

MOUND LABORATORY-MONSANTO
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PRODUCTION REPORT FOR MAY 1950

PART I

THIS DOCUMENT CONSISTS OF 11 PAGE(S)
THIS IS COPY 6 OF 7 SERIES A

1. Production Narrative

PROCESS SECTION

The special syphon closure for the digestion tube was installed in the north concentration cell, and this cell was put in operation on May 15. Both cells were operated for a period of one week, after which the south cell was shut down for repairs.

Shipment 62-W was received from Danford on May 23. Several discrepancies were found between the serial numbers of the slugs listed on the data sheet accompanying the shipment and the actual numbers on the slugs. The total number of slugs, however, was in agreement.

There has been a slight improvement in the level of contamination in the low-risk portions of the Process and Electrolysis Laboratories. The problem of contamination in this area, however, continues to be serious.

Process line three was completely reconditioned during this month.

Active materials were handled in the fourth Electrolysis line for the first time during this period. Up to now, this line has been used for development work of a "cold" nature.

There was a marked increase in the activity count of the Waste Disposal effluent starting May 10 and reaching a maximum about May 22. The cause of this increase in activity has not been determined.

An intensive program to reduce the counts of the Waste Disposal effluent has been under way for about six weeks now. This program is being

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GROUP 1
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conducted jointly by the Research and Operations Divisions. A number of experiments on different methods for reducing the count have been tried, and a number of possible ways have been eliminated. The program of experimentation has been narrowed down to about four possible procedures at the present time, and a coordinator has been appointed, responsible to a joint committee, to expedite the work on these possible methods.

CONTROL SECTION

The ampules shipped to Los Alamos are now being checked by direct counting, which replaces the former procedure of using wipe tests to check for contamination. Under this new procedure, a direct count of 500 counts per minute for the maximum is allowed for shipping, whereas the former check required a zero wipe. This method of testing now conforms to the one used at Los Alamos.

Two Simpson counters equipped with Bradley chambers have been used exclusively for the alpha counting performed during the past month. They have satisfactorily replaced the four parallel plate alpha counters previously used.

A replaceable "sleeve" has been designed for use in the Logac-S chambers, and, after several months' use, has given excellent results in maintaining a low background and eliminating decontamination.

The Operations Development Group of this section, participating in the Waste Disposal Program of reducing the effluent counts, have conducted a rather extensive series of experiments on filtering or scrubbing of the influent to the Waste Disposal process under various conditions. As a result, it is felt that such possibilities have been eliminated as possible procedures.

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The difficulties of the "jet" design for the concentration cell were eliminated, and a final "jet" design was completed. The "jet" was installed in the cell which is now operating.

A final report has been prepared on the Stannous Chloride Process.

"Y" SECTION

Three special preparations were made for the Research Division. Two of these preparations were prepared by depositing polonium by volatilization on a nickel disc. This was then covered with a thin tantalum foil held in place by a nickel washer. The washer was sealed to the disc by depositing nickel from the thermal decomposition of nickel carbonyl. The third preparation consisted of depositing the polonium by volatilization on a nickel disc without any cover.

NEUTRON SOURCE

Two polonium-beryllium neutron sources were prepared and shipped. One was for Argonne National Laboratory and one for Oak Ridge National Laboratory.

2. Construction and Plant Maintenance - Narrative

During the past month a considerable amount of work was completed toward placing the entire "T" Building into proper condition for efficient emergency operations. The tests on the additional volume of air for the emergency air conditioning system have been completed. An emergency run of all building equipment as it would be used during emergency conditions was completed satisfactorily on May 27.

As the filters and other materials and equipment required for the proposed test runs to be conducted by Chemical Warfare Service were not available in time, the tests have been rescheduled to begin August 1, 1950. At this time, the last report on the proposed shipment of new emergency filters was approximately June 15.

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3. Process Improvement, Research, and Development - Narrative

INTRODUCTION

Research projects were analyzed for cost and manpower needs for fiscal year 1951, a new cost reporting system was planned, and work continued on the five-year research plan.

