AIM

Association for Information and Image Management

1100 Wayne Avenue, Suite 1100
Silver Spring, Maryland 20910
301/587-8202

Centimeter

Inches

MANUFACTURED TO AIM STANDARDS
BY APPLIED IMAGE, INC.

1 of 1

DECLASSIFIED ~~SECRET~~RL-337 (REV. 4-65)
AEC-RLOO RICHLAND WASH.UNITED STATES ATOMIC ENERGY COMMISSION
RICHLAND OPERATIONS OFFICETO: H. E. Parker
DIRECTOR - DEPUTY DIRECTOR
CHEM. PROC. DIVISION - RLOODATE June 13, 1966HAN-93855
Report No. 5
May 1966FROM: J. T. Christy CHIEF,
CHEMICAL OPERATIONS BRANCH
CHEM. PROC. DIVISION - RLOOSUBJECT: 200 AREA MONTHLY REPORT FOR May 1966

DC:EBJ/AWL/EAA/MJR

This document consists of
16 pages, No. 7
copies. Series A

P R O C E S S I N G   S T A T I S T I C S

P R O D U C T I O N

PRODUCT					PERCENT EFFICIENCY		PERCENT WASTE LOSSES		ATM RELEASE	
PUREX REDOX URANIUM REDUCTION	URANIUM				OP	MECH	PU	U	CURIES / DAY	
	NORMAL		ENRICHED							
	TONS	PERCENT FORECAST	TONS	PERCENT FORECAST						
	<u>*16.5</u>	<u>--</u>	<u>106.1</u>	<u>78.6</u>						
	<u>--</u>		<u>76.0</u>	<u>63.3</u>						
<u>0</u>	<u>--</u>			<u>--</u>	<u>--</u>	<u>0.37</u>	<u>0.09</u>	<u>0.001</u>		
								<u>0.02</u>		
PUREX REDOX	BRANDY OR NEPTUNIUM				Classification Cancelled and Changed To					* Thorium
	KGS		PERCENT FORECAST		DECLASSIFIED					** U-233
	<u>--</u>		<u>--</u>		By Authority of <u>CG-PR-2</u>					
	<u>--</u>		<u>--</u>		<u>DS Lewis</u> 1-14-74					
	<u>--</u>		<u>--</u>		By <u>PL Sullivan</u> 1-27-94					
PLUTONIUM REDUCTION	PLUTONIUM				Verified By <u>WJ Hughes</u> 1-27-94					MASTER
	KGS		PERCENT FORECAST							
	<u>310.5</u>		<u>155</u>							
	<u>90.9</u>		<u>--</u>							
	<u>90.9</u>		<u>--</u>							
RECOVERY	<u>90.9</u>		<u>--</u>		<u>--</u>	<u>--</u>	<u>--</u>	<u>--</u>	2B DOCUMENT IS UNLIMITED	

I N V E N T O R Y   L I S T I N G   O F   T H I S   D O C U M E N T

PLUTONIUM		URANIUM	
SCRAP BACKLOG <u>821.1</u> KGS		NORMAL	ENRICHED
SCRAP COMPOSITION:		HANFORD CODE <u>C-65</u>	
PLUTONIUM PROCESSING	<u>38.1</u>	UNH <u>58</u> TONS	<u>80</u> TONS
FABRICATION	<u>12.4</u>	UO ₃ <u>11,723</u> TONS	<u>36</u> TONS
RECOVERY	<u>0.3</u>		
BNW LABORATORY	<u>12.8</u>		
OFF-SITE	<u>5.9</u>		
SUPPORTING LABORATORIES	<u>4.3</u>		
INCINERATOR	<u>26.2</u>		
GROUP 1	100 %		

EXCLUDED FROM AUTOMATIC DOWNGRADING
AND DECLASSIFICATION**RESTRICTED DATA**This document contains information that is classified
in the Atomic Energy Act of 1954. Its transmittal
in any form or by any means is prohibited.

