summary	M-1

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CHEMICAL PROCESSING DEPARTMENT
MONTHLY REPORT

JANUARY, 1961

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 was slightly below that forecasted, both for January and fiscal year-to-date.

Approximately 240 kilocuries of strontium-90 were isolated in the Purex plant and stored for further decay of strontium-89. To-date an estimated 700 kilocuries of strontium-90 have been recovered from Purex waste, of which 70 kilocuries have been delivered to Hanford Laboratories for purification.

Successful neptunium recovery campaigns were completed in the Purex and Redox plants, with a combined yield of 3.3 Kgs. After purification, the first shipment of concentrated neptunium nitrate was made to the Savannah River plant.

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

Although the production of unfabricated plutonium metal was slightly below that forecasted for January and fiscal year-to-date, all shipping commitments were met on schedule.

C. ENGINEERING

The "zebra" cartridge in the Purex first cycle scrub column was replaced with a prototype cartridge containing stainless steel nozzle plates as replacement of the plastic plates. No significant difference in performance has been noted.

A Purex High Level Analytical Work Station, which enlarges the capability of the Control Laboratory, was placed in service during January. While designed primarily for fission product analyses, the facility will also be useful for examining higher activity process samples, impractical with previous equipment.

Fabrication of the new E-metal dissolver for the Redox plant was completed and installation was started in late January.

Routine nitric acid flush of the Redox solvent extraction system yielded only 133 grams of plutonium, indicating no abnormal buildup since the last flush which was completed during September, 1960.

A process design report was issued to summarize the changes required in Redox for routine processing of NPR fuels. This report will serve as a basis for the project proposal covering total NPR processing requirements within the Chemical Processing Department.

Notification was received from the Atomic Energy Commission of two changes in the HAPO schedule for fabricating weapon components. The first revision cancelled HAPO production of Model 1249, previously scheduled for the third quarter of FY 1962. The second revision deferred the production of Model 1251 for seven months and substituted an equivalent number of Model 81C components during this period.

A BF_3 neutron counting probe was installed under the new replacement slag and crucible dissolver in Recuplex. Calibration tests indicate that the counter will aid in critical mass control.

The six new Gorton Lathes in the 234-5 Building have shown major problems in their control systems. Factory representatives, who came to Hanford to investigate the difficulties, took one of the control units back to the Gorton Plant for redesign and modification.

P. H. Reinker

General Manager
Chemical Processing Department

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CHEMICAL PROCESSING DEPARTMENT
MONTHLY REPORT

JANUARY 1961

II. ACHIEVEMENTS

A. PRODUCTION OPERATION

January   December

1. Production Statistics

a. Purex

Uranium nitrate produced (tons)	331.8	702.9
Average production rate during operation (T/D)	24.3	30
Total waste loss (%)		
Plutonium	0.52	0.36
Uranium	0.18	0.09
On-line efficiency (%)	71.4	84.4

b. Radox

Uranium nitrate produced (tons)	74.5	81.57
Average production rate during operation (T/D)	6.9	7.1
Total waste loss (%)		
Plutonium	0.29	0.31
Uranium	0.13	0.08
On-line efficiency (%)	51.4	54.2

c. Uranium Reduction

Normal UO ₃ loaded (tons)	455.83	643.7
Enriched UO ₃ loaded (tons)	120.80	0
Normal UO ₃ approved for shipment (tons)	400.9	648.0
Enriched UO ₃ approved for shipment (tons)	96.9	97.1
Normal UO ₃ shipped (tons)	599.49	499.17
Enriched UO ₃ shipped (tons)	0	97.18
Normal UNH backlog (tons U)	167	327
Enriched UNH backlog (tons U)	52	114

d. Plutonium Metal Processing

Input to Task I (batches)	260	333
Reduction yield (%)	97.8	97.2
Plutonium metal buttons produced (% of commitment)	90.3	149.3
Plutonium metal buttons shipped (% of commitment)	100.6	124.9
Product recovery output (% of commitment)	104.6	99.0
Product recovery backlog (Kg's)	261.6	282.1
Waste disposal (grams)	552	585

January   December

e. Plutonium Metal Fabrication

Weapons parts produced (% of commitment)
 Weapons parts shipped (% of commitment)

-                  -
 -                  -

200-East   200-West

f. Power

Raw water pumped (gpm)
 Filtered water pumped (gpm)
 Maximum steam generated (lbs./hr.)
 Average steam generated (lbs./hr.)
 Total steam generated (M lbs.)
 Coal consumed (est. tons)

7 164   4 981
 1 000   1 030
 290 000   155 000
 171 400   115 565
 127 528   86 049
 6 591   4 715

J. H. Warren
 Manager - Production

CHEMICAL PROCESSING DEPARTMENT
MONTHLY REPORT

JANUARY, 1961

II. ACHIEVEMENTS (Continued)

B. PUREX OPERATION

1. Operating Continuity

A neptunium recovery run was completed on January 7 with the largest recovery obtained in any run. After the shutdown maintenance and equipment changes were completed, normal processing resumed on January 16 on a 3.0 CF.

All uranium and plutonium met specifications although most of the uranium required blending or silica-gel treatment. Waste losses for both products were higher than normal due to the combined effect of a plant cleanout and lack of rework facilities due to fission product operation.

2. Processing Experience

Prior to the startup, chemical flushes of the G-1 (IOF) tank removed essentially all of the accumulated solids from the previous run period. The amount of solids in the tank measured approximately 1,000 gallons.

The waste accumulated during the UO_3 rework run was reprocessed through the final uranium cycle prior to the resumption of normal processing.

Waste from the neptunium recovery run, plus equipment flushes, was segregated in the F-11 acid waste concentrator for reprocessing. Rework commenced soon after plant startup. Gamma levels in the process increased significantly after the rework was completed. Gamma levels in the #1 organic system remained high at 15,000 microcuries per gallon.

Neptunium waste heels in the waste concentrator and tanks caused abnormal waste losses in initial IWW waste batches. The F-8 vessel, normally used in reworking wastes, was in service for Sr-90 runs and was not available for rework of the high waste solutions.

Performance of the new stainless steel cartridge in the HS (co-decontamination) column is satisfactory. Condenser vent vacuum improved markedly following replacement of the H₄ (backcycle) concentrator. Two cask transfers of aged Sr-90 (54,300 curies in 375 gallons) to the Hanford Laboratories Operation were completed.

The silica gel facility processed 205 tons of uranium during January.

3. Mechanical Experience

The replacement of the H-4 concentrator was completed. The failed unit was stored in the disposal tunnel.

The leaking east tube bundle in the F-11 #1 acid waste concentrator was replaced. Using normal procedures, the bundle was sprayed with water during removal to flush off loose contamination. The tube bundle was evidently thermally hot from radioactive waste remaining in plugged tubes thus causing steam evolution which carried some contamination to the crane and throughout the canyon.

The leaking condensate trap assembly on the east F-11 tube bundle and the No. 2 trap pit were grossly contaminated from the tube bundle failure. Chemical flushing of the trap pit and piping was only partially successful in reducing radiation fields to permit contact maintenance. The leaking trap pit jumper was replaced using improvised remote methods. C-clamps were used on all flanges on the new jumper where stud bolts were either missing or broken.

TV inspection of the leaking cell wall nozzle for the HSR jumper showed severe pitting and corrosion on the nozzle tip. The leak was corrected by installing a modified connector head with an enlarged gasket on the jumper.

The J-1 (backcycle) pump discharge jumper developed a flange leak and was replaced after attempts to repair it were unsuccessful.

The electrical jumper for the A-3 dissolver off-gas heater and the cell electrical outlet, AG-28, both failed. A new flexible electrical jumper was installed on a spare cell electrical outlet. New "flex" jumpers were installed to replace failed thermohms on the C-3 dissolver and F-11 concentrator.

The prototype organic recirculation jumper was installed to route a portion of the IOF organic flow back to the G-1 recirculation pump for improved washing efficiency.

A jumper to sample organic overflow from the G-2 (IO) column was installed and piped into the existing G-2 sampler.

The drain from the F-6 vapor demister was rerouted into the reboiler section of F-6 #2 acid concentrator via a jumper change.

The F-10 pump developed excessive upper seal leakage and was replaced.

The N cell ion exchange columns were filled with new resin. The steam condensate header was tied into the new A-30 crib which replaced the plugged A-6 condensate crib.

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The F-2 silver reactor for the vessel vent and condenser vent systems was regenerated.

The fission product loadout station was completed during the month and accepted for service.

Work was started on the new underground transfer line from the 244-CR vault to the Hot Semiworks.

Approximately 120,000 gallons of dilute waste were transferred from 106-A tank to 104-A tank in preparation for a "preheating program" for 106-A. Jumper changes to divert one batch of current waste to 106-A were undertaken on 1-20-61. High radiation levels were encountered and decontamination flushes of the diversion box were necessary. Interference with installed jumpers and short time limits for crane operators have prevented completion of this work at month's end.

4. Radiation Experience

The total radio-iodine emission for the month was 24 curies. The maximum seven-day emission was 8.8 curies. Nine radiation occurrences were reported this period. Fourteen cases of skin contamination occurred with a maximum 80 mr/hr. at surface fission product and 2000 d/m plutonium.

