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MONTHLY STATUS AND PROGRESS REPORT

FOR SEPTEMBER 1949

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A Report Submitted

by the

New York Operations Office

October 10, 1949

W. E. Kelley, Manager

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I. SUMMARY

Dismantling operations on the Step I and II Plant of the Linde Air Products Corporation are 90% complete. Surplus material from The Kellex Corporation is being redistributed throughout the AEC.

The African uranium ore supplier is now sending only magnesia-precipitated leach material to the Mallinckrodt refinery. All future shipments will be of this type. Mallinckrodt will increase green salt production during the coming quarter to compensate for a Harshaw production deficit during the first quarter of fiscal year 1950.

Production of brown oxide by the Harshaw Chemical Company during September exceeded the rated capacity of the plant by 20,000 lb. Harshaw hexafluoride production for the month exceeded the K-25 consumption rate; this high production rate will be maintained until a 90-day inventory at Oak Ridge is again attained.

By hand-sorting selected scrap, Vitro has been able to prepare 55,000 lb. of high grade material suitable for direct feed into the Mallinckrodt refinery, thus saving the cost of chemically processing this material at Vitro. Plant operations at the Electro Megallurgical Division of Union Carbide and Carbon Corporation ceased on September 30 and the facilities are being placed in a state of active standby.

During the month of September, sixteen 4.3-in.-diameter beryllium billets and ten 8-in.-diameter billets were produced at the Government-owned vacuum casting plant at The Beryllium Corporation. Using 100% excess of chlorine the Brush Beryllium Company found that the chlorination of pulverized beryl pellets containing carbon at 1450°C to 1525°C results in the chlorination of about 85% of the ore. Selectivity with regard to beryllium remains low.

The scope of activity of the Zirconium Advisory Group was increased during September to include New York Operations Office beryllium process development programs.

The installation of the 4-in. glass-column distillation plant at the Malverne (Exton, Pa.) plant of the Foote Mineral Co. was completed, and its operations to produce low hafnium ZrO_2 began.

Confirming results obtained by other laboratories, the Sylvania Electric Products Co. and M.I.T. reported that corrosion tests on zirconium crystal bar do not yield consistent results. Preliminary indications are that inconsistencies are caused by non-uniformity of contaminants present in the bars. Construction of the 4-in.-diameter glass column for effecting Hf-Zr separation by thiocyanate extraction was completed at Y-12, and the apparatus is now in operation.

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The month of September saw the AEC Training Building at the University of Rochester about 66% completed and slightly ahead of schedule. A contract was awarded for the design and construction work involved in altering a water storage tank at Lake Ontario Ordnance Works for the storage of K-65. At the Mallinckrodt Chemical Works, Plant 6E is about 75% completed, exclusive of equipment. Work on the "hot" laboratory at M.I.T. has been completed. Construction of the plant wing at Luckey, Ohio, by The Brush Beryllium Co. is about 90% complete.

Experimental work by Dr. G. L. Kehl on heat-treated 2% molybdenum-uranium alloys will be published in the Metallurgy and Ceramics Journal. The NYOO Division of Technical Advisors has prepared a comprehensive report on methods of uranium ore detection at a distance. Seven problems have been solved on the Harvard calculator; three volumes of tables will be published as part of the results.

At Brookhaven, the 3.5 Mev Van de Graaff machine and the high pressure cloud chamber have been installed and are undergoing adjustment and minor repairs. Both are expected to be in operating condition within a few months. Construction of the cosmotron is progressing. Cosmic ray experiments have been conducted with films and cloud chambers.

The NYOO Medical Division has developed a new and effective analytical method for beryllium applicable to the filter papers used in air sampling. A new alpha counter with very high stability has also been developed.

An Open House at New Brunswick Laboratory was held September 10. Discussions with the General Education Division of New York University looking toward a seminar on Atomic Energy were continued. Two educational projects informally suggested by Associated Universities, Inc. were disapproved.

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II. ADMINISTRATION

Insurance Problems

A review was completed of the insurance situation with respect to cost-type beryllium contractors. Difficulties have been experienced in obtaining certain types of insurance coverages for these contracts.

Arrangements were completed for insurance coverages on Contract No. AT-30-1-GEN-220 with Dr. George L. Kehl of Columbia University, Contract No. AT(30-1)-697 with the Hydrocarbon Research Corporation, and Contract No. AT(30-1)-638 with Brown & Matthews, Inc. Preliminary conferences were held with representatives of the Hartford Accident and Indemnity Company regarding Contract No. AT(30-1)-438 with Burns & Roe, Inc.

Recruitment

The NYOO Personnel Division assisted in recruiting technical and scientific personnel for Sandia Base, for the Idaho Operations Office, and for the Washington Office. Burns and Roe, Inc., was also assisted by referral of two candidates for a position which was successfully filled. Candidates were selecte for two positions as chemists in the NYOO Chemistry Laboratory. Efforts to place Technical Procurement personnel have resulted in offers from Kansas City for thre NYOO inspectors and from the Chicago Operations Office for one NYOO engineer.

Organization of Personnel Services

The Director, NYOO Organization and Personnel Division, attended a meeting at Oak Ridge with the Directors of Organization and Personnel, Washington Los Alamos, and Oak Ridge. The meeting was called for the purpose of discussing the reorganization of the several personnel divisions and other adjustments made necessary by the Independent Agencies Appropriation Act, which imposed ceilings on the number of persons that can be engaged in personnel services. A plan was devised to insure maximum services with a curtailed staff.

Executive Training Program

October 10, 1949, was set as the date to start the Executive Development Program. Dinner meetings will be held each Monday night from 5:30 to 8:30 for twelve consecutive weeks and will be attended by the NYOO Staff.

Disposal of Surplus Equipment

Linde Air Products. The dismantling operations on the Step I and II Plant are now 90% complete; the scheduled completion date is October 10, 1949.

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With regard to the standby status of Step III Plant, it has been decided to rehabilitate a small room and laboratory facilities for use of guard forces and abandon the idea of fencing in this unit. It was also decided that the contractor's records would be stored in this building. The laundry equipment will be dismantled and crated on or about October 17, 1949, and shipped to other AEC installations or stored at the Lake Ontario Storage Area. This equipment is contaminated. Originally, it was to be relocated and employed at the Lake Ontario Storage Area. Because of the large capacity and cost of operation of this equipment, such a plan proved to be out of the question. Studies are being made to procure a smaller home-type unit.

The Kellex Corporation - No. AT-30-1-GEN-169. The Kellex Corporation has selected the office and shop equipment which it will retain for its work under sub-contract with the General Electric Co. and Hanford Operations Office, and the remaining items will be disposed of by the New York Operations Office. The list of excess equipment is being circulated throughout the Commission's installations for transfer. An inventory is being taken of the technical and laboratory equipment.

Infirmary Activities

This month 214 persons visited the infirmary. Of these 2 had suffered on-job injuries, 3 were sent home because of illness, and 6 persons were sent to the Medical Director. Tetanus toxoid was given to 12 accident-prone employees. The laboratory conducted 14 blood counts, 9 urinalyses, and 7 Wassermans.

