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AIR PRODUCTS

22 April 1985

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Mr. Jack Davis
Nuclear Materials Safety Section A
Division of Radiation Safety and Safeguards
Nuclear Regulatory Commission, Region 1
631 Park Avenue
King of Prussia, PA 19406

As a matter of background and for your information, let me give you a synopsis of Air Products and Chemicals, Inc. Sales for 1984 exceeded $1.8 billion. We have over 20,000 employees worldwide of which 4,000 are located at the Trexlertown campus--our world headquarters. Air Products' major businesses are in the manufacture of industrial gases (oxygen, nitrogen, helium, etc.), the manufacture of an assortment of chemicals (fertilizer, paint emulsions, herbicide precursors, etc.), the manufacture of gases processing equipment (LNG and nitrogen systems), and construction engineering services.

In Trexlertown we have three modern research and development facilities with a staff of over 400 engineers, chemists, physicists, and biologists. The largest facility was completed in early 1983. The research is diverse and both practical and pure. Since our customers are usually industries themselves, we are not as highly visible as businesses which generate consumer products. I hope this gives you a better appreciation for the organization submitting application for a radioactive materials license.

The responses to questions in your letter of 5 February 1985 are attached.

Very truly yours,

Eugene I. Handwerk

Eugene I. Handwerk

/cay
Attachments

cc: M. W. Timmerman
Dr. Walter Vincent

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Re: Docket 030-22270; Control No. 18422

This is in response to your request for additional information in your letter to E. I. Handwerk dated 5 February 1985. You may contact me anytime at 215-481-8606 if you require further classification.

Item 1 - Instrumentation

Subsequent to submission of the license application (Docket No. 030-22270) we learned of the availability within the corporation of a Johnson Model GSM-5 Survey Meter with a GP-200 Geiger Probe and will use it to detect radioactive contamination of the beta emission type. The GSM-5 has three ranges of sensitivity: 0-500 cpm, 0-5,000 cpm, and 0-50,000 cpm.

The Beckman LS 5801 is a scintillation counter with automatic quench compensation. Optimum window settings increase the efficiency for detecting counts on low energy isotopes.

Item 2 - Calibration

The Johnson GSM-5 survey meter with Geiger-Mueller probe will be returned to the manufacturer at Research Park in Montville, NJ for recalibration on an annual basis.

To calibrate, the Beckman LS 5801 scintillation counter an unquenched, nitrogen-purged flame-sealed standard provided by Beckman is placed in the sample changer and the calibrate Special Program is selected. The system calibrates itself automatically based on the energy output of Cesium-137.

Item 3 - Qualifications

Mr. Handwerk has been assigned the duties of the Radiation Protection Officer for Air Products and Chemicals, Inc. Mr. Handwerk has had a variety of educational experiences with radioactivity, radioisotopes and their application in research, radioactivity measurements, and the health effects of radiation exposure. Mr. Handwerk received a Bachelor of Science degree in Natural Sciences at Muhlenberg College, Allentown, PA. Mr. Handwerk adds to his credit several graduate level courses in chemistry, genetics, biology, and biochemistry at Lehigh University in Bethlehem, PA.

Mr. Handwerk has had hands-on experience with microcurie amounts of carbon-14 and hydrogen-3 (in nonregulated quantities over a period of two years) while conducting research involving the isotopic labeling of cell components in biological systems.

Mr. Handwerk has worked with NRC for the past two years in identifying, segregating, and resolving interim disposition of an estimated 3.5 curies of thorium-232 located on property owned by Air Products and Chemicals, Inc. Resolution must take into account maximum protection for the environment and the employees working in the vicinity of the area where the material is temporarily stored.

Mr. Handwerk has had ten years of experience developing safety information and instruction in the proper handling of chemical products manufactured by Air Products and Chemicals, Inc. The basic identification, assessment, evaluation, and management process for chemical hazards is carried over in a safety program for working with radioisotopes.

Further guidance in the handling of the specific isotopes identified in the subject application will be provided by Dr. Walter Vincent, a faculty member on the staff of the University of Delaware. Dr. Vincent will work for Air Products to instruct Air Products employees in the safe practices and techniques for handling radioisotopes and in the design of the laboratory experiments involving radioisotope tracer studies. Dr. Vincent has served as Radiation Safety Officer and/or Chairman of the Radiation Safety Committee and various times during his tenure at the University of Delaware and the Marine Biological Laboratory.

Under Dr. Vincent's guidance, several days of techniques training in the laboratory (dry runs) will take place prior to the actual manipulation of licensed quantities of radioisotopes so as to insure that the authorized users are experienced and competent in the handling of the subject isotopes.

Item 4 - Responsibilities of the RPO

The responsibilities of the Air Products and Chemicals, Inc. Radiation Protection Officer are as follows:

a. Ensure adherence to NRC regulations and the terms of our license governing the use of the subject radioisotopes.

b. Implement, administrate and manage the Radiation Safety Program.

c. Maintain personnel exposure and training records.

d. Approve all radioisotope procurement requests, supervise their receipt, and maintain inventory records.

e. Supervise the radioactive waste disposal program.

f. Conduct periodic surveys in laboratories and storage areas where radioisotopes are located.

g. Ensure that the use of radioactive materials is by or under the direct supervision of the individuals listed in the license.

h. Ensure that all users wear personal monitoring equipment when handling phosphorus-32.