5. Analytical Experience

The Purex Laboratory High Level Analytical Work Station project was completed during the month. Initial use of the facility was for the analysis of the Sr-90 solution in the 244-CR-003 tank. Dose rates for operating the facility on high activity solution were only 2 mr/hr. A special pH assembly unit was designed and used in this facility. This unit permits pH measurements to be made in a closed system and reduces the possibility of a contamination spread.

Analytical method checkout for the Hot Semiworks samples is approximately 60 percent complete. Methods checked to date are strontium, cesium, barium, calcium, and the complexing agent, EDTA.

Determinations of neptunium loadout samples were based on the correlation between analytical results from the controlled potential coulometer and the alpha energy analyzer which resulted in a significant time saving.

New plutonium product specifications were adopted. ZrNb/AT and Ru/AT values have replaced the old G/AT specifications obtained from the Gamma Scintillation counters. The change was made possible by the ability of the 256-Channel Analyzer to provide a more accurate and specific determination of gamma-emitting isotopes found in final plutonium product samples. The change was made also on all plutonium cycle process samples to provide comparable values for dF measurement.

Manager-Purex

HR McMurray:EAF:gt

CHEMICAL PROCESSING DEPARTMENT
MONTHLY REPORT

JANUARY, 1961

II. ACHIEVEMENTS (Continued)

C. SPECIAL SEPARATION PROCESSING AND AUXILIARIES OPERATION

1. Operating Continuity

A very successful Birch recovery run was completed during the first week of January and recovered approximately 800 grams of product. The Birch recovery run was followed by a 60 percent nitric acid flush of the processing equipment to insure criticality control. E-metal processing was resumed on January 11 and was conducted as scheduled for the balance of the month. The monthly production commitment was met.

2. Processing Operation

The fourth Birch recovery run in the Redox Plant, and the most successful to date, was completed on January 3. A total of 801 grams of product was recovered without incident and sent to the Process Chemistry Operation for final purification and isolation. Flowsheet modifications, which were first used in the third recovery run (July 1960), were very successful in separating the uranium from the Birch. The operating time required for this run was five days, or less than one-third the time required for the previous removal run.

To insure criticality control the Birch recovery run was followed by a 60 percent nitric acid flush of extraction vessels, overflow lines and associated piping. This flush, which was completed on a very satisfactory schedule, resulted in a pickup of only 133 units of plutonium and indicates good process control since the last flush which was completed during September 1960. A flush of the vessel vent header, with the flush originating in the E-2 plutonium ozonator tower, recovered an additional 71 grams of plutonium.

E-metal processing started on 1-11-61, and except for normal week-end shutdowns, was continuous to the end of the month. Product quality was maintained at normal levels and waste losses were under good control for the entire month. The monthly production commitment was achieved.

Cell jumpers were installed this month to route the 2A extraction column (second plutonium cycle) waste stream to the top of the 1A column (precycle) instead of the F-2 concentrator. This routing displaces the present fresh salt used in the 1AA stream and also removes much of the iron which was being added to F-2 via the 2AW waste stream. The installation holds out a potential essential material and waste volume savings of about \$50/ton uranium processed.

3. Mechanical Experience

The major maintenance item during the month was the installation of a new multipurpose dissolver, a critically safe vessel for dissolving uranium metal of enrichments up to one percent U-235. Stripping of the dissolver cell and removal of the conventional B-2 dissolver was completed on 1-27-61 and the new multipurpose dissolver was in position by 1-28-61. At month end jumper installation was in progress. The work to date has been accomplished without incident, in spite of the extreme complexity of the installation. The old dissolver and associated equipment, which was removed from this position, was transferred to the Redox Waste Handling and Decontamination Operation for salvage.

The old silo column carrier in the Redox Plant was removed on 1-5-61 and a new carrier installed on 1-6-61. The old unit was damaged and grossly contaminated and its cable mechanism was inoperable. The new carrier is a sectionalized unit and should be easier to repair or replace. The work was completed without incident although the potential for personnel and building radioactive contamination was extremely high.

Three process pumps (D-8, F-7 and H-1) were replaced during the month. The D-8 pump developed an electrical short in the motor and the remaining two were replaced because of seal leakage. Five replacement cell jumpers were also installed during the month.

4. Waste Handling and Decontamination

A shipment of forty-one (41) fifty-five gallon drums of depleted uranium waste from the Dow Chemical Company's plant at Rocky Flats, Colorado, was received on 1-24-61 and buried in Dry Waste Trench No. 2 on 1-25-61.

Equipment valued at \$86,844 was received from the processing plants for decontamination, repair or inspection during the month. Equipment valued at approximately \$47,042 was decontaminated and repaired and represents a savings of approximately \$41,275 over the cost of new replacement equipment.

A total of 298 man-hours was charged to the decontamination of railroad, automotive, and heavy equipment. The following is a breakdown of the major items decontaminated:

<u>Item</u>	<u>Operation Charged</u>
Well Cars No. 37, 45 & 40	CPD Production
Flat Car No. 19028	Purex
UNH Tractor No. 68-E-8933	"
Pickup No. 1C-180	"
Sedan No. 1A-5823	Electrical Distribution
Flatbed Truck No. 68-B-2656	IPD
Water Truck	P&GM
Air compressor No. 13-16285	"
Panel Truck No. 1D-491	"
Tractor-Trailer No. 64-2704	Transportation
Drilling Rig (Hatch Co.)	AEC
Pickup Truck (Hatch Co.)	AEC
Pickup Truck No. 1C-209	FPO
Tractor-Trailer No. 64-12590	HLO
Sedan No. 1A-895	Patrol
Welding Machine No. 18929	Purex (P&GM)
Lorraine Crane	Purex (P&GM)

5. Radiation Experience

Five radiation occurrences and one radiation incident were incurred during the month. The most significant of the radiation occurrences involved the potential spread of low level contamination off-plant. This occurrence was formally investigated and reported in Radiation Exposure Occurrence, Type C, CPD-61-1. The radiation incident which occurred was due to a skin dose to a localized portion of an employee's knee, which exceeded the operational control limits for exposure to the skin. Details of the incident are reported in Radiation Occurrence Investigation, Type B, CPD-61-2.

There were two "hot" equipment moves from the 202-S Canyon Building during the month. On 1-5-61 the old silo column carrier was removed and buried. The maximum dose rate for the job was 250 mrad/hr at the edge of the burial trench. On 1-31-61 the conventional B-2 dissolver, which was removed for the multipurpose dissolver installation, was transferred to the Redox Equipment Reclamation Facility for salvage. The maximum dose rate encountered was 350 mr/hr at 53 feet from the concrete transfer box. Both equipment moves were completed without incident.

Chas. S. Smith
 Manager - Special Separation
 Processing and Auxiliaries

CHEMICAL PROCESSING DEPARTMENT
MONTHLY REPORT

JANUARY, 1961

II. ACHIEVEMENTS (Continued)

D. FINISHED PRODUCTS OPERATION

1. Operating Continuity

Fabrication continued on an unscheduled basis with activities centered on preparations for the production of Model 81. The shipping commitment for unfabricated plutonium was met, but production was 10% under schedule because of a high reject rate due to impurities. Plutonium recovery exceeded schedule by 6%. Uranium oxide met all commitments and schedules.

2. Processing Operations

a. Plutonium Fabrication

Casting process development work on all components of the Model 81 was continued under Task Force direction. Overall yield on the major parts was approximately 36%, with one good ten-day period near the end of the month when yields ranged to 65%. Task Force efforts are to continue pending significant improvement.

The machining of all of the types of parts required for Model 81 was continued this month for training and development purposes. Progress was satisfactory.

The modifications made to the new Gorton lathes failed to achieve the desired results. Tests were witnessed by the vendor's representative and further modifications are to be made.

The first shipment of graphite molds was received from the off-site fabricator. Quality is indicated as good, except that the material from which they are made may be slightly porous.

Two revisions of Document CXXX-1982 were received during the month. Revision C eliminated Model 1249 from HAPO production, and Revision D indicated a seven-month delay in the start of production of Model 1251, with an equivalent substitution of Model 81 for the seven months.

b. Plutonium Processing

The production of unfabricated plutonium continues to be carried on in the RMC Line where reliability of equipment is increasing. Gross production was up significantly, but almost 25% of the buttons were rejected because of high iron content and/or low density. The source of the difficulty has not yet been determined. Investigations regarding feed supply, calcination, fluorination, reduction, and sampling are in progress.

Recovery of plutonium was satisfactory with only minor difficulties being encountered. One of the failed slag and crucible dissolvers is back in service with the second one in the process of replacement at the end of the month. The backlog of recoverable plutonium scrap was reduced slightly during the month in spite of heavy receipts from Fabrication and HLO.

c. Uranium Reduction

Uranium Reduction operations were normal throughout the month, except in the case of accountability where a negative material balance persists. Investigations to date have revealed 12,000 pounds of the underage to be in the sump wastes sent to Purex for reclamation. Further investigation is in progress.

3. Mechanical Experience

The plutonium fabrication equipment continued to require considerable maintenance effort for repairs and modifications. Principal failures included: the 19B-1 high vacuum blower, the hood 24-B hydraulic pump, and the hoods 41-M-1 hydraulic pumps. Modifications to the electronic circuitry in the new Gorton lathe hoods are proving difficult because of poor workmanship on the original installation.

