

~~SECRET~~

- 2 -

CONTROL SECTION

As a result of the procedure recently instigated by the Atomic Energy Commission for the processing of contaminated metals, the program for the decontamination of platinum has been discontinued.

To increase efficiency and effect closer coordination of effort, the Calorimetric Assay Group and the Operations Counting Group have been combined to form one group, Calorimetry and Counting. This newly-formed group will perform all the functions of the previous groups, starting July 1, 1950.

The Operations Development Group is continuing the studies on various phases of the problem of reducing the effluent count from the Waste Disposal process. Work is under way on the use of ion-exchange resins and the scrubbing effect of steel wool, primarily on pilot-plant scale.

Results are being obtained on the use of the Stannous Chloride Reduction Process * on actual production batches. The apparatus is being modified and procedures developed which would permit the incorporation of this process in regular operations.

* Production Narrative - May.

"Y" SECTION

New type cameras have been developed, tested, and are about to be used as standard production equipment. These new cameras will save considerable operating time, reduce the personnel radiation exposure, and decrease the exposure of parts to the atmosphere.

~~SECRET~~

~~SECRET~~

- 3 -

NEUTRON SOURCE GROUP

Five polonium-beryllium neutron sources were prepared for shipment; one to Westinghouse Electric Corporation, Atomic Power Division, Homestead, Pennsylvania; one to the Naval Research Laboratory, Washington, D. C.; and three to Brookhaven National Laboratory.

2. Construction and Plant Maintenance - Narratives

An actual working test of the emergency system in the "T" Building was made on June 27, 1950. This test was conducted under all of the conditions under which we would expect to operate with the exception that the emergency water system was not used. It was felt that the extensive testing of the water systems and the lines after their use was not warranted. Operations and conditions in the buildings were satisfactory both from the standpoint of the Engineering Division and the Operations Division. Indications were that during full operation as required, we could be expected to operate our Diesels within as high as five per cent of their rated capacity, and this is the weakest point in operations for emergency. This is due to the fact that, in case of the breakdown of one of the Diesels during emergency operations, operations would necessarily shut down so that the other Diesel could provide the necessary current for operating air conditioning facilities in a reduced manner so as to keep the place liveable.

Representatives from the Chemical Warfare Service were here on June 26, 1950, to discuss final details pertinent to tests to be conducted by them starting August 1, 1950. A check on materials and equipment indicated that we were in a good position to proceed with the tests. The date of August 1 set by the Chemical Warfare Service is now dependent upon the delivery of the new type of

~~SECRET~~

~~SECRET~~

- 4 -

charcoal filters being fabricated by them and scheduled for shipment on July 15 or shortly thereafter.

3. Process Improvement, Research, and Development - Narrative

INTRODUCTION

The Research Division has completed its first year of operation under the new cost accounting and budget systems. It is estimated now that the costs for the year will fall slightly below the budget figures established in the December semi-annual fiscal review. Since the research program has been ^{well defined} (fairly well defined) for F-51, activities in the last month of F-50 have been directed toward preparations for a full scale operation immediately at the turn of the fiscal year. Staff increases dictated by the time schedules of the program have been made. Administrative controls over travel costs, salary increases, and costs in general have been slightly revised and somewhat tightened to aid operation under the new budget. A quarterly review procedure is also contemplated. Research reporting for F-51 will be continued on a quarterly basis, and reports will be made by major projects (essentially by budgetary "activities"). The Division is looking forward to an active educational program in the Wright Field - Ohio State Extension School and working seminar series at the Mount. Active participation in the laboratory management training, safety, and security programs is also planned.

POLONIUM PROJECT

Improvement of Present Process

Polonium has been deposited electrolytically from 1.35 N and 1.51 N nitric acid in an effort to check the purity of the deposit. About 80 to 86 per cent purity was obtained from the 1.35 N acid solution.

~~SECRET~~

~~SECRET~~

- 5 -

Development of New Processes

The water and the distillation unit for the polonium distillation apparatus have been fabricated and are being checked for defects.

Two production batches have been purified by the Stannous Chloride Process. Purity values, amount delivered in products, and bismuth content were favorable on product solutions containing up to 70 curies.

Waste Recovery and Disposal

An economic survey of the recovery of bismuth is being continued, and preliminary design of equipment has been started. Optimum conditions for plating and fusion of the metal on a plant scale are being worked out.

