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MONTHLY STATUS AND PROGRESS REPORT

727210

FOR MARCH 1949

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A Report Submitted

by the

New York Operations Office

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April 7, 1949

W. E. Kelley, Manager

Feb 22

MONTHLY STATUS AND PROGRESS REPORT

FOR MARCH 1949

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1. ADMINISTRATION

Extensive discussions have been held regarding the new AEC system of job evaluation. A survey of comparative wage structures in the New York area has been completed. The draft of recruitment policies has also been discussed. Labor problems have arisen at St. Louis, in connection with a city-wide laborers' strike, and at Raytheon, regarding seniority rights. Surplus equipment at the Chandler Street Plant, Buffalo, and the H. K. Ferguson Company of N.Y., has been disposed of. A survey of automotive equipment at NYOO has been completed.

Classification and Wage Administration

The objectives and course of action to be followed in the development of a new system of job evaluation for the AEC were thoroughly discussed at the NYOO Manager's staff meeting of March 10. A method for selecting and ranking key jobs was agreed upon. Accordingly, meetings were held with division representatives, who ranked key jobs in NYOO from highest to lowest on the basis of their relative importance. Almost unanimous agreement was reached. These rankings are being reviewed by division directors, who will make their final determination next week. This ranking will then be reviewed by the Manager and forwarded to Washington.

A survey was completed showing the relative wage structures of a series of key positions at NYOO, at Brookhaven National Laboratory, and in private industry in the New York metropolitan area. This information will represent a part of the background material to be considered in the development of the system of job classification and wage and salary administration.

Recruitment

During the month second meetings were held with representatives of all divisions to discuss the draft of proposed procedures and policies on recruitment, selection, promotion, and transfer. The representatives in turn held meetings with all supervisors of their divisions to discuss the draft. A progress report regarding this draft was presented at the NYOO Manager's staff meeting on March 17. The revised draft and changes suggested by supervisors at all levels were discussed again by members of the staff at subsequent meetings. Final review was made by the Manager, and the final revised draft was forwarded to Washington, together with a summary of the discussions and reasons for the changes desired by NYOO operating personnel.

Contractor Personnel Relations

Conferences and follow-up conversations were conducted in connection with several contractor labor problems.

Brookhaven Area. During the month, negotiations between AUI and Federal Labor Union #24426, AFL, were completed, and agreement was reached on all provisions of the contract.

St. Louis Area. Information was received from St. Louis that a strike had been called by the Laborers Union as the result of a jurisdictional dispute

with the Carpenters Union at St. Louis. In response to an inquiry, NYOO was told by a Washington representative of the International Hod Carriers and Building and Common Laborers Union of America that the local Laborers Union had been ordered to postpone the strike and to submit the issue to arbitration. The Director, Division of Organization and Personnel, requested the International to take steps to man the AEC job at St. Louis in the event arbitration failed and a work stoppage occurred. Assurance was given that every effort would be made to do so. Nevertheless, laborers employed on the AEC job and all other construction jobs in St. Louis went on strike Monday, March 28. The International advised that a settlement was anticipated before the week was out, but that every effort would be made to man the AEC job if settlement was not effected promptly.

Raytheon Manufacturing Company. Information regarding the question of obtaining security clearances for employees laid off at other Raytheon plants who may have seniority rights at the AEC plant was obtained at the request of the Director of Labor Relations, Washington Office. Mr. Bertram of Raytheon advised that out of 34 claims by laid-off employees for seniority rights over jobs at the AEC Plant, 21 were not honored, 11 were recognized, and 2 are pending. Security papers have been processed for the 11 whose seniority rights have been recognized. It may be pointed out that if the union's most conservative proposal had been accepted, approximately 66 additional clearances would have been obtained needlessly.

Surplus Equipment at Chandler Street Plant, Buffalo, N.Y.

Lists of the equipment and material located at the Chandler Street Plant have been circulated throughout the Atomic Energy Commission. All items requested by Oak Ridge had been deleted from these lists and have been shipped to those requesting them. Considerable interest is being shown by other AEC offices in obtaining this surplus equipment. Large lists have been received from MIT, University of Rochester, Colorado AEC Office, Brush Beryllium Co., and the Chicago and Pittsburgh AEC Offices; substantial requests are expected from these organizations. Commitments have been received for approximately 75% of the total inventory. The real estate has been reported to the Washington Office for disposal, and it was suggested that the disposal agency take custody of this property on June 1, 1949.

Close-Out of the H. K. Ferguson Office

All office and engineering equipment used by H. K. Ferguson Company in their office at 39 Broadway, New York, in connection with Contract No. AT-32-Gen-16, has been disposed of to Kellex, the University of Rochester, and the Pittsburgh and Kansas City AEC Offices, with a few small requisitions from other sources. The entire office was completely reallocated within 15 days after it had become surplus. Negotiations have been completed to transfer approximately \$269,000 worth of machine tool equipment from Brookhaven, where it was used in connection with this contract, to Project Royal, Kansas City, Mo. The lease for the space at 39 Broadway will be terminated March 31, 1949.

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Excess Automotive Equipment in the NYCO

After a thorough study of the utilization of automotive equipment throughout NYCO, conducted during the last six months, 15 automobiles have been declared excess. These vehicles include 8 sedans, 2 station wagons, and 5 trucks ranging from $\frac{1}{2}$ ton to $2\frac{1}{2}$ ton capacity. The total number of vehicles in operation is thus reduced from 283 to 268. The majority of these excess vehicles were used on contracts which have been terminated; a few became surplus as a result of the consolidation of various operations.

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II. PUBLIC INFORMATION

The Teacher's In-Service Program on Atomic Energy was continued during the month. The construction of atomic energy publicity displays is being discussed with two organizations in New York, and a classified film of AEC production operations has been made.

Teacher's In-Service Program

During the month of March, the Division of Public Information Service continued to assist the Board of Education of the City of New York in the conduct of the Teacher's In-Service Program on Atomic Energy, which consists of a series of fourteen weekly lectures. Two of the March lectures were delivered by Brig. Gen. James McCormack, Jr., Director of Division of Military Applications, Washington Office, and Mr. W. E. Kelley, Manager, New York Operations Office. Parts of Mr. Kelley's speech were rebroadcast over the Mutual Broadcasting System on Friday, March 25. The response to this lecture series has been most encouraging.

The municipal radio station, WNYC, has made recordings of the lectures, and on Tuesday, April 5, from 8:30 to 9 PM, will start broadcasting a series of 11 weekly programs to educate the public on the significance and implications of atomic energy.

Publicity Displays

R. H. Macy & Co., Inc., department store, New York, and Sloan House, YMCA, New York, have expressed keen interest in constructing publicity displays on atomic energy with the cooperation of NYOO. Discussions with both groups are now under way.

Classified Film

A photographic team toured NYOO facilities for the purpose of shooting a classified film dealing with production activities. The team spent ten days on the project. Complete pictures of all phases of the operations could not be taken because of the limited time available for the project. It was estimated that a more complete series of pictures would require several weeks. The following plants were visited:

Middlesex Warehouse, Middlesex, New Jersey
Simonds Saw & Steel Co., rolling operations, Lockport, New York
Electro Metallurgical Division, U.C.C.C., metal production,
Niagara Falls, New York
Linde Air Products Co., green salt production, Tonawanda, New York
Harshaw Chemical Co., process gas production, Cleveland, Ohio
Mallinckrodt Chemical Works, refinery operations, St. Louis, Mo.

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The general arrangements were handled by the Public Information Branch, Washington Office, and the photographers were accompanied by the Director, NYOO Division of Public Information Service. The pictures were developed and shown to interested parties at NYOO. The pictures will be edited and put into a chronological continuity. They will then be reviewed again and cut for security reasons. After this cutting and editing, commentary will be dubbed in for an unclassified picture for general release.

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III. PRODUCTION

A new plan for distribution of uranium feed materials was developed. A special conveyor unit for unloading powdered pitchblende ore from tank cars is being tested to determine the feasibility of this method of shipping. Construction plans for Middlesex feed material Warehouse are being pushed to completion. The first shipment of radium cake was made from Mallinckrodt Chemical Works to Lake Ontario under the new plan of handling and storage.

Methods of speeding design work on the new Mallinckrodt Chemical Works metal plant were discussed. Cost studies are being conducted to determine optimum metal and green salt production rates. The graphite procurement situation improved considerably during the past month. Metal rolling operations are proceeding as scheduled. Harshaw submitted engineering proposals for new green salt and process gas reactors.

Considerable progress was made in research projects at Battelle Memorial Institute on the recovery of thorium and uranium from monazite sands.

Acceptable beryllium castings from the bottom-pull type furnaces were produced last month by The Beryllium Corporation. A conference was held in Washington to plan production of beryllium assemblies for use in the Materials Development Reactor. A survey was made of the extrusion plant at Adrian, Michigan, to arrange for installation of facilities to do AEC work. A survey is being made to locate suitable shops for machining beryllium shapes. Attention has been given to health problems in beryllium flake production. Plans for the new Brush Beryllium Co. plant at Luckey, Ohio, are going forward, and considerable surplus equipment has been secured from Y-12. Work has begun on the pilot plant for the Sheer-Korman process.

