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OAK RIDGE NATIONAL LABORATORY
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Subject: Oak Ridge National Laboratory
Waste Disposal

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J A Lane

To: C. N. Rucker

From: S. McLain

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To: C. N. Rucker

From: S. McLain

Subject: Oak Ridge National Laboratory Waste Disposal

I. Introduction

This memorandum summarizes the waste disposal problems along with recommendations concerning the action to be taken in solution of these problems. The statements presented in this memorandum are a result of meetings of the Radiation Hazards Committee, the Research Council, conferences with other people, personal opinions, and the Memorandum to C. N. Rucker from Karl Z. Morgan, "Remedial Measures Regarding the Particle Problem", dated September 15, 1948, C. F. 48-9-123.

II. Statement of the Problem

The waste material discharged by the Laboratory at the present time contains excessive amounts of radioactivity in the gaseous, liquid, and solid streams. The removal of these activities will require an extensive research, development, design, and construction program.

The solid particles carried by the air discharged from the pile produces the most hazardous and urgent problem. Next in order of hazard appear to be the solid particles carried by the air and dissolver gases emitted by the isotope operations in Building 706-D and by the Pilot Plant, Building 205. About 25 curies per week are discharged to White Oak Creek in the liqui

wastes. Most of the solid wastes are buried but apparently some find their way into the incinerator and are emitted as air-borne dusts or become a part of the ash from the incinerator.

The air-borne particles have settled out rendering a large area hazardous since the particles may become air-borne again and inhaled. The elimination of the sources of these particles and the decontamination of the contaminated areas are among our most urgent problems.

III. Action to be Taken

The following paragraphs outline the work to be done by the various divisions of the Laboratory in the solution of these various problems:

a. Solid Particles in Pile Cooling Air

The solid particles in the pile cooling air are believed to be uranium oxide formed when slugs rupture in the pile.

The Technical Division has undertaken the design and procurement through the Engineering Division and Purchasing Department of equipment to remove these particles when formed from the exit air stream. To date bids have been requested from fifteen companies for cyclone type dust separators to remove 80% of particles of ten micron diameter and above. Bids must be submitted not later than September 27. Delivery and installation of this equipment should be completed by January 15. The Technical Division in conjunction with the Austin Company will design the necessary ductwork, and equipment for installation. The installation will be either conducted by the Engineering, Maintenance, and Construction Division or contracted by that division to the J. A. Jones Company.

The Technical Division will design and the Engineering, Maintenance and Construction Division will procure FG 50 American Air Filter glasswool filters to be backed up by CWS #6 Chemical Warfare Service paper filters. These filters will be placed in the ductwork between the cyclones and the fans with space for an electrostatic precipitator to be installed at a later date between the cyclones and the filters. Data supplied by Mr. J. P. Mitchell, Technical Command, Army Chemical Center, Edgewood, Maryland gives the efficiency of two layers of the F.G. 50 filter as 99.43% and the CWS #6 as 99.995% when filtering 25 cubic feet per minute per square foot of air with methylene blue, .8 micron average diameter, and dioctylphthalate, .3 micron average diameter. The CWS #6 is the best filtering medium available at present. F.G. 50 filters may be obtained and installed in six to eight weeks. Information is being obtained on delivery dates of the CWS #6 filter paper. Actual amounts needed will depend on the physical design adopted. Hanford is taking all the production for the next sixty days but the Chemical Warfare Service has stated they can put on additional shifts and supply the material at an earlier date. Delivery and installation are expected to take about six weeks. The Engineering, Maintenance, and Construction Division will make arrangements for installation of this equipment in conjunction with the designs of the Austin Company.

The Technical Division through the Engineering, Maintenance, and Construction Division will procure an electrostatic precipitator for installation ahead of the filters. Contacts have already been made with several suppliers but additional contacts must be made before adequate specifications can be written. Delivery on this equipment will be at least six months from this date. Since electrostatic precipitators increase in efficiency with decrease in the particle size, the installation of such a device should remove practically all of the small particles from the pile air. It is planned to continue the cyclones for removal of the heavy particles and the filters to remove any particles not picked up due to mechanical or electrical failure of the electrostatic precipitators. With this system practically no particles over .1 micron size will escape.