Plutonium preparation equipment operated satisfactorily with only routine repairs required.

Plutonium recovery equipment performed well except for the failure, by corrosion, of the M-1, M-2, and M-3 metal dissolvers. Replacement of the large D-1 slag and crucible dissolver was successfully completed and replacement of D-2 is underway.

Uranium reduction equipment performed satisfactorily again this month.

4. Radiation Experience

Radiation and contamination control statistics show general control to be satisfactory.

Four contaminated injuries experienced during the month. Three involved plutonium slivers entering fingers and the fourth involved a puncture wound from a contaminated thermocouple. Initial assays indicate that there will be no significant deposition in any of the cases.

5. Analytical and Final Inspection Experience

	<u>December</u>	<u>January</u>
Number of Samples Received	1,453	1,623
Number of Determinations	19,067	19,189
Average Impurity, Buttons	1,744 ppm	2,101 ppm
Buttons Rejected	6.8%	17.4%

The X-Omat automatic film processing system has been installed in Final Inspection and has reduced radiographic examination time by 70%.

Gaging equipment is essentially complete except for the optical comparator and a few minor items.

 Manager - Finished Products

CHEMICAL PROCESSING DEPARTMENT
MONTHLY REPORT

January 1961

II. ACHIEVEMENTS (continued)

E. POWER AND GENERAL MAINTENANCE OPERATION

1. Operating Continuity

Steam, water, and emergency electrical services were supplied the production facilities without interruption during the period covered by this report.

2. Inspection, Maintenance and Repair

Fabrication of the Redox Mark V Dissolver was completed on January 20. Mock-up of nine new jumpers on the dissolver, calibration, and recording of as-built dimensions were then completed, and the vessel was shipped to the Redox Plant on January 27.

Fabrication of a Redox D-12 Waste Concentrator has reached about 80 per cent of completion. The large tower flange and two canister section flanges have been assembled to the vessel, and installation of exterior piping and nozzles is now in progress.

A total of 29 process jumpers was built this month--18 for Purex and 11 for Redox.

Four process pumps were prepared for service and shipped to separations plants as replacements for failed equipment. Three of these pumps went to Redox, and the other to Purex.

Extensive repairs, including replacement of lagging and sheathing, have been completed on the decontaminated Purex F-1 Vent Condenser, and this vessel is now ready for service.

Fabrication and lagging of a Purex F-1 Vent Filter have been completed, and the only remaining work on this vessel, installation of sheathing, is underway.

Fabrication is about 75 per cent complete on four vessels for the Purex Formaldehyde Denitration Process. The receiver tank is essentially complete, except for replacement of a section of stainless steel plate which showed faults on an X-ray film. The films were of welds, but uncovered rather serious laminations in the parent plate. Design of the Up-Draft Condenser is being revised to facilitate fabrication and eliminate a condition that might promote crevice corrosion. The Reactor and Reactor Tower are complete.

Machining and assembly of the Cerium¹⁴⁴ Filter Unit have been completed, and this unit has been welded to the cask cover and shipped to Pacific Steel Products Company, at Seattle, for completion of the cask cover. The cask, being built by Pacific Steel Products, and filter unit will be returned here for testing and pouring of the heat transfer metal.

Relocation of Hood 28-F, the three-stack furnace hood, and associated equipment and services from the RMA line to the RMC line, at 234-5 Building, was completed.

Installation of electrical and communications services is about 70 per cent complete for the new General Electric 311 Computer at 234-5 Building. This equipment is for computing, storing and recalling data on plutonium buttons and fabricated shapes.

Two stainless steel hoods were installed in Room 132, 234-5 Building, as replacements for two wooden hoods which were disposed of at the contaminated equipment burial grounds. These hoods are used in connection with spectrographic analysis of plutonium button samples, and were installed under Project CG-789, Additional Fire Protection, 234-5 Building.

Installation of a Fluid Bed Reactor and associated equipment was completed in Room 179, 234-5 Building. This system will be used in development and demonstration of a chloride process for the dry-chemistry section.

Installation of the Creep Hood in 231-Z Building has progressed to 85 per cent of completion. This installation includes the hood proper, three creep-test machines, two high-vacuum systems, two electric furnaces, electrical services, and control and recording instrumentation.

Machining of a forging punch and die set was completed, and these tools were delivered to 231-Z Building for use in further development of processes for press forming of plutonium shapes.

Assistance was provided Facilities Engineering in making a compressive strength test of the concrete surface on the 103-A underground storage tank at 241-A Tank Farm. This nondestructive method of testing concrete was accomplished with a Schmidt Basil concrete test hammer. High radiation levels were encountered during the entire testing procedure, without incidents.

Assistance was given Purex in flushing down contamination to safe working limits in the 152-A Diversion Box at the 241-A Tank Farm.

Other services rendered the Purex Facility during the month included a standby rigging crew and equipment on a round-the-clock basis at trap pit no. 2, changing a trap jumper, changing gaskets and installing four-inch downcomers. Radiation levels were 30 to 100 mr/hr. at the top of the pit, and as much as 2,000 to 6,000 mr/hr. in the bottom of the pit. Several people, including supervision, received their allowable weekly dose rate. Burn-out time was becoming a serious problem at completion of the job, which required 301 ~~over~~ man hours.

A trench 250 feet long, 4 feet deep, was excavated from the north wall of the 202-S Building to the 293-S pit, for the installation of copper lines needed to replace defective instrument air lines. The presence of contamination necessitated constant RM monitoring and SWP working conditions.

A column carrier was removed and replaced by a new one in the 202-S Building. The old column carrier, fabricated in one piece, 50 feet in length, was removed from the underground track arrangement and pulled directly into a specially designed burial box, and buried without incident.

New Gravely tractors, for brushing snow from walkways and bus stops, were found to be a great improvement over methods used in the past, both in quantity and quality of work.

As a result of a performance test run, the voltage was increased on the 284-E emergency generator, to assure smooth starting of all equipment in 202-A.

Load limits on the 200-East coal conveyor belts were improved by installing a larger drive motor. This was done in connection with preventive maintenance work on the coal-car shaker.

Ventilation balance activities included: (1) completion of testing and installation of all filters for the Reactor Confinement Program; a total of 1,025 filters were smoke tested, (2) completion of rough balance of all 105 Buildings, (3) completion of balance of the new Hood 40 ventilation system in the 234-5 Building, and (4) assisting minor construction at 234-5 Building in removal of several contaminated hoods and changing numerous hood panels, without contamination incidents.

The 1961 weed control program and procedures have been finalized, and are in operation.

Manager
Power & General Maintenance

TGL:ap

CHEMICAL PROCESSING DEPARTMENT
MONTHLY REPORT

JANUARY, 1961

II. ACHIEVEMENTS (continued)

F. FACILITIES ENGINEERING OPERATION

1. Purex

a. Process Design and Development Engineering

"E" Metal Dissolving

A draft report with attached drawings was issued to propose three concepts for obtaining a 4.0 dissolving potential at Purex on either "E" Metal or normal metal. In addition, two of the alternates include flexibility for processing of long fuel elements and aluminum cladding. Although offering additional flexibility, these alternates introduce complexities which are not believed to be justified from the standpoint of projected plant operations. The preferred alternate would be based on charging the dissolver by dumping "E" Metal and normal metal into the annular crib area. The system would be safe by geometry for the 0.98 percent equivalent enrichment of irradiated "E" Metal. Total project cost for the preferred alternate was estimated at \$1,000,000.

Aqueous Makeup Modifications

A comprehensive survey of all Purex aqueous makeup facilities and requirements was made to insure that the integrated requirements of all Purex activities would be met. A summary report was issued describing the aqueous makeup changes needed, in total, at Purex for sustained 3.6 capacity factor production capability coupled with continuous Palm and fission product recovery operations. Briefly the work will consist of installation of 6 new tanks, conversion of four existing tanks to new services, and associated piping and instrumentation changes. These items of work include those currently contained in the scope of Projects CGC-821 and 895, as well as additional work presently assigned to no project.

Dissolver Containment

A draft of a summary report covering the installation of secondary off-gas filters at Purex was issued. The report proposes that backup filters packed with 115K Fiberglas media, only, be installed in each dissolver off-gas line. The proposed system includes provisions for blocking and bypassing loaded units when needed. This scheme eliminates the shielding and disposal problems associated with installations designed for removal of loaded filters, provides a far more reliable backup filter system, and involves less capital expenditure than the other alternates considered. The loaded filters would be disposed of by permanent burial, a method which appears acceptable to the interested parties.

b. Project Engineering

CAC-891 - Test Wells for 216-A-6 Crib Replacement

The tie-in of the crib to the waste line on January 13 completed all work on the project. The physical completion notice was issued on January 27.

B-42776 - Secondary Containment Bldg. at Purex Fission Product Load-out Station

Work was completed on January 17, 1961.

c. Manufacturing Engineering

Jumper Cutter - A check-out test of the jumper cutter was run in 272-E Shop. Several cuts were made on 2inch, 3inch, and 4inch diameter stainless steel pipe, with the cutter suspended in the vertical and horizontal positions by the shop crane. The purpose of the test was to make a final check on the ability of the cutter blades to retain the pipe in the jaws without supplemental holding. The test results showed adequate holding with the cutter blades. Also, a demonstration was held for about 30 persons interested in seeing the cutter operate before it is transferred to the Purex canyon.

