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BIO-MED PROGRAM COMMITTEE MINUTES

February 16, 1951

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*p. 14-89 of P.C. Minutes*

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M I N U T E S

of the

PROGRAM COMMITTEE

Division of Biological and Medical Research  
Argonne National Laboratory

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The fourteenth meeting of the Program Committee began at 10:15 A.M. on February 16, 1951 at Site B.

Present:

- A. M. Brues, Chairman
- R. J. Hasterlik
- L. D. Marinelli
- F. C. McLean
- J. E. Rose
- E. L. Powers, Executive Secretary
  
- R. L. Cardwell
  
- S. Lawroski, Chemical Engineering Division
- C. E. Stevenson, Chemical Engineering Division
  
- A. B. Hastings, Harvard Medical School

\* \* \*

Activities of  
Chemical Engineering Division

Dr. Brues stated that this meeting was the first of a series in which the activities of other Divisions of the Laboratory are to be discussed. It is hoped that several mutually advantageous purposes will be accomplished in these conferences: this Division will become aware of the hazards in the present operations of others; it may learn what the future operations are to be and, therefore, may anticipate the biological questions involved; and the visitors have the opportunity to discuss the biological and health aspects of their programs of work. Above all, perhaps, it will have the mutual advantage of permitting the participants to become aware of general problems and how one another think and do research. The first Division invited is Chemical Engineering which was represented at this meeting by its

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Director, Dr. Stephen Lawroski, and Dr. Charles E. Stephenson, Associate Director.

The general aims of the Chemical Engineering Division are 1) the recovery and purification of light elements from materials used in Laboratory operations; 2) the recovery and purification of heavy elements from materials used in Laboratory operations; and 3) the processing of radioactive effluents. These activities were described in some detail.

1) The recovery of T from LiAl alloys is one of the Division's most pressing problems. After pile exposure the metal, containing T and He from the Li-neutron reaction, is heated within a stainless steel tube to 600°C to outgas the metal. The T gas is then separated from He using a palladium "valve." An experimental storage method is being tried in which T is reacted with Zr metal to form the tritium analogue of zirconium hydride. This metal can react with T to the extent of 50 cc per g with no detectable change in the character of the metal.

A maximum of 150 ml of T in 95 ml of alloy has been observed, with about twice as much He. The T has an activity of about 2.6 curies per ml. The health problem is encountered in handling this gas. Glass lines, of course, are easily broken and are, therefore, very hazardous. Attempts to improve a metal line are in progress. A complete metal line is not possible, however, for it is necessary to observe melts in experiments on the release of gas from the heated slugs.

The slugs are heated and then disposed of without being removed from the steel container, but a source of hazard is the T which escapes into the room during this process. Whether this is in the form of HT or HTO is debatable, but it is the opinion that some of the T gas is oxidized to water during the extraction process when diffusing through the hot metal. This is believed to be the source of activity found in the urine of exposed persons. On the basis of the studies at Los Alamos which show very slow exchange between dry HT and HTO, Mr. Rose feels that T gas inhaled into the lungs is not appreciably absorbed, and that biological damage is brought about only by irradiation of the lung surfaces by the gas. He feels that the absorbed activity is inhaled as water vapor which is produced by catalysis in or around the apparatus.

The current rate of production with heated slugs is about two per week. After one experiment the persons involved showed less than 5,000 dis per min per ml of urine when the hood of newest design is used.

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One other general problem of importance is the disposal of T contaminated air. Possible methods of handling this are: 1) conversion to HTo and recovery, or disposal by dilution; 2) pumping to the outside through very high stacks; or 3) collection, followed by slow leakage to the outside. At the present time, no choice can be made.

2) The second general part of the program consists of the development of various processes for the recovery of uranium; for example, of enriched U from Zr-U fuel elements. Necessarily the fuel elements are dissolved, and for the very reason Zr is chosen as a part of the element (its resistance to corrosion) it is difficult to achieve solution. The slugs are dissolved in HF. Because the solubility product of  $UF_4$  is exceeded rapidly, some oxidizing agent such as  $KMnO_4$  is added to produce  $UF_6$  which is readily soluble. In this process  $H_2$  and volatile fission products are evolved. After conversion into its nitrate U can be separated from Zr by solvent contraction.

In other solvent extraction fuel recovery processes, the solvents being used are  $CCl_4$ , tributylphosphate and certain chlorinated hydrocarbons of the Freon type. Of these, certain have well-recognized toxic characteristics. At Knolls Atomic Laboratory, hexone is handled only with explosion-proof equipment; while its toxic action and low flash point (70°F) are appreciated at Argonne, it is not regarded as unduly dangerous as it is handled here. All manipulations with solvents are in closed systems or separately vented vessels. In Building No. 205 the solvent storage facilities are designed to minimize explosive effects.

Bromine, fluorine, and bromine trifluoride will be used in quantity in a pilot set up in the high bay area. The fuel complexes are halogenated, and then can be fractionally distilled. After passage of the volatile F.P.,  $UF_6$  comes over, resulting in an efficient bulk separation of U and Zr with good decontamination. The  $HNO_3$  method of separation consists of dissolution of the Al jacket, followed by  $HNO_3$  treatment of the metal to form nitrates. The oxides of nitrogen produced by this reaction have to be trapped by scrubbers. In these two processes only the explosive properties of  $BrF_3$ , which are acknowledged, require special precautions.

The third general type of problem being pursued by the Chemical Engineering Division is the handling and processing of radioactive effluents from the research laboratories. The incineration or other disposal of radioactive solids and the concentration, either by ion exchange or evaporation, of liquid radioactive wastes from retention tanks are being given consideration. These will be a function of the Division working from Building No. 310. No hazards from industrial toxic agents are anticipated in these operations.

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Dr. Lawroski brought up two points for the Committee's consideration:

- 1) What is the source of information concerning toxicities of substances in use now or contemplated, and who should be consulted for official advice concerning the handling of these materials. The Committee feels that since it is representative of radiological physics, medicine and biology, it should be regarded as the official source of information for the Laboratory in these matters. It felt that in any case the initial approach can be made to it.
  
- 2) Are there any plans to formalize indoctrination of new employees concerning the hazards of the installation and the regulations governing the activities of employees when in hazardous jobs? Mr. Rose said that the Radiation Hazard Control Manual is about to be issued in revised form. He, and several others, feel that the manual alone is perhaps insufficient, and that the chemical engineers themselves must be expected to help in the teaching of employees with the aid of such booklets and lectures that can be obtained or offered by the supporting facilities or divisions in the Laboratory.

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Meeting adjourned at 12:15 P.M.

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E. L. Powers  
Executive Secretary

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