The Technical Division will investigate the need for additional cleaning of the air before it goes to the pile. The Austin Company will make a design that will permit installation of two thicknesses of F.G. 50 filters on the pile air inlet.

The Chemistry, Physics, and Health Physics Divisions will make an effort to determine the number of particles actually coming from the pile stack. If possible information on particle sizes should also be obtained.

The Operations Division will check each hole in the pile daily to determine if any slugs are swelling. The Physics and Chemistry Division will study the problem of determining when swollen slugs occur along with the Technical Division. The development of new instruments for measuring the activity leaving in particulate form and thus detect ruptured slugs at the earliest moment after their occurence will be carried out. The Technical Division has been studying the problem of locating swollen slugs by a decrease in air flow. The use of temperature increases has not been successful. Slugs are tested before installation into the pile to determine if there are pores in the aluminum cans. The tests are supposed to find holes as small as 10^{-7} cm. diameter. The possibility of using purer aluminum than 2S in the cans will be studied by the Technical Division. In addition the possibility of double canning will be looked into. Since about one can in a thousand developes a rupture during its life, double canning should reduce the failures to one in a million. The Technical and Physics Divisions will look into the possibility of using enriched uranium oxide in place of uranium in the slugs. Experimental work will be required on the methods of compressing the oxide and canning procedures. The Technical and Physics Divisions will look into the possibility of using the Brookhaven type of canning slugs to prevent the hazards from ruptured slugs. It may be desirable for someone to visit Hanford to determine what protective measures are used there and to obtain information on the canning technique.

The memorandum from Karl Z. Morgan to C. N. Rucker, "Remedial Measures Regarding the Particle Problem", recommends that the Engineering, Maintenance, and Construction Division and the Safety Division fix the particles already settled by

"a. Plant grass.
"b. Wash particles off roofs, hard surface roads, etc. with a fire hose.

"c. Hard surface all permanent roadways and keep the other roadways oiled. (The hard surfacing of the roads is being investigated.)
"d. Block off roadways that are not needed."

In addition to the above recommendations the speed of vehicles, particularly patrol cars, should be kept to a minimum. Also all unnecessary traffic in the restricted area should be stopped. This includes all passenger cars, patrol cars, and unnecessary trucking. A speed limit of 15 miles an hour should be strictly enforced in the restricted area and the roads immediately North, East, and South of the area. The Safety Department should coordinate the above work.

b. Solid Particles from Other Sources

The Health Physics Division will investigate the sources of air-borne particles other than the pile. The origin, size distribution, frequency and number, activity (alpha, beta, and gamma), effectiveness of removal measures, and hazards involved will be studied. If desired, help will be obtained from the Physics, Chemistry, Technical and other Divisions in this work. This investigation will include the isotope area, particularly Building 706-D, the Pilot Plant, Building 205, the research laboratories, the tank farm, and the incinerator. The Technical Division in conjunction with the Austin Company will design equipment necessary to remove any air-borne activities found by the survey. At present it appears that dust removal equipment will be required on a high priority basis for the isotope and pilot plant areas.

c. Gaseous Decontamination

The gases being emitted during dissolving operations in the isotope area, Building 706-D, and in the Pilot Plant, Building 205, contain considerable amounts of iodine, nitric oxides, and other gaseous materials. Experimental work to determine the best means of removal of these gaseous materials will be conducted by the Chemistry and Technical Divisions.

Scrubbing with strong basic solutions should remove most of the acid gases. Hanford has contracted with the Air Reduction Company for development work on equipment to remove iodine. The process developed makes use of solid silver nitrate dried on tower packing. The iodine reacts with the silver nitrate to form silver iodide which is then removed by scrubbing with solutions of silver nitrate.

d. Decontamination Procedures

The Engineering, Maintenance, and Construction Division in conjunction with the Technical and Health Physics Divisions will investigate means of decontaminating areas which have become hazardous due to the active air-borne particles. This will include streets, sidewalks, and grass areas. Plans for growing grass on bare areas will be made up by the Engineering Department and arrangements made to cover other areas.