These duties are more fully addressed in the revised Air Products and Chemicals, Inc. Radiation Safety Manual which is enclosed.

Item 5 - Phosphorus-32

We have reviewed our experimentation plans and have determined that we can operate effectively with a lesser quantity of P-32. We request that you consider our license application to utilize and store maximally a combined total of 25 millicuries of P-32. Notably, at no time will more than 1 millicurie of P-32 be employed in any given experiment.

5a. In our application we had inadvertently omitted mention of our laboratory procedure to work behind a low density plexiglass shield when preparing diluted solutions from the stock inventory. This will indeed by an implemented practice to minimize exposure to Bremsstrahlung x-rays when working with greater than 1 millicurie quantities of P-32. A quantity less than 1 millicurie presents an acceptable external exposure level which is well within the NRC guideline.

5b. As noted in the enclosed Radiation Safety Manual (Section 4.3.b and c), Air Products demands a constant alertness to radioactive contamination and requires a survey and wipe test be performed after each use period.

5c. Experimental design will be such that at no time will more than 1 millicurie of any radioisotope be used. Due to the low energy of the beta emission and the small quantities employed, there is no value in using finger type extremity monitors for H-3 and C-14 experiments. For P-32 experiments, film badges will be worn.

5d. Dry runs will be performed under the direction of Dr. Walter Vincent to "preclude unexpected complications."

5e. By restricting the quantities used to less than 1 millicurie per experimentation operation, the radiation dose to the eyes is below the maximum acceptable level.

Item 6 - Emergency Procedures

The steps to be followed in the event of an emergency are spelled out in detail in the enclosed Radiation Safety Manual (see Section 5.0).

Item 7 - Laboratory Procedures

The standard laboratory practices for individuals working with radioactive materials are described in the attached Radiation Safety Manual (see Sections 4.3 and 4.5).

Item 8 - Procurement Procedures

Ordering radioactive materials is to be done by the RPO. A full description of the protocol and a copy of the Radioactive Material Requisition are included in the enclosed Radiation Safety Manual (see Section 4.1).

The laboratory supervisor will monitor incoming shipments and complete the appropriate section of the requisition mentioned above to be forwarded to the RPO. Delivery of radioisotopes will be arranged to insure receipt by the laboratory supervisor.

The RPO will maintain a current inventory of radioactive materials to ensure that the possession limits are not exceeded. Since all materials are ordered by the RPO, he is in a position to restrict orders that would exceed the permissible limits.

The RPO will ensure that the laboratory supervisor has secure control of all radioactive materials in house.

Item 9 - The laboratory supervisor, M. W. Timmerman, will monitor and record all incoming shipments for contamination.

Item 10 - Surveys

Surveys will be routinely performed to determine radiation exposure and radioactive contamination as is appropriate for the isotope utilized in the experimentation protocol. The particular type of monitoring and survey is addressed in Sections 4.3 and 4.8 of the enclosed Radiation Safety Manual under the headings of "Responsibilities of Users" and "Personnel Monitoring."

It is anticipated that by design, most of the experimentation will involve radioisotopes, which due to their nature (i.e. H-3 and C-14) and small quantity (less than 1 millicurie), do not require external monitoring consideration. Internal monitoring (urinalysis) for H-3 will be performed when experimental operations fit the criteria requirements proposed in the Draft Regulatory Guide on Applications of Bioassay for Tritium.

Item 11 - Disposal Via Sanitary Sewer

Disposal via the Air Products and Chemicals, Inc. sanitary sewerage system is appropriate providing the following criteria are met:

1. The isotope is soluble in water.

2. The diluted average daily and monthly concentration in the sewer system is less than --

   2×10^{-2} microcurie per ml for C-14,
   1×10^{-1} microcurie per ml for H-3, and
   5×10^{-4} microcurie per ml for P-32.

3. The total daily release is less than --

   1,000 microcuries for C-14,
   10,000 microcuries for H-3, and
   100 microcuries for P-32.

4. The total annual release to the sewerage system does not exceed --

   1 curie for C-14,
   5 curies for H-3, and
   1 curie for P-32.

Disposal via the sewerage system will be limited to water soluble isotopes.

Since by design, no more than 1 millicurie of radioisotope will be employed in an experimentation run, and since the average daily flowage to the sewer is greater than 100,000 gallons, disposal of the most restricted isotope, P-32, will no exceed the limits as determined by the following calculation:

$(5 \times 10^{-4}$ microcuries/ml)(100,000 gal)$(3.788 \times 10^{4}$ ml/gal)

= 1.9 millicuries per day which is greater than the amount which will be used daily.

Note: P-32 will be retained in storage for several half-lives to reduce the amount eventually disposed. This value is larger than the value for P-32 listed in Appendix C referred to in Section 20.303(b) and thus is the limiting factor.

Exceeding disposal limits of 1 curie per annum is not possible when less than 1 millicurie per day is available for disposal.

Item 12 - Dry Waste Disposal

Disposal of dry radioactive waste is addressed in Section 4.7 of the enclosed Radiation Safety Manual.

Item 13 - This is a repeat of your item 7 and the reader is referred to that response.