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CMR DIVISION PROGRESS REPORT

JUNE 20 - AUGUST 20, 1947 (U)

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~~CONFIDENTIAL~~

MONTHLY PROGRESS REPORT OF THE CHEMISTRY-METALLURGY DIVISION

July 20-August 20, 1947

I. Research and Development.

1. The continued heavy demand for analytical services made it mandatory to devote nearly all the efforts of the Analytical Group to routine analyses. In addition to current samples, they disposed of nearly all of the backlog. A total of 787 analyses were made during the month.

The construction of a chemical microscopy laboratory is nearly complete, and the expansion of the spectrographic laboratory was finished. The new Baird spectrograph has not yet arrived. In spite of the heavy load of routine work, some progress was made in the development of analytical methods for plutonium alloys, the study of the absorption of alpha particles by dissolved salts; and the determination of uranium in uranium tetrafluoride, of carbon in uranium tetrafluoride, and of uranium in concentrated magnesium nitrate solutions.

2. The electrodeposition of lanthanum from aqueous solutions was continued with emphasis on the use of a mercury cathode. The results were not conclusive.

3. The training program for radiochemists in connection with the determination of bomb efficiencies in the Pacific tests has been essentially completed. The members of this section have been assigned to specific problems, such as the method of determining molybdenum and the separation of U-236 and Pu-239. Work is also being done on special fission counters in connection with these problems.

4. Sources for three Rala shots were made, but much more trouble was encountered with the last shipment (No. 27) than with the previous one, although the Clinton Laboratory reported that their chemical processing was identical.

5. All parts of the new package equipment for sources for Rala shots have been received. The mechanism was assembled and worked well, but has not yet been tried in direct chemical operations. The redesign of the Rala processing equipment has made appreciable progress. A study of the various types of periscopes which have been used in other installations has been started.

6. Preliminary work on the separation of americium and curium from plutonium has continued. A concrete counting room has been designed and submitted for construction.

7. The machine for producing very large foils has been tried. Ten-foot foils with a uniformity of about 20% were made, and the uniformity compares favorably with small, hand-painted foils.

8. Early in 1945, attempts were made to secure thermal arrest points as a sample of plutonium was heated. The results could not be interpreted at the

tims, and an understanding was acquired only after dilatometric work had been done. There was, however, some discrepancy between the temperatures of the transformations as determined by these two different methods. A special apparatus was constructed in which both the expansion and the heat effects could be observed simultaneously on the same sample. The agreement between the two sets of results was excellent.

9. An apparatus which depends upon electrical resistance measurements has been designed for the determination of the solidus temperature of plutonium alloys. This device has been checked on the melting point of bismuth and several alloys, and appears to be quite satisfactory.

10. Investigation of the melting points of the Pu-Ga system by metallographic techniques has continued. The only result available, however, is that an alloy containing .5 atomic % Ga melts between 575 and 600°C. Alloys from 2 to 5 atomic % do not melt at 620°C. This probably means that the first eutectic in this system lies close to the plutonium end of the system.

11. X-ray diffraction work on the Pu-Ga system has continued. The structure of the compound Pu-Ga does not appear to be similar to that of NiAs, the latter being one of the typical structures frequently found for compounds of this type of formula.

12. The work on Brinell hardness of plutonium at elevated temperatures has continued, and the marked susceptibility to work hardening mentioned last month was confirmed. At 20°C the Brinell hardness number was 165 with 500 kg loads, and 235 with 3000 kg loads. The difference diminishes as the temperature increases. The apparatus is now being redesigned to extend the temperature range up to approximately 500°C.

13. Defective molds and furnace failures have considerably delayed the work on centrifugal casting of thin-walled tubalioy hemispheres. However, the polar cap, which contains one-half the weight of the hemisphere, may be successfully formed by hot pressing techniques.

14. Progress has been made on rolling U-235 for making the discs requested by Columbia University. The work has been delayed by continual difficulty with the vacuum annealing furnace. The die for blanking out the discs has not yet been completed.

15. A method is being developed for hot rolling uranium. Cladding with copper appears to be quite promising.

16. The plastics section has been very active during the month. Among their activities may be mentioned the preparation of eight lens covers for HE lenses, the preparation of 30 pin sets for the Weapons Division, and the preparation of 20 special slugs for piezo gauge backing.

17. U-235 hemispheres and other weapon parts oxidize slightly in air. In handling these objects, some of the oxide rubs off and high hand counts result. While a suitable protective coating can be put on such specimens by the nickel carbonyl method, a search is now being made for an electroplating method to protect the surface.

18. Four Alnico-V hemispheres were made for the Weapons Division.

19. An experimental incinerator has been built for burning towels and rags and other organic materials which are contaminated with U-235.

20. In Item XII-14 of last month's report, it was mentioned that work was being done on the use of HI solutions for dissolving $PuO_2$. During the month, six casting skulls weighing 160 grams each were thus dissolved and sent through purification, dry chemistry, and reduction operations. Analyses on the final metal have not been received.

II. Health.

1. 133 persons were sent on health passes during August. All tests were negative. All personnel exposed to polonium were given urine radioassay tests. Five persons indicated they were excreting 50-100 c/m of polonium per 24 hour sample of urine, and one person showed on one test that he was excreting 498 c/m of polonium per 24 hour urine sample. This person was removed from exposure to polonium until the counts found in his urine were less than 50 c/m of Po per 24 hour sample. All other polonium urine radioassay tests given during the month were negative.

2. Airborne alpha air contamination tests were run in all Pu, Po, and U processing areas. 70 air testing units were in operation, and approximately 1600 individual tests (air samples collected varied from 800 liters to 120,000 liters) were made in these areas. Average airborne alpha activity in the air throughout CMR laboratories dropped 80% under that of the previous month. However, temporary high air counts were observed in 20 laboratories due to (a) faulty operations, (b) leakage of water through the roof of D Building, (c) heavy construction work in D Building, and (d) weighing of an uncovered sample of plutonium on an open analytical balance.

3. Radioactive surface contamination remained at about the same level.

4. Routine and special tests with film badges, dosimeters, cobalt slugs, gamma and neutron survey counters and meters indicate beta, gamma, and neutron radiation levels were very low. No excessive exposure of any person to gamma rays or neutrons was recorded.

5. All wells and reservoirs supplying water to the Project were analyzed for the presence of Pu, Po, U, RaLa, and RaBa contaminants. No contamination in the water was found.

6. One contaminated accident occurred at DP West Site during the month. This was an excessive air count caused by a technician weighing an uncovered sample of plutonium on an open analytical balance.

III. Miscellaneous.

1. In the July 20 report, I mentioned that I had sent out job offers to 18 persons, and at that time security clearance was on the average 70 days old

without result. As of August 26, 1947, eight of these persons had been cleared. Of the remaining ten, the number of days since submission varies from 80 to 125 with an average of 100 days without clearance. In addition, we now have from this Division 12 other persons who were submitted for clearance from 56 to 125 days ago. The average of this group is 90 days.

The situation has deteriorated more than 20 days in the last month. If this continues, we may expect that in January it will require an average of six months for clearance. How does the AEC expect us to maintain programs on this basis?

Eric R. Jette

GROUP CMR-1 MONTHLY REPORT -- C. F. Metz, Group Leader -- August 20, 1947

GENERAL

The continued heavy demand for analytical services made it mandatory to devote nearly all our efforts to routine analysis. In addition to current samples, nearly all the backlog was disposed of. We are still unable to handle samples such as plutonium oxide because of lack of proper equipment. A hood for such work has been on order for over a year. Carbon analysis of plutonium by the vacuum fusion method has been discontinued due to lack of personnel and inadaptibility of the procedure for routine analysis. Equipment for a combustion method is being planned. Conversion of Room D-303 into a chemical microscopy laboratory is nearly complete. Construction work on increasing the size of the spectrographic laboratory was finished. The Baird Spectrograph has not arrived.