Considerable progress has been made in the powder metallurgy research program, and various techniques of beryllium production and fabrication are being investigated. The construction of zirconium casting apparatus has been authorized. Increased AEC requirements of zirconium have necessitated new arrangements with Foote Mineral Co. and the Bureau of Mines. Rohn and Hass expressed optimism as to the potentialities of the ion exchange method for the separation of hafnium from zirconium. The third formal meeting of the Zirconium Advisory Committee was held in New York on March 23, 1949.

NYOO Accountability Branch records were audited by Washington representatives. The Vulcan Crucible Steel Co. was visited by an NYOO representative and SF material accountability procedures were reviewed. Procedures were set up to code all government bills of lading for control of costs. NYOO confirmed to Washington the draft of revised rules on classification of SF forms.

New arrangements have been made for gold analyses of radium sludge. A large part of the flow of analytical work to the National Bureau of Standards was stopped during the month. This work will be diverted to the New Brunswick Laboratory. The Harshaw Chemical Co. was visited by an NYOO analytical representative and recommendations were made to improve procedure.

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Uranium Feed Materials Development

A proposed plan was prepared for distributing feed materials other than pitchblende and CX to the two brown oxide plants for the remainder of calendar year 1949. The portion of the plan dealing with Harshaw provides for direct shipment of all black oxide from Vitro Manufacturing Co. and Eldorado Mining and Refining, Ltd. These shipments are to be supplemented by additional black oxide from existing Middlesex stocks and purchases from vanadium producers. The part of the proposal relating to Mallinckrodt provides for the use of pitchblende supplemented by V-4 soda salt, Middlesex Warehouse soda salt stocks, purchases from vanadium producers, and the product of the new Colorado processing plant. The Middlesex soda salts were recently tested in the plant, and it was concluded that they will make satisfactory feed materials.

Brown Oxide Consumption and Inventory

During the period June 1, 1948, to December 31, 1948, production facilities administered by the New York Operations Office consumed 150 tons of brown oxide in excess of that produced. This deficiency was supplied from excess brown oxide held at the St. Louis Range. In addition, inventories of brown oxide were increased at operating plant sites to approximately 77 tons. Consequently, the stockpile of brown oxide at the Range decreased 227 tons.

Graphite Procurement for Uranium Metal Production Operations

It was mentioned in last month's report that the New York Operations Office was encountering difficulty in procuring graphite to sustain continuous metal production operations during the remainder of calendar year 1949. As a result of pressure exerted on the National Carbon Company by the Washington Division of Production, the following satisfactory arrangements have been made:

1. The National Carbon Company has indicated that it has sufficient graphite on hand and on schedule to meet orders already placed and accepted.
2. The company has indicated that it can start deliveries of graphite in June, 1949, on material for which orders were placed before March 10, 1949. Both Mallinckrodt and Electro Met placed orders with the National Carbon Co. prior to March 10, 1949, for their estimated graphite requirements through June 30, 1950. Furthermore, Electro Met has negotiated directly with National Carbon Co., and has been assured that any special graphite parts they may require before June of this year will be supplied. For this reason it is now unnecessary for NYCO to obtain any graphite for Electro Met from Hanford Operations Office reserve stockpile. Barring any further difficulties in graphite delivery from the National Carbon Co., current inventory together with present orders should be sufficient to keep metal operations at Mallinckrodt and Electro Met functioning continuously.

Uranium Metal Rolling Operations

The rolling contractors have been requested to scrap all bar sections showing excessive crosswise surface cracks. This measure was adopted after the cracking was found to be associated with the correlation which has been noted

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between low slug reactivity, low density, and high magnesium and nitrogen content.

Additional installations were made to improve health conditions at the rolling mills. In order to reduce dusting, a larger ventilation hood fan and one section of floor grating were installed at Vulcan Crucible Co. A survey will be made to determine the extent of the atmospheric dust reduction. At Simonds Saw & Steel Co., floor grating was placed at all four rolling locations to supplement the ventilation system which was completed several months ago. The atmospheric dust condition at the latter installation is still being studied by the NYCO Medical Division in an effort to control this hazard.

Simonds was requested to prepare a design and proposal for installation of a lead-bath billet-heating furnace. This measure is designed to eliminate the billet oxidation occurring in the existing furnaces and thereby reduce costs. A suggested design complete with necessary limitations was submitted to Simonds by the technical representatives of the NYCO Production Division.

A breakdown of controllable costs associated with billet rolling at Vulcan was prepared. For purposes of comparison, expected costs were calculated for a proposed forging-rolling operation. The latter indicated a saving of about $2\frac{1}{2}\phi$ per pound of metal over the former. This information should prove useful to the Hanford Group now considering a rolling mill installation.

Green Salt and Hexafluoride Reactor Proposals

Harshaw submitted its engineering proposals for the new green salt and process gas reactors. No estimated costs were submitted with the engineering proposals. Copies of these proposals were sent to ORCO, K-25, St. Louis Area, Mallinckrodt, and the Washington Office. Construction and operating estimates for a plant based on the design presented in Harshaw's proposals are now being prepared and are expected in early April.

Harshaw will prepare approximately 1500 pounds of green salt in the pilot plant equipment. This will be reduced to metal in one of the metal plants in order to ascertain definitely the suitability of green salt made in Harshaw's new-type reactor for metal production.

The Mallinckrodt Chemical Works is continuing with development work on the new type reactor for the manufacture of green salt. Some of the green salt produced by this process has already been successfully reduced to metal. In order to establish completely the feasibility of the new reactor, Mallinckrodt plans to produce several tons of this green salt for testing in metal production.

Allocation of Green Salt and Metal Production

A study was made of metal production costs at Electro Metallurgical Division, U.C.C.C., and Mallinckrodt Chemical Works at various production levels to determine the most desirable allocation of production to these plants between the present time and June, 1950. At about that time, the new

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Mallinckrodt plant will be able to produce all the uranium metal required by the Commission. It appears that it would be most economical to keep Mallinckrodt and Electro Met at a high level of operation. This would facilitate the early cessation of activity at the latter installation. A final decision in this matter can be made only after the completion of a careful budget study, which is now under way. A similar study has been started to determine the feasibility and economic justification of producing green salt at Mallinckrodt and Linde at high levels to permit an early shutdown at Linde.

New Uranium Metal Plant

The current status of the Mallinckrodt Plant 6-E design was reviewed in meetings at St. Louis and New York among Singmaster & Breyer, the engineers, Mallinckrodt, and the AEC. Although methods were discussed for speeding the design work and breaking the job into sections to permit the early starting of some construction, it was concluded that design work would continue at least into the third quarter of calendar year 1949. The cost of engineering and procurement work associated with Plant 6-E and the boiler house is estimated to be nearly \$600,000. The increase over initial estimates is largely attributable to medical requirements not anticipated at the start of the job.

Several items of equipment proposed for Plant 6-E were sufficiently novel to require some pre-testing before ordering in quantity for the plant. Of these, one recasting furnace which was installed at Mallinckrodt operates with a desirably lower vacuum than the old metal plant furnaces. The first indications are that satisfactory metal castings will be produced. It is reported that parts of the experimental reduction-bomb loading machine have been received, and that the assembled unit will be installed for testing at Mallinckrodt in about one month.

Solids Conveying Test

A test was run in a small transparent model tank car at the Convair Corporation to determine the feasibility of using this Company's unit for unloading fluidized pitchblende from a tank car by air pressure. Dust leakage necessitated interruption of the preliminary test at Convair, but the operation was carried to a successful completion. The model tank car was shipped to the Middlesex AEC Warehouse where it will be used for final testing of this unique method of conveying various solids used by the Commission. It is anticipated that the new system will reduce drum and handling expenses, and there are also indications that this technique has distinct medical advantages.

Developments at the Middlesex Warehouse

In cooperation with the NYOO Staff Engineering Division, technical representatives of the Production Division drew up a list of specifications which could be presented on bid forms to architect-engineers for the proposed improvements in the Middlesex Warehouse. Particular effort was concentrated on drawing-up the specifications for the facilities building.

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Re-drumming of the captured soda salt was begun at Middlesex. To date, approximately 75% of the entire amount of material has been re-drummed. It is being placed in reconditioned steel drums which are coated on the inside with an asphaltum-type paint to increase corrosion resistance.

Radium Cake Handling and Storage

Technical representatives of the New York Operations Office conducted a study of radium cake handling and associated problems. This investigation resulted from the African Metals Corporation's request that the Commission store all such cake produced after April 1, 1949. In the study it was concluded that drum storage of radium cake in the "igloos" at Lake Ontario Ordnance Works is the most economical solution to the problem for the Commission.

In accordance with this decision, the first shipment of cake to Lake Ontario for storage has already been made. During the month final arrangements were made for the arrival of this shipment, and a technical representative of the New York Operations Office attended the first unloading operations. The condition of the drums and drum liners was checked, and various recommendations for improvement were made to Mallinckrodt. The unloading crew from Linde performed their work satisfactorily, despite the limited temporary handling facilities. A fork-lift truck equipped with special metal shielding for radiation protection and with forks placed in vertical position for drum handling was sent from Middlesex to the Lake Ontario Ordnance Works to assist in unloading the radium cake.

The drums which arrived in this first shipment were specially treated to resist corrosion. They contained a lacquer liner and a polyethylene bag. Of the 96 drums which arrived, it was observed that approximately 12 were dented. Only one of these dents was serious enough to cause breakage of the lacquer liner. It was observed that the polyethylene bags in the few drums checked had small tears. It is believed that this can be eliminated by an improved loading technique which is now being followed at Mallinckrodt Chemical Works. Studies will continue at Lake Ontario as future cake shipments are received in order to find the best solution to the materials handling, radiation, and radon evolution problems involved.