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III. PRODUCTION

Raw Metal Production (Uranium)

Raw Material for Mallinckrodt Operations. The uranium ore supplier has releached the calcium leach product initially produced so that only magnesium material will henceforth be shipped to Mallinckrodt. This change was indicated by the findings of a research program on leach products conducted at M.I.T. As stated in previous reports, magnesia-precipitated material presents far fewer operational problems at the refinery than lime-precipitated products. A small initial sample of plant-produced magnesium leach product is scheduled to reach Mallinckrodt within a few days; the first tonnage quantity will reach Mallinckrodt about December.

Metal Quality. Some metal was made from "old-process" brown oxide for use by Hanford in tests designed to show more precisely the metal quality advantages of the current brown oxide process. The "old-process" brown oxide was that made prior to the latter part of 1948; it was prepared from orange oxide made by short-time, high-temperature decomposition of uranyl nitrate. The "new-process" brown oxide is prepared from orange oxide made by longer-time lower-temperature decomposition. At the time the process change was made it appeared to result in a metal quality improvement, but the magnitude of the effect was obscured by a simultaneous Hanford process change. In a test recently started, Hanford will determine the metal quality advantage of the new process while holding other Hanford variables constant. It is hoped that the study will lead to changes further improving metal quality.

Vitro Manufacturing Company

In addition to regular production, Vitro Manufacturing Company prepared approximately 55,000 pounds of high grade scrap for use as feed at Mallinckrodt. This scrap, which had been stored at Vitro, contained large amounts of foreign material and free metal. It required considerable labor in hand separating and burning. The first lot resulted in a black oxide of approximately 99% assay. It was possible by handling the material in this manner to avoid going through the normal processing at Vitro. This resulted in an appreciable saving to the Commission. The remainder of the high grade scrap on hand at Vitro contains approximately 200,000 pounds of uranium. It is estimated that treatment of this material will be completed in about 4 months.

Green Salt. Arrangements have been made for Mallinckrodt to produce more green salt than is required by the metal plant during the next quarter. The excess material will be sent to the Harshaw Chemical Company to compensate for a deficit in green salt production at that installation during the last quarter. The Mallinckrodt-produced tetrafluoride shipped to Harshaw will be in the form of coarse particles required for hexafluoride production. This contrasts with regular green salt production at MCW, where the material must be finely ground prior to use in the production of metal.

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Electrometallurgical Division, Union Carbide and Carbon Co.

As predicted in the NYCO monthly report for July, operations at the metal production plant of the Electrometallurgical Division ceased on September 30. Work on placing the facilities in a state of active stand-by was started immediately.

Vulcan Crucible Steel Co. Property disposal was completed at the Vulcan Crucible Steel Co. except for five Government-owned rolls. An effort is being made to sell these as rolls rather than as scrap steel. It will be difficult to do so, however, because this rolling equipment is of such a specialized nature that it requires much modification to be commercially usable.

Uranium Rolling Operations at The Simonds Saw and Steel Co.

Process Improvements. The Surface Combustion Company submitted detailed drawings to the Simonds Saw and Steel Company for the lead bath furnace which is being fabricated for uranium billet heating. The supplier now sets October 14, 1949, as a tentative shipping date, with the equipment due to arrive about 5 to 7 days later. Twenty tons of lead for use in the furnace were received from Oak Ridge. It is desired to have the furnace in operation for the November rolling, but such factors as the steel strike, delivery delays, and operating difficulties may postpone operation until the next rolling period.

Operations. Although the steel industry is now in the throes of an impending strike, the union at Simonds agreed to a temporary short term contract extending until October 19, 1949, 19 days beyond the current strike deadline. This will allow the scheduled October rolling to take place. During the period from October 10 to 19, 135 tons of billets will be rolled.

Brown Oxide Production

Production of brown oxide at Harshaw for the month was 128,000 pounds. This is the first month that production has exceeded the rated capacity of 108,000 lbs/mo. An intensive research program has been undertaken to reduce the "fluffiness", a factor which causes processing difficulties in the green salt conversion step. While the material produced this month was all of specification assay, it was "fluffy" -- i.e., its bulk density was low. As a consequence, full green salt production was not obtained during the month. It is believed that the temperature in the denitration step and the reduction temperature in the Rockwell furnace are the sources of difficulty. It is hoped that the research in progress will make it possible for Harshaw to produce during October a brown oxide which may be converted readily to green salt without sacrifice in capacity in the latter step.

Hexafluoride was produced during the month at a rate 7 per cent above the consumption rate at Oak Ridge. The high rate of hexafluoride production will continue until the K-25 stock is again built up to the desired level (3 months' inventory). It is expected that complete replacement of the Oak Ridge inventory will be accomplished during the present quarter. The Harshaw supply of green salt

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for UF_6 production has been supplemented by material shipped from St. Louis, and from the supply remaining at Niagara Falls after the shutdown of the Electro-Metallurgical Plant.

Lake Ontario Ordnance Works

A contract has been awarded to Preload Enterprises, Inc. to strengthen the water tower for radium cake storage, and a contract will soon be awarded for the drum handling and dumping facilities to be attached. Construction will start immediately, and the tower should be ready to receive cake about February, 1950. Meanwhile drums of cake will continue to be received at Lake Ontario Ordnance Works.

A study is being made of the services which will be required to operate Lake Ontario Ordnance Works on a continuing basis. Attention is also being given to the rehabilitation of buildings and equipment necessary to provide accommodations for activities to be transferred following the closing of the Tonawanda Area Office. Tentative plans were drawn up for rehabilitation; as soon as final details have been worked out, construction contractors will be contacted.

A study was started to determine the feasibility of carbonate leaching of uranium from the large amount of process sludge stored at Lake Ontario. The amount of uranium probably leachable from the sludge is believed to be about 50,000 pounds. If the process appears economically justified, it is proposed to leach the material in the large concrete basin where the sludge is now stored, and to produce a uranium concentrate in small adjacent equipment.

Raw Metal Production (Beryllium)

During September, the heat treating, sulfating, leaching and alum separation operations were started at the Luckey, Ohio, plant of the Brush Beryllium Co. Material obtained from the last of these operations was fed into the hydroxide precipitation tanks. It is expected that beryllium hydroxide will be produced during the first part of October, and then processed through ammonium beryllium fluoride to BeF_2 for reduction to metal.

As stated in the August report, plans were completed for the experimental recovery of ammonium alum and anhydrous sodium sulfate on a small scale. This small-scale work, which was started recently, will consume an estimated four to six weeks. Samples will then be submitted to prospective purchasers for their evaluation of the by-product.

Beryllium Casting

During September sixteen 4.3-in.-diameter Be billets required to fill the order of the Dayton Area and ten 8-in.-diameter billets (five containing 0.1% Al and five with 0.25% Al) for Los Alamos were produced in the Government-owned vacuum casting plant at The Beryllium Corporation. The 4.3-in.-diameter billets were shipped to Revere on September 8, 1949, for extrusion on September 14, 1949.

A production schedule has been set up at The Beryllium Corporation for the casting of beryllium billets with diameters of 8, 6.2, 5.2 and 4.3 inches. These billets will be used to complete existing orders from Los Alamos (Al-4), Schenectady and Battelle. The use of aluminum in some of these billets will confirm whether or not aluminum additions in beryllium castings are beneficial in producing sound billets.

