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1.	<i>J. Banick</i>	AED CO	3/26/89
	Name	Title	Date
2.	<i>W. R. ...</i>	ADD	3/28/89
	Name	Title	Date

- Copy 1: Greenvault
Graves
Williams
- 2: Graves
Technical
- 3: J. B. Miles
- 4: R. M. Evans
- 5: R. M. Evans
- 6: M. D. Whitaker
- 7: M. D. Whitaker
- 8: Chronological

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June 8, 1943

M E M O R A N D U M

Reviewing Official: *J. Banick*
J. Banick, AED Chief Officer

Date: *3/26/89*
WEEKLY PROGRESS REPORT - TECHNICAL DIVISION
FOR PERIOD ENDING JUNE 5, 1943

100 and 300 Areas - Hood Worthington

K. G. Jones

Tuesday was spent compiling a list of pertinent questions to be discussed with the Chicago group. Some of these were:

1. Methods of cleaning and inspecting slugs and cans at New Kensington.
2. Disposal of jacketed slugs which failed to pass the hydrogen test (marking, storing, etc.).
3. Degassing.
4. Discussion of Howe's work on coatings.
5. Graphite purity.

Wednesday and Thursday were spent in Chicago going over these questions with Chipman, Howe, and Creutz. Jeffries was also present and took part in the meeting.

A meeting was attended on Thursday where Doan and Miles reviewed the background on graphite purity.

The following points evolved from the Chicago visit:

1. A T.S.P. wash may safely be used on the slug, but there is some question as to the advisability of using anything but a mild solvent on the aluminum cans. A rinse in warm, clean tap water is satisfactory after cleaning.
2. Slugs which fail to pass the hydrogen test after jacketing need only be marked with the manufacturer's code number and grade before re-jacketing.

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3. It was definitely decided to degas the remainder of the material for Site X. While no swelling has yet been found at 300°C., Howe caused a specimen to bulge perceptibly by heating at 400°C. Degassing of the bars before straightening will get under way at Copperweld Steel Co. immediately. They will be held at 600°C. for 3 hours in an evacuated 6 or 8" pipe.
 4. Hot-dip coatings are still very much in the picture, since it is possible that a double coating may be used for W. Grasselli is to coat experimentally several slugs with aluminum-silicon brazing alloy. These will then be aluminum-jacketed and an attempt made to bond the jacket to the dipped coat by the use of heat and pressure.
 - H Howe's experiments show that swelling takes place rapidly when the jacket is not backed up by a hot-dip coating after a hole is made in the end.
 5. Tubes drawn by Wolverine from the second extruded B. & T. batch look very promising. Dimensional tolerances were held to .001" and the only flaw was a slight roughening at the base of the ribs. It was thought that this could be remedied by opening B. & T.'s extrusion die slightly at the base of the ribs to give Wolverine a little more metal to work on at this point.

A visit was made to Cleveland on Friday with Doan and Boyd to discuss graphite purity with Hamister of National Carbon.

Very little experimental work has been done on the graphite and it is felt that an investigation would be profitable. Hamister admitted that a possibility existed whereby the vanadium might be appreciably lowered. This would mean sweeping the furnace out with an inert gas to remove such impurities as there were distilled off. If this is not done, the impurities are reabsorbed on cooling. He did not feel that boron could be eliminated since he believes that boron carbide is formed.

There are 80 tons of blocks at Clarksburg, West Virginia, which are to be checked by Boyd's analysts if the samples are still identifiable. C. J. Veith is to contact our inspector there to see whether or not the markings have been lost on these sample blocks. Those which can be identified as to furnace position are to be shipped to Chicago for analysis and a functional test.

Samples of raw material could not be obtained from Hamister without permission of the New York office. A meeting is planned with Mr. Wilker on Friday in New York to straighten out such

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difficulties. Doan and Hamister will be present and the way will then be cleared for further experimental work.

T. B. Drev

Most of the work has been devoted to the calculation of temperatures and temperature gradients in the W pile when bowed. Complete information as to this matter both for bowed and flat-erected piles should be available this week.

Several discussions have been had with various members of the Technical and Manufacturing Divisions concerning the pile transients in the event of a power failure, and concerning shielding problems.