Thorium and Uranium Recovery from Monazite Sand

Progress is being made on research projects at Battelle Memorial Institute dealing with the recovery of thorium and uranium from monazite sands. These are two major steps in the treatment of the monazite raw material. In the first step, the mineral is broken up and the phosphates are removed; in the second, the resultant mixture of thorium, uranium, and rare earth oxides is dissolved in nitric acid to provide a suitable solution for solvent extraction steps.

Caustic Soda Dissolution. Preliminary studies show that treatment of finely ground monazite sand with hot aqueous caustic soda represents an excellent method of breaking up the mineral. The sodium hydroxide solution is recycled; the sodium phosphate formed is removed by crystallization.

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Dissolution of the Reaction Mass in Nitric Acid. The residual oxides and hydroxide from the caustic soda treatment can be dissolved in nitric acid solution containing hydrogen peroxide. Hydrochloric acid also dissolves the oxide cake satisfactorily without the use of hydrogen peroxide.

Separation of Thorium and Uranium from Rare Earths by Precipitation Methods. Work was undertaken to develop precipitation techniques for the preliminary separation in acid solution of the uranium and thorium from the bulk of the rare earths. Two important precipitation agents were investigated: hydrogen peroxide and ammonium hydroxide. Both reagents precipitate the thorium and uranium, leaving the rare earths in solution. Each method was tested both in nitric acid and hydrochloric acid solutions, and in all cases quantitative recoveries of thorium were obtained, although it appeared that only 50% of the uranium precipitated. In any case, 95% of the rare earth content was separated from the thorium and uranium. Analytical difficulties were indicated by uranium material balances of 120% obtained in the precipitation experiments. The analytical problem is receiving intensive study, and the question of the true amounts of uranium present in the monazite sand itself and in solutions containing large amounts of rare earths is still to be settled.

Solvent Extraction. Mixtures of butyl phosphate and hexane have desirable properties for extracting uranium and thorium from the rare earths in a nitric acid solution. Nevertheless, on the basis of the present analytical results it has been possible to extract only about 50% of the uranium. The proposed extraction process is based on the use of the above-mentioned solvent mixture in three counter-current packed columns or their equivalent. Laboratory tests were carried out by simulating a mixer settler operation with a series of separatory funnels; the funnels functioning both as mixers and settling chambers. The behavior of thorium and uranium did not seem to be entirely consistent with the distribution coefficient data already obtained. This results from a tendency of some of the lesser constituents of the rare earths to show preferential distribution in favor of the organic phase. An investigation of this problem was conducted at the Oak Ridge National Laboratory by a representative of Battelle Memorial Institute, using radioactive tracers. Results of this work should be available within a few weeks.

Beryllium Casting

Progress has been registered during the month toward the production of acceptable beryllium castings. Additional facilities for casting are being provided by converting and modifying equipment presently available.

The Beryllium Corporation. Last month it was reported that The Beryllium Corporation had completed the conversion of the Government-owned casting furnaces from a stopper-rod type to a bottom-pull type furnace. During March emphasis was placed on obtaining the operating conditions necessary for producing acceptable billets. As a result of these efforts, two acceptable billets were produced. It is felt that most of the conditions required for the reproduction of these results have been established; consequently, the continuous production of acceptable beryllium castings is expected during April.

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Massachusetts Institute of Technology

The motor-generator set at MIT used for the casting of beryllium billets broke down during March. The set is being repaired as rapidly as possible. Casting of 8" billets under controlled conditions of cooling will be continued at MIT. In connection with this, a furnace for 8" diameter billets is being constructed. This furnace will be based on modifications of the furnaces used to date and will incorporate improvements which are expected to produce consistently good billets. Another phase of the casting program that has been proposed by MIT and approved by NYOO provides for the casting of 10" diameter billets. This program for casting 10" billets came about as a result of observations made at the Revere Copper & Brass Co. this month during the extrusion of 8" diameter billets into 3-1/2" squares for the Materials Development Reactor program. On the basis of previous experience, it was felt by Dr. Kaufmann and his group that one factor causing the cracking of the extruded metal might be the small area reduction. Before constructing a furnace for the casting of 10" diameter billets, another modified furnace for 8" diameter billets will be built, in order that a maximum knowledge of casting techniques may be acquired at a minimum cost before work is begun with 10" billets.

New Facilities

As reported previously, expansion of the casting facilities at The Beryllium Corporation and the Brush Beryllium Company has been started. Arrangements have been made with The Beryllium Corporation for the immediate installation of a third casting furnace in the present Government-owned casting plant.

A supplement to Brush's construction Contract AT(30-1)-541 is in the process of being drawn up to provide for the casting facilities at Luckey, Ohio.

Beryllium Extrusion

On February 18, 1949, a conference was held in Dr. L. R. Hafstad's office in Washington to plan for the production of beryllium assemblies to be used in the Materials Development Reactor. At the conference the Reactor Steering Committee presented the following time schedule for the extrusion and machining of beryllium assemblies for the Reactor:

1. Production extrusion to commence September 15, 1949.
2. Production machining to commence November 1, 1949.

Dr. S. McLain, Chairman of the Reactor Steering Committee, stated that there is a possibility that the full scale start-up date for the Materials Development Reactor may be advanced from the summer of 1951 to March, 1951.

To meet the production schedules set up by the Committee, the following actions have been taken since the last monthly report regarding the extrusion and machining of the beryllium assemblies.

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Adrian, Michigan. On February 28, 1949, a survey was made of the surplus extrusion plant at Adrian, Michigan, with representatives of The Canton Drop Forging and Manufacturing Co. and Mr. J. L. Gregg, Metallurgical Project Coordinator, in order to determine and outline the work to be done in setting up facilities for the operation of a 2200/550-ton extrusion press with a piercing attachment.

The following day the MIT group extruded $3\frac{1}{2}$ " squares on a 2,000-ton extrusion press at the Revere Copper & Brass Co., Inc., Detroit, Michigan. The squares are the tentative extruded shapes for the Materials Development Reactor. Of seven or eight 8" diam. beryllium billets extruded, one was extruded successfully. In the other cases the extruded metal cracked in the center or trailing sections of the pieces. The crack emanated from the edge and extended in towards the center of the metal. From observations made during this extrusion, it was decided to encase the beryllium billets in thicker steel jackets and to make some revisions in the die design.

Drawings for three sets of dies were submitted to the Canton Drop Forging and Manufacturing Co. These included two similar in design to the die used at the Revere Copper and Brass Co. and one completely revised die. The company was requested to make up models of these dies and to submit them for approval. When approved, these dies will be used in the developmental extrusion at Adrian, Michigan, which is tentatively scheduled for the middle of April.

Mr. J. Larson, Administrator of the WAA, and Mr. Vanderwindy of Kaiser-Frazer were contacted, and an agreement was reached whereby the Army Air Forces, Wright Field, will sub-lease space and facilities at Adrian from Kaiser-Frazer. The space and facilities are to comprise everything required for the Reactor work, including the 2200/550-ton press and surrounding area, metallurgical laboratory facilities, etc. The Army Air Forces in turn has assigned to the Commission the space and facilities that it requires. The Commission or its contractor will not be required to pay rental to the Army Air Forces for the equipment or space that it will utilize. Arrangements for reimbursing the AAF for the utilities such as power and water which may be used on the Commission's work will be made at a later date.

The occupation of the Adrian premises by the contemplated contractor of the Commission was approved by Kaiser-Frazer and the Army Air Forces on March 29, 1949. The Canton Drop Forging & Manufacturing Co. will commence work at Adrian for the Commission on March 30, 1949. It is expected that everything will be ready for developmental extrusion of 8" diameter beryllium billets by the middle of April.

The letter contract originally submitted to the Canton Drop Forging and Manufacturing Co. was not acceptable to the company. At a meeting on March 28, 1949, counter-proposals were submitted by representatives of the company. Agreements were reached on all points in question with the exception of patents. The company's representatives agreed to discuss the latter question with other officials at their plant, and a decision was anticipated by March 30, 1949. It is expected that the question of patents will be settled as a result of a later conversation with the Vice President of the company.

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Massachusetts Institute of Technology. To assist the Materials Development Reactor Group in developing an extrusion technique for the 3½" squares, MIT will undertake the extrusion of magnesium on their experimental extrusion press. It is hoped that from data obtained, a relationship can be set up between the extrusion of magnesium and beryllium that will enable the group to use magnesium instead of beryllium during the developmental extrusion work at Adrian. This will minimize the expenditure of beryllium metal and the cost of the developmental work.

MIT will also continue to carry out experimental extrusions of beryllium at Revere, thus supplementing the work at Adrian.

Revere Copper & Brass Company. Mr. Todt, Vice President of the Revere Copper & Brass Co., Inc., has submitted to the company's lawyer a proposal for the use by the Commission of extrusion facilities at their Detroit, Michigan, plant. A meeting with representatives of the company is planned for next month to discuss a contract.

