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TO : RSB FILES DATE: September 28, 1953

FROM : P. M. Frazier, Radiological Safety Branch

SUBJECT: VISIT TO U. S. RADIUM CORPORATION LABORATORIES IN BLOOMSBURG, PENNSYLVANIA, ON APRIL 1, 1953

A visit was made to this laboratory for the purpose of reviewing their facilities and techniques with respect to radiation safety in the use of radioisotopes. This Company's general authorization #13863 expires on 6/30/53. For evaluation of comments on waste disposal later in this report it seems advisable to describe briefly the geographical location of this laboratory. These facilities are located approximately 5 miles from Bloomsburg in an easterly direction on the outskirts of a small settlement called Almedia. The plant buildings are situated in a valley a mile to 2 miles wide, which is bordered by two high ridges. The Susquehanna River flows down this valley, the main bed of the river being an estimated 200 feet in back of the laboratory. A number of houses have been erected around the facilities, the closest being about 1/4 of a mile. ~~Ex~~ I would expect that the water supply for these houses comes from water wells.

During this visit I talked primarily with Mr. C. C. Carroll, Chief Chemist and Secretary of the Isotopes Committee, Mr. H. H. Dooley, Assistant Chief Chemist and Radiation Safety Officer. I also met Mr. J. E. Paul, Senior Vice President in charge of production and Dr. S. D. Bowers, Jr., Associate Chemist who are also members of the Committee. Mr. C. W. Wallhausen, Vice President in charge of sales, who is Chairman of the Isotopes Committee, was not able to be present during the time of my visit.

I was taken on a tour of the entire plant facilities and was favorably impressed with the cleanliness which had been practiced.

Mr. Carroll indicated that they considered their General Authorization quite indispensable and probably the most important service that it has offered to them was the privilege of being able to distribute radioactive materials to their customers without obtaining special authorization. Some twenty companies had obtained products from them which contained Commission-distributed radioisotopes. Our files show six shipping memos for material that this company has ordered under their General Authorization.

Facilities

This company's facilities for handling radioactive material are very complete and were described by Dr. Manov in his trip report of May, 1951.

Facilities for Fabricating Luminous Markers

They have prepared storage containers composed of wood and lucite for storing and handling curie quantities of Strontium 90. The chemical processing will be carried out in a small room about 10 x 15 feet which adjoins the larger

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assembly room. They are erecting a hood of their own design which will, in effect, be a complete enclosure with 1/2" lucite front. This hood is exhausted and filters are located at the air inlet to the hood and at the discharge of the hood before the air passes through the fan. The duct from the system passes through a window in this room and terminates just outside with a 90° elbow whose open end is directed toward the ground. I suggested that it would be more desirable to extend this discharge duct to a point above the roof since this would do much to eliminate the possibility of airborne activity being blown back into the room. Mr. Carroll indicated that the windows were tight and would never be opened during operations. He indicated that the chemical manipulations were such that there should be very little or no airborne activity formed. In the event that some should become airborne, he felt that it would be removed from the air stream by the filter located at the exit of the hood. I did not feel that there was much likelihood of a hazard from this standpoint in their proposed operations but suggested as a further precaution that smear samples be taken inside the air duct at the discharge and checked for activity. If any activity were found it would be strongly recommended that the discharge be extended above the roof of the building. Mr. Carroll agreed that this would be done.