The Beryllium Corporation is conducting a metallographic study on sections of beryllium billets. Results of preliminary work along these lines indicates that radiographs of the billets do not give a true picture of their physical condition. Cracks, minor pipes and inclusions which were found in beryllium billet sections by macroscopic study could not be found in the radiographs of these same sections. Additional metallographic work is being planned in conjunction with radiography to confirm these findings.

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Beryllium Sintering

Construction of the large sintering furnace at The Brush Beryllium Company is progressing satisfactorily. The first of a series of twenty-one rods, approximately 1-1/2 inches in diameter by 4 feet in length was produced by powder metallurgy for General Electric. Small test pieces of various grades of powder metallurgy products were shipped to the Oak Ridge National Laboratory, Westinghouse, Sylvania, and the Argonne National Laboratory.

Thirteen fluted beryllium retainers were fabricated at the Brush Beryllium Company by warm pressing at 425°C and 100 t.s.i., followed by vacuum sintering at 1050°C for five hours. This completes the present order for these shapes, all of which were shipped to the General Electric Company.

Raw Metal Production (Zirconium)

Foote Mineral Company. The installation of the four-inch glass-column distillation plant at the Malverne (Exton), Pennsylvania, plant of the Foote Mineral Company was completed, and its operations to produce low-hafnium ZrO_2 were begun. A 70-pound batch of zirconium tetrachloride-phosphorus oxychloride complex prepared in a pyrex boiler does not present any difficulty. It is anticipated that approximately 200 lbs. of low-hafnium ZrO_2 will be produced during the month of October. Operation of the 1-in. column was suspended, and will be held in standby. Approximately 1500 grams of low-hafnium (less than 0.1% Hf) zirconium oxide and about 2000 grams of 0.2% hafnium complex are in inventory from the operation of the one-inch column.

Foote found that the decomposition of the complex to ZrO_2 is best accomplished by use of normal-propyl alcohol as compared with methyl, ethyl, and butyl alcohols tested. Small-scale work is being performed to determine methods for breaking down the amine-zirconium tetrachloride salt obtained by reacting the complex with anhydrous ammonia gas. Indications are that this salt has the formula $ZrCl_4 \cdot 12NH_3$.

Approximately 300 pounds of normal zirconium crystal bar have been shipped to AEC laboratories to date as partial fulfillment of the 1,000 pound contract with the Foote Mineral Company.

The Brush Beryllium Company. Zirkite ore, ZrO_2, and $ZrCO_3 \cdot X\,H_2O$ will be used as raw materials for the production of low-hafnium $(NH_4)_2ZrF_6$. Production at the Brush Lorain plant began during the last week of September, and will continue until November when approximately 10,000 pounds of Zr content will have been produced as low-hafnium $(NH_4)_2ZrF_6$.

Bureau of Mines. The Bureau has shipped 153 lb of sponge and 333.5 lb of ingot against requirements of 1211.5 and 1533.5 lb, respectively, for the period July 1, 1949, to January 1, 1950. The remaining 100 lb of sponge and 100 lb of ingot which were scheduled for September production will be shipped during the early part of October.

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Production Research and Development (Uranium)

Massachusetts Institute of Technology. Equipment was assembled to measure the anisotropic expansion of alpha-extruded uranium by means of strain gauges. Work continues on the measurement of residual stresses in alpha-extruded uranium, utilizing x-ray methods. In connection with heating uranium billets in a lead bath, the solubility of uranium in lead is being determined. Initial results indicate that it is greater than previously reported. Oxidation losses during rolling of uranium were investigated. The percent loss varied from 1.3 at 400°C to 1.39 at 600°C.

Recovery of Uranium and Thorium from Monazite Sands

Recent studies at Battelle Memorial Institute have shown that a preliminary separation of most of the rare earths can be made from monazite sands. This is accomplished by treating the monazite with hot caustic soda, dissolving the residual hydrated oxides of uranium, thorium, and the rare earths in nitric or hydrochloric acid, and then carrying out a precipitation with ammonia, which brings down 99% of the uranium and thorium together with about 5% of the rare earths. This part of the proposed purification process is ideal from the rare earth industry standpoint. Conceivably, the Commission could process large quantities of monazite, recovering most of the rare earths for return to industry, without seriously upsetting raw material production.

Separation of the uranium and thorium is now receiving considerable attention. On the basis of preliminary anion exchange studies, it has been concluded that uranium may be absorbed quantitatively from a carbonate solution of the precipitated product discussed above. It is hoped that a process flow plan can be evolved by January 1, 1950.

Research and Development (Beryllium)

The Brush Beryllium Company. Using 100 per cent excess of chlorine, Brush found that the chlorination of pulverized beryl pellets containing an admixture of carbon at 1450°C to 1525°C results in a chlorination of about 85 per cent of the ore. Selectivity with regard to beryllium remains low, however.

As mentioned last month, a number of beryllium-clad, beryllium-uranium fuel rods were prepared employing a combination sintering and low-temperature extrusion technique. X-ray and micrographic examinations of these rods indicate the beryllium-uranium core to be well centered throughout the entire length. Other work in connection with these rod-type fuel elements indicates that it is possible to extrude the material and obtain a rod that is capped or sealed at both ends. This is accomplished by inserting, prior to extrusion, a beryllium plug in the drilled beryllium billet after the core has been inserted. In its present state of development, 1/4-in.- to 1/2-in.-diameter beryllium rods and 7/16-in. beryllium squares can be extruded by the "extru-powder" process. Initial attempts to extrude tri-fluted retainers were unsuccessful; cracks occurred along the edges. Further work on the design of graphite conical lubricators is under way in order to provide sufficient lubrication at the three retainer edges.

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Massachusetts Institute of Technology. In attempts at the development of brazing techniques for bonding metals to ceramics, six beryllium tensile specimens were prepared with a brazed interface perpendicular to the specimen axis. Three were brazed with aluminum-zirconium alloy and three with zirconium hydride. These specimens have not yet been tested. In addition, a 1/2-in. beryllium oxide tube was brazed to a tantalum tube with an aluminum-zirconium brazing alloy.

The unusually high ductility and strength of extruded QM and QMV metal produced by The Brush Beryllium Company is probably a result of the fine grain size of the metal, which is indicated by microstructure studies.

Hot-pressed samples of beryllium-beryllium oxide bodies containing 20 and 25 weight per cent beryllium were prepared, and their compressive strengths determined. Pressing techniques and particle size distribution have a very great effect on the strength values obtained.

Production Research (Zirconium)

Horizons, Incorporated. Work continues at Horizons on the preparation of zirconium by fused salt electrolysis. The use of a low-melting-point mixed chloride and of potassium zirconium fluoride as electrolyte is being studied; metal powder was obtained in each case. Consideration is being given to the use of ammonium zirconium fluoride or barium zirconium fluoride in connection with fluoride electrolysis. This program is presently set up on s short-range, four-month basis. Horizons is expected to submit a feasibility report in October so that the electrolysis method may be evaluated and a decision made as to whether justification exists for continuation of the program beyond its scheduled expiration date of November 15, 1949.

Titanium Alloy Manufacturing Division, National Lead Company. The reduction apparatus which is employed by the Titanium Alloy Manufacturing Co. for titanium is being continually improved. Because of the great similarity in the processing of zirconium and titanium, it is expected that these improvements will be almost directly applicable to zirconium. A batch of zirconium chloride made from baddeleyite ore was prepared by Titanium Alloy for use in this program.