The breakdown of analytical services is as follows:

| Source | Analyses Reported |
|---|---|
| CMR-1 | 5 |
| CMR-4 | 35 |
| CMR-5 | 3 |
| CMR-6 | 68 |
| CMR-8 | 312 |
| CMR-11 | 351 |
| Miscellaneous | 13 |
| Total | 787 |

PROJECT & PERSONNEL

CMR-1-7
Analytical Methods for Plutonium Alloys (Ni, Co, Cu)

Borgstresser

PROGRESS

Synthetic solutions containing Pu-Ni, Pu-Co, and Pu-Cu were subjected to electrolysis. The alloying elements, Ni, Co, and Cu, were quantitatively deposited in a mercury cathode. In seeking shorter, more rapid methods, colorimetric procedures were tried without preliminary separation of the plutonium. Results indicated that cobalt can be determined in the presence of plutonium with nitroso-R salt as a color reagent. One mg of plutonium gave no interference when present with 1 to 100 micrograms of cobalt.

CMR-1-14
Radiochemical Assay Methods

Borgstresser, Bradford, Kingsley, LaCombe, Reynolds

The study of errors due to absorption of alpha particles by dissolved salts was extended to solutions containing oxalic acid and potassium oxalate. Earlier work of a similar nature was repeated, using an amount of plutonium that gave approximately 100 counts per minute on a foil, instead of approximately 1200 counts per minute.

GROUP CMR-1 MONTHLY REPORT -- C. F. Metz, Group Leader -- August 20, 1947 (contd.)

| PROJECT & PERSONNEL | PROGRESS |
|---|---|
| CMR-1-16<br>Chemical Microscopy of Plutonium Metals<br><br>Gettens | The laboratory for this work was completed. Considerable time was spent in assembling and calibrating equipment. A search of the literature was made and a table prepared containing information that might be of value in this work. |
| CMR-1-20<br>Determination of Uranium in Uranium Tetrafluoride<br><br>Ashley, Menicksman | Assay was attempted using colorimetric, volumetric, and gravimetric methods. Results to date have been erratic and inconsistent. A method in which the sample was ignited to $U_3O_8$, dissolved in nitric acid, fumed first with perchloric and then with sulfuric, then run through a Jones reductor and titrated with $KMnO_4$, gave consistent results. However, the method has not been checked by another procedure. |
| CMR-1-21<br>Determination of Carbon in Uranium Tetrafluoride<br><br>Van Kooten | Present results indicate that the fluorine can be quantitatively absorbed by powdered, unfired magnesium oxide and $CO_2$ not absorbed, when the temperature of the magnesium oxide is held at 900°C. Fairly consistent results for carbon in a commercial tetrafluoride were obtained. However, as yet there is no way of proving the value obtained is the correct one. Considerable trouble has been encountered in weight variation of the absorption tubes, due to humidity or some other form of interference. |
| CMR-1-27<br><br>Determination of Uranium in Concentrated Magnesium Nitrate Solutions<br><br>Menicksman | The solutions of particular interest contain iron, calcium, and chromium, in addition to large amounts (6N) of magnesium. An ammonium hydroxide precipitation to separate iron, chromium, and uranium from most of the magnesium and calcium seemed to be satisfactory for colorimetric determination of the uranium. Recovery from synthetic solutions approximating the composition of M Building charge solutions was within 0.8% of the true value over the range 5 to 50 mg per 100 ml. The same separation was applied to M Building concentrates, containing from 200 to 300 mg of uranium per 100 ml. Numerous attempts were made to check the colorimetric results by standard volumetric and gravimetric procedures, but without success. |

| PROJECT & PERSONNEL | PROGRESS |
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| CMR-2-2<br>Absorption of Low Concentrations of Plutonium Ion by Exchange Resins<br><br>Huber | This problem was inactive during a portion of the month, due to a lost-time injury to personnel. An acceptable analytical procedure is not yet available. The procedure at present involves the concentration of the hot solution and precipitation of Pu hydroxide using lanthanum carrier followed by precipitation of the Pu and La as the fluoride which is then plated and counted. At present, the hydroxide precipitation is ineffective in stripping the solution of plutonium. It may be necessary to attempt an entirely different procedure. |
| CMR-2-5<br>Preparation of Volatile Plutonium Fluorides<br><br>Florin | Inactive. |
| CMR-2-6<br>Preparation of Plutonium Carbides<br><br>Stillson, Lemons | The apparatus for this preparation was ready for operation during the month. A breakdown in the induction heating apparatus is delaying operations at present. |
| CMR-2-7<br>Electrodeposition of a Lanthanum Alloy<br><br>Florin | Continued attempts were made to electrolyze lanthanum from aqueous solution. A mercury cathode, graphite anode, and graphite third electrode for measuring independent cathode potentials were employed in a small pyrex cell equipped with a stopcock at the bottom to permit removal of the mercury cathode without interrupting the current. Stirring was provided by an electric motor, and cooling was effected by a stream of cold water directed on the cell. The independent cathode potential was measured by a vacuum tube voltmeter. 10 ml. of solution were used in the cell. Yields were determined by measurement of radiolanthanum tracer activity.<br><br>Ostensibly, no La yield resulted on electrolysis of the solutions:<br><br>1) 5 M $NH_4Cl$ - 0.27 M $LaCl_3$<br>2) 10 M LiCl - 0.27 M $LaCl_3$<br>3) 10 M LiCl - $1.4 \times 10^{-3}$ M $LaCl_3$<br><br>Independent cathode potentials, measured with respect to the third electrode, vs. current diagrams showed a break at approximately 2.5 volts |

| PROJECT & PERSONNEL | PROGRESS |
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| CMR-2-7 (contd.) | for the $NH_4Cl$ solution. The LiCl solutions gave curves with a break that depended upon the acidity; the basic solutions showing a break at about 2.5 volts, and the acid solutions showing a break at about 1 volt. |

PROJECT & DESIGNATION

PROGRESS

A. Initiator Production and Incidental Production Research

CNR-S-1
Urchin Initiator Production

The major portion of the work of the group was spent in the production of urchins and in problems directly related.

1. Counting Assays

Abel, Georgi, L.Moulton, Thomas Laughlin

The foils and gauzes of five shipments totalling 850 curies were counted in the $BF_3$ and Geiger-Muller counter assemblies.

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Three assembled test gun initiators were prepared and neutron backgrounds followed after assembly. The neutron backgrounds of these assemblies are slowly increasing.