Crane-operated Valve - Design was completed and an estimate was received to build and test a verification model of a crane-operated remote valve for canyon service.

2. Special Separations Processing

a. Process Design and Development Engineering

NPR Processing

A process design report summarizing the changes required in the Redox Plant for routine processing of NPR fuels was issued. Briefly these changes consist of equipping A Cell with a Mark V Dissolver and associated equipment needed for zirflex processing of NPR fuels, additions to the existing B Cell dissolver system needed for zirflex processing, routine changes in the head end of the plant to permit centrifugation of zirflex cladding solution streams, and cold-side equipment needed to receive and distribute ammonium fluoride. The report will serve as a basis for preparation of the project proposal covering total NPR processing requirements within CPD.

b. Project Engineering

CGC-830, Rev. 4 - Plant Modifications for Reprocessing Non-production Reactor Fuels

The project proposal for abandonment is being circulated for approvals.

CGC-913 - Project Birch - Redox

A project proposal revision is being made to request total project authorization in the amount of \$325,000.

c. Manufacturing Engineering

Mark V Dissolver - The Vessel as-builts have been taken and recorded, testing has been completed, and the Vessel has been shipped to Redox.

Closed Circuit TV - Specifications for the purchase of new television equipment to replace the existing equipment used on the crane maintenance crew platform were completed. Procurement is awaiting approval of funds.

3. Finished Products Operation

a. Process Design and Development Engineering

Button Line Improvement Program

All effort has been stopped on the Bird 6" Centrifugal Separator. Continued difficulty has been experienced with start-up after disassembly and re-assembly. Consequently, the performance test agenda has not been performed. Bird Machine Company has been advised of the situation, and the machine and associated engineering efforts will remain secured pending advice from Bird.

The first polyethylene cloth was installed on the vacuum drum filter in HC-9 on December 28, 1960 and replaced with a second similar cloth on January 20, 1961. An examination of the replaced cloth revealed good strength and integrity, no holes or other physical defects. This is a marked improvement over the dynel cloth which is often badly deteriorated.

Plutonium Reclamation Facility

At the request of the Atomic Energy Commission, the design scope of the subject project was reviewed to answer questions concerning possible cost reduction. Document No. HW-68165 was issued to answer the questions. The following conclusions were drawn:

- (1) No significant cost reductions can be achieved by reducing the design capacity since the as-scoped facility is a minimum practical size for a continuous processing plant.
- (2) The project costs can be reduced about \$5,000 by using NPR instead of NPF feed as the design basis and sacrificing some safety in event of a critical mass incident.
- (3) Reduction of maintenance space is not feasible since the existing maintenance facilities are inadequate for this and other projects presently planned or in progress for which such facilities are not provided.
- (4) A glove box facility housing all process equipment does not result in a capital cost reduction; in addition, the concrete wall of the as-scoped facility provides important protection to operating personnel in the event of a criticality accident.

Gorton Lathes

Work has continued in an attempt to improve the operation of the lathes. There are three major problems common to all six - these are: (1) excessive hunting and stylus deflection of the tracer attachment in X - Y mode operation; (2) excessive hunting and stylus deflection of the ram in R-theta mode operation; and (3) unstable speed control and operation of the spindle.

The Vendor sent representatives to Hanford for study and assistance with the problems. They have returned to their plant, taking the modified control unit for re-design and further modification.

b. Project Engineering

CAC-880 - Plutonium Reclamation Facility - "Z" Plant

On January 6, 1961, the Commission directed the General Electric Company to stop design effort on this project. Washington AEC personnel were at Hanford during the week of January 23, to discuss this project.

Interim Work Authority CAC-880 (3), dated January 27, authorized an additional \$50,000 for continuation of design. Revised design schedules will be prepared reflecting the delays which the suspension of work has caused.

c. Manufacturing Engineering

Segregated Powder Handling

The scope for a powder unloading system for "H" calciner at 224-UA Building has been completed and issued in Document No. HW-68296.

It is proposed that "H" Cell will be converted to the processing of "E" Metal. Therefore, the NPR metal will require separate unloading facilities.

Methods Analysis

The motion pictures of several operations on the button line were shown to "Z" Plant supervisors and operators. In conjunction with Radiation Monitoring, the radiation exposure analysis was explained, and more realistic control limits were set. Methods improvements were discussed to minimize hand exposure and insure contamination control.

DECLASSIFIED

HW-68345

4. General

a. Process Design and Development Engineering

Line Voltage Monitor

A monitor has been designed which will record line voltage, the occurrence of transients on the line, and momentary interruption of the line. The monitor is expected to aid the quantitative observation of line disturbances on the AC power mains. Also, the monitor has specific application in investigating problems with line disturbances of sensitive instruments and control devices as used in CPD facilities.

Pulsed Neutron Pre-criticality Instrumentation

The technique of using a pulsed neutron source and neutron decay rate instrumentation to detect and warn of approach to criticality in the separations facilities is being investigated by a study group of HLO and CPD personnel, started in November, 1960. The current literature has been reviewed and a preliminary series of calculations made. Although it is expected that this technique will have some application, it does not basically change the requirements for control instrumentation and post-criticality alarms. A program of experimental work on the pulse technique is planned in HLO facilities.

Shipping Cask Design

Design work was completed on Strontium-90 carbonate cask and on modifications to the cerium cask. The carbonate cask was designed for shipment of a maximum of 168,000 curies of Strontium-90 with the associated impurities. Tentative approvals have been obtained from AEC and the Bureau of Explosives; and when finally approved, the design package will be used for construction of one or more casks. Modifications to the cerium cask include a decalco insert which will permit shipment of about 80,000 curies of Strontium-90 nitrate. Design of this cask has been approved in principle by the Hazards and Liability Evaluation Team.

REF ID: A66117

HW-68345

b. Project Engineering

Project Cost Information as of January 22, 1961:

Total Authorized Funds (13 active projects)	\$ 7,148,000
Total cost-to-date	5,039,000
Commitments and Open Work Releases	161,000
Unencumbered Balance	1,948,000
Costs Charged to Above Projects 12/18/60 to 1/22/61	215,252

CGC-897 - Fission Product Storage

Three major alternates for storage of fission product concentrates are under study. The first, holdup of LWW solution in acidic form under vacuum, allows aging of all isotopes as self-concentrated LWW and defers operating costs for separations until firm orders are received. The second, continued operation of interim 244-CR and Semiworks facilities, is based on limiting the production of strontium-90 concentrates to about four megacuries per year. Although capital expenditures probably would be required, they can be deferred until the market situation is further clarified. The third, "B" Plant reactivation under reduced scope, involves Cells 5 through 12, only, under Phase I. Only strontium-90 concentrates would be stored, and storage would be limited to about 20,000 gallons.

Manager - Facilities Engineering
Chemical Processing Department

HP Shaw:WWC/alr

CHEMICAL PROCESSING DEPARTMENT
MONTHLY REPORT

JANUARY, 1961

II. ACHIEVEMENTS (Continued)

G. RESEARCH AND ENGINEERING OPERATION

1. Purex Process Technology -

a. Fission Product Recovery

Continued recovery operations using lead-sulfate carrier precipitation, carbonate metathesis and oxalate precipitation isolated 355 kilocuries of Sr 90 from normal IWW during the month. Concentration of the strontium product by carbonate precipitation followed by nitric acid dissolution produced a final product of the following typical analysis.

Curies/Gal.

Sr 89	1400	HNO ₃	0.16 M
Sr 90	135	Fe	0.13 M
Ce 144 & 141	3100		
Ru 103 & 106	25		
Zr-Nb	2200		

Shipments continued to the Hanford Laboratories during the month and to date 70 kilocuries of Sr 90 have been delivered for purification.

b. Solvent Extraction

Shortly after startup decontamination performance was increased several fold while processing 100 - 120 day "cooled" feed material to which waste from the neptunium recovery run was added as rework in the ratio of 1:10. All uranium product from solvent extraction during this period was below the < 2.0 gamma ratio specification. Likewise, the plutonium product from ion exchange analyzed $< 2.5 \times 10^{-11}$ ZrNb/AT on the multichannel analyzer which is the new equivalent of $< 2.0 \times 10^{-11}$ G/AT as measured on the GSC.

As feed containing the final batch of rework was being processed, the gamma activity of the intercycle streams started to increase and continued to rise after completion of the rework until equilibrium values were reached which were slightly higher than those established in the past while processing comparable feed material. Gamma ratios of

uranium product rose to 5.0 - 5.5, but were reduced to <2.0 by silica gel treatment. Less effect was noted in plutonium processing with the product continuing to analyze <2.5 x 10⁻¹¹ ZrNb/AT after ion exchange processing.

Plutonium losses to the HA Column effluent (HAW) were controlled in the 0.05 - 0.15 per cent range to promote maximum decontamination performance.

Prior to startup, the "zebra" cartridge in the HS Column was replaced with a cartridge containing ten per cent free area, stainless steel, nozzle plates on two inch spacing. To date, no significant difference has been noted between the performance of the new cartridge and the one removed.

c. Neptunium Recovery

A run to isolate and decontaminate 2.92 kg of neptunium accumulated in the plant was completed early in the month. This accumulation represented 82 per cent of the neptunium added to the solvent extraction system via recycle and virgin feed during the last processing period. Plant operation while using the standard ferrous sulfamate-hydrazine, reducing flowsheet was satisfactory. Eighty-seven per cent (2.54 kg) of the neptunium was isolated for further purification by ion exchange processing.