Titanium Alloy has developed its own method for the production of zirconium tetraiodide from zirconium cyanonitride (ZrCN) on a laboratory scale. This method is considered extremely promising for the direct production of zirconium tetraiodide without going through the crude metal stage. Consideration is being given by the Titanium Alloy Manufacturing Division to the possibility of increasing the scale of operations to meet possible increased requirements for this material by the National Research Corporation, Westinghouse, and M.I.T.

National Research Corporation. It has been mentioned previously that a revised zirconium iodide dissociation unit was being designed by National Research Corporation. This design was submitted to NYOO, and in accordance with the recommendations of the Zirconium Advisory Group at its

September 23 meeting, approval for construction of the unit was given. The new design will overcome the difficulties of the previously-used iodide decomposition apparatus. It consists of the following components:

1. a feed pot for vaporizing zirconium tetraiodide into

2. a dissociation chamber wherein it is decomposed in an electric arc to form zirconium metal;

3. a refrigerated condenser to collect the iodine and unreacted iodide leaving the dissociation chamber,

4. a unit for the preparation of zirconium iodide, and

5. a vacuum pump.

This experimental apparatus will permit the study of all aspects of the process more precisely than has previously been possible. The factors which will be studied include the effect of operating variables on per cent dissociation and the effect of electrode materials on the purity of zirconium produced. The corrosion resistance of materials of construction will also be studied. It is expected that this apparatus will be completed by the middle of November.

A series of minor changes in the continuous casting machine for zirconium, involving such features as the electrode connections and the ingots withdrawal mechanisms, were made. Preliminary studies on the feeding of zirconium powder are planned within the next two weeks. A supply of Bureau-of-Mines sponge was crushed and is being outgassed for use in this work. The upper electrode in this machine will consist of a water-cooled copper tip. It is expected that such an electrode tip will reduce contamination of the metal below that encountered when graphite or tungsten electrodes are employed.

Zirconium Advisory Group. It was decided by the New York Operations Office to increase the scope of activity of the Zirconium Advisory Group so as to include NYOO beryllium process development programs. Consequently, at the September 22 meeting, the Group was introduced to their new activity with a description of the Sheer-Korman process which is being developed by Burns & Roe. Drs. Sheer and Korman attended the meeting and discussed their process.

A timetable on the zirconium process development progress had been established some time ago. It was agreed at this meeting that efforts will be made to adhere to the timetable, which calls for the selection of a process or processes for pilot plant development by November, 1949.

Sylvania Electric Products, Inc. Several 1/8-in. diameter, zirconium-clad, zirconium-uranium-core fuel element wires were prepared for the Argonne National Laboratory. A spot-welding technique for welding caps to the wire was developed, and appears to be quite satisfactory. Corrosion and metallographic tests are in progress to appraise the quality of the zirconium cladding.

Sintering of zirconium-clad, zirconium-uranium-core sandwich fuel elements containing stearic acid was attempted. Although it proved advantageous as a lubricant during pressing, the acid is not completely removed during sintering, so that the carbon content of the alloys is raised to an excessively high value. The use of organic lubricants will consequently be abandoned.

Sylvania is studying the problem of preparing a uranium-zirconium core in which the uranium is dispersed as large, sharply-defined agglomerates which diffuse very little during sintering. Uranium powder prepared by the hydride method is unsatisfactory for this purpose, since its ultimate particle size is not sufficiently large and since the uranium grains diffuse during sintering. The incorporation of uranium nitride powder in a zirconium matrix will be investigated as a method of overcoming the shortcomings of hydride-process uranium powder. Essentially pure uranium nitride has been prepared by heating uranium powder in nitrogen at 1075°C for 3-1/2 hours. A uranium-zirconium core consisting of 6 weight per cent uranium as the nitride was prepared by powder metallurgy. It is believed that the nitride is stable, and the sintered specimen revealed sharply-defined uranium-bearing areas in the zirconium matrix, indicating that little uranium diffusion occurred. These experiments will continue, and will include the preparation of uranium nitride of two grain sizes, 90-100 microns and 9-11 microns, for sintering with zirconium.

Massachusetts Institute of Technology. M.I.T. prepared a 5/8-in.-diameter disc of zirconium weighing approximately five grams by passing zirconium tetraiodide over a thin disc of tantalum heated by induction. Deposition on a two-inch diameter disc will be tried shortly.

A study of the uranium-zirconium system is in progress. Thus far, x-ray diffraction studies of alloys containing 0.074, 11, and 15.85 weight per cent uranium have been completed. Alloys of 48, 55, and 66 weight per cent uranium were prepared, and are being examined by x-ray methods. Alloys of the latter three compositions could easily be cold-rolled to a 30 per cent reduction.

Samples of crystal bar zirconium have been out-gassed at 1500°C in vacuo and then treated with pure oxygen and nitrogen at this temperature for various lengths of time. Crystal bar heated in nitrogen under these conditions corroded at a rate very much greater than a similar sample heated in oxygen.

M.I.T. has found that Foote crystal bar is not uniform in corrosion resistance, a fact confirmed by work at other laboratories. Work is in progress to determine the cause for variations in corrosion resistance in crystal bar. It is suspected that these inconsistences are the result of non-uniformity of contaminants in the bars.

Both Bureau of Mines and Foote zirconium metal show decreased corrosion resistance after extrusion. Crystal bar which is slowly melted in droplets and cast (drip casting) appears as good as the virgin metal; Bureau-of-Mines metal which has been drip cast appears to have greater corrosion resistance than "as-received" Bureau-of-Mines zirconium billets. A study of polished sections of corroded Bureau-of-Mines metal indicates that the corrosion

penetrates deeply into the specimen and seems to attack carbide inclusions.

The laboratory at M.I.T. has extruded Bureau-of-Mines cast metal to produce tubing having an 0.5-in. ID with OD's of 0.8 in. and 0.7 in. It appears possible to extrude zirconium tubing small enough to be drawn into very small tubing. One heavy-walled tube was produced by extrusion of crystal bar zirconium.

Hafnium-Zirconium Separation

Bureau of Standards. As mentioned previously, it was decided to continue the pilot-plant phase of the Bureau of Standards' program on the separation of hafnium from zirconium by phosphate precipitation. The pilot-plant installation was completed, and initial precipitations are being conducted. Pilot-plant work now indicates that greater fractions of zirconium are co-precipitated with hafnium as phosphate than were obtained in the laboratory studies previously conducted. Consequently, it is likely that the expected output of 100 pounds of low-hafnium zirconium oxide from the supply of zirconium salt on hand may not be realized, but it is reasonable to expect a yield of at least 50 pounds.

Brush Beryllium Company. Studies, described previously, continue on the thermal decomposition of ammonium zirconium fluoride into ammonium fluoride and zirconium fluoride. At this time, the optimum temperature range for decomposition appears to be 500 - 600°C, at which temperature the ammonium fluoride sublimes. Initial sublimation of zirconium fluoride occurs at 700°C.

Ionics, Incorporated. The Ionics group found that partial precipitation of the hydroxides of hafnium and zirconium directly from the ion-exchange resin at a controlled pH produces a hafnium-enriched precipitate, in contrast to the zirconium-enriched precipitate which results when precipitation is accomplished from solutions of complex anions. In addition, it was found that, at a pH of 5, zirconium is more tenaciously held by the anion-exchange resin (chloride form of Dowex A-2) than is hafnium.