DOE 2(a)

A program has been initiated to identify and eliminate the cause of the increase in neutron background after assembly of gun type initiators.

| PROJECT & PERSONNEL | PROGRESS |
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| CMR-4-1<br>Training Program for Radiochemists<br><br>Balagna, Elkin, Gilmore, Lang, Mower, McClendon, Melnick, Minkkinen, Moor, Sattizahn, Spence | The training program has been essentially completed, and the personnel assigned to specific problems in connection with efficiency measurements. |
| CMR-4-2<br>Determination of the Half-Life of Tritium<br><br>Goldblatt, Robinson | This work will be held up until the new laboratories in U Building are completed. |
| CMR-4-3<br>Analysis of Hydrogen-Tritium Mixtures with the Mass Spectrometer<br><br>Jones, Povelites | The $D_2$ gas used in preparing the DI whose behavior was reported last month was analyzed and gave a D/H ratio of about 35:1, which agrees well with the DI/HI ratio obtained from the large sample of DI. It does not agree with the DI/HI ratio of about 7:1 obtained with the small DI sample. This checks earlier evidence that large DI samples give more trustworthy results than small DI samples.<br><br>A sample of DCl was prepared by the photochemical combination of $D_2$ (over 99% pure) and $Cl_2$ prepared from $AuCl_3$. The $DCl^{37}/HCl^{37}$ ratio was only about 3:1; it was expected that a much higher ratio would be found since exchange processes involving DCl should be less likely than if DI were used. The atomic chlorine peaks were anomalously high.<br><br>We have found the results depend upon the gas pressure behind the capillary leak. Correspondence with Dr. A. O. Nier revealed that such behavior has been met with elsewhere. A leak which insures molecular flow is necessary, and we believe such a leak can be procured from a commercial source.<br><br>In view of the lack of success so far achieved in using the mass spectrometer for analyzing hydrogen-tritium mixtures, very little more work will be done on this problem. |
| CMR-4-4<br>Preparation of Tritium and Deuterium Foils<br><br>Rodriguez | One 4 mil tantalum foil containing deuterium was prepared and given to Group P-3. Three attempts to reduce the brittleness of tantalum foils by coating one side of the tantalum with copper failed; the copper wet the tantalum, but the foils were |

| PROJECT & PERSONNEL | PROGRESS |
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| CAR-4-4 (contd.) | still brittle. In one case the copper seemed to alloy with the tantalum, and no deuterium could be absorbed.<br><br>An induction furnace has been set up to heat the tantalum by induction in such a way that the brittleness is greatly reduced. |
| CAR-4-8 Preparation of Foils of Active Material<br><br>Gilmore, Potter | One 28 foil and sixteen 25 foils were prepared by the sapon technique. |
| CAR-4-9 Routine Preparation of RaLa Sources<br><br>Barker, Bone, Fitzgibbon, Halligan, Leary, Marjon, E. Newbury, F. Newbury, Shaffer, Tafoya, Wilhelm | Shipment No. 27 was received and dissolved on July 25. It measured 2035 curies. This shipment was processed as follows: |

| Date | Yield | Disposition |
|---|---|---|
| July 30 | 1190 c. | Shot #84 |
| Aug. 6 | 740 c. | Shot #85 |
| Aug. 13 | 700 c. | Shot #86 |

Much more trouble was encountered with this shipment than with the previous one, although the Clinton Laboratory reported that their chemical processing was identical with each shipment.

| | |
|---|---|
| CAR-4-11 Re-Engineering of RaLa Packaging<br><br>Crits | All parts of the new packaging equipment have been received. The mechanism was assembled and worked well. It has been installed in Bayo Canyon and will be tested in a cold run as soon as the RaLa schedule permits. |
| CAR-4-12 Redesign and Re-Engineering of the RaLa Process<br><br>Cox, Leary, Lilienthal | All the drawings have been released for manufacture of the spindle assembly. The total number of drawings for this assembly is sixty-one.<br><br>A total of 19 drawings has been released for the manufacture of a tip removing packaging unit. The final assembly cannot be completed until receipt of the purchased parts.<br><br>The drawings for the jib crane assembly upon which the spindle rides is nearing completion. The purchased parts required for this assembly were ordered on July 25. |

| PROJECT & PERSONNEL | PROGRESS |
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| CMR-4-12 (contd.) | A tentative building layout for the operations necessary to the Bayo Chemistry has been made.<br><br>Some further work has been done with lead ore concrete using mixtures of cement, sand, and lead ore. Better bonding of the cement is apparent but not at all satisfactory. If the block will hold structurally, radiation absorption tests will be made. It is felt that the percentage of lead present will not allow a material reduction in wall thickness.<br><br>Sample blocks have been tried using a mix of water glass, litharge, and lead ore. A sample was also made using just litharge and water glass. In both cases the blocks crumble easily and cannot be handled.<br><br>The draftsman in V Shop, who has been working on design and detail work since March 18, has left the project. The work he has been on has been picked up by Mrs. Coe.<br><br>Eight drawings have been submitted by Black & Veatch, but before they can be checked extensive revisions will be necessary.<br><br>On August 18, assembly drawings for five types of periscopes were received from the Argonne National Laboratory. A complete study has not yet been made, but tentatively two types appear to be satisfactory for our use. The D-A type periscope is designed for insertion through a five foot wall and provides scanning of 150°. The D-B type is designed for a thick wall and is used for close inspection of objects behind the wall. Inquiries will be made concerning the possibility of obtaining complete units or obtaining the lenses and mounts with the assembly being done here. |
| CMR-4-13<br>Americium Production Design<br><br>Briesmeister, Dalton, Ludwig | Work has begun on the construction of the new laboratories.<br><br>A new drybox for small scale separation experiments, a large hood for americium work, and a hood to house the reservoir and centrifuge used in connection with supernatants from the peroxide precipitation are now being designed.<br><br>The hood which will house the apparatus for the dissolution of plutonium and the precipitation of plutonium peroxide has been designed and constructed. |

| PROJECT & PERSONNEL | PROGRESS |
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| CMR-4-14<br>Plutonium Chemistry Involved in Transplutonics Production<br><br>Lane, Nigon | A ten gram trial run of the dissolution of plutonium metal and the precipitation of plutonium peroxide was made. Results were better than with smaller amounts of plutonium. It has been decided that the small amount of oxide formed in the dissolution of plutonium metal is too small to cause serious trouble, and no attempt will be made to dissolve it.<br><br>The optimum temperature for the precipitation of plutonium peroxide has been found to be in the range 40-50°C. It is desirable to cool to 0°C after precipitation to facilitate rapid settling of the peroxide. |
| CMR-4-16<br>Research on Foils<br><br>Gilmore, Potter | The preliminary work on the machine to produce very large foils has been completed. The 10 foot foils show a uniformity of about 20%. This uniformity compares favorably with small hand-painted foils.<br><br>Work has been done on the preparation of photographic emulsions impregnated with U-235. The emulsions were soaked in alcoholic solutions of uranyl nitrate for varying lengths of time. Densities of 1 mg of U per $cm^2$ have been obtained. These foils will be used by Rosen of Group P-12 in an attempt to find triple fission. |
| CMR-4-19<br>Development of Methods for Determination of $Mo^{99}$, $Zr^{97}$, and $Np^{239}$<br><br>Hower, Lang, Melnick, Minkkinen, Moor | Work is continuing on the Mo procedure; a somewhat shorter method of Stanley and Katcoff is now being tried. The spread in results is still somewhat too great (10% for 10 determinations run by five analyets), although the experimental half-lives obtained indicate satisfactory decontamination. |
| CMR-4-20<br>Fission and Alpha Counting Development<br><br>Balagna, Elkin, McClendon Sattizahn | Several runs have been made at Omega using the present stainless steel double fission counter. While absolute results have not yet been obtained, the problems are being systematically studied. A lucite double fission counter drawn to our specifications is now being constructed.<br><br>The chemical separation of U-235 and Pu-239 prior to the electrodeposition of these elements for alpha counting is being investigated using U-233 as a tracer for uranium. Apparatus needed for the electrodeposition work is now being made. |

GROUP CMR-5 MONTHLY REPORT -- A. S. Coffinberry, Group Leader -- August 20, 1947

PROJECT & PERSONNEL

CMR-5-1
Alloy Survey

Struebing, Whyte, Wensch

PROGRESS

The only alloy compositions prepared (other than Pu-Ga alloys for CMR-5-2) were in the plutonium-gold system and contained the following atomic percentages of gold: 1, 2, 3, 97, 98, and 99. After original melting and solidification, each of these alloys was recast according to established practice into two ingots of approximately equal size. Two good castings were obtained in each case except 2 and 3% gold, of which only one sound casting each was obtained. Further alloy preparation has been suspended pending receipt of casting crucibles of a new size, large enough to enable each alloy to be recast and annealed as a single ingot.