DECLASSIFIED

~~SECRET~~

DECLASSIFIED

PUREX

The plant continued flushing and equipment changeout operations until May 11, 1966. Thoria was then charged to the dissolvers and the rework of the test run material was started in the final thorium cycle equipment on that date. Hot thorium processing was started in the solvent extraction battery on May 23, 1966. Processing was then continuous for the remainder of the month except for a shutdown on May 26 to install a new booster jet to improve the flow of LBXT (partition cycle). The Th processing rate has been limited to 6 tons per day by the dissolver operation. At month end, about 45 tons of thoria had been dissolved. Improvement to the dissolving cycle is being attempted in order to increase the processing rate.

The thorium nitrate solution from the test run of January 1965 was reprocessed in the final thorium cycle. The principal contaminants were sodium (10,000 ppm) and U_{238} (200 ppm). The U_{238} was reduced after twelve passes through the cycle to 7 ppm.

The product quality at month end was acceptable for both thorium and U-233. The ruthenium levels in the thorium product were 2- to 3-fold higher than predicted. This level is still acceptable and can be expected to rise as the "cooling" time decreases.

Replacement of several pieces of processing equipment in N-Cell processing hood was completed. This included the N-6 concentrator loop and XCP cooler made of tantalum and N-7 product receivers and associated piping made of titanium.

A new 10-ton rotating hook was fabricated and assembled for use on either Purex canyon crane.

A mechanical drive coupling failed on the west canyon crane due to metal fatigue. A new coupling was installed and the crane was returned to service.

An electrical heating system was installed on the two canyon vacuum breakers to prevent freezing during cold weather.

The 203-A pump house was renovated including an overhaul of two acid pumps.

The agitator on the J-1 tank (1st uranium cycle receiver) failed and was replaced. The tank was also repositioned in the cell by placing shims on the support pads.

~~SECRET~~

~~SECRET~~

PUREX (continued)

Twenty canyon process jumpers were repaired or modified for use in the thorium operations. Ten other jumpers were replaced by new ones.

A new H3 column pulser was installed as a replacement for a failed unit.

Core drilling was started for installation of a spare line for the K4 concentrator steam condensate.

A box of failed jumpers was buried without contamination spread.

Iodine-131 emission:

Total for the month	.03 curie
Average	.001 curie
Maximum for one day	.01 curie

DECLASSIFIED

~~SECRET~~

~~SECRET~~
DECLASSIFIED

REDOX

Production of enriched UNH was 104 tons U, which was 78.6 % of forecast. The material processed during the month included 31.2 tons of NPR "Spike" fuel elements (125 uranium outer tube and 94 uranium inner tube) and 72.8 tons standard 94 uranium.

Processing Experience

Dissolution and solvent-extraction processing of the production campaign of Zircaloy-clad NPR Spike fuel was completed on May 9. Process performance data and experience are summarized below:

1. Over-all dissolution capacity was approximately half of that achieved during 94 NPR fuel processing. The rate reduction was caused by requirements for criticality control and decrease in the amount of uranium that could be transported on each cask car. The dissolver charge was reduced by about 10 percent and the amount transported per cask car was decreased by a factor of two.
2. The Zircaloy decladding flowsheet utilized 5.5 M NH_4NO_3 , a 7:1 fluoride-to-zirconium mole ratio, and a 15-hour boiling digest. Under these conditions, the Zircaloy cladding was not totally dissolved on any fuel charge.
3. Product losses to canister decladding, Zircaloy decladding, and solvent extraction wastes were:

	Waste Losses	Percent
	<u>Pu</u>	<u>U</u>
Canister Dissolution	0.02	0.02
Zircaloy Decladding	0.46	0.94
Solvent Extraction Wastes	0.13	0.11

4. Plugging of the waste transfer line used for routing canister and neutralized Zircaloy wastes to the waste tank required the use of an alternate routing. No line pluggage problems were experienced after this routing change was made. Zircaloy wastes were neutralized by "reverse strike" procedure during the entire campaign. Laboratory efforts to find a dispersing agent capable of keeping neutralized Zircaloy solids in suspension is under investigation.

~~SECRET~~
REDOX (continued)

Processing Experience (continued)

5. Fluoride analysis of first cut dissolver solutions indicate a U-to-UF₄ conversion of 6.0 percent of the "spike" fuel charge. The corresponding value for the 0.947 percent enriched NPR fuel averaged 3.8 percent.