All the chemical manipulations and handling will be peformed by means of remote control mechanisms. The chemical processing, as I recall, involves precipitating the Strontium 90 on zinc sulphide phosphor, filtering the activated phosphor and drying by use of acetone. This material is then taken to the assembly room where it is loaded into a special exhausted apparatus for subsequent placing in an aluminum cup which is later fabricated in the lucite marker housing. In this device for filling the aluminum cup, the activated phosphor is mixed with a water soluble binder. Mr. Carroll indicated that the purpose of using a water soluble binder was a company secret. This loading device is so constructed that the phosphor and the binder is measured and mixed by means of remote control device, vibrated to assure uniform depth of the phosphor in the cup and the loaded cup is then moved into special holders which are later transferred to exhausted, drying ovens. As I recall, this drying takes place at about 150° Fahrenheit. Since the activated material is not volatile and the drying will be slow, it was not expected that any contamination would result from this operation. After drying, the aluminum cups are placed in the lucite housing of the marker, a thin aluminum disc is then cemented by use of a solution (lucite and solvent) in position so that the phosphor is sealed into the housing. After the cement has dried, a piece of lead is placed over the back of the marker and this assembly is then placed inside a sheet metal cup which is crimped over the lucite housing. This makes a unit that would require great effort to destroy. A certain number of markers are then exposed to accelerated weather tests. If any markers are not sealed tightly, this fact will be evident by either moisture collecting on the inside of the lucite or the water soluble binder will liquefy and the phosphor will then take on the characteristics of a thin paste. The luminousity of the markers will be seriously reduced if leakage occurs.

Instrumentation, Personnel Monitoring and Records

This company has available for survey work several GM meters and ionization type instruments. For personnel monitoring they use pocket chambers and film badges. At present they subscribe to the film badge service offered

by ORNL. They indicated that when ORNL discontinues its film badge service they were seriously considering setting up their own film badge facilities. Mr. Carroll gave me a copy of their "Yearly Badge and Pocket Chamber Report" for the year 1952. He indicated that they had made no attempt to separate the readings attributable to the exposures to Commission-distributed radioactive materials from those which were realized through work with naturally-occurring radioactive substances. This report, which is filed in the AFSB folder for U. S. Radium Corporation, indicates over-exposures in a few cases which they attribute to -radiation. For the most part the exposures are well below the yearly tolerance of 15,600 mr, which is based upon the permissible weekly exposure of 300 mr.

The Isotopes Committee of this institution meets formally whenever there is occasion for the Committee to meet and review new or unusual applications for radioactive material. Formal minutes are prepared for each meeting. In addition to the Isotopes Committee, this company has a so-called Safety Committee which meets once every four to six weeks to discuss safety problems at this plant. This Safety Committee reviews radiation protection problems as well as other safety problems encountered in industrial operations performed here.

<u>Waste Disposal</u>

This company disposes of contaminated glassware and some solid wastes which are encountered in processing Commission-distributed radioisotopes by sealing them in a metal container which is then thrown into the steel-lined disposal pit which was described by Dr. Manov in his previous report. Instrument dials containing natural radioactivity, such as Radium, are thrown into this pit without being placed in a container.

Ordinary liquid chemical wastes as well as liquid wastes containing both naturally-occurring radioactivity and Commission-distributed activity are discharged into a dry well. A dry well is normally constructed by making an excavation which is in turn partially filled by rock or similar solid material into which the drains from the various sinks empty. The rock fill is then covered by dirt. Disposal by this means relies on seepage into surrounding soil and strata which ultimately finds its way into underground or surface water supplies.

I did not feel that this was an acceptable way to dispose of long-lived Commission-distributed radioisotopes, such as Strontium 90, and recommended that these particular waste products be either returned to Commission facilities for disposal or be sent to one of the various companies offering sea disposal service.

This company is using an ion exchange column obtained from the Vitro Corporation for removing most of the radioactivity from the liquid wastes before this liquid is discharged into the dry well. They reported collection efficiencies of the exchange column as very high. ~~as 500 to 1000 time~~s Their in-put concentrations were as high as 0.5 microcuries per millimeter of waste. The outlet concentrations were 1/500 to 1/1000 that of the input.