Graphite crucibles, to be used in studying the system plutonium-carbon, are also on order. Using these, it is hoped to be able to obtain a carbon gradient in plutonium by a method reported to have been successfully used in determining the variation of microstructure with carbon content in uranium. Analytical results from CMR-1 on a specimen of what had been supposed to be pure plutonium showed 1905 ppm, or 3.67 atomic percent, of carbon. This specimen contained numerous inclusions of the "plate-like carbide" type found in the 5 atomic percent carbon alloy discussed in last month's progress report. When the origin of this specimen was traced, it was found to be a third remelt of plutonium obtained from CM-8 on September 6, 1945.

An ingot of pure plutonium was cast and hot pressed for dilatometry. This specimen was run by Mr. Walters, who, using a newly constructed device for automatically controlling heating and cooling rates, obtained both dilatometric and inverse rate of temperature change data for three successive heatings of the specimen, and for cooling following the second heating.

Two previously prepared dilatometer specimens, containing 5 atomic percent respectively of indium and tin, have been given a new homogenization heat treatment for 100 hours at 550°C preparatory to re-running them in the dilatometer. Two new furnaces with temperature controllers for homogenization heat treatments are being installed in order

PROJECT & PERSONNEL

CMR-5-1
(contd.)

PROGRESS

to increase from one to three the number of such units available for simultaneous use at different temperatures.

Further work with the electrical resistivity method of determining phase changes indicated a need for improvement of the apparatus with regard to such features as relay contacts, cold junction control, and electrical connections generally. Palladium contact relays have been ordered; considerable improvement in cold junction control has been effected, with further changes contemplated; and soldering of all electrical connections has eliminated the most unsatisfactory characteristics originally observed in this equipment.

The 50 weight percent lead-antimony alloy first used to test this method gave a well defined indication of resistivity change at the eutectic temperature, but, probably because of the almost 250° difference between eutectic and liquidus at this composition, no discernable change in slope of the resistance versus temperature curve could be detected at the liquidus temperature. For this reason, it was decided to investigate instead the bismuth-antimony alloys, which manifest complete liquid and solid solubility. Six runs were made with chemically pure bismuth, and this metal's unique increase in conductivity on melting was clearly and consistently indicated to occur at 270°C, in good agreement with 269-271°C reported in available literature. Attempts to work with antimony were abandoned, however, for the reason that this metal apparently alloys with the thermocouple elements (in metallic contact with the specimen in order to serve also as conductors in the resistivity circuit) in such a way as to introduce extraneous potentials or resistances which obscure other electrical effects. An investigation of the bismuth-lead system has therefore been initiated, and while results are as yet incomplete, enough data have been obtained to give promise of good success throughout most of this system involving a eutectic, a peritectic, and extensive solid solution.

In obtaining this data, readings recorded on the Micromax strip chart have to be replotted on an enlarged scale in order to emphasize changes in

PROJECT & PERSONNEL

CMR-5-1
(contd.)

PROGRESS

slope. In order that critical points may be obtained directly from readings automatically recorded in magnified form, an electronic amplifier is being procured to multiply currents supplied to the Micromax.

CMR-5-2
Phase Diagram of Plutonium-Gallium

Gerds, Schonfeld, Whyte, Ellinger, Struebing

The principal work on the plutonium-gallium system has consisted of an as yet uncompleted attempt to determine the liquidus line for the composition range 0.5 to 5.0 atomic percent gallium. Use is being made of seven ingots of Pu-Ga alloys already made up to have the compositions: 0.5, 1.0, 2.0, 3.0, 3.5, 4.0, and 5.0 atomic percent gallium. All had been homogenized at 450°C for 100 hours, and the 4.0 and 5.0 percent alloys had, in addition, been subsequently annealed at 400°C for 24 hours.

The procedure being followed is to subject the seven specimens, each sealed into an evacuated glass or vitreosil capsule, to overnight heating (16 hours) at successively higher temperatures according to a predetermined schedule. The specimens are water-quenched from the furnace and examined metallographically after each treatment.

The temperatures investigated so far are 525, 550, 575, 600, 610, and 620°C. The only specimen in which definite evidence of melting has yet been observed is the 0.5% Ga composition, which had melted sufficiently to assume the shape of the capsule after the 600° treatment. At 610°C the 1.0% alloy had softened somewhat, as shown by slight deformation on the surface of the specimen; but after heating both to this temperature and to 620° (with somewhat further deformation but no marked change in shape) no metallographic evidence of melting could be found. The remaining specimens have shown no evidence of either melting or softening after the 620° treatment.

Consideration has been given to the possibility that an oxide coating of high mechanical strength may be preventing molten metal from changing its shape; so that the microstructures now being observed, which reveal some type of decomposition of the original structure in every case, may be de-

PROJECT & PERSONNEL

CMR-5-2
(contd.)

PROGRESS

rived from the quenching of a liquid metal. This seems unlikely, however, because all specimens have appeared to be bright and free from oxide after every heating.

Photomicrographs of every specimen are being taken after each heat treatment, and the beginning of a pattern of solid state transformations in the composition and temperature range covered seems to be evolving as a by-product of the solidus determination. Density measurements have also been made on every specimen after each heat treatment. These results indicate changes of density as large as 0.60 g/cc for the 0.6 and 1.0% Ga compositions, but not more than 0.30 g/cc for any one of the other specimens.

A dilatometer specimen containing 0.75 atomic percent gallium has been given a preparatory homogenization heat treatment at 550°C for 100 hours.

A second attempt was made to prepare a 50 atomic percent gallium-plutonium alloy, but some of the added gallium was observed to have remained unalloyed on the side of the crucible. Allowance for the weight of this gave 29.3% as the gallium content of the alloy. However, its x-ray diffraction pattern was found to be almost identical with that of the 25% gallium alloy, except that weak lines extraneous to the eta phase ($Pu_3Ga$?), suspected of indicating the existence of another phase between 25% and 50% gallium, were very slightly stronger.

Second and third attempts were made to obtain an entirely satisfactory 50 atomic percent gallium-plutonium alloy. The second attempt, carried out at 1400°C, resulted in complete melting but yielded an ingot containing a large central cavity. The density of this material was determined to be 10.86; but its diffraction pattern showed only a few weak diffuse lines and a dense background. These lines bore no resemblance to the excellent pattern obtained with the first 50% composition attempted.

In the third attempt, melting seemed to have just been accomplished at 1100°C. Densities determined on two portions of the original ingot averaged 11.818 (11.814 and 11.810), which for 50% Ga lies

PROJECT & PERSONNEL

PROGRESS

CMR-6-2
(contd.)

closely on a straight line for density vs. atomic percent gallium extrapolated from the 3% to 29% Ga range. After recasting the two portions of this ingot, densities of only 10.930 and 11.110 were obtained; and both x-ray diffraction and metallographic examinations of the recast specimens indicated a gallium content appreciably different from 50%. According to Kelley's log-P equation for pure gallium, both the original melting and the recasting of these specimens was carried out under a sufficient pressure of atmosphere to prevent loss of gallium by boiling. However, Harteck's scattered experimental data on gallium, from which Kelley's equation is derived, indicate the possibility of vapor pressures almost ten times greater than were allowed for. In view of this discrepancy, experiments are being undertaken to determine more exactly the vapor pressure of pure gallium at the temperatures involved in alloying.

