MOUND LABORATORY-MONSANTO
Central File No. 50-5-8

SECRET



# PRODUCTION REPORT FOR APRIL 1950

PART I

THIS DOCUMENT CONSISTS OF 15 PAGE(S)
THIS IS COPY 6 OF 8 SERIES A

## 1. Production Narrative

### PROCESS SECTION

All initial concentration was done in the south cell. The north cell was shut down during the entire month for installation of a syphon closure for the digestion tube. Numerous maintenance jobs were necessary to keep the south cell in operation.

Contamination in the low risk area of the Process and Electrolysis laboratories continues to be a problem. Two experimental solid male glove rings have been put into use to see if they provide a better seal than the present split rings. Several lower hood compartments that open into the high risk area have been sealed in an attempt to keep the contamination confined.

The activity level from the effluent for the "ED" process remained at a high level ranging from 5 to 20 counts per minute per milliliter. There was an increase in the volume of water received in the "ED" Building as compared to March. A progress of intensive investigation of the cause of continued high effluent count has been started.

### CONTROL SECTION

Considerable down time was realized on the quartz fiber microbalances this period. However, all have been repaired and no undue effect was experienced on operating schedules.





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The dry-box colorimeter for the routine analysis of activity solutions as to contaminating ions has been installed and procedures and curves for operation are now being established.

The recalibration of Logae-5 instruments made effective on April 1, 1950, has been checked against standard solution previously calibrated by direct colorimetric measurement and shows excellent agreement.

Some success has been attained in the decontamination of platinum solutions with the use of a continuous extractor with butyl acetate as the activity extracting medium.

NEUTRON SOURCES

Nine polonium-beryllium neutron sources were prepared, two for Oak Ridge National Laboratory, three for Brookhaven National Laboratory, one for Rochester, and three for the Electronics Section.

One polonium-sodium fluoborate-sodium fluberylate neutron source was prepared and shipped to Los Alamos.

2. Construction and Plant Maintenance - Narrative

CONSTRUCTION

Mason Construction Company have completed all work at Scioto Laboratory, Marion, Ohio. The last two persons left Scioto on April 28th. Books have been balanced, surplus property disposed of, and custody of necessary records for long term storage by the Contractor has been handled.

Demolition of Unit IV has progressed to the stage where the remaining portions, principally underground concrete, are free of contamination. Consequently, it has been possible to augment the equipment by one motor crane from Mound Laboratory, and one power shovel and three trucks on rental from Mattern Construction Company.

By the use of the South Broadway (private) dump, the haul has been reduced from 32 miles to 8 miles round trip. Truck loadings have been increased from 22 to 70 per day. A material monetary saving and earlier completion will result.

PLANT MAINTENANCE

No major difficulties in the general maintenance were experienced. For the purpose of efficiency, schedules have been put into effect covering the periodic check of safety equipment and the operation of emergency equipment. Such emergency equipment as boilers, Diesel generators, refrigeration equipment, etc. are being operated for a minimum of three hours each month. Among the Major Work Orders which were started during this period was the addition of larger motors to some of the emergency air conditioning equipment to provide efficient ventilation during such periods.

A representative of the Arthur D. Little Company, manufacturer of the paper type filters we use in our filter banks, visited the plant and discussed various properties of their filters as well as construction of the filter banks and methods of filter replacements and maintenance. These representatives had very little to offer in the way of improvement of our present operation replacement methods.

We are awaiting shipment of new carbon filters for our emergency bank so that test operations starting June 1st will be performed under normal conditions of operating these banks in the future. We have also started on minor changes and additions to be made to the air conditioning equipment necessary for conducting tests by the Chemical Warfare Service.

Inspection of the brick in all of the ventilating stacks has indicated that spalling of the yellow brick in these stacks is becoming serious. The contractor who constructed these chimneys has recommended that we waterproof the interior of these stacks with an asphalt compound first and after a drying out period also waterproof the exterior of the stacks. We are taking this into consideration as it means the possibility of a shutdown of operations for a period estimated at no less than a week. Further investigation of these conditions and the way to combat them will be made before a final decision is made.

3. Process Improvement, Research, and Development - Narrative

INTRODUCTION

A detailed prospectus and operating budget request for Research and Development for F-51 was completed during this month and is at present being duplicated for distribution. Preliminary work has begun on the much longer range planning for research activities.

POLONIUM PROJECT

Polonium work on the first phase of the Polonium Project, the improvement of the present process, has been concerned largely with the techniques of mass purity assay. Detailed work is still in progress on a scheme for determining mass purity by a direct weighing of production foils. This involves the measurement of the buoyancy effect of a thermally hot sample. On April 1, 1950 a recalibration of all low geometry alpha counters was made based upon a standard chamber. This standard chamber was calibrated by actual measurement of the geometry. In order to check the new calibration, a dilution cross check between the low geometry alpha counters and the calorimeter was made. The values checked within 1 percent, which can be considered excellent agreement and supports the accuracy of the recalibration method.