At the completion of the NPR fuel processing, the equipment was cleaned out and flushed with 57% nitric acid. Processing of standard 94 metal was begun on May 21, and with the exception of two minor outages, operations were continuous to month end.

Maintenance Experience

After nine years of operation, the D-8 (waste neutralizer) agitator failed and was replaced with the last spare. This same agitator spares the D-2 (condensate sampler) and in the event another unit is needed for either of these positions, one of the D-1 (sump receiver) series can be modified by lengthening the shaft. The D-14 (backcycle concentrator) pump was removed because of low capacity and was replaced with a new unit. Work accomplished during the shutdown period between campaigns included removal and disposal of the charcoal filter, replacement of the D-12 waste evaporator, reactivation of the column carrier, and overhaul of the column instrumentation.

Radiation Experience

Iodine Emission:

Average	0.02 ci/da
Daily Maximum	0.06 ci
Total for Month	0.64 ci

DECLASSIFIED

~~SECRET~~

DECLASSIFIED

UO₃

Processing of enriched oxide was 63.3% of forecast. There was no normal UNH available for processing because Purex processed thoria during the month. Four carloads of enriched uranium oxide were shipped to Fernald during the month.

Processing of enriched material was interrupted 15 days during the month due to an inadequate supply of feed. All of the NPR material produced during the recent campaign at Redox was processed. "G" and "H" calciners were back on standard 94 material on May 31.

~~SECRET~~

~~SECRET~~

PLUTONIUM FINISHING 234-5

The production of plutonium metal was 155 % of forecast.

Processing Experience

Plutonium metal production operated for three weeks during May, but thereafter was shut down for lack of feed solution. There was no time lost for maintenance but the button line was operated only 50% of the available time. The average rate while operating was only .88 kg Pu per hour due primarily to a slower schedule while producing plutonium oxide. About 35% of the month's production was oxide, thus saving essential chemicals and the cost of recovering slag and crucible fragments. Reduction yields were excellent averaging 98.5% recovery.

There were several product changes during the month with less than one day turnaround time required to cleanout and start the next product. The several products included plutonium metal at 6% Pu-240, plutonium metal at 8% Pu-240, plutonium metal at 12% Pu-240, and plutonium oxide at 12% Pu-240.

Miscellaneous maintenance included the replacement of 224 filters in the E-3 hood exhaust system.

Product Quality

The plutonium metal was of high quality but with slightly more impurities than in recent months. Total metallic impurities plus carbon averaged 834 ppm. No buttons were rejected for either impurities or density. Average metal density was 19.41 g/cc. The weapons grade plutonium contained 6.26% Pu-240.

Nonweapons Plutonium

Studies were made on the availability of 10 to 12% Pu-240 plutonium metal for the ZPPR Program. Shipments of nonweapons plutonium were as follows: 880 grams containing 8% Pu-240 shipped as oxide to Battelle-Ohio; 2 kg of metal and 80 kg of plutonium oxide containing 12% Pu-240 to Pacific Northwest Laboratories. There were no shipments to Euratom but 6.3 kg of plutonium oxide is being held for the account of Division of International Affairs.

DECLASSIFIED

~~SECRET~~

~~SECRET~~

DECLASSIFIED

PLUTONIUM RECLAMATION

Dissolving of the slag and crucible material exceeded the previous record. There were 91 kg of plutonium recovered for button line feed. The scrap backlog at month end was 821.1 kg of plutonium.

Plutonium Reclamation Facility

There were 45 kg of plutonium recovered from 1,856 cans of slag and crucible material. One dissolver changeout was necessary when the 06 unit plugged and was removed for maintenance. There were 15 pump failures, 12 of which were mechanical failures; all were repaired for reuse. The product concentrator developed a severe leak into the process cell. The vessel was flushed, drained, and removed to the maintenance station where repair work permitted the concentrator to be returned to service.

The uranium depletion flowsheet was used once and 200 grams of uranium were purged from the system.