The addition of 0.25 grams of activated carbon and 0.2 grams of sodium sulfide per liter of influent solution will remove 50 to 90 per cent of the activity which is not removed by the alum. Studies of the removal of activity from the sand filter effluent by means of ion exchange, chemical reduction, and electroreduction are continuing.

Hot runs will be made on the pilot plant for combustible waste as soon as a new Wash pump is obtained.

Basic Research

Measurement of the lines occurring in the spark spectrogram of polonium between 4225 and 6790 angstroms has been made, but wave length calculations have not been completed. A back-reflection pattern of X-rays on polonium was obtained at the temperature of liquid nitrogen. Freon gas has a high absorption for X-rays and gave poor results at the temperature of liquid Freon.

~~SECRET~~

~~SECRET~~

- 6 -

Construction of the apparatus for determining the Hall effect and resistivity of polonium is under way.

Experimental data have been completed on the rate of combination of dry oxygen gas in contact with polonium dioxide after a reacting period of 140 days. The data indicate no formation of a higher oxide of polonium such as the trioxide, but rather there is evidence of the formation of oxides of lead, probably lead dioxide.

RADIUM-ACTINIUM PROJECT

Radium Process Development

Continued research on the Curie method and alternate methods for the separation of radium from pitchblende (N-65) residues has provided more detailed information on optimum operating conditions.

For a satisfactory extraction of lead sulfate, a three-fold excess of 15 per cent or a four-fold excess of 10 per cent boiling sodium hydroxide is required. This procedure, when applied directly to the residue (omitting the proposed preliminary water leach and the hydrogen fluoride, silica removal step) also removes silica and aluminum from the residue. Thirty to 40 per cent, respectively, of the total solids are removed; the 10 per cent caustic solution giving more complete lead removal and more rapid filtration. The resulting product may be carried through the subsequent sulfate to carbonate conversion with improved radium recovery.

Results on the separation of radium from barium by fractional crystallization of the bromides gave an improved partition factor of 15 compared with a value of 9 reported in the literature. The radium-barium separation carried out by fractional precipitation of the chromates has given partition

~~SECRET~~

~~SECRET~~

- 7 -

factors of 14 to 19. The chromates are precipitated from nitric acid solution by neutralizing the acid, which can be done homogeneously by adding urea and hydrolyzing at the boiling point. This procedure precipitates the radium in the equilibrium ratio and eliminates the aging period (approximately one day) so frequently encountered in other types of precipitation or fractional crystallization methods.

Ninety-eight per cent of the radium was separated from a 30,000 to 1 barium-radium mixture by elution of Dowex-50 ion-exchange column with ammonium citrate solution. This method appears promising for the final radium-barium separation after a preliminary concentration has been achieved.

The decontamination of the waste liquors from the radium process has been studied, using the lead sulfate extracted from the process as a carrier for the activity. By slowly neutralizing the sodium hydroxide extract with the sulfuric acid filtrate from the hydrofluoric acid treatment to pH 8, and stirring for one hour, and filtering, the filtrate activity was reduced to 10-30 alpha and 30 beta counts per minute per milliliter. Equally good results were obtained by neutralizing the sodium hydroxide leach obtained when the hydrofluoric acid treatment was omitted from the process. The sodium carbonate filtrates must first be acidified and then neutralized with the sodium hydroxide leach to obtain equally good results.

The major portion of the engineering work has been done on the building completion and the mechanical process features. A preliminary engineering flow sheet is about 70 per cent complete on the process up to the radium-barium separation. Calculations have been made on the heat transfer, material balance and equipment size, and the process equipment is being evaluated.

~~SECRET~~

~~SECRET~~

- 8 -

Actinium Process Development

The engineering work on the cave structure for the separation of actinium from radium is nearing completion. Considerable drafting remains to be done.

REACTOR WASTE PRODUCT

The work on the ferrous ferrocyanide process for decontamination of neutralized Hanford second-cycle waste has been completed on a laboratory scale. By this procedure the activity of a sample of the above-mentioned waste has been reduced from 39,000 counts per minute per milliliter (beta) to 600 counts per minute per milliliter. This procedure may be applied successfully to materials which are being stored, as no change in pH is necessary.