A memorandum on the available types of low flow-resistance dummy slugs was prepared.

The primary problems on the docket at present are:

1. Completion of thermal gradient studies in the pile proper and in the revised shield.
2. Transients in the pile.
3. Dilution of effluent with river water.

S. Kuniatsky

Activity in the Cooling Water from the Pile at Site W. In regard to the necessary shielding in the retention basin, a study was made of the activity in the cooling water from the pile produced by the following mechanisms: (1) by the dissolving of metal as a consequence of coating failures; (2) from neutron bombardment in the pile. From source (1) the radiation was calculated as 0.029 r/8-hour day at the surface of the water, as compared with that from source (2) of 0.3* r/8-hour day 6 feet above the water level, both figured at zero time from the pile. From these figures it is obvious that the activity from the metal dissolved in the cooling water is a negligible factor in the shielding of the retention basin. These calculations and results are presented in a memorandum of June 2, 1943.

Boiling Disease in the Bowed Pile. The results from calculations of the pressure drops in the central tube of the pile with low flow rates at which boiling occurred in the tubes were presented in last week's progress report. The statement was made that this might not be the limiting tube since tubes with a greater number of active slugs might conceivably have greater pressure drops at low flow rates in spite of lower heat loads, due to the greater number of undersized dummy slugs in the central tube. Subsequent calculations

* Memorandum of April 30, 1943 of Wende.

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revealed that the central tube with a pressure drop of 150 lb./sq.in. had the greatest pressure drop of all the tubes under flow rates where boiling occurred. A more comprehensive study of water flow in the bowed pile is to be undertaken next week in which consideration will be given to flows at which boiling does not occur.

Heat Absorption by Cooling Water at Various Levels in Bowed Pile. At the request of T. B. Drew, and based on equations supplied by him, the heat absorbed by the cooling water at various levels from the pile center was calculated as a function of the distance from the center of the active slugs. By different pile levels is meant the various stages starting from the center of the pile at which the active tube length increases to give a bowed effect.

Radiation from Discharged Metal in the Pile Area Transit and Storage Channel. A memorandum with the above title was issued June 4, the results of this study having been presented in a previous progress report. However, as a result of a correction in the calculations, the radiation from the activated water (due to dissolved metal) came out 0.01 r per 8-hour day at 70 centimeters above the surface of the channel instead of at 44 centimeters above the surface, as reported previously.

C. P. Kidder

Architectural details of Building 145, that is to house the CMX water-treating facilities, laboratory, darkroom and offices, have been completed and forwarded to the field for construction. Concrete foundation plans and details have also been prepared. Detailed design continues on electrical, plumbing, pipe-line, power, and auxiliary facilities.

A list of office furniture and stationery supplies, together with auxiliary operating, maintenance, and photographic equipment requirements, has been submitted to the Design Division for procurement.

A visit is to be made to W next week to review construction details with the Construction Division and to arrange for the procurement of operating labor and supplies for the water-corrosion experiments.

Complete water analyses of Columbia River water are being made periodically, and it is of interest to note that the chloride content of the water has been less than 1 p.p.m. for the last five samples.

W. M. Coons

The list of photographic equipment and supplies has been completed. It is suggested that this equipment be obtained through

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Milton H. Hill, Inc. to expedite procurement. J. A. Dick, the Company photographer, has offered to advise the writer on special uses of the equipment. The camera and certain accessories must be on hand by June 22 in order that we may work with it for a week with Mr. Dick's assistance. Mr. Hill's knowledge and the advice he has and will give us also make it desirable to purchase from him.

Measurement of the solution potentials of metals is being studied.

Water-analysis methods are to be collected.

P. A. Dahlen

Calculations were completed and curves drawn for exponents and coefficients of equation giving the rate of fission for varying values of excess k.

The coal consumption for the corrosion test at W is estimated to be about 28 tons per day at the initial test conditions and about 44 tons per day as the maximum.

W. H. Wahl

The proposed instrumentation for the 300 Area test pile was reviewed in detail with S. J. Bugbee. It developed that some of the circuits were not balanced as far as sensitivity was concerned, so several substitutions were made in the suggested list of instruments. The detailed list of required equipment, which is being prepared, cannot be completed until additional information is obtained regarding several of the circuits. It is planned to obtain this information during our trip to Chicago next week.