The processing efficiencies in using Strontium 90 have been in excess of 99%. This means that of all the Strontium which they process somewhat less than 1% of the active material is lost in the waste products. For the period from Jan. 19 to Feb. 19 they disposed of approximately 15 to 20 microcuries of Strontium 90 in the dry well. This material had been passed through the ion exchange column. On the basis of this previous data when they start to process an estimated 35 curies of Strontium in luminous markers the quantity of Strontium 90 discharged to the dry well would be on the order of 300 microcuries.

The U. S. Radium Corporation is already using services of one of the companies offering sea disposal. This service is obtained from the Radiation Services Company in New York. Wastes are put in 5 gallon cans similar to those used in the paint industry. The can is equipped with a top which can be clamped on to the can. A gasket, apparently made out of rubber, is used to make this seal liquid-tight.

Mr. Carroll said that they would discontinue discharging the Strontium 90 into the dry well and instead would send it to the disposal company for burial at sea. This does not represent any great expense to the company since the whole waste for the monthly period just described x was on the order of 20 liters. Mr. Carroll indicated it would be fairly simple to reduce this volume by evaporation.

Polonium Foil

Mr. Carroll described their procedures for producing Polonium foil. The procedures described employ powder metallurgical techniques and are very similar to those described in a letter from Mr. Carroll to Dr. Lough on May 18, 1951 for fabricating Strontium 90 foil. The Sr 90 foil was used for revision of Army metascopes. A copy of this letter is filed in the RSB U. S. Radium File.

U. S. Radium has been making Polonium foils under a process which they have patented and the foils have been sold under their copyright trade name of "Ionitron." The Polonium used in this manufacture has been obtained from the Canadian Radium and Uranium Corporation in New York. Mr. Carroll indicated that they were quite anxious to find another supplier of Polonium since that which they have been obtaining has a lot of impurities, and since their method of measuring the activity indicates that they are receiving only one-half as much material as they had ordered.

Mr. Carroll reported that they are currently conducting studies on these foils. The tests thus far are performed by cleaning the foils with Radiac solution and then two months later performing a cleaning operation and making a count of the wipe. He reported his first test showed only a few counts per minute while the second test showed an increase in the counts per minute by a factor of from 5 to 10. He indicated that his testing procedures needed further development and considered the data which he gave me as not too reliable.

Alpha Counts in Radium Dial Painting Room

Mr. Carroll reported that they had not made any studies of alpha contamination resulting from their processing of Polonium foils. He did mention that they had found alpha counts as high as 2000 counts per minute in an undisclosed area on surfaces in their radium dial painting room. Despite this high alpha count, Mr. Carroll reported that they did not have any trouble in keeping the quantity of activity in the air below the maximum permissible concentration. A Juno survey instrument is used for making qualitative determinations for the presence of alpha contamination.

Medical Inspection

Routine medical inspections are made on workers involved in the use of radioactive materials. Particular attention is given to radon determination for those who are employed in the use of Radium. Mr. Carroll reported that they have recently inaugurated a study along with a dermatologist from one of the local hospitals for examining the hands of radium workers which are exposed to radiation intensities as high as several roentgens per hour. The overall weekly hand exposure was reported to be between 1 and 2 roentgens. No effects have been reported thus far.

Comments and Recommendations

1. Discontinue the practice of disposal of long-lived Commission-distributed radioisotopes in dry wells.

2. If activity is found at the discharge end of the exhaust system used in the Strontium 90 processing room, the exhaust duct should be extended above the roof of the building.

Overall, I was very favorably impressed by this company's facilities and techniques and radiation safety practices employed in their use of radioactive materials. I feel that they use greater precautions in their use of Commission-distributed radioactive materials than they do with naturally-occurring materials, such as Radium. They report that their Radium operations are conducted in accordance with all known safety recommendations.

Their system for internal control in the procurement of radioisotopes from the Commission as described on the attached sheet which discusses their Isotopes Committee and the experience of its members, assures close control of the radioisotopes obtained.

When the application for renewal of their General Authorization is received, it is my recommendation that this application be approved.

PMF

P. M. Frazier