Engineering drawings were completed for the proposed Pilot Plant Building, and coordination between research and design for the process engineering phase of the work was established.

POLONIUM PROJECT

Work on the first phase of the polonium project, the improvement of the present process, has been concerned with mass purity assay techniques. An increase of purity of polonium deposit with increasing normality of plating solutions was observed over the range 1.4, 1.5, and 1.6 N. Results at 1.7 N were obscured by a faulty potential controller. The accuracy of the direct weighing of a production foil has been improved by a new method of sample introduction and by the use of an auxiliary reference weight of a suitable amount. The weight of heat sources 2 and 3 has been determined with a maximum deviation of 3%.

The new process development phase of polonium work has been concerned with the Stannous Chloride Process and the Metal Distillation Process. A regular production batch of polonium was purified by the Stannous Chloride Process, and 67% of the activity received was delivered in final solutions. The rough draft of a final report on the pilot plant for this process has been completed. Design drawings have been completed for a revised slug-dissolver cell. All design work of the Metal Distillation Process has been finished. Most of the drafting work has been completed.

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The third phase of the Polonium Project, Waste Recovery and Disposal, is receiving considerable attention. The recovery of bismuth from solution, using a plating bath devised recently, was 84%. Fourteen percent of this amount was lost in rinsing, thereby giving a final recovery of 72% of the original amount. Good slugs have been prepared by a new method. Molten bismuth is poured into a solid cast-iron mold lubricated with flake graphite. The slugs from the mold are then reduced to a uniform diameter by being pressed through a sizing die.

Laboratory studies on the polonium liquid waste disposal problem have shown results which seem to promise a solution to high effluent counts. The addition of Na_2S and activated carbon to influent solutions of 444 c./min./ml. and 1630 c./min./ml. reduced the counts to 28 and 68 respectively in the same units. Solutions free of CO_3 , PO_4 , and SO_4 with 72 c./min./ml. were reduced to 0 c./min./ml. by the use of six columns containing IRH-400, an anion exchange resin, and a bed containing IR-120, a cation exchange resin. This latter development is the most significant to date.

Cold runs have been made with the pilot plant for combustible waste disposal. Flu gases have been analyzed for per cent of CO_2 , CO, and oxygen for various rates of entrance of air or oxygen.

A stainless-steel bomb to withstand 500 pounds per square inch internal pressure has been constructed for use in the study of the effects of alpha irradiation of water. There have been several contributions in the area of basic studies on polonium. Assembly of apparatus and preparations to make measurements have continued on the two vapor pressure experiments and the Hall effect. One hundred and thirty-one spectral lines ^{lying} between 3050Å and

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3465 Å have been tentatively assigned to polonium and their wave lengths have been measured to within 0.02 Å. The lattice parameters of $PbPo_2$ have been observed by means of X-ray diffraction to change slowly with respect to time.

Three out of four calorimetric remeasurements of the half-life of polonium are in agreement with the 1947 determination. The fourth value, which is in slight disagreement, has been made with a calorimeter of poorer accuracy. A value by counting on the Logac-5 is in fair agreement.

RADIUM-ACTINIUM PROJECT

In the removal of radium from uranium residues, further investigation of the water leach and fluorination steps of the process have been directed toward determination of optimum process conditions. Up to 9.5% of the K-65 residue can now be removed by leaching.

Lead sulfate removal by excess sodium hydroxide is apparently affected by silica concentration, with 3.5 times the theoretical sodium hydroxide concentration being required for low silica content samples. Investigation of samples having higher silica content is under way.

A two-stage counter-current carbonation system is being tried for removing impurities from the lead-free residues. High conversion rates have been obtained, and consumption of sodium carbonate is reduced to 50% of the amount originally required. However, crude barium-radium sulfate recovered from the carbonated residue had interfering impurities. These were removed by recarbonation, dissolving in acid, and precipitating acid sulfides and then hydroxides. The impurities are suspected to include lead, polonium, bismuth, and actinium. The barium-radium ratio in the purified carbonates was 78,000 to 1.