Machining of Beryllium

A survey has been started to locate suitably equipped contract machine shops willing to machine the beryllium shapes required for the Materials Development Reactor. On March 25, 1949 Mr. George R. Beckwith, Sales Representative of The C. L. Gougler Machine Co., Kent, Ohio, visited NYOO at the request of the Beryllium Branch to discuss the production machining of the beryllium shapes for the Reactor. Mr. Beckwith expressed an interest in doing such work for the Commission. It was decided at the meeting that when the design for the beryllium shapes is "frozen", the company will be given an opportunity to make a sample shape in order to arrive at a price for the machining of the shapes. Time and motion studies of the machining operations will be made by the company.

Meanwhile, the survey is continuing in an effort to locate other available contract machine shops.

Beryllium Development

Health and safety problems in connection with beryllium production are being studied. A satisfactory grade of beryllium chloride has been prepared from relatively impure beryllium hydroxide.

Clifton Products, Inc. Results of the air sample taken March 7, 1949, showed the concentration of beryllium in the air to be far above tolerance during loading of the chlorinator. The sample may not have been representative, and Clifton will take another air sample during the next loading. If this sample does not indicate improvement, other steps will have to be taken to reduce the concentration during this operation. The period during which it is not permitted to enter the electrolysis cellroom after pouring the cell has been reduced from eight to four hours, since air samples recently analyzed indicate that the beryllium concentration in the room reaches the tolerance limit in approximately three hours.

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During the first regular production week approximately 25 pounds of beryllium were produced. This represented three electrolysis batches. As of March 25 enough unbeneftiated material was on hand to produce approximately thirty pounds of high-quality flake beryllium. The maximum production rate was considered to be five electrolysis batches per week, which is equivalent to about forty pounds of flake. Health and safety chlorinator changes have altered operating characteristics, and thus reduced the output rate to the equivalent of three batches per week. For example, heat transfer characteristics have changed as a result of the installation of a ventilation system. An increase in the production rate of the chlorinator will in general depend upon the rediscovery of the optimum combination of the operating variables under the new conditions.

The program for the preparation of course-grain samples of beryllium oxide by decomposition of beryllium oxalate is nearly complete at Clifton, and arrangements have been made for the preparation of electron photomicrographs of these samples at Oak Ridge.

Brush Beryllium Company. As reported previously, the semi-pilot plant scale equipment for the vapor-phase reduction of beryllium chloride with sodium is essentially completed, and expansion of operations is contingent on the accumulation of sufficient stocks of suitable beryllium chloride.

In connection with beryllium chloride reduction studies, Brush has been able to prepare a satisfactory grade of chloride, starting with a relatively impure, production-plant type of beryllium hydroxide. By a careful control of the chlorinator and condenser temperatures, it has been possible to separate effectively the beryllium chloride from the iron contaminant.

In a study of the direct chlorination of beryl ore, Brush has recently been able to obtain a conversion to beryllium chloride of 60 per cent of the beryllium content in the ore.

Beryllium Metal Production

The target date for operation of the new Brush plant at Luckey, Ohio, has been set as August 1, 1949. To ensure that operations will actually begin by this date, schedules have been set up for the various stages of construction and installation. Brush is making arrangements to procure all the necessary materials in time to ensure that this schedule will be met.

Negotiations are nearing completion with Brush to produce approximately 1,000 pounds of metal in the Cleveland pressure furnace and to fabricate this together with approximately 2,000 pounds of Government metal.

On December 9, 1948, a meeting was held among representatives of OROO, NYOO, ORNL, and the Research Division, Washington Office, regarding beryllium quality control. As a result of this meeting, Mr. W. E. Kelley, NYOO Manager, submitted a proposed Beryllium Quality Control Record Form, which was approved and printed. The printed forms were received this month, and steps have been taken to supply all producers and fabricators of beryllium in order to get the quality control program started.

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Beryllium Plant Construction

New facilities for the production of beryllium are under construction, and procurement of the special equipment necessary is in process.

Burns & Roe, Inc. As anticipated in the previous monthly report, work has begun on the alteration of the Maspeth buildings of the Naval Shipyard, in preparation for installing a pilot plant for the Sheer-Korman process. At the present time, Burns & Roe is making arrangements for the removal of property such as lockers, etc. which is owned by the Navy and is now in the buildings. At the same time, plans are under way to erect a fence around the property. Burns & Roe is contacting various companies for the purpose of getting quotations on the construction of the special equipment necessary for the Sheer-Korman process.

Brush Beryllium Company. As arranged previously with the Brush Beryllium Company, procurement schedules have been set up for the equipment required in the beryllium production plant at Luckey, Ohio. A trip was made to Oak Ridge to investigate the possibility of obtaining some of the necessary equipment from that available at Y-12. It was possible to locate much of the tanks and control equipment needed at the Luckey plant, and thus to eliminate the long delays which would have been necessary for procurement. Arrangements are being made for transfer of this equipment. At the same time approvals are being given to the Brush Beryllium Company to purchase equipment which cannot be obtained from surplus sources.

In the light of the restrictions imposed by the Munitions Board on the use of the Luckey plant, it was necessary to make a re-appraisal of installation plans and the estimated costs for the beryllium production plant on this site. As originally planned, the new beryllium plant would have occupied the area of the present 10 Luckey furnaces plus the center portion of the building. It was indicated, however, that the Munitions Board would require that the 10 furnaces be replaced if an emergency were declared, in order to guarantee a production capacity of 10 million pounds of magnesium. A total of 5 plans were developed for circumventing these difficulties. The fourth plan was finally selected as the most desirable; the details of the various plans were as follows:

1. The original plan provided for the removal of the 10 furnaces.
2. The second plan involved the use of the entire center aisle of the first floor, plus the center section and the ground floor and center section. This plan was eliminated because it would involve spreading the equipment over great distances, thus making it impossible to achieve satisfactory operating efficiency.
3. The third plan involved the removal of the first four Luckey furnaces on the northwest side of the building closest to the center section. This plan was eliminated because of the high costs which would be involved in restoring the magnesium producing capacity in case of necessity.

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4. The fourth plan was considered to be the most desirable from the standpoint of cost and efficient plant arrangement. It involved the use of the center portion of the smelting building on the first and ground floors, plus the addition of a building, approximately 50' x 400', on the south side of the present building. Under this arrangement none of the present magnesium plant would be disturbed, and both the beryllium plant and the magnesium plant could be operated simultaneously. Although the additional cost for this plan would be approximately \$100,000, this additional expenditure would result in a beryllium plant which would not have to be disturbed for magnesium production in the event of an emergency. This plan would also permit arrangement of plant equipment so as to secure maximum efficiency of operations.

5. The fifth plan contemplated the construction of a new building to house the complete beryllium production plant, and use of two Luckey furnaces in their present location. This plan was eliminated on the basis of its high cost and the time involved in constructing a new building completely equipped with service facilities.

Middlesex AEC Warehouse

All equipment used for sampling and crushing operations at Middlesex was cleaned thoroughly in preparation for the crushing and sampling of beryl ore. On Monday, March 28, 1949, three thousand pounds of beryl ore was fed to the system at Middlesex as a test to see if the equipment would crush and sample it satisfactorily. Several minor adjustments will have to be made before this ore can be handled properly. These adjustments should be completed by the end of April, and the equipment should then be ready for crushing and sampling on a production basis.

Metallurgical Research and Development

Uranium powder required for powder-metallurgy studies on uranium and its alloys is prepared by Brush and Sylvania by converting massive uranium to the hydride and degassing. The preparation of uranium powder by the vapor-phase reduction of uranium tetrachloride with sodium is being considered as an alternate method by the NYOO technical staff. Various methods of beryllium production and fabrication are being investigated at MIT.

Sylvania Electric Products, Inc. The 500-ton Lake Erie hydraulic press has been installed in Building No. 2 at Sylvania and is now in satisfactory operation.

The die for hot-pressing powder under vacuum is expected to be completed very shortly. Two immediate uses for this die include:

1. The preparation of undoped uranium samples, sintered in the alpha range. It is expected that the specimens obtained will be randomly oriented by virtue of the preparation by powder metallurgy and will be fine grained in view of the relatively low sintering temperature involved.
2. The preparation of Hanford-type slugs by hot-pressing uranium powder in aluminum tubing.

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A conference was held at Sylvania on March 21 to discuss health-physics problems associated with future handling of enriched uranium by the company. Sylvania was instructed on the preparation of a feasibility report, covering the metallurgical, security, and health aspects of handling this material. The enriched uranium quota of Argonne National Laboratory includes sufficient metal to fill Sylvania's requirements.

Considerable progress is being made on the preparation of sandwiches composed of uranium-zirconium meat with zirconium bread, and it is expected that several samples using normal uranium will be available for shipment to Argonne National Laboratory within the next few weeks. Heretofore, Sylvania has prepared the zirconium powder required in sandwich studies by converting zirconium crystal bar to zirconium hydride and degassing to yield zirconium metal powder. Recent work has indicated that it is possible to sinter zirconium hydride and obtain zirconium of 97 per cent theoretical density, in which no residual hydrogen can be detected. In this case the hydrogen decomposition and sintering are accomplished in one operation.

A supplement to Contract AT-30-1-GEN-224 has been issued and is awaiting signature. This supplement provides funds for additional security and safety installations required at Sylvania. It also includes the erection of cyclone fencing and protective lighting, which will be required before Sylvania is permitted to receive enriched uranium. Work on the erection of the fence will be initiated shortly.