Neptunium recovery, subsequent to the isolation run, has generally been good, but a few sporadic high losses via the HA Column effluent (HAW) have been experienced. Adjustments in the organic addition to the HA Column scrub section (HAO) and nitric acid addition to the top of the HA Column (HSR-HNO₃) reduced the neptunium loss via the HAW.

d. Solvent Treatment

Recirculation of solvent through the No. 1 Solvent System equipment during the neptunium recovery run reduced the gamma activity of the solvent from 5000 to about 700 uc/gal. However, with the start of normal processing and especially during the period of processing rework, the gamma activity of the solvent increased to reach 16,000 uc/gal by month end. Accelerated schedules for changing the carbonate wash in both the Batch Wash Tank (TK-G1) and the Turbomixer (TK-G7) have been inaugurated in an attempt to more rapidly lower the solvent gamma activity.

A 1000 gallon solids holdup (presumably MnO₂) in the packed section of the Batch Wash Tank (TK-G1) was completely removed by a series of oxalic acid-nitric acid flushes and a caustic-tartrate flush during the plant shutdown.

Installation of a sampler at the top of the IC Column (dilute HNO_3 wash) has provided sample analyses which indicate a solvent gross gamma decontamination factor of three to four for the alkaline permanganate contact in Batch Wash Tank and 1.5 to two for the sodium carbonate contact in the Turbomixer.

e. Waste Treatment and Acid Recovery

Waste volumes sent to underground storage tanks averaged 72, 220, 840 and 190 gallons per ton of uranium processed for neutralized IWW, IWW after treatment for strontium recovery, solvent washes and cell drainage, respectively. The high solvent wash volume reflects the flushes of the Batch Wash Tank while canyon decontamination efforts increased the cell drainage volume.

2. Redox Process Technology -a. Neptunium Recovery

The fourth neptunium recovery run, the most successful to date, was completed early in the month. A total of 801 grams of the approximately 1000 grams accumulated was recovered without incident and sent to the Process Chemistry Operation for final purification and isolation. The operating time required for this run was five days, or less than one-third the time required for the previous removal run. During the removal, nine grams of neptunium were irretrievably lost to the waste sent to underground storage. The remainder was retained in accumulated "wastes", recovered, and returned to internal recycle as usual on resumption of operations. The four neptunium removal runs are compared in the following tables:

PRODUCT COMPARISON

	<u>Removal No. 1</u> <u>December, 1959</u>	<u>Removal No. 2</u> <u>March, 1960</u>	<u>Removal No. 3</u> <u>July-Aug, 1960</u>	<u>Removal No. 4</u> <u>Dec.-Jan., 1960-61</u>
Removal, Percent of Starting Amt.	37	42	60	80
Pu/Np, Gm/Gm	2.8	0.5	1.8	0.12
U/Np, Gm/Gm	3.8	6.1	25	0.002
Gamma/Np Microcuries/Gm	1.21×10^4	2.4×10^4	3.3×10^4	3.3×10^3

ARITHMETIC FISSION PRODUCT DECONTAMINATION FACTORS

(Dissolver solution contains approx. 1×10^{11} microcuries of gross gamma activity per gram of neptunium)

<u>Process Step</u>	<u>Removal</u> <u>No. 1</u>	<u>Removal</u> <u>No. 2</u>	<u>Removal</u> <u>No. 3</u>	<u>Removal</u> <u>No. 4</u>
Accumulation	85	500	440	4800
Precycle	5	8	25	10
2nd Extraction Cycle and Partitioning	850	4	8	3.8
3rd Extraction Cycle and Ozonation	20	420	35	120
Over-all D. F.	8×10^6	4×10^6	3×10^6	3×10^7

Combining the data from this run with previous material balance data and calculations of input, total accumulation (recovery) since the start of this program in October, 1959, is computed at 83-85 percent of theoretical and total removals at 73-75 percent.

The possible use of the HS Column (currently used mainly for reworking waste) as a combined extraction and stripping unit appears attractive for both interim and long-range neptunium recovery. Initial testing to determine the extent of salt transfer ("back-mixing") between the extraction section and the overlying stagnant aqueous stripping section, has been completed. Preliminary results were highly favorable; back-mixing appeared to be negligible.

b. Solvent Extraction

The routine semi-annual 60 percent nitric acid flush of the extraction columns, overflow lines and associated vessels completed during September, 1960, recovered more than 8 kilograms of plutonium, showing that plutonium deposition had recurred, mainly in the partition cycle columns (1A and 1B). For this reason, the frequency of scheduled flushes was increased to three per year, and thus following the neptunium removal run, another 60 percent nitric acid flush of extraction vessels, overflow lines and associated vessels was performed. A total of only 133 grams of plutonium was recovered; this small quantity indicates that abnormal build-up of plutonium has not been occurring since September, 1960, and that the plutonium deposition problem is once more temporarily under control. It is not yet definitely known whether or not the solvent is the key to this problem, but the study of the hexone quality and performance is continuing. A flush of the vessel vent header, with the flush originating in the E-2 plutonium ozonator tower, recovered an additional 71 grams of plutonium.

c. Tail-End Treatment

Back-flushing facilities were added to the sampler used for sampling the contents of the E-13 tank in which the final product uranium solution is ozonated. It had been suspected for some time that the sample circulation was insufficient to remove all of the highly contaminated solution trapped in the sampler suction leg. Back-flushing of the sampler prior to each sample displaces the entrapped contaminated solution thus permitting collection of a sample representative of the tank contents. The improved procedure was used in continued testing of tail-end throughput capacity as a function of the rate of removal of fission product ruthenium from uranium solutions.

Seven batches of solution, each equivalent to 3.5 tons of uranium, were treated under conditions to minimize reflux of ruthenium into the E-13 vessel. After one hour of sparging with 20 CFM of 1 percent ozone (in air) at 90 C, the solution was made up to 60-80 parts per million with periodic acid, digested

for two hours, cooled, sampled and analyzed for radio-ruthenium. The results show that this treatment removed 97 percent of the ruthenium initially present in one-third the time required with reflux operation, thus confirming the observations made on three test runs the preceding month.

From the data thus obtained, it is tentatively concluded that 1) the E-13 tower can and should be permanently removed to prevent reflux; 2) due to the faulty sampler some past problems have been more apparent than real; and 3) the potential E-13 capacity is greater than any foreseeable future load it will be called on to carry. Tests will be continued in attempts to define the optimum process and operating conditions.

3. Finished Products Technology

Metal Finishing Operation

1. Recuplex

A new slag and crucible dissolver was installed in place of the original D-1 dissolver which had failed after approximately 7500 hours of 1 M fluoride ion service (three hour dissolution cycle). A BF_3 neutron counting probe was installed below the new dissolver for detection of plutonium in the dissolver heel. The probe is encased in a stainless steel tube and is accessible for maintenance from outside the hood. Initial calibration tests indicate that the counter will aid critical mass control.

Initial Zr-Pr dissolution tests were made in the Hood 42 small dissolvers. The zirconium and plutonium existed as sintered oxides. Three 3-hour dissolutions with 1 M fluoride ion and 13 M nitric acid successfully dissolved the oxides.

2. Task I, II, and III

The hydrofluorinator vacuum was reduced to one inch of water from two inches of water, and the flexible line between the hydrofluorinator and the primary off-gas filter was replaced. About 195 kgs were subsequently processed before the primary filter required brushing. This represents a two to three-fold improvement based on performance during the previous year.

4. Process Chemistry

a. Purex Process Assistance

From additional laboratory work on the use of freshly precipitated magnesium hydroxide as a washing agent for Purex solvent, the following information was obtained:

- 1) Upon centrifugation, a mixture of Purex solvent with a 1 M NaOH suspension of $Mg(OH)_2$ separates into four distinct layers -- a precipitate, an aqueous phase, an interfacial volume, and an organic phase. The material held at the organic-aqueous interface is white and gelatinous in appearance and is probably $Mg(OH)_2$ saturated with organic. The major portion of the gamma activity which is removed from the solvent is held in this interfacial material.
- 2) In capacity tests of the $Mg(OH)_2$ slurry, effective solvent-cleansing action was attained with organic/aqueous volume ratios as high as 20:1.
- 3) Experiments designed to test the extent of organic loss to the wash solution showed as diluent (Shell E-2342) loss of about one to three per cent for equal volume contacts with a one per cent $Mg(OH)_2$ slurry. Pure tri-butyl phosphate did not appear to be adsorbed on the $Mg(OH)_2$.
- 4) A simulated plant test was carried out using plant unwashed solvent (1CW) and equal volume contacts made successively with the following reagents: 1) 3% Na_2CO_3 at 50 C, 1 M HNO_3 at 25 C, 1% NaOH - 1% $Mg(OH)_2$ at 25 C, and 1 M HNO_3 at 25 C. This treatment improved the plutonium retention number of the solvent by a factor of about 20. When the last contact (1 M HNO_3) was made with only momentary mixing, an over-all Zr, Nb⁹⁵ decontamination factor of about 80 was observed. The factor was increased to greater than 1000 when five minutes of agitation was used.

b. Neptunium Purification

Eight hundred grams of virgin neptunium was received from Redox and 2540 grams was received from Purex during the month. A batch of purified neptunium nitrate (488 g Np) from the Redox run was shipped to the Savannah River Plant to test the nitrate handling facilities, both at HAPO and at Savannah River. The nitrate solution was prepared by the standard ion exchange purification flowsheet, with subsequent partial boil-down of the product to oxidize the neptunium(IV) and to increase the neptunium concentration. Analysis of the material shipped was as follows:

Np 50.24 g/l
 Np(V) 71%
 Np(VI) 29%
 HNO₃ 2.72 M
 Pu 0.01% (Np basis)
 Fe 0.05% (Np basis)
 TMI 0.15% (Np basis)
 Zr, Nb⁹⁵ 2.5 µc/gm Np
 Ru¹⁰³⁻¹⁰⁶ 0.5 µc/gm Np

RECEIVED

For shipment, the nitrate solution was divided between three one-gallon plastic bottles, each about 80% full. These bottles were sealed in plastic and placed in the Savannah River shipping container.