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This mixture is then treated to obtain the radium-barium separation. A fractional precipitation utilizing the homogeneous phase decomposition of the trichloroacetates gave an enrichment to 250 - 1 (Ba to Ra), but the process would probably be too costly for plant operation. Fractional precipitation with chromates appears promising both from cost and speed standpoints. It will be investigated further. Separation of radium-barium by ion exchange is also receiving attention. Equilibrium studies using Dowex 50 resin in the barium form and 0.01 to 1.0 N barium acetate solutions showed that the separation factor remained constant at 4.3.

Decontamination work on radium wastes indicates that the order of mixing sulfuric acid, sodium hydroxide, and sodium carbonate wastes is important. Alpha and beta activity in water leach residues can be reduced to background by precipitating barium sulfate.

ALPHA-NEUTRON PROJECT

The preparation of polonium-beryllium neutron sources has been improved by distilling the polonium from the foils into the source container rather than placing the foils in the source container. The preparation of rock-fission sources has been modified in order to investigate the introduction of polonium chloride vapor by means of a gas stream.

A number of phosphors have been tested for suitability in scintillation counting. A scintillation counter has been compared to the Hanson counter. The two instruments apparently have different sensitivities at various energies, as the results were significantly different. In neutron counting with electrets, the pulse rise-time and the noise level have been reduced by putting a 50 megohm resistor across the electret and coupling the

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electret to the amplifier through a small capacitor. The device used to test the neutron detecting efficiencies of raw materials for electrets will itself be investigated for its possibilities as a neutron counter. The efforts to detect neutrons by the change of resistance of zinc sulfide and cadmium sulfide powders gave no significant results at this stage.

The energies of some 400 proton recoils from Po-Ba neutrons have been determined by measurements on tracks recorded on photographic films. About a thousand tracks will be needed to determine statistically the neutron distribution in energy.

REACTOR WASTE PROJECT

The Hanford second-cycle wastes were treated in a concentration apparatus with silica gel, activated alumina, iron scrub and ferrous-ferrocyanide precipitation, in that order. Activity was reduced from 39,000 to 260 c./min./ml. Difficulty in maintaining the desired pH in the adsorption columns may be overcome by changing to iron sulfide, manganese dioxide or Muchar 000, all of which have high capacity for fission products.

The ferrous-ferrocyanide precipitation experiments are being completed. This method will satisfactorily remove ruthenium and cesium, but only partial removal of antimony is possible. Pure isotope experiments indicate that the fluoride ion aids in the removal of fission products, somewhat contradicting the March reports of experiments run on waste solutions.

SUPPORTING RESEARCH

First plates obtained with the mass spectrograph showed excellent intensity and poor focusing. A new supermicrocalorimeter had a very high sensitivity. The quartz-fiber-drawing machine was improved by adding a brake and fiber guide to the reel. Additional research is under way on a

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high-gain amplifier for neutron counting, a continuous alpha counter for water-soluble wastes, sample preparation for beta counting, and a fast neutron survey meter.

BIOLOGICAL RESEARCH SECTION

Group 36

The Effects of Polonium upon Cell Metabolism

During the past month, a synthetic medium has been used for the growth of yeast cells to compare polonium effects on these cells with effects upon cells grown on a natural medium. Hydrogen peroxide has been used in a series of concentrations to compare its effects with polonium effects upon growing yeast cells. Also, large cell cultures produced by polonium treatment have been regrown in an effort to determine viability of length of the inhibitory period.

Difficulty has been encountered in obtaining quantitative separation of the various phosphorus compounds of yeast cells. Variations in the method are being used in an effort to obtain good separations. Several methods have been compared for quick estimations of protein-nitrogen in cell extracts. The Folin method is being used in preference to the Biuret or a refractometric method. These determinations are used in handling cell extracts for electrophoretic study.