The processing of magnesia crucibles from the idled fabrication line has become routine. These magnesia crucible fragments are ground and canned. Two cans of the magnesia are interspersed among 10 cans of reduction waste as feed to the continuous S&C dissolvers. More of the magnesia is dissolved in the batch dissolvers as time permits. The present schedule will permit approximately 75 kg of plutonium to be recovered in about 11 months. The recovery of trace plutonium from fabrication oil (lard oil plus carbon tetrachloride) became routine. The plutonium is stripped from the organic with 10 M HNO_3 containing 50 to 100 ppm of Mistron as a de-emulsifier.

Waste Treatment

Treatment of 123,915 liters of aqueous waste yielded 203 grams of plutonium for return to production. There were 19.8 grams of americium recovered in crude solution.

Incinerator Building

Installation of the new combustion chambers, flues, and cyclones in the incinerator furnace is underway. There were 24 waste boxes received, 5 of which were processed by leaching leaving 604 boxes to be processed.

Recuplex Cleanup

Plutonium cleanout from the S&C hood was completed. Plutonium removals from Recuplex now total 33.5 kg. It is necessary to reenforce a sagging panel on the SE Hood after which the access ports to these hoods are to be closed for long term storage.

~~SECRET~~

FISSION PRODUCTS

Purex head end did not produce fission products during the month because the equipment was in use for thorium processing.

At the Strontium Semiworks, promethium processing, which began in March, was completed during the month with the recovery and delivery to Pacific Northwest Laboratory of 3.545 megacuries of 2.5 year aged Pm-147. Using a D2EHPA (di-2-ethylhexylphosphoric acid) extraction flowsheet, the two-month campaign was very successful. In the final run, promethium losses were less than 0.7 percent, and decontamination factors for the major impurities, lead and sodium, were 5000 and 2000, respectively. Over-all promethium flowsheet losses were less than one percent during the entire campaign. There are approximately 80 grams of americium-241 that are associated with the 3.545 megacuries of Pm-147 which may be recoverable during further PNL ion exchange processing. The Semiworks facility is currently being flushed and cleaned out in preparation for B-Plant flowsheet process tests.

During the last cesium-137 processing campaign at 801-C Loadout Facility, plugging of a filter screen in the cask feed line was encountered, requiring frequent interruptions of the cask loading for filter backflushing. It was determined that solids precipitate in a cooler in the feed line at the cask loading temperature of 20° C. Process tests indicate that precipitation does not occur if the feed is kept above 35° C. As an interim measure, the casks are being loaded at about 40° C with reduced loading until a more satisfactory long-term solution is developed.

At B-Plant, oxalate processing of Tank 003CR fission product crude was resumed on May 20. Approximately 3890 kilocuries of Pm-147 and 880 kilocuries of Sr-90 were separated. Promethium losses to the strontium fraction were less than two percent.

Cask Loadings and Shipments

Two shipments of Pm-147, 520 kci and 560 kci, were shipped to PNL during May. This completes the FY-1966 and a portion of FY-1967 Pm-147 requirements for PNL. The HAPO II-2 cask, containing 150 kci of Sr-90 scheduled for Quehanna, was diverted enroute to ORNL after it was determined by OR that the material could be better used at ORNL. The HAPO IB-1 cask containing 340 kci of Sr-90 was shipped to ORNL on May 2, 1966. Cesium casks 44 and 48 were shipped to ORNL on May 8, 1966. The HAPO IB-3 cask was loaded with Sr-90 and is undergoing calorimeter checking in preparation for shipment to ORNL early in June. This will complete all off-site Sr-90 requirements covered by the Interim Fission Product Program.

DECLASSIFIED

~~SECRET~~

FISSION PRODUCTS (continued)

Fission Product Inventory (kci)

	<u>CR Vault</u>	<u>B-Plant</u>	<u>SSW</u>	<u>Casks</u>	<u>Total</u>
Sr-90	2,810	940 ⁽¹⁾	910	410 ⁽³⁾	5,070
Pm-147 (unaged)	720	15,100 ⁽²⁾	0	0	16,820

- (1) Process loss 20 kci
 (2) Process loss 80 kci
 (3) Loaded in HAPO IB-3

~~SECRET~~

~~SECRET~~

WASTE MANAGEMENT ACTIVITIES

The following table shows the May 31, 1966, status of waste storage tanks that have leaked or are suspected leakers.