The remainder of the Redox material and 820 grams of Purex material, for a total of 1130 grams, have been converted to the oxide (NpO₂) and delivered to the Plutonium Metallurgy Operation (HLO). A summary of the purification runs follows:

Run	Source of Material	Amt. loaded on resin (grams)	Measured Losses %	Recycle	Purified Product (grams)
40	Redox	780	0.14	1.63	488 (nitrate) 274 (oxide)
41	Purex	958	0.4	2.0	905 (oxide)

Attempts to eliminate the chemical plutonium valence adjustment step in the plutonium recovery cycle have been unsuccessful. The oxidation of hydrazine with dichromate, allowing 16 to 24 hours for complete reaction, has been the most successful plutonium valence adjustment procedure tried.

c. Analytical Assistance

1. Alpha Scintillation Counting

An alpha scintillation counter (ASC) has been modified and calibrated to accommodate large sized (1-7/16 inch diameter) stainless steel counting disks. The large disks are currently being evaluated for use in the mounting of organic solutions for alpha counting. It is hoped that the larger disks will minimize the problem of

mounting losses (from solution run-off) and alpha-absorption by solids in the sample.

2. Analytical Separation of Neptunium

In recent months, a new analytical separation of neptunium from waste streams has been developed and made available to the analytical laboratories. The new method employs a combination of tri-iso-octylamine (TIOA) and thenoyltri-fluoroacetone (TTA) extractions to separate neptunium from plutonium, uranium, americium-curi-um, and beta-gamma emitters. The analytical procedure consists of the following principal steps:

- a) A neptunium(IV) extraction using 10 vol. per cent TIOA in xylene from a 4-5 M HNO_3 , reducing solution, to separate neptunium from plutonium, americium-curi-um, and the bulk of the fission products.
- b) A scrub step for further separation from plutonium and fission products. These first two steps also give some separation from uranium ($\sim$ factor of 4-10).
- c) A stripping step in which neptunium(IV) is stripped from the TIOA phase into 1.0 M HCl .
- d) A final extraction of neptunium(VI) from dilute HCl ($\sim$ 0.9 M) into 0.5 M TTA-xylene.

The above combination gives a plutonium decontamination factor of about 5×10^5 and a beta-gamma decontamination factor of about 1×10^6 on current plant streams.

3. High Precision Separation - Alpha Counting Method for Neptunium in Neptunium Product Solutions

Because of the difficulties encountered in obtaining the high precision desired in the mounting of neptunium contained in TTA-xylene solutions from neptunium product stream analyses, a technique was established for quantitatively transferring the neptunium from the TTA-xylene to a dilute nitric acid system. Mounting from a dilute nitric acid system gives an over-all method precision of 1-2% (standard deviation) compared to 5-10% (standard deviation) for the mounting of the TTA-xylene neptunium solutions. The analytical method consists of a TTA extraction from a dilute HCl or HNO_3 ($\sim$ 1.0 M) reducing solution to remove plutonium. This is followed by a stripping step in which the neptunium is stripped from the TTA into 8.0 M HNO_3 . The concentrated nitric acid solution is diluted with water in volumetric glassware to yield a dilute nitric acid solution which is compatible with conventional aqueous alpha mounting techniques.

5. 234-5 Developmenta. Ammonium Bifluoride Fusion Of Plutonium Dioxide

Ammonium bifluoride fusion is a promising means of rapidly solubilizing high-fired plutonium oxide.

Two fusion runs were made using ammonium bifluoride and plutonium oxide in an 8:1 mol ratio. The 35-gram batches of oxide were ignited to 1000 C prior to fusion to simulate high-temperature oxide conditions. The oxide was loaded into stainless steel vessel with ammonium bifluoride and heated at 200 C for two hours under an argon purge. The molten salt was then poured into 2 M ANN (aluminum nitrate) to solubilize the plutonium. Conversion to soluble plutonium was greater than 98 percent.

One fusion run was made using ignited plutonium oxide spiked with incinerator-type ash. A conversion of 93 percent of the plutonium to soluble tetrafluoride was achieved. The residual ash particles were separated from the plutonium solution by filtration.

Future work will be directed toward developing process reliability and optimizing the time cycle.

b. Continuous Dissolution Of Slag And Crucible

Small-scale tests are under way to determine plutonium dissolution rates, firm up iodine behavior, and determine if a digestion period is needed.

Initial dissolver runs were completed in the two-liter dissolver pot using plutonium-bearing slag and crucible residue. The longest continuous run was of seven hours' duration. The run conditions specified in the Plutonium Reclamation Facility - Process Flow Diagram, SK-2-18400, were used in the run. Slag and crucible feed rate was 175 grams per hour. The following significant points resulted from the seven-hour run:

1. Slag and crucible residue and the plutonium dissolved at the flow sheet rates.
2. The iodine concentration as iodine and iodate in the dissolver overflow solution was 0.55 g/l and 2.5 g/l respectively.
3. Substantial, but controlled foaming accompanied the addition of each slag and crucible charge to the dissolver.
4. At the end of the run, a solids heel of 130 grams remained in the pot. A total of 1200 grams of slag and crucible residue was charged during the run.

5. Dissolver overflow solution developed a gelatinous-appearing precipitate after being stored overnight. The solid phase occupied 60 percent of the solution volume and resembled uncoagulated silica in appearance. The solids have not been identified at this time.

A 40 - 50 hour run will be attempted to further define the solids buildup problem in the dissolver pot. Work is in progress to identify the gelatinous precipitate.

c. Extraction Of Residual Plutonium From Recuplex Waste

Further tests with dibutyl-butyl-phosphonate have partially defined solvent capacity and have shown that the organic can be stripped with carbonate solutions.

Solvent consisting of 35 percent DBBP and 65 percent CCl_4 was used as an extractant for low-level waste (3 mg/l). The organic was found effective through nine consecutive batch stages. The waste was reduced in plutonium content by a factor of ten even in the last stage using $L/V = 2$.

During the stripping studies the most effective stripping agent was 5% Na_2CO_3 used after a 1 M HNO_3 wash. In tests with an $L/V = 0.2$, stripping did not occur until the acidity was appreciably reduced, then 85 percent of the plutonium was stripped in one stage. After four stages, 0.2 percent remained unstripped. At this time, the pH of the organic was 10 - 12.

d. Ceramic Development

Further development of magnesia-titania slip casting has resulted in samples with porosity as low as 0.8 percent.

This result was attained with a ten percent fraction of relatively coarse -28 +100 magnesia, milled along with the -200 magnesia and calcined titania. The resulting bodies were of high density and were also glazed. A significant effect was noted in that firing in the lower portion of the induction furnace resulted in greater porosity than in the upper portion.

Recent work has reduced the porosity of slip-cast magnesia from 25 percent to 9 - 10 percent and subsequently to 2 percent. The measurements were performed in the Chemical Development Operation using an Aminco-Winslow Porosimeter. For reference, gas-tight zirconia shows 2.7 percent porosity.

Manager
Research and Engineering

CHEMICAL PROCESSING DEPARTMENT
MONTHLY REPORT

JANUARY, 1961

II. ACHIEVEMENTS (continued)

H. FINANCIAL OPERATION

1. Production Cost

FY 1961 Midyear Budget Review data were forwarded to Accounting Operations for inclusion in January reporting.

FY 1962 and FY 1963 budgeted manpower has been approved at the department level and is now ready for submission to Contract and Accounting Operation.

Plant and General Maintenance process account codes were revised, effective with February business, in order to provide more definitive breakdowns for cost control and reporting purposes.

Work on a revised coding system for Purex maintenance was essentially completed by month end. The new coding system will segregate maintenance cost into control centers which will be more meaningful to Purex management and will isolate areas of potential cost jeopardy more promptly than in the past.

Statistics on Recuplex costs from CY 1956 through CY 1960 were provided the Manager, Finished Products Operation for use at a Washington, D. C. conference.