The second phase, development of a still designed to distill polonium from molten bismuth metal is continuing.

The third phase of the Polonium Project, Waste Recovery and Disposal, is still receiving considerable attention. Design work is underway on equipment necessary for the recovery of bismuth from the production effluents.

Considerable effort is being placed on the operation of the polonium liquid waste disposal plant. It has been found that the analytical technique, which has been used on the effluent samples may be in error by as much as 300 percent. Because of the seriousness of this possibility, several men from the Operations Division have been added to the research staff considering this general problem. The most promising results to date seem to be those of a process which involves the addition of sodium sulfide to the influent tanks. Since a considerable amount of free sulphur is formed, it is also necessary to add aluminum sulphate to aid in coagulation. This process is under intensive investigation as a possibility of materially reducing the effluent counts.

The pilot plant for the disposal of combustible wastes has been completed and preliminary cold runs have been made. Three pound charges consisting of wood, paper, rubber gloves, etc., were used in varying amounts. There was no evidence of a major "explosion" but a fluctuation in pressure did occur at the start of the burning of the material. It is felt that this difficulty can be overcome by the use of a surge tank directly following the incinerator.

The long term observation of the formation of polonium dioxide has continued. The consistency of pressure in this system indicates that the lead being formed in the decay of polonium is combining with oxygen to form lead dioxide.

The vapor pressure of polonium and polonium chloride, the Hall effect of polonium and the coefficient of expansion of polonium are also under consideration. Measurements have been completed on the spark spectrum lines in the region 1930 to 3290 Å units. A total of 233 lines in this region have been tentatively identified as belonging to polonium.

RADIUM-ACTINIUM PROJECT

It will be recalled that the first two phases of the Radium-Actinium Project are presently under investigation at the Mound Laboratory. The first phase consists of the separation of radium from uranium residues. Summarizing the laboratory work to date and combining these results with the results of previous investigations, the best process for the recovery of radium from uranium residues seems to take the following steps: One, a water leach of the K-65 residues; two, a partial removal of silica by hydrogen fluoride; three, lead removal by sodium hydroxide; four, a carbonation of the residues after the removal of lead; five, a separation of radium from barium in the carbonate residues.

Work has continued on the problem of the water leach of K-65 residues. Such data as the amount of water and water temperatures necessary for the removal of the soluble salts by leaching have been obtained.

Data have been also obtained on the amount and concentration of sulphuric acid and the amount of hydrogen fluoride necessary for the silica removal step.

Experiments have been initiated for the purpose of ascertaining the optimum conditions needed to remove lead sulphate from the radium residues by the solution of lead sulphate in sodium hydroxide.

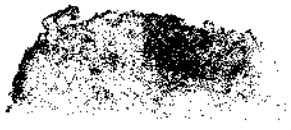
The carbonation of the residues after the removal of lead has also been studied. This step has been shown to yield about two-fold enrichment of radium in the barium sulphate which is not converted to carbonate. It is planned to take advantage of this enrichment by accumulating the residual barium sulphate from the final carbonation concentrates before actual fractionization is started.

The final phase of the radium process is the separation of radium from barium in the carbonate residues. One possible procedure under investigation is the homogeneous phase precipitation of carbonates. Samples which originally had barium to radium ratios of 90,000 to 1 were treated and yielded in three steps mixtures which contain ratios of 10,000 to 1. An investigation of an ion exchange technique for separating radium and barium is also underway. A column run has been made in which 35 micrograms of radium per liter of one normal barium chloride was passed through a 75 centimeter bed containing 56 grams of the sodium form of Dowex 50. Eighty-seven percent of the barium passed through the column carrying with it about 30 percent of the radium. The chemical engineering development work on the radium process has been largely concerned with providing specifications of space, shape, design, ventilation, and other service needs of the radium process. It is planned to augment this group in the near future in order to expedite the designing of the pilot plant equipment.

Additional information has been obtained from the Argonne Laboratory concerning the design drawings of the "cave" and remote control equipment.

ALPHA NEUTRON PROJECT

Development work is continuing on the preparation of alpha and neutron sources. The detection of neutrons by scintillation methods is still under consideration. Zinc sulfide and cadmium sulfide powders under pressure are being tried in place of



fluorescent cadmium sulfide crystals. Thus far work on this problem has been confined to attempts to develop a satisfactory method of mounting the powder. Methods are being investigated to produce a more light transparent phosphor-plastic mixture by using reduced quantities of the phosphor. Equipment has been completed for the production of thin electrets. The experiments indicate that the optimum thickness probably lies somewhere between 0.35 millimeters and 3.0 millimeters.