In other experiments, Ionics was able to develop a quantity of the complex hafnium and zirconium fluorides adsorbed on the top portion of the resin column so as to produce zirconium-enriched and hafnium-enriched sections in the resin column. In these investigations the complexes in 1M solution

The use of incandescent carbon for decomposition of the $POCl_3$ complex is under consideration.

Y-12, Oak Ridge. Construction of the four-inch-diameter glass column for effecting the hafnium-zirconium separation by thiocyanate extraction was completed at Y-12, and the column is now in operation on a 24-hour basis. Indications are that a minimum throughput of 10 pounds of zirconium oxide in 24 hours will be obtained. Optimum operating conditions are being established, and by further adjustment in the aqueous/organic ratio, greater zirconium throughput may be realized. It was observed that, during column operation, the thiocyanate tends to polymerize slightly, and it is necessary at present to shut down the column to remove this polymerized material with a caustic wash. This shutdown is of short duration, and little time is lost before normal operation is resumed, since column equilibrium is established so rapidly. Studies are being made in an effort to eliminate the polymerization problem.

SF Material Accountability Statistical Results

Vitro. At the Vitro Manufacturing Co. there is a supply of scrap on hand (exclusive of C, C-Special, CL, and CR items) for which the producers' figures give a total U content of 337,929 pounds. In view of the difficulty of representative sampling by the producers, it is expected that their estimate of the total U content will deviate from the value finally arrived at by Vitro, which melts the scrap and samples it much more adequately at the time of processing. Nevertheless, statistical studies based on 17 months of past experience show that the probability is 95% that the Vitro value for total U content will not differ from the producers' estimates by more than 9500 pounds (2.8% of 337,929).

Harshaw and Mallinckrodt Green Plants. On the basis of data for the period from February, 1949, through August, 1949, the probability is 95% that the true total inventory at Harshaw is not more than 0.63% away from the measured total inventory. The assumption that underlies this statistical determination is that the variance (mean of squared deviations) in each figure used for the monthly material balance is proportional to the amount involved regardless of the type of item. Under the same assumption, using data for the period from January, 1949, through August, 1949, the probability is 95% that the true total inventory at Mallinckrodt is not more than 0.48% away from the measured total inventory.

Middlesex. Considering only that part of the fluctuation in the final assay of ore introduced by chance variations in the composition of the sample taken before the first grinding, the probability is 95% that the measured assay will be within 0.35% of the true assay. If the deviation between measured and true assay is to be less than 0.1% 95 times out of 100, then the size of the sample to be taken before the first grinding must be 3750 pounds. For less than a 0.2% deviation 95 times out of 100, the size must be 970 pounds; for less than a 0.3% deviation 95 times out of 100, the size must be 450 pounds.

IV. ENGINEERING

University of Rochester

At the end of September the AEC Training and Laboratory Building at the University of Rochester was approximately 66% complete. During the month the exterior was completed and the brick and stonework washed down. Aluminum window sashes were installed on the first three floors, with glazing to begin in October. Interior tile partitions were substantially completed in the basement and ground floors, and about30% completed on the first floor. The roof areas were water-tightened and insulated. All the mechanical trades progressed according to schedule. Duct work installation was begun, and the main elevator components were delivered to the site and their installation begun. Provisions were made to utilize a portion of the permanent heating system as temporary heating during the coming winter months.

Middlesex Warehouse

About 45% of the work on this project has been completed to date. All of the work on the warehouse itself has been completed except for a few minor details, and the loading platform and the railroad track adjustments are likewise completed. The drainage ditch in the rear of the property was completed this month, and about 50% of the boiler house construction work was done.

Mallinckrodt Chemical Works

Little was done this month under the J. S. Alberici Construction Co. contract for the erection of the boiler house structure, since the remaining work involves painting which cannot be finished until equipment installation is completed. Consequently, this contract remains at 95% of completion. Boiler house equipment installation is also 95% completed, except for insulation of equipment and piping. Kremer-Hicks, the subcontractor doing this work, has had difficulty maintaining an adequate crew because other projects in this vicinity are paying premium wages.

In Plant 6E the storage area walls, the first floor cement finish, and the steel erection have been completed; this building is 75% completed. Piping work was begun during September and graphite shop equipment was installed.

A subcontract for Plant 6E equipment and machinery installation was awarded September 14 to Kremer-Hicks Co., whose bid of $29,650 was lower than two other bids of $49,950 and $55,100. A subcontract for duct work and sheet metal work is now being advertised, and bids are to be reviewed on October 12, 1949. This will complete the letting of unclassified contracts.

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Massachusetts Institute of Technology

The Hood Building "hot laboratory" is now considered to be 100% complete, although a final inspection before acceptance of the work will not be made until the first week of October. During September the crane and hoist were delivered and installed, and a waterproofing wall about the vault was constructed as an addendum to the Poley-Abrams Contract.

The contract for the first portion of the ceramics laboratory and foundry ventilating system was awarded to the low bidder, Park L. Davis Co., on September 28. The successful bid was for $19,656.00. One other bid was received from the Delbrook Ventilating Co. for $20,000, and three others solicited declined to bid. Bids were invited for the second portion of the ventilating system on September 28. All of the ventilating work is to be completed by Dec. 30, 1949.

Brush Beryllium Co. Plant, Luckey, Ohio

The necessary construction work involved in converting an existing plant to produce beryllium for the Brush Beryllium Co. is now about 90% complete. The work of T. J. Hume Company, the contractor for the erection of the production plant wing at Luckey, is 99% complete; movement and installation of machinery and service piping installation have also been 99% completed by A. Bentley & Sons. The ventilation contract of A. H. Lumm is 65% completed, and power and lighting installation is 85% completed by Preeter Electric Co. The Newberry Construction Co. has completed construction of a new railroad siding and repair of an existing railroad siding.

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V. RESEARCH AND DEVELOPMENT

Metallurgical Research at Columbia University (Dr. G. L. Kehl)

Experimental work on the metallographic examination of the heat-treated 2% molybdenum-uranium alloy has been completed. A report covering this work will be presented in the January issue of the Metallurgy and Ceramics Journal. Work is now beginning on the kinetics of transformation and associated hardness change for the 4% uranium-molybdenum alloy.

Metallurgical and Ceramics Research at M.I.T.

Experimental work under the direction of Professor J. Chipman on the activity of sulphur in molten iron has been completed. The effect of a third component upon the activity of sulphur in molten iron will next be studied; the first such substance to be investigated will be manganese.

All of the equipment has been ordered for Professor Norton's experimental program on methods for measurement of the thermal conductivity of ceramic bodies at elevated temperatures. Samples of alumina for thermal conductivity measurement are being prepared.

Raw Material Exploration

A report dealing principally with means for remote detection of uranium ores has been prepared for the Exploration Branch of the New York Raw Materials Office. Uranium emits alpha particles, which can be either detected directly or measured as helium after they lose their ionization. The following means of remote detection were considered:

1. The helium gas may be detected at considerable distances from the orebed after the gas has diffused to these remote points. Certain peculiar characteristics of helium are being utilized in developing good detection methods

2. Uranium ions in solution can travel to points remote from the orebed by dissolving and diffusion action. The alpha particles emitted from the uranium can then be detected. Work on this approach is in progress.