The density value, 11.316, for the 50 atomic percent gallium alloy requires that the hexagonal, close packed unit cell reported for PuGa, with $a_o$ = 6.29 A, $c_o$ = 9.00 A, c/a = 1.44, contain 6.82 molecules of PuGa. Since the nickel arsenide structure ($a_o$ = 3.54-4.30 A, $c_o$ = 5.03-6.12 A, for 17 known examples) contains two molecules of NiAs per unit cell, it seems unlikely that PuGa can be regarded as derived from any multiplication of the NiAs arrangement. Resemblance to NiAs is further rendered doubtful by the fact that, while not all 59 lines of the PuGa pattern have as yet been indexed according to either cell, an alternative unit cell that seems to be equally satisfactory is a simple hexagonal with $a_o$ = 6.29 A, $c_o$ = 4.50 A, c/a = 0.72.

Other x-ray diffraction work on the plutonium-gallium system has involved phase identification and lattice parameter determinations on the 3 and 16 atomic percent gallium alloys. The results of these determinations will be reported in a later summary of similar results for all diffraction work done on plutonium-gallium compositions.

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Regarding optimum temperature and time for stress relief of Pu-Ga filings, it was decided that, since 5% Ga filings annealed at 200°C for 70 hours gave no PuO lines but did not produce sharp K-alpha doublets, a suitable treatment for the 3% Ga alloy might be 12 hours at 250°C. This gave sharp K-alpha

PROJECT & PERSONNEL

CMR-5-2
(contd.)

CMR-5-3
Services

Gerds, Schonfeld, Winburn, Southard

CMR-5-5
Crystal Structures of Plutonium

Krill, Ellinger

CMR-5-6
Mechanical Properties of Plutonium

Winburn, Southard

PROGRESS

doublets and only extremely faint, low order lines of PuO.

Three members of Group CMR-5 visited an X-2 laboratory at S Site for consultation on the preparation of explosives for microscopic examination. Several Pu specimens were sawed into smaller samples for CMR-1. Five concrete cylinders were compression tested for the Engineering Operations Inspection Department.

Attempts were made to improve line sharpness and reduce background in photograms of beta-plutonium obtained with the high temperature diffraction camera. Stress-relief annealing of the extruded wire used as specimen accomplished no improvement in line sharpness.

Neither nickel nor aluminum foils, used as filters both in contact with the film and several millimeters in front of it, accomplished any perceptible decrease of background blackening. Exposures were then tried using empty silica glass and Lindemann glass capillaries, and finally without either specimen or capillary in the camera. Since the background remained practically unchanged in all cases, it was concluded that the camera, and not the specimen nor its container, constitutes the source of background scattering. Because the diameters of the collimating pinholes were once increased without any corresponding enlargement of the ray trap at the back of the camera, attention will be given to making sure that all of the undeviated beam is caught in this trap.

Further hardness determinations on pure plutonium in the temperature range 20° to 200°C have been made, about half with a 500 kg load and half using a 3000 kg load. At room temperature (20°C), average hardnesses of the alpha phase were found to be BHN 165 with a 500 kg load and BHN 235 with a 3000 kg load. This difference in hardness due to difference in load was found to decrease with increasing temperature. At 70°C average Brinell hardness numbers of 140 and 165 were obtained using, respectively, 500 and 3000 kg loads. These results substantiate the previously reported

PROJECT & PERSONNEL

CMR-5-6
(contd.)

PROGRESS

observation that alpha-plutonium is highly susceptible to work hardening during hardness testing.

Because of the previously noted properties of extreme softness and tendency toward oxidation of plutonium at higher temperatures, the present method of hardness testing, using the Riehle hydraulic machine, will not be suitable for use at temperatures above the beta range. For this reason, two different types of apparatus have been designed to enable the obtaining of satisfactory hardness values, either Brinell or Vickers, at high temperatures, possibly into the epsilon range. One of these designs is now being constructed, and depending upon its performance, the other may also be built for comparison.

A simple device has been constructed and put into use in order to measure, and thereby enable correction for, linear contraction of the hardness impression on cooling from the temperature of its formation to room temperature. Also, some improvement in avoidance of oxidation has been attained by adding a diffusion pump to the mechanical pump used to evacuate the can in which hardness impressions are taken.

GROUP CMR-8 MONTHLY REPORT -- J. M. Taub, Group Leader -- August 20, 1947

| PROJECT & PERSONNEL | PROGRESS |
|---|---|
| | Note: Production of special materials is outlined in a separate report. |
| CMR-8-1<br>Refractories | 260 MgO casting plates, crucibles, and pouring rods were delivered to Groups CMR-5, 6, and 11. |
| E.Sletin, Cordero, Johnson | The large gas kiln was down for repairs again, and it was necessary to fire some of the products in the induction coils. |
| | DP West received several Y-3 crucibles which had been high fired in the induction coils. Although these crucibles showed little or no penetration of metal into the walls of the crucible, the mold crucible continued to crack. It is now believed that the combination of casting technique plus the coefficients of expansion of the MgO and the plutonium are the cause of cracking, rather than the crucible design. |
| | Twenty-four support rings of BeO have been requested by M Division. The techniques are being developed for the production of these rings. |
| CMR-8-2<br>General Foundry Work | A total of 3827 pounds of tubalIoy was cast this month. Included in this total are 147 cubes and two large plates for Group M-2, nine hemispheres for Rala shots, and six large pieces for Group M-4. |
| Arnold, Castro, Wicklin, Donahoe, R. Martinez, Palmer | Eight cadmium hemispheres, 4.5 inches in diameter, were cast for Rala shots. |
| | Four vacuum premelts, each weighing 300 pounds, were cast of copper scrap to refine the metal and to produce melting charges for cylinders to be used in the fast reactor. |
| | Two silver castings were made for Group CMR-8. |
| | A magnesium plate 2 x 10 x 12 inches was cast for radiographic test purposes. Proper flux materials were not available, and the substitute material proved inadequate, resulting in a defective casting. The necessary flux has been on order, and the casting will be repeated upon receipt of the flux. |
| | Further work on casting stand-in pieces for explosive lenses has indicated that it may be possible to cast Wood's metal into the standard Cerro-tru |

| PROJECT & PERSONNEL | PROGRESS |
|---|---|
| CMR-6-2<br>(contd.) | lined molds. The castings would be cored so that the resulting lens would have a mass approximately equal to that of the HE lens.<br><br>During the past few weeks many orders, several of them quite large, have been received for tuballoy, cadmium, and copper castings. This work alone will carry over for the next few months, and unless early clearance is obtained for men with job offers, who will replace personnel returning to school, the work of the foundry section will be seriously curtailed. |
| CMR-6-3<br>General Powder Metallurgy<br><br>Dorfman | Most of the time this month has been spent in the construction of the high vacuum sintering equipment. This is now practically completed.<br><br>The drybox used in the handling of uranium powders was overhauled and new gaskets installed. The box had been leaking air, resulting in the oxidation of the uranium powder.<br><br>Additional uranium powder was received from Group CMR-8 but has not been tested. |
| CMR-6-4<br>General Fabrication | |
| (1) U-235<br><br>Andrews, Barnard, Raql, Steinberg, Salazar | Progress indicated in special report. |
| (2) Development<br><br>Keyser, Braverman, Edelmann, Osborn | Defective molds and furnace failures have delayed considerably the work on the centrifugal casting of thin-wall tuballoy hemispheres. However, it was found that the polar cap, which contains one-half the weight of the hemisphere, may be successfully formed by hot pressing techniques. Graphite dies are now being made for forming the central rings of the thin walled sphere.<br><br>The rolling for the Columbia University disc job has been partially completed. The delay in this work has been caused by continual difficulty with the vacuum annealing furnace. A new and faster method for annealing uranium is now being worked upon. The die for blanking out the Columbia discs has not been received from the shop but is expected within the next few days. |

PROJECT & PERSONNEL

PROGRESS

CMR-6-4 (2)
(contd.)