It has been demonstrated that the optimum pH for the removal of activity from waste solutions by means of ferrous sulfide does not correspond to the pH at which ferrous sulfide precipitation is complete. By allowing the solutions in this procedure to stand for long periods of time, the initial activity of 39,000 counts per minute per milliliter (beta) has been reduced to 120 counts per minute per milliliter. The best conditions for this procedure are being investigated.

Kuchar 000 in the presence of hydrogen sulfide appears to be the best adsorbent in the decontamination of these wastes. In all of this work, ruthenium remains the most difficult element to remove.

Several more runs were made with the bench-scale model for concentrating reactor wastes by adsorption, scrubbing, and precipitation. Results were obtained comparable to those reported before.

~~SECRET~~

~~SECRET~~

- 9 -

ALPHA-NEUTRON PROJECT

Neutron Source Preparation

Volatilizing polonium into source containers does not improve efficiencies but does minimize radiation hazard. Sealing weak fission sources under reduced pressure and heating does improve efficiencies, especially when polonium chloride is used.

Neutron Source Evaluation

It appears that a new method of measuring radiation called the radio-electric effect has been discovered. Two electrochemically dissimilar materials are separated by a medium which does not contain mobile ions and are connected by an impedance. When exposed to gamma radiation, a current flows through this impedance which appears to be proportional to the flux. The best electrodes to date are lead and lead dioxide plated on gold. When separated by an inch of air, a weak gamma source (8-hour tolerance at one inch) developed 0.6 volts across 10^{11} ohms and a 25-milligram radium source gave 4.5 volts across 10^{11} ohms six inches from the cell and 2.5 volts across 10^{10} ohms beside the cell. Using a galvanometer, the radium source gave 1.9×10^{-10} amperes and -1.25×10^{-10} amperes with reversed connections. Such a cell should be responsive to neutrons if arranged so that the principle ionization between the electrodes is caused by proton recoils, n-reactions or both. The radio-electric cell appears analogous to the self-generating photo-cell. Hence, it is possible that eventually a radiation-measuring instrument might be developed which is as simple as a photographic exposure meter.

~~SECRET~~

SECRET

- 10 -

Certain dielectrics count neutrons when externally polarized. Polystyrene appears good, and equipment is being constructed to prepare polystyrene electrets.

It was observed that neutrons cause water, alcohol, benzene, xylene, and mineral oil to fluoresce. Counting efficiency is increased by addition of materials fluorescing strongly in the visible. The best material to date is p-terphenyl in xylene, which gave a neutron efficiency of about 6 per cent.

A lead absorption curve for the gammas from the Be (α -n, γ) reaction has been made, using a Geiger Mueller tube.

A consistent method of determining neutron attenuation was established. The half-thickness of paraffin is less for mock fission than for polonium-beryllium sources. A lower energy is indicated for low-efficiency than for high-efficiency polonium-beryllium sources.

A single chamber, proportional counter, fast neutron survey meter is being developed. The chamber is being tested and appears to have a neutron efficiency of 0.05 to 0.06 per cent. A dual-compartment chamber is ready for testing.

Neutron and Alpha Source Exploitation

The investigation of the effect of alpha particles on water is progressing well. An apparatus for measuring equilibrium pressure has been designed and is being constructed. A Cartesian manostat has been modified for use in regulating the pressure in the low-geometry alpha counter (Logan-1). Also, a scintillation counter is being fitted to this instrument in an attempt to measure alpha energies.

SECRET

~~SECRET~~

- 11 -

SUPPORTING RESEARCH

The various supporting research projects in physics and electronics have continued to make worthwhile contributions.

Bismuth and tin have been used as samples during the focusing and aligning of the mass spectrograph. Strong intensities have been achieved and indicate that the method of excitation was well chosen.

Vibration at the point of draw in the quartz-fiber-drawing machine has been reduced by placing solid bands over the rungs of the reel. Fibers of 100 and 200 microns in diameter, which had been drawn from General Electric fused-quartz cans have shown the same type variation of diameter which had occurred when using Thermal Syndicate stock. Regions of the fibers which contained variations in diameter showed no crystalline structure when examined with X-rays.

Development work in calorimetry has been concerned with experiments to estimate the relative amounts of heat lost by conduction and radiation from well-silvered, poorly-silvered, and unsilvered Dewar flasks. These data are applicable to the design of high-sensitivity calorimeters. A new resistance bridge for controlling bath temperature has been constructed. A sensitivity of 25 microvolts per 0.0001° and short response time have been achieved. The control of liquid level in a liquid nitrogen bath by quenching a spark is being investigated.