Design Division's latest proposed arrangement of removable stringers was approved. They were informed of the desired location for the resistance thermometer and, in addition, were advised that a reflector would be required at the ends as well as at the sides, top, and bottom of the pile. Their proposal to employ AGOT-AGHT-AGX graphite in the ratio of 41.8-43.2-15 was vetoed and, in its stead, they were requested to utilize at least as much of the AGOT grade as appears in the "as received" material, namely, 61.5-26.0-12.5. Moreover, they were advised that the AGOT should be increased to 66-68% if it formed the central section of the end reflectors.

Design were advised that shim and safety rods 1-1/2" in diameter would be adequate for the 300 Area test pile, but that 1-3/4" diameter rods would be satisfactory if mechanisms for such rods had been designed for X. The size of the control rod is in

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doubt and it is intended to clarify this situation while in Chicago next week. D. F. Babcock suggested that a 1-1/2" or 2" ID aluminum tube be employed as a well for the "safety shot". During the discussion with Design, we learned that they are planning to use a 1-7/8" OD x 1.435" ID seamless steel tube for this purpose at X; this information was passed on to Babcock.

200 Area - L. Squires

M. F. Acken
O. H. Greager
L. Squires

*no I checked
with Babcock - they
are using al - DFB*

A decision has been reached on separation processes for Site W. A final summarizing review of the wet fluoride and bismuth phosphate processes was held at Chicago on June 1, at which the Metallurgical Laboratory reported its conclusion that either process could be used satisfactorily, without making any specific recommendation as to one over the other. The situation was then discussed with Manufacturing in a conference on June 4, and it was pointed out that a choice between the two must rest largely upon estimated margins of safety in operating and in the process chemistry, since neither has been brought to a state of complete development. Balancing out more or less equivalent uncertainties in each process, the comparison reduces essentially to a consideration of the greater inherent corrosion hazard for wet fluoride as against the smaller margin of carrying power for bismuth phosphate.

On this basis it was decided with Manufacturing that design should proceed on a bismuth phosphate process, but that sufficient capacity should be provided at all points to accommodate the fluoride process as a possible alternative in case of necessity. In this connection it should be noted that a fluoride extraction of fission products from the phosphate process waste metal solution (if wanted or necessary) would permit a waste disposal set-up common to both methods, and also would provide a comfortable margin of cell capacity in case of operating on a wet fluoride basis.

It also was decided that the Metallurgical Laboratory will be asked to concentrate attention on further development of the bismuth phosphate process, with the objective of working out a completely operable process by August 1. This timing is dictated by the necessities of both Site X operation and Site W design.

J. A. Collins

A correlation of corrosion test data was prepared to permit a comparison of the corrosiveness of the wet B (fluoride) and wet D (bismuth phosphate) extraction processes. This comparison

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showed that for the specified operating conditions the expected corrosion rate for the wet B process was 0.00055 inch penetration per month, and that for the wet D process was 0.00005 inch penetration per month. Secondly, the wet B liquors are extremely sensitive to structural variations in the steel and require that all 25-12-S-Cb be annealed and water-quenched. This is not the case for the wet D process whose liquors are not sensitive. While every precaution is being taken to insure correct heat treatment of all equipment, the heat treatment is a potential source of corrosion difficulties if it is not done correctly. Experimental work is in progress to evaluate exactly how critical the heat treatment is and how exacting it must be carried out.

Meetings were attended at the Metallurgical Laboratory and in Wilmington in which the potentialities of the two extraction processes were compared.

25-12-S-Cb stainless steel plate and bar were secured and arrangements made to have four steam jets, two 400 cc. beakers, and two 1000 cc. beakers fabricated. The beakers are for J. B. Sutton and G. T. Seaborg at the Metallurgical Laboratory so that their extraction tests can be carried out in laboratory ware which is of the same material as the plant process equipment. The jets are to be used in the semiworks to replace pumps and will permit an estimate to be made of the corrosion and erosion that may be expected on the plant jet. The tests proposed include: (1) a measurement of jet efficiency, (2) a service period in the semiworks, and (3) re-evaluation of jet efficiency. The decrease or change in jet efficiency as a function of service time will be used as a measure of corrosion and to indicate possible service life for the various liquors involved. The stainless steel plate is to be used in preparing welded corrosion test pieces which will be used in the above-mentioned testing program, in which the effect of sensitization and poor heat treatment on corrosion resistance to wet B process liquors is being evaluated.