Work has begun on a program of rolling .020 inch stock for the fabrication of 1.960 inch diameter discs for the General Electric Company. Master patterns have been prepared for investment molding of the rolling stock.

Work is continuing on a method for hot rolling uranium. Cladding with copper appears to be quite promising. The major problem to be overcome at this time is the cutting of the uranium by the impinging stream of molten copper.

Analytical results on the U-Be alloys still reveal a loss of uranium during the melting and casting operation. The relatively long period of time required for the completion of this job is partially due to the delay in receiving the analytical reports. The method of analysis is necessarily long and has required several weeks for the analysis of a sample.

The vacuum melting furnace has been assembled and tested for leaks. The heating system will be tested as soon as the electrical connections have been completed.

CMR-6-5
Plastic Services

Church, West,
M.Arnold, Griffin

Group CMR-5 requested 1000 ml of methacrylate casting resin for mounting Pu. 500 ml was delivered from stock, but it will be necessary to set up vacuum distillation apparatus to complete the order.

The five inch diameter die for the pressing of thin $UO_3$-polystyrene discs for Group M-4 has been received and several discs have been pressed.

Eight lens covers for the 12L60D HE lens were delivered to Group X-8. The die for the 32190 lens is not expected before November.

A total of 30 pin sets has been mounted and delivered to Group M-4. These have proved satisfactory in test shots, and production is continuing on this job. Molds for other types of pin sets are being designed for production use.

Two sets of hemispheres were blow-molded for Group M-4. This completes the current order.

Twenty slugs 1 inch in diameter and 1 inch long of the following compositions were delivered to Group M-4 to be used as piezo gauge backing:

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CMR-6-5
(contd.)

PROGRESS

(a) 23.4% (vol.) of $UO_2$ in polystyrene; density 3.0-3.2 gms/cc; compressive strength 11,400 psi.

(b) 21.7% (vol.) of $UO_2$ in Durez 237; density 3.0-3.2 gms/cc; compressive strength 25,600 psi.

One steel mold for casting piezo gauge backings was used and delivered for testing. The molds are not removed from the casting since they become an integral part of the testing apparatus. Fifty brass molds were received from the shop but cannot be used because the casting resin reacts with brass. These will be plated and tested for reaction. This work is for Groups M-4 and X-8.

Twelve platinum foils were coated with a urea-formaldehyde A stage resin and the coating polymerized in place. Coating thicknesses were .003 inches to .005 inches thick and had a nitrogen content approximately 2.65 $mg/cm^2$. The foils were requested by Group P-3.

Twenty foils containing 0.29 $mg/cm^2$ of $U_3O_8$ were delivered to Group P-3. Still to be delivered are ten foils, each containing 30 volume percent of Bi, NaI, Sb, As, and P, respectively, in a binder of polythene.

Corrosion resistant tubing of lucite and Saran were bent to specified shapes for Group CMR-11.

A special laminated shape was built up of rubber and Resinite T-850. This was for Group X-3.

An adhesive for holding steel pins in insulator bushings was developed for Group M-4. A chloroform solution of methyl methacrylate polymer was satisfactory for use on lucite bushings. A large scale order for bushings may be forthcoming soon.

Preliminary work has been started on the fabrication of plastic target bases for Group M-4. The bases are 7 inches in diameter and 0.75 inches thick, and contain a depression 2.5 inches in diameter by 0.187 inches deep in the center of the plate. The faces of the plate must be parallel within $\pm$ .0005 inches.

A slug of polythene 1 inch in diameter by 1 inch long was molded for Group P-3.

| PROJECT & PERSONNEL | PROGRESS |
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| CMR-6-5 (contd.) | Foils containing the oxides of Mo, Fe, Cr, and Ni isotopes bonded in polythene are being prepared for Group P-3.<br><br>Group CMR-3 has requested that manometers be mounted in a plastic. Lucite molds will be made and a Kriston casting resin will be used. Manometers are now being made in the glass shop.<br><br>Three dummy boron-plastic assemblies have been requested by Group M-4 for delivery in September. Mixing with unenriched boron is now under way. |
| CMR-6-6<br>Electroplating | Two pieces of U-235 were stripped and replated with silver. |
| Slatin, Gore | The copper from the large, defective heat exchanger casting is being stripped from the coils so that it may be remelted. The steel coils will be exposed and the cause of the failure may then be determined.<br><br>The service work this month consisted of plating a number of miscellaneous items with silver, cadmium, chromium, and gold.<br><br>Considerable work has been carried on to develop a thin nickel plate on uranium metal. Some of the experimental data obtained thus far are as follows:<br><br>(a) Tuballoy with .0005 inches nickel placed in dry atmosphere at 100°C is still in original form, and the weight has increased .004 grams over a period of 185 hours.<br><br>(b) Tuballoy with .0005 inch nickel plate was held in a steam bath for 36 hours. The plate peeled off because of oxidation of the tuballoy. This test is probably too rugged, and further tests will be conducted at 60°C over water.<br><br>(c) Nickel plated pieces held at room temperature have been checked by a monitor at various time intervals after plating and no counts have been observed. |
| CMR-6-7<br>Miscellaneous Hot Pressing | The following jobs were completed this month:<br><br>(a) Mounted four thermocouples in an insulating medium for Group M-5. |

GROUP CMR-6 MONTHLY REPORT -- J. M. Teal, Group Leader -- August 20, 1947 (contd.)

| PROJECT & PERSONNEL | PROGRESS |
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| CMR-6-7 (contd.)<br><br>Wellborn, Smith, Johnson, Kain, L.Martinez | (b) Fabricated four Alnico V hemispheres for Group M-3.<br><br>(c) Annealed 80 pieces of Kovar for Group P-3.<br><br>(d) Annealed 40 steel cups for Group P-5.<br><br>(e) Fabricated three tungsten carbide pestles for Group CMR-1.<br><br>One more half density aluminum casting was made for Group M-5.<br><br>Preliminary work began on a metal-filled paraffin hemisphere for Group M-5.<br><br>Dies for the production of tungsten carbide cutters for Group A-3 were designed and submitted to the graphite shop.<br><br>Some work was carried on for the production of ceramic crystal mounts for Group M-5.<br><br>Titanium carbide powder was prepared to be used in the fabrication of crucibles for Group CMR-2. |

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GROUP CMR-8 MONTHLY REPORT -- R. D. Baker, Group Leader -- August 20, 1947

| PROJECT & PERSONNEL | PROGRESS |
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| CMR-8-1<br>Reduction of Normal Uranium<br><br>Hayward, Schiavone | Three samples of calcium from Electro-Met were tested. Two of the samples were found to be satisfactory, and one was too high in $N_2$ and Al.<br><br>Three special fluorides from Oak Ridge were tested.<br><br>Seventy-four kilograms of high purity normal uranium were produced during the period. |
| CMR-8-4<br>Development of Recovery Processes for U-235 | |
| (1) Final Recovery & Purification<br><br>Kolchmer, Kircher | Most of the time was spent on production which is covered in a special report under Project No. CMR-8-3.<br><br>The installation of the enclosed hood for the processing of U-235 was completed and put into operation. This new hood has reduced the air count in the room to normal.<br><br>The experimental incinerator was received from the shop, and work started on its development for use in the recovery process. An electric heater was installed above the grate in the burning-box. Runs were made to develop a method for burning towels and rags. The weight of charge was varied as well as the air-oxygen mixture. It was found that toweling can be burned and ashed in the incinerator, and that all volatile products are retained in the condensing system. The resulting ash can be washed out of the burning-box without opening the incinerator. Additional tests using actual residues will be made when the installation of incinerator in the furnace room is complete.<br><br>A new type of filtration trap which uses CaO was put into use.<br><br>Work was started on recovery methods for trichloroacetic acid solutions and for solutions containing large amounts of cutting oil. |
| (2) Hydrofluorination<br><br>Goldsmith, Fry | All of the time was spent on production which is covered in a special report under Project No. CMR-8-3. |