3. Gamma rays from uranium near the surface of land areas might be detected by airborne instruments. Capillary action could bring weak uranium solutions from deep deposits to the surface and give a reliable gamma intensity above background. The work of groups of investigators pursuing this attack is being followed.

4. The fact that orebeds have a different density than surrounding formations suggests the possibility of using sonic or supersonic methods of detection. Geological considerations lead to the belief, however, that methods 1, 2, and 3 will prove to be easier and quicker to bring to a practical stage of development.

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Harvard Calculating Machine

The solutions of seven problems have been or are now being obtained on the Aiken Mark I Calculator in the nine months during which half-time operation of the machine has been supported by the AEC. The titles of the problems indicate the varied nature of the work that has been done:

1. Helmholtz-Rayleigh flow
2. The forces between neutrons and protons in the atomic nucleus
3. Double refraction of flow and the dimensions of large asymmetrical molecules
4. Heat transfer by radiation between layers of a comet model
5. Aerodynamic flame propagation
6. Calculation of internal conversion coefficients for the K-shell
7. Neutron diffusion and stellar atmospheric problems

Three of these problems have been written up in formal reports. In addition, two volumes of the Annals of the Computation Laboratory of Harvard University dealing with Bessel functions of Orders 64-78 and an exponential integral function are being published.

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VI. BROOKHAVEN NATIONAL LABORATORY

3.5 Mev Van de Graaff

Physical installation of the 3.5 Mev Van de Graaff machine in the new cyclotron-Van de Graaff building has been completed. First tests achieved a maximum column voltage of about 2.0 Mev with a proton beam current of five microamperes. The beam fairly well focused to approximately 1/4-in. diameter. It became apparent that there is some distortion of the focusing system and several other minor items which require repair or adjustment. These are now being attended to, and it is expected that further tests will be made early in October. Other work nearing completion in the Van de Graaff chamber consists of the test platform in the experimental area and the air drier necessitated by Long Island's high humidity.

High Pressure Cloud Chamber

The high pressure cloud chamber has been assembled, and pressure tests have been conducted up to the full 300 atmospheres. At present, several small leaks are being stopped, and other operating equipment is being installed. It is expected that operations will start about the first of the year without the magnetic field. The five 540-KW Navy surplus diesel MG sets have been installed in a new generator building. Work is underway testing and reconditioning the sets and making the necessary connections to the cloud chamber. It is expected that this work will be completed shortly after the first of the year, so that full cloud chamber operation can begin in early spring.

Cosmotron

Building foundations and concrete walls for the main floor have been completed; concrete walls and roof for the machinery space have been poured; and erection of steel for the building frame was started September 30. Building work is proceeding upon schedule.

Magnet. Of 288 magnet blocks, 155 have been received from the Bethlehem Steel Co.; completion is scheduled by October 30. BNL has completed test equipment, and magnetic tests have been started using photographic methods for recording data.

Magnet Power Supply. The fabrication of the 40,000 KVA generator-ignitron set under contract with Westinghouse Electric Company is progressing on schedule.

Magnet Coils. All 70 tons of copper bus bar have been received. The coil-winding contract was granted to Hyre Electric Company of Chicago, who have completed winding the jig and are presently engaged in fabrication of the coils.

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Injection System. Construction of the 4 Mev Van de Graaff generator by High Voltage Engineering Corporation is proceeding ahead of schedule, and the development work on the PIG-type ion source is proceeding satisfactorily.

Vacuum System. Development work is continuing to determine the most satisfactory vacuum chamber. A glass-impregnated plastic with the trade name "Melamine" is undergoing tests to determine its suitability.

Radio Frequency Components. The decision has been reached to utilize Ferrite material for the transformer core, and a purchase order is being prepared for North American Phillips Company.

Physics Department

Activities of the Physics Department are proceeding along the lines outlined in the semiannual Scientific Progress Report of the Laboratory. The Department is making preparations to move into the new pile laboratories and is actively working on various experimental equipment for use in conjunction with the pile. Work is proceeding satisfactorily on the neutron spectrometer, in cooperation with Columbia University; a small laboratory under Dr. Baker is being set up for this work in the cyclotron building. The members of the Van de Graaff Group are assisting in the tune-up of the Van de Graaff machine and are also running various experiments on beta ray spectra. The neutron velocity selector has been received and is being assembled for use with the pile. The Time of Flight Mass Spectrometer Group is running tests and will move into a new laboratory in modified Building T-109 during October.

Dr. Piccioni's Group is continuing the building of equipment for cosmic ray work at mountain altitudes as well as for use in B-29's. One series of B-29 experiments has recently been completely, and the results are considered to be successful. They will be published within the next few months. A series of cosmic ray experiments is scheduled to be conducted at Berthoud Pass on the Continental Divide in Colorado this winter.

Work is continuing on the use of photographic emulsions as a detecting medium in the study of cosmic rays and beams from various accelerators. This group is also cooperating with the Office of Naval Research in high altitude balloon flights.

The Cloud Chamber Group completed a series of high altitude balloon flights using cloud chamber techniques during the summer. Preliminary investigation indicates that the flights were successful, but more detailed study of the film must be made.

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VII. MEDICAL

Analysis of Beryllium from Air Sampling

The determination of beryllium in air for studies of exposure offers a considerable problem to the analyst. The tolerance for out-plant air is 0.01 micrograms per cubic meter; this means that if a normal sample of 1000 cubic meters is taken at 10% of the tolerance level, one microgram of beryllium per sample is available. In order to collect a sample of this size in a reasonable time, a large reinforced filter paper must be used. This introduces about a gram of extraneous inorganic material which must be removed before analysis, even when a relatively specific method, such as the spectrographic, is used. Previous methods for accomplishing this left much to be desired, both as to completeness of removal of interfering elements and as to recovery of beryllium. Accordingly, the analytical laboratory addressed itself to the problem and developed a new method which is now in use. When further results are available, the work will be written up as a report for project distribution. While none of the principles of the present method is new, the combination which has been adopted allows more accurate and precise analyses to be made than was previously possible.

The organic matter is removed with nitric and sulfuric acids, and HF is used to volatilize silica. The iron and aluminum are precipitated with 8-hydroxyquinoline, and the beryllium in the solution is collected by precipitation with ammonia, using a known amount of aluminum as a collector.

The beryllium-aluminum precipitate is dissolved in one ml. of 50% sulfuric acid, and 0.05 ml aliquots of this solution are transferred to spectrographic electrodes. These are cupped graphite electrodes containing 100 mg of NaCl as a spectrographic buffer and carrier. The sample is excited in a D. C. arc at 15 amperes for two minutes. The optical density of a beryllium and an aluminum line is measured on the photographic plate, and the Be/Al ratio is used as a measure of beryllium concentration.

The sensitivity of the method is 0.005 micrograms on the electrode or 0.1 microgram in the total sample. The reproducibility of the method is higher than the accuracy, which is of the order of 25%. While higher sensitivity or accuracy has been reported previously, the present method is superior for the large filter papers necessary for low-concentration air samples.

Scintillation Counters

When the counting facilities of the Medical Division were first established, it was necessary to set up counters for measuring dust samples taken on filter paper and other dry media. The only suitable equipment which was then available, parallel plate ionization chambers, was accordingly put into use. These devices are generally unsatisfactory, for the reasons that the maintenance problem is severe, outside conditions strongly influence the behavior of the

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instrument and its stability, and the natural contamination background level is so high that accurate counting is a tediously involved procedure.