F. S. Chambers

Off-Gas Disposal. It was learned at the Metallurgical Laboratory that the "long-lived" I_{129} with a fission yield of 0.26 has a half-life on the order of a thousand years. Decay tests on iodine separated from bombarded metal indicate that the activity of I_{129} is negligible compared to that of 8-day I_{131} . Consequently, facilities which will handle the short-lived material should be satisfactory for I_{129} as well.

Waste Disposal. Now that the phosphate process has been adopted, a study of methods for improving the neutralization characteristics of the waste metal solution is required. The metal in this solution is completely precipitated at pH 6-7, at

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which point the fluoride waste is only a thin slurry. It is planned to treat this waste with a step similar to the fluoride process by-product precipitation, namely, barium sulfate, zirconium phosphate, and lanthanum fluoride precipitates. This should not only give it the desirable properties of fluoride process metal waste but should also simplify the ultimate recovery of metal or by-products.

Methods for making clear alkaline or neutral solutions of the other wastes will also be considered.

Physics, Instrumentation, and 100 Area Control - D. F. Babcock

D. F. Babcock

A preliminary picture of the number and location of safety and shim rods was given to Manufacturing in a memorandum written with Gast dated June 4. The subject of safety mechanisms other than drop rods was not discussed in this memorandum but is receiving active consideration. It is planned to wait a week or so for Design and Manufacturing to make a selection as to the size of rods and the general mechanism of construction, then review the entire control-rod system with Chicago. We will also ask Chicago to test the actual control rod that will be used in order to determine the induced radioactivity and the amount of heat generated.

A review of X pile drawings was made with Worthington and the results of the findings reported in a memorandum to Whitaker dated June 7. This memorandum pointed out several places where radiation leakage might be excessive.

Paul F. Gast

Calculations were completed on the spacing of the safety control rods for a pile at W. Several alternative patterns for the rods were presented in a memorandum issued jointly with D. F. Babcock.

Calculations were also made for various degrees of control and various arrangements of shim rods for a pile at W. These calculations indicate that, when the rods are arranged on a circle, the radius of the circle for which maximum control is obtained depends upon the number of rods and their size.

C. W. J. Wende

A review of the shielding of the Site X pile was completed during the week and has been summarized in a report by Babcock. Preliminary calculations indicate that the use of undersized

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dummy slugs in the reflector and shield of the Site W pile will probably be feasible; and further work on this subject is in progress. Assistance has been given to the Design Division on miscellaneous problems involving the shielding of the 200 Area.

During the coming week, attention will center on the shielding of the Site W pile.

John A. Wheeler

In collaboration with P. F. Gast, the most effective disposal of control rods in a pile was investigated and it was found that the optimum arrangement was represented by a pile divided into two zones. In the outer zone run no control rods while in the inner zone the control rods are uniformly spaced. The size of the inner zone is greater, the greater the degree of control required.

A simple result was devised for the rate of fission of a pile within an interval of the order of a second after a number of control rods have suddenly been inserted into the pile. In terms of the deficit, $-k_0$, of the effective multiplication factor produced by the control rods and the fraction f , ~ 0.006 , of delayed neutrons resulting from fission, it was found that the rate of fission just after the control rod has been inserted, relative to the rate of fission during the steady operation, is given by the ratio

$$\frac{f}{(-k_0) + f}$$

For example, if two per cent of control is available, the rate of fission drops approximately to 23% of its original value. It then continues to fall off but much more slowly than during the first instant after insertion of the control.

With P. F. Gast, a memorandum was prepared on the distribution of heat production in the pile at X for various conditions of loading.

A memorandum on methods of altering the distribution of heat production in the water-cooled pile has been nearly completed and will be issued in the coming week.

Katharine Way

The mechanical work on the chart of isotopes was completed and the chart is now ready for reproduction. Mr. Coryell writes that the life-time of Iodine¹²⁹ is of the order of hundreds of years so that no trouble should arise from this isotope.