Several arrangements of samples and counting tubes were checked for efficiency in neutron counting.

REACTOR WASTE PROJECT

Four procedures appear to be applicable to the third sample of Hanford second cycle waste. Effectiveness of each of these processes increases in the order given: silica gel, ferrous ferrocyanide, titanium sulfate, and ferrous sulfide. Thus, the initial activity of 28,000 counts per minute per milliliter can be reduced to 3000 counts per minute per milliliter by passage through a column of silica gel and to 650 counts per minute per milliliter by the coprecipitation of ferrous sulfide.

SUPPORTING RESEARCH

In the area of supporting research, work is in progress in various aspects of calorimetry, quartz fiber units, spectroscopy, analytical chemistry, health instrumentation, and general electronic instrumentation.

BIOLOGICAL RESEARCH

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

The polonium recovery data taken from the various organs of the rats used in this polonium distribution study have been converted to microcuries per gram of animal tissue and plotted on semilogarithmic graph paper. These data will be used to establish the over-all picture of polonium distribution in the tissues of the rat.

A new constant-temperature respiration chamber for measuring the oxygen consumption of rats was built and tests have been run. These test runs show greater consistency and accuracy of measurement than was found in earlier tests. This oxygen consumption test will be used to measure the effects of polonium upon the whole-body metabolism of rats.

The estrus experiment reported in the Quarterly Report for Biological Research, MDDC-442 is in the seventh week of progress. Daily vaginal smears have been taken and recorded. Thirteen out of the 20 rats in the highest level of injection (29.5 microcuries per kilogram of body weight) have died to date and have been autopsied. Photographic records of the genital tracts have been maintained.

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

All the rats injected by way of the superior mesenteric vein have been sacrificed and no gross pathological changes were observed. The tissue sections have been prepared and the histopathological findings will be reported at a later date.

The group of rats injected with 31 microcuries of polonium per kilogram of body weight via the caudal vein, and used to determine early hematological and histopathological changes have been sacrificed and tissue sections have been prepared. The histopathological findings will be reported next month. The early hematological changes, which were observed at one hour and at each four hour interval for two and one-half days, showed an early leucocytosis in both control and experimental animals. The details of this experiment will be reported in the next quarterly report.

The tissue sections and hematological studies were completed on the rats injected intravenously with 8 microcuries of polonium per kilogram of body weight.

The data have been collected on erythrocyte counts and hemaglobin determinations made on 200 persons using the Coleman Jr. spectrophotometer. A close correlation has been found between this method and the standard methods for these determinations.

Autoradiographs are being taken on tissue sections of rats injected with 31 microcuries of polonium per kilogram of body weight.

Effects of Polonium Upon the Cell Metabolism

Liter cultures of yeast cells have been grown. Portions of both control and polonium-treated cultures are being analyzed for a variety of phosphorus and nitrogen compounds. Difficulties have been encountered in the handling of these cultures and in the analyses, so that the experiment constitutes only a good preliminary run. Experiments comparing yeast cell nitrogen extraction by means of ultrasonic treatment, lyophilization, and powdering, freezing and thawing, Lebedew extractions, toluene breakdown, and grinding with alumina have been performed. Easiest and most effective extractions have been obtained by grinding cells with alumina. A growth curve for yeast on a synthetic medium has been determined preliminary to determining polonium effects on growth and cell division in such a medium.

Assay Techniques Improvement

An experiment to compare polonium recoveries on air-dried copper discs with solvent-dried discs was started. Solvent-dried discs seemed to give higher recoveries; but it was observed that a longer period of washing in tap water had been used in the case of the air-dried discs. Recoveries are being re-evaluated to correct for a possible error due to the washing period. A method for determining copper in assay solutions is being set up. It will be used in the attempt to correlate copper concentration in assay solutions with polonium recoveries.

Analysis of various lipid fractions in two rat diets have been made. Fats produced by rats grown on these diets will be compared for several characteristics including their ease of digestability.

4. Other Related Activities - Narrative

There is nothing of interest to report for the month of April, 1950. Six talks were given in the interest of atomic energy.

5. Industrial Relations - Narrative

The Atomic Energy Commission's Labor Relations Panel has not yet taken jurisdiction of the dispute referred to in the Production Report for March. They asked that both the Company and the Union reconsider the items in dispute to see if agreement could be reached, and made the suggestion that "new faces" be brought into the picture. Both the Union and the Company complied with this request and met on April 26th, but were unable to resolve the dispute on the classifications. The possibility of any changes in classifications did not come into the discussion at that time because the Union was insistent that whatever changes to be made, would be retroactive to last June 27th, a position with which the Company could not agree.