Assay Techniques Improvement

Work has continued on the adaptation of a method for determining iodine numbers of animal oils. A modified Harus method seems to give the most consistent results. A start has been made on determining the percentage recoveries of polonium from solutions of various normalities of

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hydrochloric, nitric, perchloric, and sulfuric acids, as well as determining the copper concentrations of these solutions after polonium analysis. A standard curve for copper determinations has been established.

Group 19

Distribution of Polonium in the Different Tissues, Fluids, and Excretory Products of Sprague-Dawley Rats

Further analysis is being made on the organ polonium recovery data obtained from the distribution study, and these data will be consolidated with the completed carcass digestion results.

A pilot study was begun to determine the blood concentration of polonium following its introduction by caudal-vein injection. Rats were injected with 7.4 microcuries of polonium per kilogram of body weight, while some rats were injected with the carrier solution and served as controls. Heparinized whole blood samples of 0.4 milliliters were taken from the tails of these rats at 1, 4, 6, 24, and 48 hours and at 7, 14, 18, and 21 days post-injection. Aliquots of 0.1 milliliter of these blood samples were digested for plating and counting purposes to determine their polonium concentration.

The 16-week estrus experiment reported in the Quarterly Report for Biological Research, MLR-442, is in the 11th week of progress. Further irregularities in the estrus cycles of the treated rats have been observed from the daily vaginal smears. These effects will be evaluated in the three polonium injection levels upon the termination of the experiment.

Experimental Diagnostic Tests of the Physiological Effects of Polonium

Oxygen consumption data obtained upon normal, thyroidectomized, thyroxin-injected and polonium-injected rats of both sexes are being collected.

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A comparison of these data will be used to determine what effects polonium has upon the metabolic rate of rats of the Sprague-Dawley strain. Refinements in the apparatus and techniques of measuring the Respiratory Quotients of rats have been sought with the purpose of establishing a greater consistency in the measurements.

Blood sugar determinations have been done on rats injected intravenously with polonium. This experiment was instituted to see if this clinical test could be used diagnostically to detect any alterations in tissue metabolism or tissue damage resulting from the introduction of polonium into the metabolic system of the rats. No indication of abnormal changes of blood sugar levels have been found at the present stage of the experiment.

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

Tissue sections of rats injected via the superior mesenteric vein are still being studied for histopathological changes. To date no changes in the liver were found, although lung lesions were present.

Early histopathological changes and autoradiographic studies of rats injected via the caudal vein with 31 microcuries of polonium per kilogram of body weight are being continued. A correlation and comparison of tissue sections relative to counts per minute per unit area of tissue are being made along with autoradiographs of these sections.

The histopathological study of the tissues of starved rats is in progress and will be reported later.

Data were collected on erythrocyte counts and hemoglobin determinations from 200 humans by means of the Coleman Jr. Spectrophotometer.

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These data showed that the optical-density reading of the erythrocyte counts read at 5 and 30 minutes were only slightly increased in the longer time interval by an average of 0.027 million red cells per cubic millimeter of blood.

The histopathological studies of the gonads, liver, skin, and gastrointestinal tracts of the rats injected with 23 microcuries of polonium per kilogram of body weight (Level II) have been completed.

4. Other Related Activities - Narrative

There is nothing of interest to report for the month of May, 1950. One talk was given in the interest of atomic energy.

5. Industrial Relations - Narrative

Settlement of the Reclassification Grievances has finally been instituted. In our last report, we noted that the Union was insistent upon the retroactivity of the classifications, a position the Company could not agree with, since it felt that just lately the men had shown efficiency and ability to warrant the first-class ratings. Due to the efforts of our personnel, the Union decided it would drop the question of retroactivity and ask only for individual cases. As a result of this, a settlement was negotiated with the Union which involved reclassifying six men from second to first-class workers. Due to this compromise settlement, a major area of disagreement was eliminated, and the morale of the maintenance group was greatly increased. Since we are soon to negotiate a renewal contract with this group, we feel that this settlement will be a great aide in better relations between the Company and the Union.