Massachusetts Institute of Technology. Additional laboratory space will be provided on the first floor of the Hood Building in a room separate from but adjacent to the present laboratory. The necessary items of steel-construction laboratory equipment will be purchased and installed during the coming month. In addition to providing for general laboratory expansion, the new facilities will allow for the determination of elements such as N₂ and B, which are difficult to determine accurately under present conditions because of contamination from outside sources.

Efforts to prepare high-purity beryllium by electrodeposition from liquid ammonia were unsuccessful. Work is now in progress on deposition from ethyl pyridinium bromide, and a preliminary experiment has given a small amount of gray deposit which reacts with water. Arrangements have been made to supply MIT with information concerning the work on deposition of aluminum from ethyl pyridinium chloride now being done by Battelle under a Navy contract.

Liquid to solid evaporation from a tantalum crucible using glass apparatus is being tried as a method for preparation of high-purity beryllium. Difficulties have been encountered with the heating coils, so that condensation could not be controlled and confined to the proper place, but this is not expected to present a major obstacle. MIT has tried this same method previously without success, but this time it is planned to use a much higher vacuum to reduce the oxygen pick-up of the distilled metal.

A recent extrusion of beryllium flake metal has not shown the high stress-rupture strength at 2000°F reported sometime ago. This may be the result of the reduction of oxide content of the finished product. More work is planned on the extrusion of the flake metal to check these results. Efforts at homogenization heat treatment of extruded crystal bar to distribute the

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oxide uniformly throughout the entire cross section seem to be successful thus far. No homogenized specimens have been rolled as yet.

The use of heated molds in casting beryllium has been tried in an attempt to avoid the cracking of billets as poured. Four eight-inch billets were cast in succession, and they appeared to be satisfactory.

Corrosion behavior of beryllium in high-temperature water has been erratic. A sample taken from a vacuum-cast billet disintegrated completely in 300°C water, whereas other samples have often exhibited very good corrosion resistance. A piece of a single crystal and also a piece of a large-grained casting came apart during the corrosion test. It is thought that impurities may cause these erratic results.

Until recently the fabrication of uranium-zirconium sandwiches by rolling has progressed slowly, chiefly because of the shortage of zirconium metal. Work done thus far on the rolling of uranium-zirconium alloys has shown that alloys with up to 22 per cent uranium can be cold rolled.

In connection with the construction of the hot laboratory, the final decision reached was that New York Operations Office will contract directly for the unclassified phase of the construction. Bids for this work will be invited shortly. Previously it had been thought that the New York Operations Office would write a lump-sum contract with MIT, who in turn would subcontract to have this construction work performed. It is now felt that it will be more expedient for NYOO to contract directly with the construction company.

Zirconium Process Development

Several research programs for the development of processes for the production of zirconium are already under way, and others are being arranged.

National Research Corporation. National Research Corporation has requested authorization to proceed with construction of the continuous zirconium casting apparatus according to the drawing recently received by NYOO. The drawing and general scheme of operation were reviewed by Dr. M. Cohen of MIT during his recent visit to NRC, as well as by the entire Zirconium Advisory Committee during their meeting on March 23. General approval was expressed by the Committee, but one modification was suggested. Instead of attempting to bend the cast ingot, the ingot will be withdrawn straight, thus limiting its length. It is felt that this modification will remove one probable source of trouble. If and when short, even ingots are produced by this method, suitable means can be devised to make the casting continuous.

National Research Corporation estimated the cost of the casting apparatus to be approximately \$5000. NYOO is awaiting a cost breakdown from NRC before giving official approval. A timetable prepared by NRC calls for construction of the unit during March and April, 1949.

Progress on the halide dissociation phase of NRC's program is still in the planning stage. Recent calculations, using new data, indicate that the

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chloride does dissociate appreciably at temperatures slightly above the melting point of zirconium. Consequently, $ZrCl_4$ will probably be used as feed to the the dissociation unit. Previously, it was thought that the chloride might not dissociate appreciably under the planned operating conditions, and the iodide was to be used in its place.

Brush Beryllium Company. Brush submitted a proposal to undertake a study of the preparation of ductile zirconium by the vapor-phase reduction of zirconium tetrachloride with sodium. Authorization to initiate this study under Contract AT-(30-1)-510 has been given. In the initial phases of the work an effort will be made to use as much as possible the laboratory equipment employed in the study of the vapor reduction of beryllium chloride with sodium.

Electro Metallurgical Division, U.C.C.C. At the March 23 Zirconium Advisory Committee meeting, it was decided that consideration should be given to the possibility of Electro Metallurgical's undertaking a zirconium development program for the AEC. The projected work involves possible improvements in the Bureau of Mines process for the reduction of zirconium tetrachloride to metal. On March 24, 1949, a discussion was also held with representatives of the Electro Metallurgical Division on this subject. They expressed considerable interest in the possibility of their undertaking such a program, and will submit a proposal shortly.

University of Louisville. Authorization was given to the University of Louisville to purchase approximately \$900 worth of glass laboratory distillation equipment to initiate the hafnium-zirconium separation program. Arrangements are being made to have a Louisville representative visit Foote Mineral Company during start-up of their column. An Argonne National Laboratory representative will also be present at the same time, and it is expected that through this meeting Louisville will receive firsthand all information now available on the distillation method for hafnium-zirconium separation.

National Bureau of Standards. The National Bureau of Standards will start work on a pilot-plant scale on their process of hafnium-zirconium separation by fractional precipitation of the phosphates in strong acid solutions. A transfer of funds, \$5000, to the Bureau from the New York Operations Office will be arranged to cover this work. Laboratory work is continuing on the program, and the effect of acid concentration upon separation efficiency is currently being investigated. By using ethyl phosphate as the precipitating agent, a granular precipitate is produced, which represents an improvement over the slimy precipitates usually produced with phosphoric acid.

Oak Ridge (Y-12). It was reported last month that Y-12 had been requested to submit a proposal on the zirconium program which they were interested in conducting. This proposal has not been received to date, but it is expected at any time. In view of the interest of Y-12 in conducting extraction studies, the Zirconium Advisory Committee at the March 23 meeting decided that the Y-12 laboratory might well be the logical place to carry on the zirconium-hafnium separation studies by thiocyanate and TTA extraction.

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Rohm & Haas. A meeting was held at Rohm & Haas early in March to discuss the company's program on the separation of hafnium from zirconium by ion exchange. The representatives of Rohm & Haas felt that ion exchange was worthy of further consideration and expressed optimism as to the potentialities of this method. In preliminary work reported by Rohm & Haas, the hafnium content was only reduced to approximately one per cent, and large solution dilutions were involved. Nevertheless, the company felt that these experiments had succeeded, since they were designed to demonstrate the relative ease of picking up and removing hafnium and zirconium ions from an ion-exchange resin.

Dr. Evers advised that Rohm & Haas would not be in a position to undertake a long range development program for the AEC on the ion exchange separation of hafnium and zirconium; however, he stressed the interest of his company in this problem. He further stated that Rohm & Haas would be most willing to lend all possible assistance to whichever group undertakes this ion-exchange study. Rohm & Haas will continue their investigation for the next six to eight weeks in an effort to achieve a limit of 0.1 per cent hafnium in the product. They will also investigate many of the variables involved in this process such as solution concentration, temperature, pH, complexing agent, resin particle size, and developer or eluting agent. It is felt that upon conclusion of these studies a fairly realistic evaluation of ion exchange as a potential large-scale method for separation of hafnium from zirconium can be made.

The services of the Bureau of Standards will no longer be available to conduct hafnium-zirconium analyses for Rohm & Haas. Arrangements have been made with Dr. Kaufmann of the MIT metallurgical project to analyze a limited number of samples for Rohm & Haas. Dr. Kaufmann's spectrographic laboratory is interested in running these analyses in order to obtain the experience.

A discussion was also held with Dr. L. Hurd of Rohm & Haas regarding hafnium-zirconium separation by oxychloride crystallization. Dr. Hurd advised that his company would be unable to carry on this program since it is, for the most part, leaving the field of zirconium chemistry and concentrating on organic chemistry. Nevertheless, Dr. Hurd agreed to submit a detailed report to New York Operations Office based on his experience with zirconium oxychloride. This report will include his recommendations as to the studies which should be conducted on the hafnium-zirconium separation by oxychloride crystallization.

Ionics, Inc. Dr. Gilliland, President, and Dr. Juda, Vice President of Ionics, Inc. at Cambridge, Massachusetts, were contacted by New York Operations Office to discuss ion exchange as a possible method for hafnium-zirconium separation. An attempt was made to determine their interest in doing work in this field for the AEC. As a result of this meeting, it is expected that Ionics, Inc. will submit a proposal to the Commission to perform basic research on the problem. The results obtained will be used to determine the feasibility of hafnium-zirconium separation by ion exchange. If the indications are favorable, further calculations will be made regarding the type and size of apparatus, the method of operation, and cost.

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Penn State College. At the February 23 meeting of the Zirconium Advisory Committee, it was generally agreed that a program should be initiated for the synthesis of zirconium and hafnium compounds which might lend themselves to separation by distillation or extraction. It was decided that Penn State College would be considered to undertake such a program, and a proposal was requested and received from them. Negotiations were held with Penn State for a contract to cover the preparation of a series of beta diketones of hafnium and zirconium. It is felt that within this series of compounds one or more may be found which may permit the hafnium-zirconium separation by distillation or extraction. Penn State will merely prepare these compounds and determine their degree of volatility or solubility in organic solvents, as the case may be. The actual extraction or distillation studies on these compounds will be conducted elsewhere.