The Health Physics Division will determine the effectiveness of these measures and keep records of the activities of various areas.

The Engineering and Safety Departments will carry out a procedure for oiling and wetting the roads and sidewalks until equipment can be installed to remove the particles being emitted by the pile stack. They will arrange to vacuum the area, decontaminating by dust removal, grass planting, etc., in accordance with procedures developed by the Technical and Health Physics Divisions in conjunction with Engineering Division as outlined above. If necessary calcium chloride will be used to keep the dust on roads and sidewalks down.

In addition to the above, the Health Physics Division aided by the Physics, Chemistry, and Engineering Divisions will complete construction of the large dust collectors. These will be used to study the dust problem in Oak Ridge and other locations.

The Biology and Health Physics Divisions will look into possible locations for investigation of the effects of particles in the lungs. Places with qualified personnel suggested are University of Rochester, Soranac Lake, and the Toxicology Laboratory at the University of Chicago. Rochester has already started work. The Health Department will make daily swipes on about fifty persons.

c. Additional Waste Disposal Facilities

The Technical Division, in cooperation with Engineering, Maintenance, and Construction Divisions, will supply data to the Austin Company for design of a new waste disposal system. The Health Physics Division will continue surveys of the

activity in White Oak Creek and other divisions may be asked to supply information or carry out research of problems arising from the design. The items to be covered by this design work are:

1. Tank Farm

The Technical Division in cooperation with the Operations Division has designed an evaporator to concentrate the highly active wastes which have been sent to tank W-6 for short time storage and decay. The Engineering, Maintenance and Construction Division is making the detailed drawings of this evaporator at the present time. The evaporator is designed to carry out a reduction in volume from 45,000 gallons per week to 2,000 gallons per week. The product from the evaporator can be stored for approximately two years giving a decay of approximately 10^{2}. The Technical Division will design a suitable drier to further concentrate the waste product from this evaporator to permit canning for permanent storage through burial of the products.

The tank farm facilities are believed to be inadequate to take care of the waste from the new isotope area and the new research area which are being designed. The Austin Company will be asked to carry out a redesign of the tank farm or possibly the design of an entirely new tank farm to handle our future liquid wastes. It should be pointed out that the present tanks were designed for a three-year use and are gunnite lined. Since these tanks have been used approximately five years they cannot be expected to last indefinitely and therefore must be replaced.

2. Isotope Area

A new isotope plant is being designed. The Austin Company will be asked to design facilities to handle the waste from this area. To date the Technical Division has made no study of the drawings of this equipment and can make no recommendations to the Austin Company.

3. Research Area

The Austin Company is carrying our a design of new buildings for the research area. They will carry out the design of a waste disposal system for the gases and solids, as well as the liquid wastes from this area.

4. Incinerator

The Austin Company will be asked to design a new incinerator which will be equipped with scrubbers to remove acid materials from the stack gases and with electrical precipitators and filters to remove all solid air-borne particles.

5. Fissionable Material Recovery

A large amount of fissionable material has been sent to the tank farm and precipitated in the tanks. The Chemistry Division in conjunction with the Technical Division will develop procedures for recovering this material.

6. White Oak Creek

The Health Physics, Engineering, Maintenance, and Construction and Technical Divisions will study the White Oak Creek situation. It is probable that a new dam for an enlarged retention basin will be required. At the present time approximately 25 curies of activity per week is dumped into the creek. The Engineering Division will make arrangements for carrying out the design of this dam.

IV. Operation's Policy

The pile should be kept under operation, at least temporarily. The Operations Division should use extreme care to detect swollen slugs and remove them with the greatest care. The Technical Division along with the Austin Company and Engineering Division should expedite the installation of filters by all possible means.

The question of continued operations of the pile will be reviewed weekly.

Stewart McLain

S. McLain

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