W. E. Kirst (on vacation)

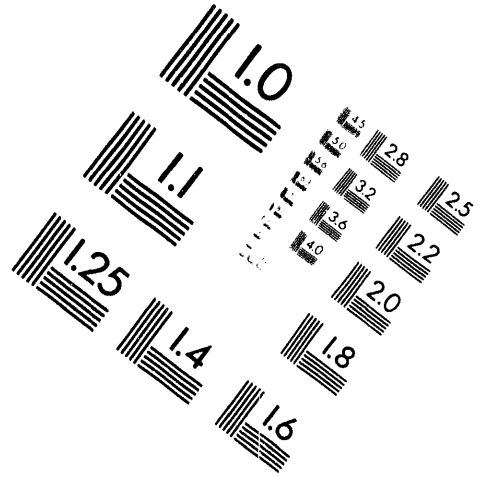
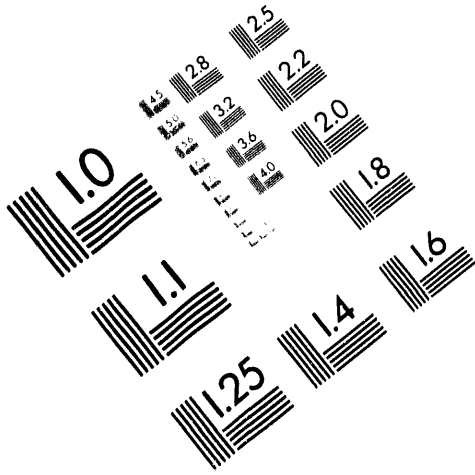
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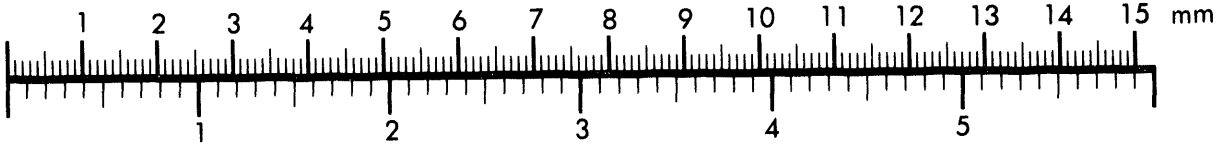
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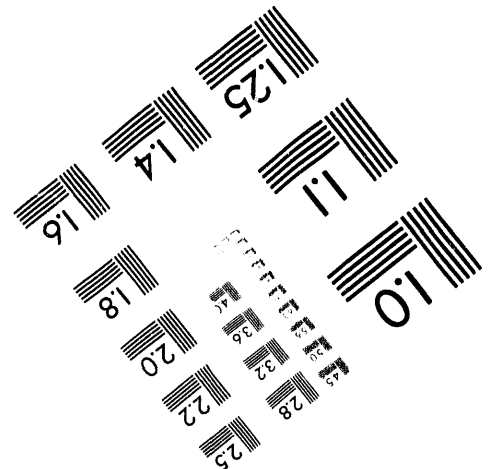
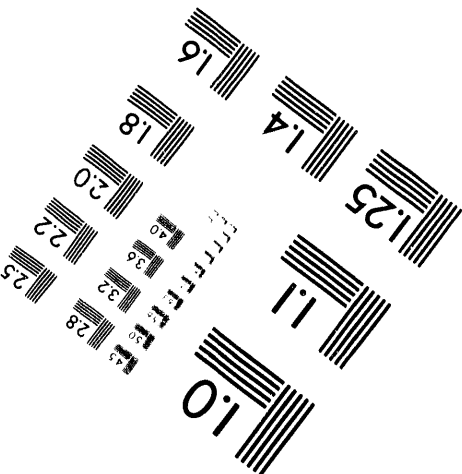
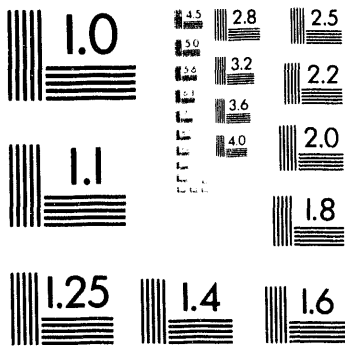
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