Zirconium Production

The additional requirements of the Commission for zirconium metal have necessitated increased production by Foote Mineral Company and the Bureau of Mines.

Foote Mineral Company. As previously reported, a contract has been executed with the Foote Mineral Co. for the production of 10 pounds of low-hafnium (less than 0.10% hafnium) zirconium crystal bar, and for the operation of a $ZrCl_4 \cdot POCl_3$ distillation column to produce low-hafnium zirconium oxide. At the present time most of the installation of the distillation equipment has been completed, and it is estimated that this plant will be ready to operate within approximately two weeks. The status of the production of the 10 pounds of low-hafnium zirconium metal is such that it will be completed on or before June 15, 1949. Additional Commission requirements for zirconium crystal bar have necessitated the issuance of Supplement No. 2 to Contract AT-30-1-Gen-336 providing for an additional 25 pounds. This brings the total amount of crystal bar purchased under this contract to 150 pounds.

Bureau of Mines. A working fund of \$20,000 has been established with the Bureau of Mines to supply Commission zirconium requirements for the period April to September, 1949. Approximately 500 to 600 pounds of metal will be supplied through the use of this fund, in addition to the 450 pounds already supplied by the Bureau.

Zirconium Advisory Committee

On March 23 the third formal Zirconium Advisory Committee meeting was held at New York Operations Office. The highlights of the meeting, several of which are discussed above, were as follows:

1. It was agreed that the separation of hafnium from zirconium by ion exchange was worthy of full consideration, and consequently other studies should be initiated in addition to those being conducted at Rohm & Haas. It was agreed that Ionics, Inc. appeared well qualified to carry on such work, and it was mentioned that a proposal was expected from them shortly.

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2. It was also agreed that the hafnium-zirconium separation studies at the Bureau of Standards by phosphate precipitation were quite encouraging and that the AEC should push this work. The Group concluded that it would be beneficial to initiate pilot-plant studies at the Bureau on this method as soon as possible in order that such problems as filtration, materials of construction, etc., could be solved.

3. Representatives of Foote Mineral Company attended the meeting and reviewed the status of their program for the AEC, which includes (a) the operation, on a production basis, of a distillation column for hafnium-zirconium separation and (b) the production of approximately 10 pounds of low-hafnium zirconium crystal bar. Foote representatives also discussed the possibilities of their producing larger diameter crystal bars than are presently available. Foote would be willing to enter into a contract for 10 pounds of 5/8" minimum diameter crystal bar at \$500. per pound. Payment for this material would be contingent on the crystal bar meeting the diameter requirements.

4. It was felt that NYOO should not enter into a contract with Foote Mineral Company for this larger-sized crystal bar unless required by time factors. If time permits, it will be to the advantage of the AEC to enter into a development contract with Battelle Memorial Institute to investigate methods for increasing the size of zirconium shapes which can be made by the iodide process. In this case the Commission would obtain full knowledge of the process developed, whereas no such information would be obtained from Foote.

5. It was pointed out that Knolls Atomic Power Laboratory has completed its studies on hafnium-zirconium separation by TTA extraction, and that chemical engineering studies seem justified. It was agreed that this work should be pushed. Apparently it cannot be conducted in the K.A.P.L. chemical engineering laboratories because of the urgency of other matters. A determination will be made whether redirection of effort might make it possible to undertake this program. Should K.A.P.L. be unable to continue the TTA studies, consideration will be given to the possibility of conducting this work at Y-12. The necessary personnel and equipment is available there, and it would apparently be possible to do this work with existing funds. Should Y-12 not undertake this work, consideration will be given to Syracuse University and/or Arthur D. Little.

6. It was reported that Rohm & Haas was not in a position to conduct studies on hafnium-zirconium separation by oxychloride crystallization. The Committee agreed that this method, classic in nature, was one which should be investigated further. Consideration will be given to the possibility of having this work, which would be initially on a beaker scale, done at MIT, under the existing Contract W-7405-Eng-175.

7. A proposal was received from the Bureau of Mines relative to their undertaking a program on the separation of hafnium from zirconium by thiocyanate extraction. It was decided that action on this proposal would be deferred until a decision is reached regarding the possibility of such a study being conducted at Y-12.

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Source and Fissionable Material Accountability

During the month the NYOO Metal Accountability Branch was concerned with the annual audit of its records, the new procedure for cost control, the upgrading of the classification of the rules covering SF shipping forms, and a study of unaccounted-for losses. Accountability procedures were reviewed and installed at the Vulcan Crucible Steel Company and the Vitro Manufacturing Company. The survey of accountability procedures at the Middlesex Warehouse was received.

Annual NYOO Accountability Audit. A representative of the SF Accountability Branch, ORE, made an audit of the NYOO accountability records of SF materials for the year 1948. A report will be rendered to the Director, Division of Production, Washington Office, on the results of the audit. NYOO records were found satisfactory, and questions which arose were explained. The consolidated NYOO monthly reports for the year 1948 did not give information on the accuracy of the inventories and on the monthly trend of losses. These two items will be included in all future reports. The greatest difficulty experienced in making the audit was in reconciling the cumulative figures on the reports from the St. Louis Area and Mallinckrodt Chemical Works. The auditor will criticize this in his report, inasmuch as most of the trouble resulted from errors made by the installations in their reports.

Cost Control. A procedure was set up during the month by which copies of all government bills of lading will be sent to the NYOO Metal Accountability Branch, in order that those covering transfer of SF material may be coded for control of costs. Assistance was also rendered to a representative of the NYOO Cost Accounting Branch in securing inventory, transfer, and production information for determining costs of SF material.

Classification Rules for SF Shipping Forms. The Washington Office transmitted to the NYOO Metal Accountability Branch a copy of the revisions of the rules regarding SF shipping forms and requested comments. The essential change is to upgrade the classification of the list of rules for classifying SF shipping forms. The Washington Office was advised that NYOO has no objection to the revision.

Vulcan Crucible Steel Company. A visit was made by representatives of the NYOO Production Division to the Vulcan Crucible Steel Company to instruct the newly designated accountability representative concerning records, procedures and transfer of SF material. The methods of preparation, classification, and distribution of SF shipping forms for the transfer of material were explained, as were also the records to be maintained in order to check the reasonable relationship between the weight of the billet rolled and that of the rod produced. The form and preparation of the monthly report were discussed.

During the visit at the Vulcan Crucible Steel Company the procedures for SF material accountability were surveyed. A report of this survey will be prepared and submitted to the SF Accountability Branch, ORE.

Vitro Manufacturing Company. During the month a representative of the Vitro Manufacturing Company visited the New York Office to discuss the new procedures for SF material accountability to be followed at the Vitro Manufacturing Company as the result of a recent survey made there. The use of AEC Form 104 for recording SF forms and the application of adjustments when scrap is reassayed by Vitro were discussed.

Middlesex Warehouse. The draft of a report from the SF Accountability Branch, Oak Ridge Extension, covering a survey of accountability procedures at Middlesex Warehouse was received at the end of the month. This will be reviewed and returned to Oak Ridge to be prepared in final form and submitted to the Washington Director of Production. The Washington Office has requested that studies on the sampling and assaying procedures at Middlesex and that spot weighing and assays should be made monthly in addition to physical inventory counts, in order to verify the contents of the containers.

Analytical Procedures

Several problems were resolved in connection with analysis of radium sludge, transfer of analytical work to the New Brunswick Laboratory, and uranium analysis at Harshaw.

Special Review
Final Determination
Unclassified

By: 4-9-54
P. F. Brown

Radium Sludge Analyses. A request was made to the Director, NYCO Contract Coordination Division, for a modification of the Lucius Pitkin contract for analytical services to permit a gold analysis on the radium sludge for \$8.00 per sample. This is a substitution for the \$27.00 per sample previously allowed for platinum, palladium, silver, and gold assay. This work is not to be transferred to the New Brunswick Laboratory, since the contractor is accepting Pitkin's result.

Transfer of Waste Analyses to the New Brunswick Laboratory. The program for weekly checking of the uranium content of the waste solutions and cakes of the Vitro Manufacturing Company was discontinued after the first set of samples, until the New Brunswick Laboratory is in operation. Except for umpire radium, umpire uranium, neutron absorption, "shotgun", and radon breath samples, the flow of all other samples to the National Bureau of Standards was discontinued on March 20, 1949, and will be transferred to the New Brunswick Laboratory starting April 11, 1949. At the same time arrangements were made with the Raw Materials Operations Office for the discontinuance of their practice of sending samples of Colorado materials to the National Bureau of Standards for umpire uranium assays. The specification analyses on these materials will be undertaken by the New Brunswick Laboratory.

Analyses at Harshaw. A trip was made to the Harshaw plant in Cleveland, Ohio, in order to inspect analytical facilities, discuss methods of analysis, and help in the company's program for the detection of losses. The "shotgun" extraction equipment used at the duPont brown oxide plant is now at Harshaw, and arrangements are being made to supply the necessary operating instructions. Harshaw has been supplied with general uranium analytical chemistry reports and outlines of methods of detection of small amounts of uranium. It is expected that considerable help will be required for a time from the New Brunswick Laboratory.