Personnel Summary

<u>Classification</u>	<u>Number</u> <u>Last Month</u>	<u>Terminations</u>	<u>Reported</u> <u>This Month</u>	<u>Transfers</u>		<u>Total</u>
				<u>In</u>	<u>Out</u>	
<u>Mound Laboratory</u>						
Administration	89	6	1	0	0	84
Research	94	0	1	1	0	96
Operations	123	2	0	1	2	120
Maintenance	125	3	0	0	0	122
Protection	99	2	0	0	0	97
Services	231	2	1	1	1	230
<u>Scioto Laboratory</u>						
Administration	4	0	0	0	0	4
Maintenance	23	0	1	0	0	24
Protection	30	0	0	0	0	30

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

Male	621 (Mound)	56 (Scioto)	Salary	493 (Mound)	13 (Scioto)
Female	128 (Mound)	2 (Scioto)	Hourly	256 (Mound)	45 (Scioto)
Total Last Month	818		Total Technical	214	
May Terminations	15		Total Semitechnical	126	
	803		Total Nontechnical	467	
May Employment	4				
Total	807		Total	807	

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Naval Laboratory Personnel

Scientific and Technical	373
Administrative and Clerical	117
Service, Maintenance, Custodial, and Guards	259
Construction	<u>0</u>
Total	749

Naval Laboratory Personnel

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

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6. Operating Costs (Estimated)

	<u>Actual</u> <u>July 1, 1949</u> <u>to</u> <u>April 30, 1950</u>	<u>Estimate</u> <u>May, 1950</u>	<u>July 1, 1949</u> <u>to</u> <u>May 31, 1950</u>
#3,000 (Weapons)			
Production	\$ 1,529,981.44	\$ 150,000.00	\$ 1,679,981.44
General Research	688,240.81	67,500.00	755,740.81
Items ("Y" Work)	<u>629,426.89</u>	<u>65,000.00</u>	<u>694,426.89</u>
Total	\$ 2,847,649.14	\$ 282,500.00	\$ 3,130,149.14
#4,000 (Reactor Development)			
F. D. Research	143,590.26	15,500.00	159,090.26
#6,000 (Biology and Medicine)			
Biological Research	286,407.89	27,500.00	313,907.89
Undistributed Costs:			
A.E.C. Local Office	4,814.66	500.00	5,314.66
Dismantling Units 3 & 4	<u>71,723.40</u>	<u>--</u>	<u>71,723.40</u>
Total	\$ <u>3,354,185.35</u>	\$ <u>326,000.00</u>	\$ <u>3,680,185.35</u>
Scioto Laboratory, Marion, Ohio	\$ <u>596,421.92</u>	\$ <u>38,000.00</u>	\$ <u>594,421.92</u>

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	<u>Actual</u> <u>April, 1950</u>	<u>July 1, 1949</u> <u>to</u> <u>April 30, 1950</u>
#3,000 (Weapons)		
Production		
Primary Product \$ 132,519.20		
Sources <u>13,301.61</u>	\$ 145,820.81	\$1,529,981.44
General Research	64,980.01	688,240.81
Items ("Y" Work)	<u>60,107.56</u>	<u>629,426.89</u>
Total	\$ 270,908.36	\$2,847,649.14
# 4,000 (Reactor Development)		
W. D. Research	15,697.53	143,590.26
# 6,000 (Biology and Medicine)		
Biological Research	26,474.20	286,407.89
Undistributed Costs:		
A.F.C. Local Office	311.12	4,814.66
Dismantling Units 3 and 4	<u>(79.20)</u>	<u>71,723.40</u>
Total	\$ 313,312.01	\$3,354,185.35
Scioto Laboratory, Marion, Ohio	\$ 37,489.79	\$ 556,421.92

() = Credits

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