With the development of a photomultiplier tube suitable for a practical scintillation counter, it was decided that the Health Instruments Laboratory would undertake a program to develop an alpha counter with highly stable operating characteristics, and with the lowest possible background rate. In reviewing the problem, the RCA type C-7132 (RMA Type 5819) photomultiplier tube was chosen, in view of its excellent optical arrangement, and the possibility of securing high geometry factor. The electrical noise background of the tube is far better than in other commercial types, as judged by signal-to-noise ratio. It was also decided that commercial scalers should be adapted for use with this instrument, since it was our opinion that no essential benefit would accrue from the construction of new scalers.

The program was started approximately six months ago, and the first operable prototype was placed in service during the week of September 19, 1949. The instrument has a spurious count background of less than one count/hr; with a scintillation phosphor and a counting geometry greater than 40% of all disintegrations, the background is less than 8 counts/hr. After one week's use, contamination of the phosphor increased the background count to 15 counts/hr. The improvement of background is marked, since under the best operating conditions, it had never been possible consistently to reduce the normal background count of chambers below 2 counts/min.

The new equipment has speeded up the rate of sample counting, so that although no more than 40 samples per day could be counted with four operable parallel plate chambers and one operator, it is now possible to count 60 samples per day with one scintillation counter and one operator. Three additional scintillation units will be constructed, so that the full requirements of the Analytical Laboratory may be met. With the installation of the additional units, the sample rate per operator will probably be doubled. One new scintillation counter will be constructed within the next month, and the balance will follow at a later date.

VIII. LICENSING

Since March, 1947, the Licensing Division has issued 2,172 licenses in the following categories:

	March, 1947 Through September, 1949	During September, 1949
Producers	427	32
Distributors.	321	4
Processors.	35	-
Consumers	1,389	28
	2,172	64

Nearly all of these licenses are for one year's duration. Approximately 1,379 have been renewed for an additional one year period. Others will be renewed 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 September:

Incandescent Mantles	528,674*
Uranium Acetate.	43.06 lb.
Uranium Nitrate.	27.50 lb.
Thorium Metal Powder	88. lb.
Thorium Nitrate.	1622.06 lb.
Thoriated Tungsten	2.69 lb.
Miscellaneous Ores	6.63 lb.

Shipments of incandescent mantles were made to 33 countries. Thorium nitrate for the manufacture of mantles was shipped to India and Egypt. Materials for vacuum tubes were sent to the Netherlands East Indies, Holland, Argentina, and England. Other exports involved small quantities of material for educational, analytical, or medicinal purposes.

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* The ThO_2 content of these mantles is estimated at 529 lb.

IX. PUBLIC INFORMATION SERVICE

New Brunswick Open House

On September 10 New Brunswick Laboratory held an Open House. Those attending included members of the New Jersey Section of the American Chemical Society, faculty members of neighboring universities, analytical chemists from various industrial firms in New York and New Jersey, members of the New Jersey Press Association, metropolitan press correspondents, and local city and county officials. A total of 600 visited the Laboratory. Commissioner Sumner T. Pike, W. E. Kelley, NYOO Manager, and C. J. Rodden, Director of the New Brunswick Laboratory, were interviewed by the press, which gave good coverage to the occasion.

N.Y.U. Seminar

Dr. Sidney Roth of the N.Y.U. General Education Department has progressed with plans for a Seminar on Atomic Energy. Prior engagements of some of the speakers require that the Seminar be held on January 10,11, and 12, rather than in late November or early December as previously planned. The emphasis of the Seminar is on the industrial applications of atomic energy, with special reference to uses and handling of radioisotopes. It is believed by N.Y.U. that the majority of those taking the course will be safety and industrial management personnel from industry.

N.Y.U. will charge a fee for the seminar which is the first such course to be offered by a private institution.

Associated Universities, Incorporated

Two projects, informally suggested for consideration by John Jameson of AUI, were disapproved by NYOO.

The first, which would have entailed the allocation of $5,000 to AUI, proposed the writing and publication of a pamphlet on fundamental research with special emphasis on atomic energy. Writing was to be done by Stuart Chase and the pamphlet was to be published by Public Affairs Pamphlets. The AUI contribution of up to $5,000 of the overall cost ($12,000 to $15,000) would have purchased 60,000 copies of the pamphlet. After discussion with Morse Salsibury of the Washington staff, the project was disapproved.

The second project had to do with the preparation of a scenario for a movie on the same subject. It too, would have required the allocation of approximately $5,000 to AUI. The scenario would have been used to interest private sources in producing a movie on basic research and in undertaking work on other movies on atomic energy. This project was also discussed with Washington PTIS and disapproved.

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V. ENGINEERING

University of Rochester

Construction operations on the AEC Training Building at the University of Rochester have progressed to 77% completion. The interior partitions were erected up to the 2nd floor, and the 1st floor was washed down and made ready for installation of laboratory furniture and equipment. Windows have been installed throughout the building, and 95% of the glazing requirements have been completed. Plumbers are up-to-date on the progress schedule of their work; partial heating of the building is already in operation. Ventilation is about 60% complete. Electrical work is far ahead of schedule - 80% complete. Installation of refrigeration rooms has been started and is 5% complete. The tunnel elevator installation will start November 7 and will be completed in about three weeks. Exterior landscaping was begun, and all of the access roads have been completed except for topping.

The Harshaw Chemical Company

The installation of a fume recovery system in the Harshaw hexafluoride plant in Cleveland, which was begun on August 1, 1949, is now about 95% complete and is several weeks ahead of schedule. The recovery system utilizes two 2,500-cfm Buffalo Scrubbers. Some equipment installation and piping and duct work still remain to be done.

Lake Ontario Ordnance Works

The alteration and construction of the K-65 storage tank under the Preload Corporation contract has progressed to 37% completion, design work to 90%, and actual construction to about 25%. Excavation for the foundation is complete, and the wire machine for wire-winding and gunite work is in place.

On October 28th contract negotiations with Jervis B. Webb Company were completed, and a contract was awarded to them for the design, fabrication, and installation of necessary drum-handling and conveyor equipment for the sum of $39,101. The Webb Company bid was the lower of two original bids, but the proposed price was negotiated downwards, by revising scope of work and equipment requirements.

Mallinckrodt Chemical Works

Painting was begun on October 26 under the J. S. Alberici contract for the construction of the Boiler House; this is the final phase of work. The construction is now 95.5% complete. The Boiler House equipment is being installed by Kremer-Hicks and is 97% complete.

Under the Robert Paulus contract the construction of Plant 6-E has progressed to 86% completion. The progress status of the various construction items is as follows: the walls, cement-finishing, and window glazing are almost completed, the roofing work and floor finishing have been started, 50% of the

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foundation pads for the equipment have been poured, exterior painting is 85% complete, heating and ventilating duct work is 5% installed; heating piping is 20% complete, electrical work is 6% complete, and the installation of plant equipment is 40% complete.

On October 13 a subcontract was awarded to the General Installation Company, who was the lowest of 3 bidders, for the duct and sheetmetal work remaining in Plant 6-E in the sum of $10,220.00. Shop work is now being done under this contract.