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IV. ENGINEERING

Substructure work at the University of Rochester was completed; bids for construction of superstructure will be opened on April 5, 1949. The laborers' strike in St. Louis has seriously delayed construction at Mallinckrodt Chemical Works. New Brunswick Laboratory building alteration neared completion; beneficial occupancy will be possible by mid-April. Construction of offices, locker room facilities, and guard house at the Harshaw Chemical Company was sufficiently complete to permit occupancy by Cleveland Area Office personnel.

University of Rochester

Substructure work on the training building was 98% completed by the contractor, A. Friederich & Sons Company. Form stripping and cement finishing has been completed, and work is under way on removal of the protective shed and backfilling to proper grade level on the exterior of the building.

Bids for construction of the superstructure will be opened at Rochester on April 5, 1949.

Mallinckrodt Chemical Works

As discussed in the section on Administration, laborers and hod carriers at St. Louis went out on strike March 28, 1949. Construction of the facilities building, where only mechanical work is now in progress, has been delayed for six weeks because of this strike and inclement weather. The George L. Cousins Contracting Company has completed about 68% of the work under its contract for facilities building construction. All brick work except second floor partitions has been completed. Mechanical and electrical work is about 80% completed.

The laborers' strike has caused the Robert Paulus Construction Company to shut down completely on Plant 6E construction with only 3% of work completed. The J. S. Alberici Construction Company, which has completed 18% of boiler house construction, is continuing the ~~fitting work~~, but other work has been suspended. Kremer-Hicks is working a small crew on installation of boiler-house equipment. This work is 5% complete. Boiler erection has not been affected by the strike.

New Brunswick Laboratory

Frank Belluscio & Sons, Inc., have completed 80% of the work under their contract for interior and exterior alterations to the New Brunswick Laboratory building. Although work under the contract is still a week behind schedule, contractors have been urged to make every effort to complete all alteration work, except for minor cleanup details, by the end of April. Beneficial occupancy of most laboratory rooms will be possible about mid-April.

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Harshaw Chemical Company

Rehabilitation of a portion of an existing Harshaw Chemical Company building is 95% complete. This work has provided needed office and locker room facilities; it also included construction of a new guard house for control of visitors and plant personnel. Cleveland Area office personnel occupied their part of the new office space during the month, when progress was sufficiently advanced to permit it.

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V. RESEARCH AND DEVELOPMENT

Cross section measurements are continuing at Columbia University. Physics research is under way at Johns Hopkins University. Considerable metallurgical research is being undertaken at MIT. Several problems have been solved by the Harvard Mark I computer. Work is continuing on the uranium recovery process. Progress has been registered in uranium orebed detection at a distance.

Physics Research at Columbia University

Supplement No. 7 to Contract AT-30-1-GEN-72, providing for classified measurements of the neutron cross sections of fissionable materials, has been signed both by the University and by the AEC Contracting Officer. Prof. John R. Dunning is the Scientific Director for all research in nuclear physics under this contract. Cross section measurements were actually started in August, 1947, and are now partially completed. Since the prime contract calls for unclassified research, Supplemental Agreement No. 7 was issued to keep the classified measurements administratively separate from the unclassified research.

Publications based on unclassified research under the contract have appeared in recent issues of the Physical Review and the Bulletin of the American Physical Society. The latter contains chiefly abstracts of papers presented at meetings of the American Physical Society.

Physics Research at Johns Hopkins University

Work is progressing under Contract AT-(49-1)-309, which provides for research in the molecular spectra of hydrogen isotopes under the direction of Prof. G. H. Dieke.

Contract AT-(49-1)-310, which provides for research in energy states of nuclei under the direction of Prof. D. R. Inglis, is also active. The angular distribution of alpha particles in the lithium (n, α) is being investigated at present.

Metallurgical Research at MIT

Work is beginning under the direction of Prof. A. M. Gaudin on Contract AT-(30-1)-GEN-370, which provides for research and development in the application of radioactive tracer techniques to problems in metallurgical engineering and more particularly, mineral engineering. Laboratories have been set up and some of the personnel are in residence.

Under Scope I of Contract AT-30-1-GEN-368, "Thermodynamics of Metallic Solutions" work has been completed on the activity of sulphur in iron in the temperature range of 1530° + 1650°C. The results are in agreement with those of the Bureau of Mines. Current work is concerned with the effect of a third element, manganese or carbon, upon this activity.

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The electrode potentials of cadmium are being studied in comparison with the ternary systems cadmium-lead-tin, cadmium-lead-bismuth, and cadmium-lead-antimony in order to determine the activity of cadmium in these systems.

Under Scope II, "Solid Solutions and Grain Boundaries", fundamental data are being sought to determine the nature of solid solutions and grain boundaries. Activity coefficients will be obtained, and these results will be correlated with x-ray determination of short-range order and anti-short-range order. Finally, small-angle x-ray scattering will be used to determine the size and distribution of prenuclei. The first progress report covering these aspects in detail will be issued in a few weeks.

Mass Spectrographic Research at Wesleyan University

The Wesleyan University double-focussing mass spectrograph has been adjusted for accurate measurement of isotope abundance, using the redesigned 90° electrostatic analyzer. The present work consists of a search for very low abundance isotopes, and in particular for the lightest isotopes of certain even-atomic-number elements such as Te¹¹⁸ and Pt¹⁹⁰.

Mechanical Computer at Harvard University

The Mark I mechanical computer at Harvard University is being supported on a half-time basis by AEC funds for the purpose of solving problems of general scientific interest. Problems which have been solved so far are:

1. Computation of the function $\sin x/x$ and its first eleven derivatives.
2. Determination of the pattern of flow in the neighborhood of a flat plate inserted in a moving stream.
3. Calculation of theoretical neutron-proton quadrupole interaction for various assumed types of potential.

The next problem which is scheduled for solution is the calculation of internal energy conversion coefficients for Dr. A. S. Householder of the Mathematics Branch, ORNL.

About ten other problems are being considered by the Harvard committee in charge of the Computational Laboratory.

Uranium Recovery

Early in March Kellex submitted a report entitled "Proposed Gas Decontamination - Laboratory Program", which outlines an experimental investigation of the decontamination of radioactive off-gases resulting from process steps by use of a sonic agglomerator and an impingement-plate dynamic scrubber. This report was transmitted to the Washington Office, and it is expected that it will be reviewed by the Stack Gas Committee in the near future.

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The chelation studies which are being performed by California Research Corporation under a sub-contract to Kellex appear very promising. The possibility of chelating uranium is being investigated, as well as the normal chelation of plutonium and zirconium. Five cc of dissolver solution from Hanford will be shipped to California Research Corporation during the first week of April to test the radiation stability of TTA and the possibility of polymerization of zirconium.

A pilot-scale operation to test the feed preparation system of the proposed Kellex process has been set up, but final results are not yet available. In this operation simulated Hanford waste supernatant is treated with caustic, and the resulting diuranate precipitate is separated as a slurry in a modified Sharples nozzlejector centrifuge. Success of this experiment will show that Hanford supernatant can be sent through a relatively simple continuous process in preparation for decontamination by solvent extraction.

One gallon of 103T supernatant has been requested from Carbide & Carbon Chemicals Corp. at Oak Ridge for complete laboratory bench runs at the Kellex Jersey City Laboratory to check the feasibility of the proposed Kellex process. It is anticipated that this material will be shipped during the first week of April.

Uranium Orebed Detection

At the request of the Exploration and Procurement Branch of the Raw Materials Operations Office, N.Y., the NYCO Division of Technical Advisers is carrying on a program of investigation and coordination regarding detection of uranium orebeds at considerable distances.

Samples of cores from drill holes in Colorado have been sent to NYCO. These samples have been tested at MIT for their uranium content by counting the alpha particles emitted. The theory behind the tests is that tertiary washing of uranium from secondary orebeds will be carried to regions beyond the orebed in concentrations not detected by usual indications of ore colors, but in sufficient quantity to be detected by alpha-count measurements. By plotting uranium percentages on a map of the region of the drillings, it is hoped that a gradient will be indicated and that this will lead to the discovery of orebeds which are not directly revealed by a geologist's examination of the core samples. Thus far the number of tests made is too small to give conclusive results, but these tests do show that identifiable gradients may exist.

On the basis of similar reasoning, studies are also being made of the uptake of uranium in vegetation growing at various distances from orebeds. In addition, gradients in the concentration of helium from orebeds are under investigation.

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VI. BROOKHAVEN NATIONAL LABORATORY

Meteorological work at Brookhaven is considerably advanced, especially with regard to control of effluent gases from the pile. A new pathology laboratory is being equipped.

Meteorology Group

The meteorology program at Brookhaven is being continued by the BNL Meteorology Group in cooperation with the special station of the US Weather Bureau. During the Fall, the station and the group were joint hosts to Prof. O. G. Sutton of the Military College of Science at Shrivenham, England, an expert in dispersion phenomena. Much useful information was interchanged in discussions with Prof. Sutton during this period. The Meteorological Building is now fully occupied and almost completely equipped. The weather towers, recorder building, and microset are essentially complete and are undergoing a series of tests.

One of the most important objects of the meteorology program is the control of radioactive gases from the Brookhaven reactor. Within the next few months, it is expected that the reactor will be put into initial operation, and the problem of radioactive waste disposal inherent in the use of air as a coolant will then arise. After passing through the reactor, ducts, fan house, cooling tower, and 320-foot stack, the cooling air will contain a small quantity of radioactive argon, A⁴¹. To keep this contamination at a minimum, the cooling air will be twice filtered. By removing dust particles from the entering air, the pile inlet air filters will prevent rapid loading of the hot exhaust filters, thus making it possible to change the latter filters at longer intervals. In view of the low air temperatures encountered in the inlet, a standard type of low pressure-drop, bonded glass filter medium was selected for this application.