CPD's net investment in inventories at 12-31-60 is compared to the net investment at 11-30-60 below:

(amounts in thousands)	<u>Balance</u> <u>11-30-60</u>	<u>Balance</u> <u>12-31-60</u>	<u>Dollar</u> <u>Change</u>	<u>Percent</u> <u>Change</u>
<u>Inventories</u>				
Essential Materials	\$ 842	\$ 780	\$(62)	(7.4)
Special Materials	65	64	(1)	(1.5)
Spare Parts	<u>1 568</u>	<u>1 579</u>	<u>11</u>	<u>.7</u>
Gross Inventories	<u>2 475</u>	<u>2 423</u>	<u>(52)</u>	<u>(2.1)</u>
<u>Reserves</u>				
Essential Materials	(53)	(52)	1	1.9
Special Materials	-0-	-0-		
Spare Parts	<u>(420)</u>	<u>(419)</u>	<u>1</u>	<u>.2</u>
Total Reserves	<u>(473)</u>	<u>(471)</u>	<u>2</u>	<u>.4</u>
Net Investment	<u>\$2 002</u>	<u>\$1 952</u>	<u>\$(50)</u>	<u>(2.5)</u>

The Essential Material turnover rate was 4.2 in December and 3.7 FYTD compared to 2.6 in FY 1960.

The Spare Parts turnover rate was .61 in December and .53 FYTD compared to .43 in FY 1960.

2. Singular Cost Studies

Two CPD and one HOO-AEC financial representatives travelled to Savannah River during the month for the purpose of comparing chemical separations costs of the two sites. These cost comparisons were requested of the HOO-AEC office by the Washington, D. C. Director, Division of Production.

3. General Accounting

As of December 31, 1960, there were thirteen active projects with incurred costs of \$4,948,154 against authorized funds of \$7,148,400. Outstanding commitments totaled \$106,749.

During the month an AEC Authority was received increasing the amount authorized for Project CAC-880 - Plutonium Reclamation Facility, Z Plant from \$150,000 to \$200,000.

Construction projects totalling \$3,481,291 were unitized during January.

During December the AEC requested that the value of Plant and Equipment held in standby status be removed from Plant and Equipment asset accounts so that their value would not show on the Plant and Equipment reports. Since Plant and Equipment is placed in standby status with 100% reserve, this entry resulted in a reduction of total CPD asset value by \$36,703,279 but did not change the net value of assets less reserve. Memorandum records will continue to be maintained for control of this property.

4. Personnel Accounting

After reinvestigation, a 1955 Workmen's Compensation claim was reopened resulting in the awarding of approximately \$600 of additional benefits to the employee.

A new interpretation of total disability and its application to weekly sickness and accident payments was received from Services in New York which was reviewed with appropriate personnel responsible for implementing the policy.

Newly designed time cards were placed in use this month which provide greater facility in processing cards of employees working standard shifts on which no overtime, holiday pay, or absence occurred.

5. Auditing

An audit report was issued relating to an examination of records supporting CPD eligibility for safety awards during CY 1960. The activities audited were satisfactory.

Field work was completed in connection with an audit of CPD administration of the GE Suggestion Plan.

Field work was started on an audit of CPD Motor Pool Operations.

6. Measurements and Procedures

Office, photographic and radio and audio-visual equipment budgets for CPD were completed in January and forwarded to CE&JO for inclusion in the HAPO budgets for submission to AEC.

Manager - Finance

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HW-68345

CHEMICAL PROCESSING DEPARTMENT
MONTHLY REPORT

JANUARY--1961

II. ACHIEVEMENTS (continued)

I. RELATIONS PRACTICES OPERATION

1. Salary Administration

Analyses of the results of the 1960 Exempt Appraisal and 1961 Salary Review Programs were prepared and discussed with the General Manager. The Review was approved and placed in effect as scheduled. Several discussions of the Salary Review analysis as applied to the individual sections have been made with section managers.

The Department Salary Distribution Data and Personnel Ratio reports were issued.

Revised organizations for the Purex Processing and Purex Special Products and Material Handling Subsections were approved. As a result of restructuring and placement of new product responsibilities, ten new or revised positions were established in the Purex Operation.

2. Personnel Placement

An offer was extended to a former MTP graduate for permanent assignment within the Chemical Processing Department during the month. An acceptance was received from one of the offers for a permanent assignment extended last month. Offers were made to two additional Technical Graduates from the Western Circuit of the Engineering Program with acceptances being received from both people.

In response to a request from the Manager, Education and Training, an estimate was submitted for the numbers of MTP trainees and regular employees from CPD who will enroll in the Manufacturing Studies to begin next September, 1961.

3. Wage and Benefits

One employee, a supervisor in Power and General Maintenance, retired this month.

An audit covering representative semi-technical jobs in the Department was started. This audit is being conducted by the Relations Operation Wage Administrator with the assistance of the CPD Wage and Benefits Specialist and is scheduled for completion by March 1.

A new simplified procedure for distribution of suggestion award checks was put into effect this month. Checks are now sent directly to the suggester's component by Payroll along with the weekly salary checks. Also, starting this month silver certificates are presented for awards of \$50 - \$499 and gold certificates are presented for awards of \$500 or more.

The first of a series of meetings with the Suggestion Administrators for IPD and FPD was attended this month. The purpose of these meetings is to exchange information on problems, methods, and experience in an effort to improve performance and provide for more uniform interpretation and administration of the Suggestion Plan in the production departments. Depending on the benefits gained, the meetings may be established on a regular monthly or bi-monthly basis.

An employee death occurred on January 11. An Ironworker-Rigger from Finished Products Operation passed away suddenly due to a heart attack. Completion of life insurance, salary and stock bonus matters are awaiting action by the beneficiary.

Suggestion Plan Activity

	January 1961	December 1960
Received	43	36
Adopted	21	18
Awards	\$205.00	\$270.00
Savings	\$337.58	\$1,508.00

4. Health, Safety, and Radiation

Two injuries that had some potential for recorded disability were declared by Medical to be non-tab or medical treatment cases.

A small section of freshly coated surface in G-cell, 224-U Building, caught fire from welding slag that dropped from an overhead work area in adjacent H-cell. The area, covering approximately 8 ft. square, was completely blistered to the bare surface.

5. Communication

Arrangements were made early in the month for the Manager, Relations Operation to have meetings with groups of 200 and 100 Area management people on the subject of negotiations.

The two Chemical Processing Department Business Operations in our Changing Environment classes were completed and certificates presented during the month.

The "Living in the Tri-Cities" booklet being revised as an assistance to Hanford Laboratories Operation was completed and printed during the month.

RB Britton
Manager, Relations Practices

RB Britton:swj

CHEMICAL PROCESSING DEPARTMENT
MONTHLY REPORT

JANUARY - 1961

III. PERSONNEL ACTIVITIES

A. FORCE SUMMARY

<u>Operation</u>	<u>Monthly Salaried</u>		<u>Weekly Salaried</u>		<u>Total</u>	
	<u>12-31-60</u>	<u>1-31-61</u>	<u>12-31-60</u>	<u>1-31-61</u>	<u>12-31-60</u>	<u>1-31-61</u>
General Manager's Group	11	10	1	1	12	11
Financial	13	13	13	13	26	26
Relations Practices	5	5	6	6	11	11
Research & Engineering	62	62	27	27	89	89
Facilities Engineering	65	65	22	22	87	87
Power & General Maintenance	42	42	244	243	286	285
Production	5	5	3	3	8	8
Special Separation Processing and Auxiliaries	50	50	214	214	264	264
Purex	51	53	218	215	269	268
Finished Products	<u>54</u>	<u>53</u>	<u>219</u>	<u>231</u>	<u>273</u>	<u>284</u>
Total	<u>358</u>	<u>358</u>	<u>967</u>	<u>975</u>	<u>1 325</u>	<u>1 333</u>

B. PERSONNEL CHANGES

Francis A. Fieser, Specialist-Measurements and Procedures, transferred to Computer Department, Phoenix, Arizona, effective February 1, 1961.

C. TRIPS

<u>Visitor</u>	<u>To</u>	<u>Nature of Discussion</u>
<u>To Other G.E. Components</u>		
H. E. York	Manufacturing Services Schenectady, N.Y.	Numerical input systems. (1/19/61)
P. E. Cunningham	Manufacturing Services Schenectady, N.Y.	Power & Maintenance problems. (1/26-27/61)
M. G. Mass	APED San Jose, Calif.	Communication problems. (1/26/61)
<u>To AEC and Other AEC Contractors</u>		
K. G. Grimm J. E. McDonald	duPont (SRP) Aiken, S. C.	Unit Cost comparisons (1/3-6/61)
L. I. Brecke A. E. Smith H. E. York	UCNC(ORNL) Oak Ridge, Tenn.	Super accuracy meeting (1/16-18/61)
<u>To General Industry</u>		
P. S. Kingsley G. E. Williams	Griscom-Russel Co. Massillon, Ohio	Welding techniques and inspect titanium tube bundles. (1/9-12/61)
L. L. McGregor	Metrolonics, Inc. Burbank, Calif.	Linear metrology (1/23-27/61)
<u>To Conventions and General Meetings</u>		
P. E. Cunningham Alex Smith	Chicago, Ill.	Plant Maintenance and Engineer- ing Conference (1/23-25/61)
Alex Smith	Chicago, Ill.	Plant Maintenance & Engineering Executive Study Group. (1/26-27/61)
W. G. Browne	Burbank, Wash.	Address high school students. (1/24/61)
M. Mass	San Francisco, Calif.	Communication workshop (1/27/61)