Redesign of the trigger-pair input circuit of an amplifier for neutron counting has resulted in improved pulse shape. The circuit involves a pentode input (6 AG5) coupled to a triode output through a cathode follower (12 AT7).

~~SECRET~~

~~SECRET~~

- 12 -

The output has an amplitude of 25 volts, rise time of 0.075 microseconds, and a duration of 0.3 to 0.5 microseconds, depending on the circuit parameters. A Legac-S chamber has been modified to allow alpha energy determinations by absorption at a specific activity lower by a factor of ten than previously possible. Precision with the Bradley counter has been improved by dipping the slides in Rubalt electroconducting paint.

An analysis of the gamma radiation from waste disposal residues has been started.

BIOLOGICAL RESEARCH SECTION

Group 26

Effects of Polonium upon Cell Metabolism

The effects of polonium upon the growth and division of yeast cells in a synthetic medium have been studied more extensively during the past month. Cells that had been exposed to definite concentrations of polonium were plated in agar in order to determine the viable cells remaining after varying periods of exposure.

Further observations have been made on the effect which cell concentration exerts upon the cell response to polonium.

In separating various yeast cell nitrogen fractions, it was noted that a 10 per cent trichloroacetic acid extract of frozen polonium-treated cells is turbid in contrast to an extract from normal cells. An investigation has been made to determine whether this difference affects the cell nitrogen distribution between acid soluble and protein nitrogen.

~~SECRET~~

Separations and measurements of the protein, acid soluble, ammonia, amide, and alpha-amino nitrogen of the cells of a polonium-treated and control cultures are in progress. A more drastic hydrolytic method for amide nitrogen which gives a considerably larger amide measurement has been tried.

Group 19

Distribution of Polonium in the Different Tissues, Fluids, and Secretory Products of Laboratory Animals

The polonium recovery data on the rat polonium distribution and metabolism study have been compiled in tabular and graphic form. Data are being accumulated on the estrus experiment which demonstrates a definite polonium effect upon the regularity of the rat estrus cycle. The experiment is in the fifteenth week. The upper and intermediate dosage levels have shown a marked response, and daily vaginal smear observations will be continued to determine if the low dosage level will elicit similar response within the time allotted.

Basal metabolic rate tests have been continued. Tests were made on normal and polonium-injected rats on a pilot study basis. A series of male and female thyroidectomized rats have been used to establish low basal metabolic rates for the Sprague-Dawley rat.

A veterinary X-ray unit was received, assembled, and tested.

The study to determine the blood concentration of polonium following intravenous injection of eight microcuries of polonium per kilogram of body weight is still in progress. The analyses of the sixth weekly blood samples gave a mean recovery of 10×10^{-6} microcuries of polonium per 0.1 milliliter of blood. These analyses will be continued as long as significant amounts of polonium are recovered.

SECRET

- 14 -

Diagnostic Tests - No abnormal levels of blood sugar have been found in rats following intravenous injection of 35, 23, and 8 microcuries of polonium per kilogram of body weight. The rats of the 35-microcurie level died at five weeks from the effects of the polonium. Blood sugar determinations on the rats of the 23- and 8-microcurie injection levels will continue.

The Hematological and Pathological Effects of Varying Amounts of Polonium with Different Modes of Administration on Various Species of Animals

Histopathological studies were completed on tissue sections of rats from the following experiments:

1. Rats injected intravenously with 35 microcuries of polonium per kilogram of body weight.
2. Rat insuflation studies.
3. Early pathological changes in rats intravenously injected with 31 microcuries of polonium per kilogram of body weight. The ovary, testis, and liver tissue sections of the rats injected with the 23-microcurie level of polonium have been studied, as well as the ovary and testis sections from the rats of the 8-microcurie injection level. Special techniques such as autoradiographs, fat stains, and glycogen stains were made on these tissues whenever the conditions warranted them. A photomicrographic record was made of many of the pathologically altered tissue sections.

The following hematological experiments have been completed during the past month: the evaluation of a spectrophotometric method for determining human erythrocyte counts and hemoglobin concentrations, hematological studies of Sprague-Dawley rats injected intravenously with 8 microcuries of polonium per kilogram of body weight, early hematological effects following

SECRET

5. Industrial Relations - Narrative

Activity this month was centered around preparations for negotiations for a new contract with the United Gas, Coke and Chemical Workers, CIO, Local 420. The present contract expires August 12, 1950. Negotiations will begin July 6, 1950.