Massachusetts Institute of Technology

Parke L. Davis Co., the contractor for the first half of the ventilation work in the Hood Building Laboratory, has progressed the work to within 95% of completion; the work will be completed about November 3. On October 18th a contract was awarded to the Capitol Engineering Co. for the second half of the ventilation work. Capitol's bid was $27,375; the highest of three other high bids was $32,890.

The Brush Beryllium Co.

The construction of the beryllium wing at the Brush plant in Luckey, Ohio, progressed to about 95% of completion. The completion status at the end of October is as follows: the erection of the plant wing by the T. J. Hume Co. - 100%, moving and installation of machinery by A. Bentley & Sons - 100%, installation of service piping - 100%, ventilation work under A. H. Lumm contract - 85%, and electrical work under the Preeter Electric Co. contract - 100%.

Burns & Roe, Inc. Pilot Plant

In the construction of the Burns & Roe, Inc. laboratory at Maspeth, L.I., various items of equipment have been placed under ventilation hoods and are in operating condition. These items include a crusher, sampler, sieve, oven, extruder, and fluorine table. A large dust collector has been installed; the duct work installation will begin shortly and will be in operation about November 15.

No construction schedule has been prepared for the beryllium pilot plant itself because equipment cannot be designed until certain criteria are given to the subcontractor. These criteria will be determined by the operation of the laboratory during the latter part of November and December.

Middlesex Warehouse

The construction and alteration work at the Middlesex Warehouse, being performed by S. T. Peterson & Co., Inc., the general contractor, has progressed to 75% completion. Roofing has been placed, all windows have been installed, and interior partition walls have been started.

Industrial Contractors, Inc., as subcontractor to S. T. Peterson, is supplying various steel items and has delivered the columns for the outside steam pipe trestles. As a subcontractor to Brown and Matthews, the AEM for this project,

Industrial Contractors, Inc. has submitted shop drawings on the first phase of the ore handling equipment in the Thaw House and from the Thaw House to the Hopper. It has also made a study of the second stage of the work, involving the handling of CX material and its sampling.

The heating and plumbing work is about 80% complete, and the electrical work is up to schedule at 80%. Concerted efforts were made to expedite construction and installation of equipment so as to meet the completion date for this work, November 18. The overall construction work is now 85% complete.

VI. RESEARCH AND DEVELOPMENT

Kellex Corporation

The Kellex Corporation Contract No. AT-30-1-Gen-169 has been terminated, with the exception of a few remaining items. A final fee for total performance under the contract has been agreed upon at $218,000 (6.2% of costs).

Columbia University (Bonilla) - AT(30-1)-668

The preliminary experimental work was concerned with the measurement of heat transfer to water, toluene, and mercury, in order to check the results of previous investigators. General agreement has been established with McAdam's correlation of heat transfer by natural convection from horizontal cylinders. Two additional features were noted; (1) that the slope at low Grasshoff numbers is 1/4 instead of 1/3 and (2) that there is a critical Grasshoff number above which eddy currents form and heat transfer rate becomes much greater.

The J. S. Spevack Report on Heavy Water

The New York Office has given special project-wide distribution to the "Secret" Report No. NYOO-85, prepared by J. S. Spevack under Contract No. AT(30-1)-759 entitled "The Improved Dual-Temperature Process for the Production of Heavy Water". The Dual-Temperature process makes use of the variation with temperature of the equilibrium constant for the isotopic exchange reaction, $HDS + H_2O \rightleftharpoons HDO + H_2S$. By contacting water and hydrogen sulfide countercurrently in two towers at two different temperatures, it is possible to concentrate deuterium oxide from normal water.

The report evaluates the Dual-Temperature process, incorporating improvements and modifications that were not known at the time of publication of previous reports on this method. It also includes a cost analysis which estimates that a plant costing $11,000,000 would be capable of producing five tons of heavy water per month at an operating cost of $11.50 a pound. An $850,000 pilot plant would produce 500 pounds of heavy water per month at a gross cost, including amortization of the plant in five years, of $44.26 a pound.

Hydrocarbon Research, Inc.

A supplement to Contract No. AT(30-1)-697 with Hydrocarbon Research, Inc. has been prepared, calling for a brief engineering study and a report on the feasibility and cost of a plant for the production of approximately 0.2 ton of heavy water per day. The method being studied is one using a liquid hydrogen fractionation unit attached to a Haber process ammonia plant. The report is expected by November 15.

University of New Hampshire

The Washington Division of Research has requested the New York Office to negotiate and administer a new research contract with the University of New Hampshire for investigation of inorganic fluorides. Under the direction of Dr. Helmut Haendler, Associate Professor of Chemistry, a study will be made of the relative properties of the halides of zirconium and hafnium. These properties include vapor pressures, heats of formation, solubility, and reactivity. Similar studies will be made of the halides of rare earths.

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This contract is one more of a group of research contracts in an unclassified subject area. However, the data to be determined and reported will be checked security-wise by Dr. Haendler prior to publication. If restricted data are uncovered, the report will be classified.

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VII. HEALTH AND SAFETY

Reorganization

On October 3, 1949, Dr. B. S. Wolf, Medical Director, NYOO Medical Division, resigned. He had been the Director since May, 1947, when the Division was established. The name of the Division was changed to Health and Safety Division, and Mr. Merril Eisenbud, former Chief, NYOO Health and Safety Branch, was designated as Director. Dr. Wolf will continue his association with AEC in the capacity of a consultant to NYOO on problems affecting the work of the Health and Safety Division.

Disaster Programs

The NYOO has participated in several discussions concerning disaster planning during the past year. On October 12 a conference was held in Chicago, attended by AEC personnel from the Washington Office and the various Operations Offices, to formulate specific plans for the immediate future. Dr. Shields Warren, Director, Division of Biology and Medicine, Washington Office, discussed the basic directive, AEC-192, covering instrument stock-piling programs. Considerable work had been done by NYOO toward the development of such plans prior to the October 12 meeting, and additional impetus was given the work as a result of the conference.

The proposed NYOO program was outlined in detail in a memorandum from the Manager, NYOO, dated October 27. Pending a reply from Washington concerning the NYOO proposal, a ten-man team has been organized to carry out AEC responsibilities should a disaster occur in the interim. This temporary organization is a variation of our plant-emergency program team and includes provision for emergency transportation by the Air Force if necessary.

Uranium Photo-Fluorimeter

The fluorimeter originally received from the University of Rochester had insufficient sensitivity to provide reproducible readings of the low uranium concentrations found in some of the urine samples sent by our contractors. The NYOO Analytical Laboratory requested that a fluorimeter be constructed with an adequate sensitivity to detect a change of 5×10^{-12} grams of uranium in the standard sample. With this requirement in mind, a fluorimeter has been constructed that has more than adequate sensitivity to meet this requirement. Actually, the device could provide greater sensitivity than can be utilized with the present sample non-uniformity. It is believed that this non-uniformity results from the fusion of the sample with sodium fluoride in a gas flame and the inability to control the fusion conditions. An improved method of heating is discussed below.

The fluorimeter consists of a high pressure water-cooled mercury arc light source that shines through filters on the sample. The uranium compound fluoresces in the presence of sodium fluoride, and this fluorescent light is projected in the plane of the photo-cathode of a photomultiplier tube. The

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