After passing through the pile, the air will be drawn through the exhaust filters, which are designed to remove all material, regardless of size, as completely as possible. In order to accomplish this at the high temperatures which will be encountered in the exhaust, a glass-tex cloth with the following arrestance characteristics was selected as a filter medium:

95% initial to 99% at full load for standard test
89% initial for 3/4 micron particles.

Because of the very small weight of material which is expected in these filters, it is felt that this high arrestance will not unduly increase the frequency of change of the filter media.

The hazard presented by the small quantity of radioactive argon remaining in the filtered air constitutes the chief problem of the meteorological program. The pile stack will discharge its effluent rapidly at a temperature considerably higher than that of the surrounding air, so that under normal conditions it may be expected that the effluent will be dispersed to insignificant concentrations by atmospheric turbulence. Even on leaving the stack, the concentration of A⁴¹ will be small, since only 1.28 percent of the total mass of atmosphere is argon, and only a very minor fraction of this argon becomes

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radioactive as the air passes through the reactor. A large stack diameter is called for, however, in order that sufficient diluting air may be forced through with the pollutant, so that the concentration at stack top will not be too great to be endured for short periods at ground level.

Argon⁴¹ has a half-life of 110 minutes. Given the very light atmospheric turbulence assumed and a vertical temperature inversion, most of the argon will decay before it reaches the ground by molecular diffusion, and its concentration will consequently be so small as to be harmless. However, if the effluent should contain particulate matter of sufficient mass to fall out quickly, or substances of long half-life, then persons within a few stack-heights of the reactor would probably be exposed to danger, if the flow of effluent were not curtailed or stopped. Another problem is presented by a temperature lapse. Under these circumstances, the atmosphere is filled with large, three-dimensional eddies, which carry effluent from the stack top to the ground at points from one to perhaps ten stack-heights away from the stack base. The concentration at stack-top level is then brought to the ground with little additional dilution, and while this condition may not persist longer than a few minutes, it generally recurs throughout a longer period. Although the eddy velocities can be determined independently, a different method of investigation has been adopted at BNL. Relations have been sought between observed effluent concentration and the variables that appear on the daily weather map. It is to obtain this data that such equipment as the meteorological towers was planned and constructed at the Laboratory.

Pathology Laboratory

Capital Improvement Authorization No. BNL-12-49 was approved on March 21. This authorization provides for the alteration of an existing infirmary building into one of four laboratories for medical research. This first unit will be a Pathology Laboratory, and will include a tissue laboratory, dog metabolism and diet rooms, two operating rooms, a mass spectrograph room, a hood room containing 4 hoods, and a chemistry laboratory, as well as necessary offices and storage rooms.

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●VII. MEDICAL

A final report on non-occupational berylliosis has been released, and final versions of the NYCO emergency plans have been prepared. A complete summary of the health situations at the NYCO uranium facilities is being finished. Health and safety service has been extended to a Hanford Operations Office contractor working through the Schenectady Area Office.

Non-Occupational Berylliosis

In the August, 1948, Monthly Report an account was given of the work that had been done to that time, and the conclusions that had been drawn from that work regarding the problem of non-occupational berylliosis. Columbia University, the University of Rochester, and the U. S. Weather Bureau have cooperated with NYCO in preparing the final study. The results are being released as a paper which will be presented to the annual meeting of the American Industrial Hygiene Association, Detroit, Michigan, on April 7. This recent work provides corrections to some of the data reported last August. The major points of the final study are outlined below:

1. Eleven cases of chronic beryllium poisoning (berylliosis) have been reported among residents in the vicinity of the plant of the Brush Beryllium Company, Lorain, Ohio. In none of the cases was there a history of occupational exposure to beryllium.
2. Ten of the cases resided within 3/4 mile of the plant. The distribution of cases with respect to the plant indicates that the incidence of disease was a function of the concentration to which the residents were exposed.
3. The eleventh case resided almost two miles from the plant but occurred in a member of the household of an employee of the plant. The case is believed to have resulted from atmospheric contamination introduced into the household by work clothes of the employee. On the basis of air analyses during simulated home cleaning of work clothes, it has been concluded that a daily laundering of contaminated clothing can result in the inhalation of 17 micrograms of beryllium.
4. An extensive air analysis program conducted in the vicinity of the plant yielded useful data on levels of atmospheric contamination. The concentration at a distance of 3/4 mile is of particular interest because the lower concentrations farther from the plant have not produced known cases in the seven years that this plant has been in active operation. It is estimated that the average concentration 3/4 mile from the plant has ranged from 0.01 to 0.1 $\mu\text{g}/\text{m}^3$. The cases appear to have resulted from exposure prior to 1946, when the 3/4 mile concentration is estimated to have been approximately 0.1 $\mu\text{g}/\text{m}^3$.

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5. The average daily concentrations of beryllium in the vicinity of a plant producing and processing beryllium should be limited to 0.01 micrograms per cubic meter. There is no justification for applying these data as criteria in judging the hazard of exposed workers in the beryllium industry.

6. The plant in question has had a comparatively low incidence of berylliosis, despite the relatively high exposure to atmospheric contamination within the plant. No satisfactory explanation can be given for this discrepancy, but the specific toxicity of the neighborhood contamination may be enhanced by smaller particle size than would be expected within the plant.

7. The minimal exposure of the affected residents is consistent with the low beryllium content of tissues from two cases which have been autopsied. The lungs from these cases contained .07 and .10 micrograms of beryllium respectively per 100 grams of wet tissue.

8. The air analysis data, when related to the amount of effluent from this plant, are found to be in close agreement with theoretical methods of estimation proposed by Sutton and by Bosanquet & Pearson.

Emergency Plans

In the May, 1948, Monthly Report a brief statement was made concerning the procedures that were being planned for emergencies. Since that time, detailed plans have been worked out in cooperation with the Security and Production Divisions for the Brookhaven National Laboratory, Mallinckrodt Chemical Works, Harshaw Chemical Company, Vitro Manufacturing Company, Linde Air Products, Electro Metallurgical Division (U.C.C.C.), Middlesex AEC Warehouse, University of Rochester, and Brush Beryllium Co. (Cleveland Plant), and within the New York Operations Office itself. An emergency plan for the New Brunswick Laboratory will be drawn up when that organization is more fully developed. These plans provide for action to be taken by the contractor and by appropriate representatives of NYOO in the event of major fires, floods, earthquakes, explosions, and the like.

Health Status of Uranium Plants

For almost 2 years, the NYOO Medical Division has been surveying the health problems at uranium handling and producing facilities. It has finally become possible to take an overall view of the whole problem and assess it in detail. During the month of March one of the major projects of the Medical Division was to draw up a complete summary of the situation at eight uranium facilities, giving a description of the plant processes, ways in which hazards arise, summaries of exposures of employees, general data on hazardous conditions, and the present status of recommendations previously made. This report will be furnished to the Division of Biology and Medicine, Washington Office, and will serve as a basis for future action.

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Air Reduction Company

At the request of the Schenectady Area Office of the Hanford Operations Office, the NYOO Medical Division is giving health and safety service to the Air Reduction Company, Murray Hill, N.J., which is under contract with Schenectady. The contractor is attempting to develop methods of removing gaseous iodine compounds from other gases. In order to measure the amount extracted, I^{131} is being used as a tracer material. NYOO is supplying the contractor with instruments and complete monitoring service and will make the necessary radiation surveys.

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VIII. LICENSING

Since March, 1947, the Licensing Division has issued 1,807 licenses in the following categories:

| | March 1947 Through <u>March 1948</u> | During <u>March 1948</u> |
|------------------------|--|-----------------------------|
| Producers | 302 | 23 |
| Processors | 35 | 1 |
| Distributors | 287 | 8 |
| Consumers | <u>1183</u> | <u>44</u> |
| | 1807 | 76 |

Nearly all of these licenses are for one year's duration. Approximately 850 have been renewed for an additional one year period. Others will be extended from time to time as their expiration dates are reached and applications are made for renewal.

Examination of the inventories and records of domestic processors, distributors, and consumers of source material continued during the month.

The following exports were authorized during March:

| | |
|--------------------------------------|-------------|
| Incandescent Mantles | 537,381* |
| Thorium Metal Powder | .16 lb. |
| Thorium Nitrate | 5531.25 lb. |
| Thorium Oxide | 8.50 lb. |
| Thoriated Tungsten | 11.46 lb. |
| Uranium Acetate | 9.56 lb. |
| Uranium Nitrate | .50 lb. |
| Monazite Sand | 16.18 lb. |
| Miscellaneous Uranium Ores | 15.93 lb. |

Shipments of incandescent mantles were made to 33 countries. Quantities of thorium nitrate for the manufacture of mantles were sent to Austria, Canada, China, Germany, India, and the Netherlands East Indies. Thoriated tungsten for vacuum tubes was shipped to Australia, Canada, France, and Italy. All other exports involved small quantities of uranium and thorium to be used for analytical and educational purposes. Thorium oxide for manufacturing resistors was sent to Belgium.

* The ThO₂ content of these mantles is estimated at 537 lb.