<u>Tank</u>	<u>Lateral</u>	<u>Radiation C/M</u>	<u>Liquid Depth (in)</u>	<u>Sludge Depth (in)</u>	<u>Average Temp. (C°)</u>
107 SX	S68°15'E	1.65 x 10 ⁶	188	24	141.7
108 SX	S41°50'E	1.05 x 10 ⁶	238.5	24	136.1
	S59°18'E	1.02 x 10 ⁵			
	S77°15'E	97 x 10 ⁴			
109 SX	S20°45'W	38 x 10 ³	219	72	116.1
	S45° 0'W	54 x 10 ³			
	S69°15'W	15 x 10 ⁴			
105 A	No. 3	225 x 10 ³	312	24	110
Test Well	No. 29	4 x 10 ⁵			

Individual tank inventories and tank farm inventory measurements indicate no measurable loss of material.

The temperature increase in tank 103-AX reported last month has been arrested, with sludge temperatures showing a downward trend during the month. Some of the thermocouples still read near 200° C, with a maximum temperature measurement of 260° C. The tank contents were diluted from 880,000 to 950,000 gallons on April 20 and additionally diluted to 990,000 gallons on May 17. A total of 310 CFM of air is being added via the air circulators to provide maximum circulation. Sludge temperature has decreased from 156° C to 139° C during the month. The sludge depth averages 1.5 feet. Additions to the tank have been limited to condensate water since May 17.

In-Tank Solidification

The installation of a second parallel Teflon de-entrainer pad on the ITS off-gas train has permitted operation on a nearly continuous basis at a boil-off rate of 4.9 gpm. Alternate flushing of the de-entrainer pads has eliminated the need to shut down because of differential pressure in the off-gas system. Excessive back-pressure in the air circulator resulted in a rupture in the upper expansion joint which required replacement. Also, a once-per-shift flushing of the air circulator is necessary to maintain adequate air flow into the unit. The periodic rapid water flush to the circulator has

DECLASSIFIED

SECRET
WASTE MANAGEMENT ACTIVITIES (continued)

In-Tank Solidification (continued)

maintained satisfactory back-pressure without shut downs. The ITS unit recovered 134,000 gallons of waste storage space during the month for a total to date of 2,045,000 gallons.

242-T Waste Evaporator

The 242-T evaporator operated at an on-line efficiency of 83% at an average boil-off rate of 3.5 gpm. This unit recovered 129,000 gallons of storage space during the month for a total to date of 1,280,313 gallons. Approximately five days of outage were required for maintenance of the evaporator facility. This maintenance consisted of the installation of a new lid on the off-gas scrubber and rerouting of the steam line used to purge the evaporator bottoms discharge line.

~~SECRET~~

CHEMICAL RESEARCH AND DEVELOPMENT

Thoria and U-233

Tests with a series of thoria pellets containing sodium oxide indicated that maximum density is obtained when sodium is between 8% and 14%, probably near 11%.

Ion exchange processing studies of de-daughterizing U-233 nitrate solution indicated that thorium loading on a cation resin column is lowered from 75-80% of theoretical thorium retention to approximately 25-40% due to small amounts of chloride or sulfate in the feed. Scouting work indicated there were advantages to using an anion exchange system where 40% of theoretical thorium loading was indicated and with less dilution of the process stream.

A solvent extraction process for removing daughters from aged U-233 product is under development. A study flowsheet is being prepared in preparation for a miniature mixer settler test of a process using 10% DSBPP- CCL_4 (di-sec-butyl phenylphosphonate in carbon tetrachloride).

Bismuth-Polonium Separation

Further studies of the chemical stability of dibutyl carbitol (DBC) in contact with nitric acid show that nitrite has an important role in catalyzing reactions which result in marked reduction in polonium extraction. When nitrite was deliberately added to an experiment the polonium distribution ratio was reduced by a factor of 100. In a plant process it may be desirable to have a nitrite suppressor present in the polonium feed stream.