PERSONNEL SUMMARY

<u>Classification</u>	<u>Number</u> <u>Last Month</u>	<u>Termina-</u> <u>tions</u>	<u>Reported</u> <u>This Month</u>	<u>Transfers</u>		<u>Total</u>
				<u>In</u>	<u>Out</u>	
<u>Neound Laboratory</u>						
Administration	84	3	0	0	0	81
Research	96	0	5	1	0	102
Operations	120	1	0	0	1	118
Maintenance	122	3	1	0	0	120
Protection	97	0	0	0	0	97
Services	230	3	2	0	0	229
<u>Scioto Laboratory</u>						
Administration	4	0	0	0	0	4
Maintenance	24	0	0	0	0	24
Protection	30	0	0	0	0	30

(The breakdown in this summary is by categories and functions)

Male	621 (Neound)	56 (Scioto)	Salary	495 (Neound)	13 (Scioto)
Female	126 (Neound)	2 (Scioto)	Hourly	252 (Neound)	45 (Scioto)
Total Last Month	807		Total Technical		218
June Terminations	<u>10</u> 797		Total Semitechnical		124
June Employment	<u>8</u>		Total Nontechnical		<u>463</u>
Total	805		Total		805

Round Laboratory Personnel

Scientific and Technical	377
Administrative and Clerical	113
Service, Maintenance, Custodial, and Guards	257
Construction	<u>0</u>
Total (includes 4 summer and 2 part-time employees)	747

Scioto Laboratory

Scientific and Technical	3
Administrative and Clerical	5
Service, Maintenance, Custodial, and Guards	50
Construction	<u>0</u>
Total	58

6. Operating Costs (Estimated)

	<u>Actual</u> <u>July 1, 1949</u> <u>to</u> <u>May 31, 1950</u>	<u>Estimated</u> <u>June 1950</u>	<u>July 1, 1949</u> <u>to</u> <u>June 30, 1950</u>
\$ 3,000 (Weapons)			
Production	\$ 1,685,592.49	\$ 157,000.00	\$ 1,842,592.49
General Research	760,510.15	73,500.00	834,010.15
Items ("Y" work)	<u>701,045.61</u>	<u>74,250.00</u>	<u>777,295.61</u>
Total	\$ 3,149,148.25	\$ 304,750.00	\$ 3,453,898.25
\$ 4,000 (Reactor Development)			
W.D. Research	160,163.42	17,000.00	177,163.42
\$ 6,000 (Biology and Medicine)			
Biological Research	315,735.66	30,000.00	345,735.66
Undistributed Costs			
AEC Local Office	5,243.26	500.00	5,743.26
Dismantling Units 3 & 4	<u>71,723.40</u>	<u>—</u>	<u>71,723.40</u>
Total	\$ 3,702,013.99	\$ 352,250.00	\$ 4,054,263.99
Scioto Laboratory, Marion, Ohio	<u>\$ 578,729.05</u>	<u>\$ 25,000.00</u>	<u>\$ 603,729.05</u>

[Handwritten signature]

~~SECRET~~

-18-

		<u>Actual</u> <u>May 1950</u>	<u>July 1, 1949</u> <u>to</u> <u>Nov 31, 1950</u>
# 3,000 (Weapons)			
Production			
Primary Product	\$139,185.55		
Sources	<u>16,425.50</u>	\$ 155,611.05	\$ 1,685,592.49
General Research		72,269.34	760,510.15
Items ("Y" Work)		<u>73,618.72</u>	<u>703,045.61</u>
Total		\$ 301,499.11	\$ 3,149,148.25
# 4,000 (Reactor Development)			
W. D. Research		16,573.16	160,163.42
# 6,000 (Biology and Medicine)			
Biological Research		29,327.77	315,735.66
Undistributed Costs:			
ABO Local Office		428.60	5,243.26
Dismantling Units 3 & 4		--	<u>71,723.40</u>
Total		\$ 347,828.64	\$ 3,702,013.99
Scioto Laboratory, Marion, Ohio		<u>\$ 22,307.11</u>	<u>\$ 578,729.95</u>

~~SECRET~~