GROUP CMR-8 MONTHLY REPORT -- R. D. Baker, Group Leader -- August 20, 1947 (contd.)

| PROJECT & PERSONNEL | PROGRESS |
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| CMR-8-4 (contd.)<br>(3) Concentration Process<br><br>Maraman, Bradshaw, Wilkinson, Hayter | The installation of the filtrate still was completed, and distillation tests run using nitric acid solutions.<br><br>The extraction column was cleaned of the entrapped silica and experimental extractions run. It is now believed that the presence of entrapped silica in the column decreases the extraction efficiency. A method of back-washing the column periodically was developed.<br><br>The installation of the new charge system was completed and tests run. The new system is much more satisfactory than the previous design.<br><br>A steam-jet vacuum system for the plant was designed and installed. Design work on the ether recovery systems was completed.<br><br>Repair parts for the glass-lined kettle were received, and a study of their installation started.<br><br>A study of the acid properties of synthetic charge solutions was made. The use of methyl red as an acid titrating indicator gives less than one percent error for the general types of liner-charge solutions encountered in the process. pH measurements are not reliable.<br><br>Thirty samples were prepared by the control lab for analysis. Experiments were started on the ether extraction of solutions containing less than 0.1 ppm of uranium. |
| CMR-8-5<br>Determination of Temperatures in the Reduction Bomb<br><br>Hayward | Four runs were made, but physical difficulties were encountered each time. Changes in the apparatus are being made in an attempt to avoid these difficulties. |
| CMR-8-6<br>Determination of Pressures in the Reduction Bomb<br><br>Hayward | No further work done during the period. |

GROUP CMR-8 MONTHLY REPORT -- R. D. Baker, Group Leader -- August 20, 1947 (contd.)

| PROJECT & PERSONNEL | PROGRESS |
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| CMR-8-9<br>Research on the Hydro-fluorination Processes<br>Goldsmith, Fry | Work continued on the study of the temperatures inside the reaction tube during the complete hydro-fluorination cycle. Large variations in the temperatures along the tube were found. A set-up for measuring the temperatures of the oxide and fluoride in the reaction boats was completed, and determinations are being made at various points. Literature work continued.<br><br>Ten peroxide precipitations were made for the purpose of obtaining a supply of "standard" oxide. |
| CMR-8-11<br>Chemical Service on the Water Boiler<br>Gurney | Three samples of "soup" were analyzed during the period. |
| CMR-8-12<br>Analysis of the Gases from the Water Boiler<br>Gurney | No further work done during the period |
| CMR-8-14<br>Preparation of Samarium Metal<br>Goldsmith, Hayward | The literature survey on this problem was completed. Very little useful data were found. One run was made to prepare $SmF_3$ from $Sm_2O_3$. At 300°C for 3 hours, a conversion of 96% was obtained on a 5 gram sample. The resulting product was hygroscopic.<br><br>Reduction apparatus was ordered for the metal preparation work. |

GROUP CMR-9 MONTHLY REPORT -- E. T. Hammel, Group Leader -- August 20, 1957

| PROJECT & PERSONNEL | PROGRESS |
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| CMR-9-2<br>Plutonium Coefficient of Expansion Studies<br><br>Benesi, Hammel | Densitometer now complete. Blank runs and calibration being run at end of month. |
| CMR-9-3<br>Low Temperature Studies of Plutonium Properties<br><br>Hammel | Apparatus under construction. |
| CMR-9-4<br>Density of liquid Plutonium<br><br>Hammel | No work on this during month. |
| CMR-9-6<br>High Temperature Electrical Resistance of Plutonium<br><br>Hammel | No work on this during month. |
| CMR-9-7<br>Determination of the Elastic Constants of Plutonium<br><br>Hammel | No work on this during month. |
| Training Course<br><br>Benesi | Part I, Basic Thermodynamics, completed. |

| PROJECT & PERSONNEL | PROGRESS |
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| 1. General Plant Operation<br>Pittman | During the period July 21 through August 20, production schedules were maintained in all operations. Certain changes in production procedures have been instituted, based on recommendation of Group CMR-5. These changes are fully outlined under "Production". Mr. Wayne C. Hazen arrived on August 4 to assume his duties as head of the Process Development Group. |
| 3. Material Control<br>Champion | The solution storage room of the main vault, in which a spillage occurred July 17, 1947, has been decontaminated and painted. The room is now essentially uncontaminated with the exception of the door casing, which will need further decontamination before material is returned to the room. |
| 4. Production<br>Venable, Nordeen, McNeese, Dumrose, Ballard | Solutions Room:<br>(a) Prepared and checked all solutions and chemicals for purification, recovery and metal fabrications operations.<br>(b) Provided solvents and cleaning solutions for all operations and the HI Group.<br>(c) Prepared calcium for use at D Building and DP Site.<br><br>Bomb Decontamination: The average percentage rejection on plugs for the month has been 14%. On bomb bodies the rejection rate has been of the order of 30%.<br><br>Recovery: Work is progressing very well on concentrating supernatants from the purification operation. In addition, several other miscellaneous solutions have been concentrated and stored or returned to Operation 4.<br><br>Purification: The sampling equipment in Room 308 will be transferred to a drybox equipped with a balance in Room 313 as soon as possible. This will release Room 308 for other functions and eliminate a possible source of air contamination. Some difficulty has been experienced in the past month in obtaining solid-free samples from Hanford lots for assay. The cause is not yet known.<br><br>Dry Chemistry: Considerable difficulty has been encountered in obtaining a satisfactory fluoride conversion during the past month. The cause is not known, but more complete records are now being made |

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PROGRESS

4. (contd.)

of each run so that any abnormal operating conditions can be detected immediately. Pressure masks are now being used for any work involved inside the dry chemistry hoods.

Reduction: There have been some low reduction yields in the past month. This is probably due to the presence of moisture in the bombs. Steps have been taken to correct this condition. In the near future it is hoped that other factors affecting reduction yields will be fully controlled.

Alloying and Casting: Two castings were run with a 10-hour annealing cycle instead of the normal 5-hour period. Two other castings were made annealing at 500°C instead of 450°C. The latter change in the annealing conditions will be made on each casting now fabricated until analytical results are received for evaluation.

Beginning next month all casting will be done in high-fired refractory. Experiments have indicated that the use of this type crucible will practically eliminate cracking and minimize metal penetration.

Machining and Pressing: Several unusable dies were placed in double-sealed wooden boxes and turned over to the property section for disposal. The new drybox arrangement in Room 513 is working very well. The only contaminated areas present at this time are the lids of the pressing cans. It is hoped that in the next month a new procedure for loading and unloading the dies will be in effect which will completely eliminate chances of contaminating external portions of equipment.

Cleaning and Coating: The hemisphere coating units were completely overhauled and cleaned. A vast improvement in performance has been noted since the overhaul. Room 508 has been decontaminated several times and is now relatively "cold". In the coming month it is intended to adapt the equipment in Room 513 to the cleaning operation. This will eliminate the use of Room 508 by Production and promote the program of operational consolidation now under way.