The contract between the Mound Laboratory Patrol, Local #7, and Monsanto Chemical Company is due to expire April 30th, but will continue in force indefinitely until a settlement is reached on any of the prospective changes. The continuance in force is provided for in Article XVI of the present contract. The Company and the Union met for the first time on April 27th, at which time the Union presented its demands. No date has been set for the next session of negotiations.

Personnel Summary

| Classification | Number Last Month | Terminations | Reported This Month | Transfers In | Transfers Out | Total |
|---|---|---|---|---|---|---|
| **Mound Laboratory** | | | | | | |
| Administration | 90 | 1 | 0 | 0 | 0 | 89 |
| Research | 94 | 0 | 0 | 0 | 0 | 94 |
| Operations | 125 | 2 | 0 | 0 | 0 | 123 |
| Maintenance | 130 | 4 | 0 | 0 | 1 | 125 |
| Protection | 102 | 3 | 0 | 0 | 0 | 99 |
| Services | 232 | 2 | 0 | 1 | 0 | 231 |
| **Seioto Laboratory** | | | | | | |
| Administration | 4 | 0 | 0 | 0 | 0 | 4 |
| Maintenance | 23 | 0 | 0 | 0 | 0 | 23 |
| Protection | 31 | 1 | 0 | 0 | 0 | 30 |

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

| | | | | | |
|---|---|---|---|---|---|
| Male | 629 (Mound) | 55 (Seioto) | Salary | 499 (Mound) | 13 (Seioto) |
| Female | 132 " | 2 " | Hourly | 262 " | 44 " |
| Total Last Month | 831 | | Total Technical | | 213 |
| April Terminations | 13 | | Total Semitechnical | | 129 |
| | 818 | | Total Nontechnical | | 476 |
| April Employment | 0 | | Total | | 818 |
| Total | 818 | | | | |

Mound Laboratory Personnel

| | |
|---|---|
| Scientific and Technical | 375 |
| Administrative and Clerical | 122 |

Mound Laboratory Personnel (Cont'd)

| | |
|---|---|
| Service, Maintenance, Custodial and Guards | 264 |
| Construction | 0 |
| Total | 761 |

Ealeta Laboratory Personnel

| | |
|---|---|
| Scientific and Technical | 3 |
| Administrative and Clerical | 5 |
| Service, Maintenance, Custodial and Guards | 49 |
| Construction | 0 |
| Total | 57 |

6. Operating Costs (Estimated)

| | Actual July 1, 1949 to March 31, 1950 | Estimate April, 1950 | July 1, 1949 to April 30, 1950 |
|---|---|---|---|
| #3,000 (Weapons) | | | |
| Production | $1,384,160.63 | $ 151,000.00 | $ 1,535,160.63 |
| General Research | 623,260.80 | 71,500.00 | 694,760.80 |
| Item ("Y" Work) | 569,319.35 | 66,000.00 | 635,319.35 |
| Total | $2,576,740.78 | $ 288,500.00 | $ 2,865,240.78 |
| #4,000 (Reactor Development) | | | |
| N. D. Research | 127,892.73 | 15,500.00 | 143,392.73 |
| #6,000 (Biology and Medicine) | | | |
| Biological Research | 259,933.69 | 29,000.00 | 288,933.69 |
| Undistributed Costs: | | | |
| A.E.C. Local Office | 4,503.54 | 500.00 | 5,003.54 |
| Dismantling Units #3 & #4 | 71,802.60 | 150.00 | 71,952.60 |
| Total | $3,040,873.34 | $ 333,650.00 | $3,374,523.34 |
| Scioto Laboratory, Marion, Ohio | $518,932.13 | $ 40,000.00 | $ 558,932.13 |

Operating Costs

| | | Actual March 1950 | July 1, 1949 to March 31, 1950 |
|---|---|---|---|
| #3,000 (Weapons) | | | |
| Production | | | |
| Primary Product | $ 134,689.49 | | |
| Sources | 14,781.02 | $ 149,470.51 | $ 1,384,160.63 |
| General Research | | 71,878.50 | 623,260.80 |
| Item ("Y" Work) | | 65,843.47 | 569,319.35 |
| Total | | 287,192.48 | 2,576,740.78 |
| #4,000 (Reactor Development) | | | |
| N. D. Research | | 15,485.50 | 127,892.73 |
| #6,000 (Biology and Medicine) | | | |
| Biological Research | | 29,201.98 | 259,933.69 |
| Undistributed Costs: | | | |
| A.E.C. Local Office | | ( 673.84 ) | 4,503.54 |
| Dismantling Units #3 and #4 | | 103.08 | 71,802.60 |
| Total | | $ 331,309.20 | $ 3,040,873.34 |
| Scioto Laboratory, Marion, Ohio | | 39,740.10 | $ 518,932.13 |

( ) - Credits