The study of bismuth recycle chemistry was continued. That Fe_2O_3 and Cr_2O_3 were not reduced by the carbon monoxide was confirmed through filtration and specific activity techniques.

Extraction of Np and Pu from Purex 1WW

Batch solvent extraction studies were continued on use of DBBP for extracting neptunium and plutonium from Purex acid waste. Attempts to reduce the extraction of Zr-Nb and Ce by addition of organic complexing agents such as citric acid, EDTA, etc., were not successful. It was found that scrubbing the organic with 6 molar HNO_3 removed over 95% of Ce but less than 1% of the Np and Pu. Studies continue on the behavior of the Zr-Nb.

DECLASSIFIED

~~SECRET~~

DECLASSIFIED

~~SECRET~~

CHEMICAL RESEARCH AND DEVELOPMENT (continued)

Insertion of Transfer Pumps into Waste Storage Tanks

When inserting transfer pumps into underground waste storage tanks, the pump may be prevented from going full depth by interference from the sludge. A reduced scale model of a sluicing ring designed by Vitro engineers to sluice a hole in the sludge was tested in simulated materials. The tests indicate the original design must be modified and therefore additional development work was planned to assure a successful design.

Nuclear Safety Studies

A series of studies on 210 uranium were completed in the Plutonium Critical Mass Laboratory. Nuclear safety limits were defined for 210 uranium in handling zircaloy clad fuels, scrap metal, and the uranium oxide.

Twenty tests have been made on plutonium metal fires. Magnesium oxide sands or lead metal are the most effective extinguishments tested thus far. Argon gas is effective if supplied at 35 cubic feet per hour.

The above plutonium metal fire tests were utilized to measure the extent to which plutonium became airborne. The plutonium release appears to be a function of metal condition and structure phase in addition to air flow. The minimum release occurred when the burning metal was covered with magnesium oxide sand. In the highest release, 0.049% of the plutonium was airborne.

~~SECRET~~

~~SECRET~~

PROJECT ACTIVITY

CGC-124 - Increased Processing Flexibility--Purex

Construction is 82% versus an 82% scheduled. Delivery of remaining four tanks is expected in October 1966 for installation in November.

CAC-144 - Waste Fractionization--B-Plant

Construction is 50% versus 45% scheduled.

CAC-169 - Sludge Removal and Transfer, 200-E Area

Favorable lump sum construction bids were received on June 2, 1966, for the major portion of the project.

CAC-171 - Ventilation Improvements--234-5 Analytical Laboratory

Construction is 33% complete and ahead of schedule.

CAC-172 - Plutonium Concentration and Storage Facilities
Modifications "L" Cell

Design is 95% complete. A criteria change to give U-233 capability is being considered.

CAC-176 - In-Tank Solidification Unit No. 2

Design is 75% complete versus 97% scheduled. Delay has resulted from necessity to perform additional laboratory development work.

CGC-180 - Plutonium Buy-Back Facility

Physical completion was attained on May 31, 1966.

CAC-181 - B-Plant Modification for FPCE Integration.

Project Proposal Revision 2 was approved and forwarded to Headquarters on May 24, 1966. Design is proceeding under a previous authorization.

CGC-183 - Purex 4.0 Capacity Factor Expansion

Design criteria has been approved and design authorized.

~~SECRET~~

DECLASSIFIED

PROJECT ACTIVITY (continued)

IAE-600 - UNH Facility Modifications--Purex

Project was authorized on May 6, 1966, in the amount of \$60,000.

IAP-602 - Export Water Line

Design criteria was approved and a project proposal is being considered for FY-1967 funding.

ICP-603 - Modify Tank 105-SX for Boiling Waste

A project was authorized in the amount of \$95,000, with completion targeted for November 1966.

ICP-604 - Analytical Laboratory for Waste Management in 222-S Building

A project in the amount of \$340,000 was authorized on May 24, 1966.

In addition, design criteria has been developed for (1) Expansion of Vapor Handling Facilities for 241-A and 241-AX Tank Farms and (2) Purex Coil Water Diversion Facilities.

~~SECRET~~

DATE

FILMED

8/17/94

END