D. VISITORS

<u>Visitor</u>	<u>From</u>	<u>Nature of Discussion</u>
<u>From Other G.E. Components</u>		
J. L. Michaelson	GEL, Schenectady, N.Y.	Research contracts (1/17/61)
G. Sege	APED, San Jose, Calif.	Technological hazards review. (1/30/61)
<u>From AEC and AEC Operational Contractors</u>		
A. D. Starbird	DMA-AEC Washington, D.C.	234-5 processing and tour. (1/10/61)
A. W. Joyce	duPont (SRP)	Technology of dissolving,
R. I. Martens	Aiken, S. C.	equipment, and process.
D. A. Orth		(1/18-19/61)
F. W. Empson	UCNC (ORNL) Oak Ridge, Tenn.	Waste disposal (1/20/61)
C. W. Showalter	DOP-AEC Washington, D.C.	Purex plant and process orienta- tion (1/20/61)
R. A. Kohler	DOP-AEC	Program review (1/23-25/61)
W. J. Lindsey	Washington, D.C.	
E. F. Miller		
L. F. Murphy		
G. F. Quinn		
C. W. Showalter		
<u>From General Industry</u>		
R. H. Studebaker	Process Equipment Co. Tripp City, Ohio	Waste storage tanks. (1/8-9/61)
W. Philson	Mallinckrodt Chem. Co.	Process discussion and tour
W. T. Trask	Weldon Springs, Mo.	Purex (1/11/61)
M. Garger	Pennsalt Chem. Corp. Los Angeles, Calif.	Decontamination procedures. (1/12/61)
A. Gunderson	Groton Machine Co.	Problems and testing of lathes.
C. A. Larson	Racine, Wisc.	(1/16-19/61)
P. Berner	Star Machinery Co. Seattle, Wash.	Problems and testing of lathes. (1/16-19/61)

DECLASSIFIED

HW-68345

<u>Visitor</u>	<u>From</u>	<u>Nature of Discussion</u>
H. Rowan	Inductotherm Corp. Delanco, N.J.	Equipment problem (1/16/61)
V. L. Anderson	Engineered Protective Coatings Co. San Bruno, Calif.	Application of protective coatings (1/24/61)

OFFICIAL USE ONLY
CHEMICAL PROCESSING DEPARTMENT
MONTHLY REPORT

January - 1961

IV. SAFETY AND SECURITY

Operation	Facil.		Finan.	Fin.	P&GM	Purex	SSP&AO	Prod.	Rel.		Res.& Eng.	Total CPD	Yr.to	
	Eng.	Prac.							Prac.	Eng.			Date	
Disabling Injuries												0	0	
Serious Accidents												0	0	
Medical Treatment	1		8		12	7	5			2		35	35	
Injuries														
Radiation Occur.			10			9	6					25	25	
Contam. Wounds			4*									4	4	
Pu Depositions												0	0	
Fires			1**									1	1	
Security Violations		1				1						2	2	

* An operator received a contaminated injury while handling a casting in the RMA conveyor hood. Counting results indicated approximately 0.011 uc within the punctured finger. The contaminant was removed, reducing the amount present to 0.0008 uc. Further studies and results pending.

An operator received a puncture wound while handling a casting in Unit I, Task VII. After incision, the amount of contamination remaining was 0.0005 uc. Bioassay results pending.

An instrument technician punctured his left hand middle finger while working in a hood. Results indicate a small amount of contaminant remained within the finger (0.00087 uc). Bioassay samples were scheduled and results are pending.

An operator punctured his left index finger while working in Hood 24B. After cleansing 0.0004 uc of contaminant remained within the finger. Bioassay results are pending.

** A fire occurred in 224-UA Building (G-cell) when welding slag ignited fresh paint causing approximately \$10 damage.

CHEMICAL PROCESSING DEPARTMENT
MONTHLY REPORT

JANUARY, 1961

V. REPORTS

A. PREPARED AND ISSUED

IIW-65000, Rev. 1, Secret, "Plutonium Conversion Program, Ten-Year Business Plan", dated December 10, 1960, W. N. Mobley.

IIW-64928, Secret, "Preliminary Design Criteria for the Interim Storage of High-level Radioactive Liquid Wastes", dated December 16, 1960, H. W. Stivers.

IIW-67957, Secret, "Separations Program - CPD", dated January 12, 1961, L. L. Zahn.

IIW-68004 RD, Secret, "Redox Plant Production Schedule, January, 1961", dated January 4, 1961, D. McDonald.

IIW-68005 RD, Secret, "Purex Plant Production Schedule, January, 1961", dated January 4, 1961, D. McDonald.

IIW-68006 RD, Secret, "UO₃ Plant Production Schedule, January, 1961", dated January 4, 1961, D. McDonald.

IIW-68007 RD, Secret, "234-5 Building Production Schedule, January, 1961", dated January 4, 1961, D. McDonald.

IIW-68021, Unclassified, "Shielding Requirements for NPR Production in Plutonium Reclamation Facility - Project CAC 880", dated January 5, 1961, H. A. Moulthrop.

IIW-68023, Unclassified, "Development of Gamma and Neutron Radiation Data from Three Alternate Design Concepts for the Plutonium Reclamation Facility - CAC-880", dated January 4, 1961, H. A. Moulthrop.

IIW-68027, Secret, "CPD Daily Production Reports, 10-3-60 through 12-31-60", dated January 5, 1961, R. E. Roberts.

IIW-68038, Secret, "Hanford Ten-Year Machine Tool and Gage Modernization Program", dated January 12, 1961, R. E. Olson, A. E. Smith, W. P. Ingalls.

IIW-68044, Unclassified, "Mark V Dissolver Information Manual", dated January 6, 1961, H. P. Simonds.

- IIW-68081, Official Use Only, "Strontium-90 Shipping Cask Design and Hazards Evaluation", dated January 13, 1961, C. W. Smith.
- IIW-68117, Secret, "Essential Materials Consumption - Purex, December, 1960", dated January 10, 1961, J. E. Lentz.
- IIW-68126, Secret, "CPD - Plant Improvement Program", dated January 16, 1961, P. H. Reinker.
- IIW-68128, Unclassified, "An Alternate Method for Purex Solvent Recovery", dated January 12, 1961, C. W. Pollock and T. R. McKenzie.
- IIW-68153, Unclassified, "Glove Box Glove Retainer", dated January 13, 1961, R. A. Ciccarelli and D. D. Wodrich.
- IIW-68165, Secret, "Design Scope Review, Project CAC-880 - Plutonium Reclamation Facility", dated January 18, 1961, D. E. Braden and E. O. Swain.
- IIW-68221 RD, Secret, "Quarterly Forecast CPD - January, 1961 through June, 1966", dated January 18, 1961, D. McDonald.
- IIW-68266 RD, Secret, "Third Quarter FY-61 and First Quarter FY-62 Forecast of Nuclear Material Requirements - CPD", dated January 25, 1961, R. E. Roberts.
- IIW-68267, Secret, "In-Plant Neutron Multiplication Test No. 1", dated January 25, 1961, R. L. Stevenson.
- IIW-68282, Unclassified, "Reprocessing of NPR Fuels at Redox", dated January 27, 1961, W. A. Graf.
- IIW-68283 RD, Secret, "Radioisotope Requirements", dated January 26, 1961, B. F. Judson.
- IIW-68290, Unclassified, "Fission Product Shipping Cask Hazard and Liability Evaluation Team Report", dated January 27, 1961, L. L. Zahn.
- IIW-68291, Secret, "CPD Waste Status Summary for November, 1960", dated January 25, 1961, J. E. Lentz.
- IIW-68292, Secret, "CPD Waste Status Summary for December, 1960", dated January 25, 1961.
- IIW-68301, Unclassified, "Annular Decalco Insert for Cerium Cask", dated January 27, 1961, C. W. Smith.
- IIW-68327 RD, Secret, "Monthly Activity Reports, 234-5 Development, CY-1961" dated January 31, 1961, H. H. Hopkins, Jr., by Members of 234-5 Development Operation.

B. PREPARED FOR SIGNATURE AND ISSUANCE

IIW-67984, Secret, "Production, December, 1960", dated January 3, 1961,
W. E. Johnson.

IIW-68078, Secret, "HAPO Production Forecast - January, 1961 Through
June, 1966", dated January 25, 1961, W. E. Johnson.

CHEMICAL PROCESSING DEPARTMENT
MONTHLY REPORT

JANUARY, 1961

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>
Morris S. May, Power & General Maintenance	A Device for Remotely Re-
Dougald Thompson " " "	placing Electrical Wall
Henry C. Wiegert " " "	Connectors
L. R. Michels, Facilities Engineering	Improved Method for Storage
	of Radioactive Waste Solutions
	Through the Use of Vacuum
L. R. Michels, Facilities Engineering	Improved Sampling Equipment
W. A. Graf " "	for Nuclear or Toxic Materials
C. W. Pollock, Research and Engineering	An Alternate Method for Purex
T. R. McKenzie " "	Solvent Recovery (Unclassified
	HW-68128) dated January 12, 1961

P. H. Rinker

General Manager
Chemical Processing Department

END

**DATE
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