Final Inspection: Some slight changes in final inspection procedure have resulted in the delivery of gadgets which pass all specifications and are well within maximum allowable tolerances.

| PROJECT & PERSONNEL | PROGRESS | |
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| 5. Process Development - Chemical Section | CMR-11-3. Gallium: | |
| | On hand July 21, 1947 | 15,794.46 gms. |
| | Receipts - E & A | 801.71 |
| Henrickson, Hasen | G.E. | 3,309.24 |
| | | 19,904.41 gms. |
| | Disbursements | None |
| | On hand August 20, 1947 | 19,904.41 gms. |

Mullins

CMR-11-25. Ion exchange columns for separation or concentration of plutonium: The analytical method for determining Pu in very low concentrations was investigated further. The method consists of carrier precipitation first with lanthanum hydroxide, then with lanthanum fluoride, followed by evaporation on a plate and counting. The work was done with 10 ml aliquot instead of the 0.6 ml aliquot normally used. Samples spiked with 8, 89, and 689 c/m were used. Although the results of duplicates were relatively consistent among themselves, they indicated that only from 40% to 80% of the added "spike" was recovered, depending upon the concentration and other factors at present undetermined. There is a possibility that an empirical factor might be developed to make the method useful, though this would not be desirable. Further work on pH control and technique is indicated. At present the work is suspended because of the necessity of using Mr. Mullins on the problems associated with recovery in Operation 2.

Lowe, W. Magness

CMR-11-32. Dissolving of solid Pu wastes from metallurgical operations: Six lots of skulls weighing 160 grams each were dissolved in 800 ml of 5.5 NHI and sent through purification, dry chemistry, and reduction operations. Two buttons have been made from these lots, and samples have been turned in for analysis. A drybox for dissolving the backlog of skulls has been designed, and installation is scheduled for completion in the early part of September.

Experimental work on the dissolving of crucibles showed that it is possible to dissolve the fired magnesia in hot 6 N $HNO_3$ although the reaction is not swift. This work was suspended while the treatment of old solutions from hydroxide precipitation of recovery solutions is investigated.

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5. Process Development - (contd.)

Gibson

CMR-11-36. Electrolytic purification and reduction of plutonium solutions: The quantitative data taken from batch runs of synthetic "cold" solutions showed that after 72 hours chromium was substantially removed. The mercury cathode in which all these experiments were run was considered inadequate for "hot" runs. Accordingly, a continuous flow cell, complete with a mercury cleansing unit has been designed and is under construction. This new cell will provide quantitative information for design of production units if the idea is proven on "hot" runs using evaporated supernatant solutions.

Henrickson

CMR-11-40. Installation of "cold" laboratory in Room 206: It is anticipated that this new laboratory will be ready for use in the first half of September.

Engineering Section

Ryland, Hagen

Schell

CMR-11-6. Installation of suitable cutting apparatus in purification hoods (combination of Operations 4A and 4B): An arrangement has been made with CMR-1 so that two samples from every other Hanford batch may be sent in for analysis. These alternate batches will be sampled by both the routine pipette method and the automatic sampler installed in the purification hood. During the next six weeks this will give 48 comparisons of the routine sampling method with the new samples.

Thomas

CMR-11-8. Combination of Operations 5 and 6: The Lucite HF flowmeters received last month were found to be completely worthless. The tube deteriorated after a few minutes of HF flow. They have been returned to the manufacturer. It is intended to use the equipment without these meters, since everything else is ready in Room 406.

Herrmann

CMR-11-9. Combination of purification with the combined Operation 5 and 6 Unit in Room 406: During the month the installation of equipment was completed. A new bubbler was installed and various minor changes made in piping. The room was closed and is now ready for hot testing.

Hartshorne

CMR-11-12. Design of drybox for Hardinge lathe in Operation 8: The drawings have been completed, but installation of the lathe will be postponed until its need is more definitely proven.

| PROJECT & PERSONNEL | PROGRESS |
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| 5. (contd.) | CMR-11-22. Removal of the precipitron sludge: Work on this problem has been suspended temporarily because of its low priority in relation to other problems. Tentative plans have been laid for setting up equipment in Room 213 to test the feasibility of recovering a large percentage of the oil in the sludge by settling. |
| Thomas, Sheinberg, Schell | No work was done on the phase of the problem dealing with the method of removal of the sludge from the precipitrons. |
| Roth, Zukas, Jenkins | CMR-11-37. Redesign of pressing can: The new pressing can was received this month. It was found that the clamps for holding down the lid were structurally weak. Heavier clamps are being made. |
| | Final drawings of the drybox for loading and unloading the new can are proceeding very slowly because of the shortage of draftsmen. |
| | The new instrument panel to carry the increased load occasioned by the high capacity heating elements is nearly completed. The new elements have not yet been received. |
| Thomas, Ryland | CMR-11-17. Coating incoming "W" containers to eliminate necessity for decontamination: Three types of plastic strip coats have been tried. They are: Spray Peel Nos. 721, 723 and 725. Of these, the No. 725 seemed the most satisfactory. |
| | A new design has been made of the disposable plastic plug. This new design consists of three parts and eliminates all threads to avoid what might have been an expensive molding problem in the previous design. Three sets of the new plug will be machined of lucite for demonstration and testing. |
| Schell, Sheinberg, Hartshorne | CMR-11-38. Sampling and transfer of material from recovery evaporator: The type of sampler being tested in Operation 4 was adapted for use under slight pressure instead of vacuum. |
| | Construction was started on the reservoir to draw solution from the evaporator. This reservoir will be on top of the drybox so that the solution can flow by gravity to a bottle set inside the drybox. |

GROUP CMR-12 MONTHLY REPORT -- J. F. Tribby, Group Leader -- August 20, 1947

The detailed report of the work of this group is given in LAMS-815.

Health Work, General

1. 133 persons were sent on health passes during August. All tests were negative. All personnel exposed to polonium were given urine radioassay tests. Five persons indicated they were excreting 50-100 c/m of polonium per 24 hour sample of urine, and one person showed on one test that he was excreting 498 c/m of polonium per 24 hour urine sample. This person was removed from exposure to polonium until the counts found in his urine were less than 50 c/m of Po per 24 hour sample. All other polonium urine radioassay tests given during the month were negative.

2. Airborne alpha air contamination tests were run in all Pu, Po, and U processing areas. 70 air testing units were in continued operation, and approximately 1600 individual tests (air samples collected varied from 800 liters to 120,000 liters) were made in these areas. Average airborne alpha activity in the air throughout CMR laboratories dropped 80% under that of the previous month. However, temporary high air counts were observed in 20 laboratories due to (a) faulty operations, (b) leakage of water through the roof of D Building, (c) heavy construction work in D Building, (d) weighing an uncovered sample of plutonium on an open analytical balance.

3. Radioactive surface contamination remained at about the same level.

4. Routine and special tests with film badges, dosimeters, cobalt slugs, gamma and neutron survey counters and meters indicate beta, gamma, and neutron radiation levels were very low. No excessive exposure of any person to gamma rays or neutrons was recorded.

5. An improved system of monitoring the pick-up and disposal of contaminated trash from the Tech Area, DP Site, Bayo, Omega, and Pajarito Canyons and additional protective measures to avoid excessive radiation hazards in these areas were instituted.

6. All wells and reservoirs supplying water to the project were analyzed for the presence of Po, Pu, U, RaIa, and RaBa contaminants. No contamination in the water was found.

7. Plans for an improved and revised health program for D Building upon the completion of the new construction have been outlined. In general, a tighter control of personnel entering the area will be effected, and it will be possible to prevent unnecessary persons from entering the contaminated portion of the building. The new construction also will provide improved locker and washroom facilities and provide an adequate clothing dispensary.

8. One contaminated accident occurred at DP West Site during the month. This was an excessive air count caused by a technician weighing an uncovered sample of plutonium on an open analytical balance. This could be considered a

voluntary breach of health-safety rules rather than an accident.

Research and Development

Most of the work planned for this section is being held up pending the arrival of additional electronic personnel. The majority of the work done during the month consisted of routine maintenance of the instruments now in use. Some work was done on a portable audio type alpha survey proportional counter modified for use in various CMR laboratories.

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