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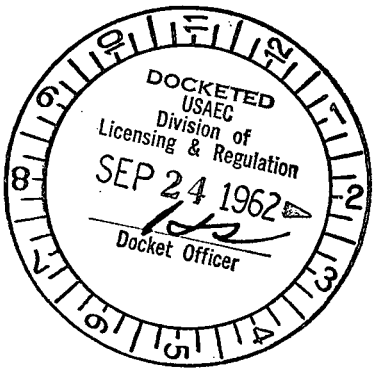
UNION CARBIDE NUCLEAR COMPANY

DIVISION OF UNION CARBIDE CORPORATION

P. O. BOX 324, TUXEDO, NEW YORK

RESEARCH CENTER

September 21, 1962



Division of Licensing and Regulation
United States Atomic Energy Commission
Washington 23, D. C.

Att: Mr. Robert Lowenstein, Director

Gentlemen:

Re: Amendment No. 2 to Application for Broad Specific Byproduct Material License and for Source and Special Nuclear Material Licenses.

On July 11, 1962 we submitted ten copies of an application for a Broad Specific Byproduct Material License. Mr. W. Cunningham, Chief, Isotope Branch, and Mr. G.W. Kerr visited our Research Center on September 11, 1962 to discuss the application and develop additional information.

As a result of this meeting we are hereby transmitting, as an amendment to the original application, ten copies of the additional information requested.

Very truly yours,

UNION CARBIDE CORPORATION
Acting by and through its Division
UNION CARBIDE NUCLEAR COMPANY

Pu-Be sources

By: D. B. Holzgraf

D. B. Holzgraf
Manager - Nuclear Operations,
Union Carbide Nuclear Company,
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SUPPLEMENTAL INFORMATION TO APPLICATION FOR BROAD SPECIFIC BYPRODUCT MATERIAL LICENSE AND FOR SOURCE AND SPECIAL NUCLEAR MATERIAL LICENSES

Ventilation System

1. Absolute filters will be installed at the exhaust opening from each individual cell. This will provide double filtration of all exhaust air from the hot cells.

2. Union Carbide will ask for certification of all new filters from the manufacturer when additional units are purchased.

3. Tests will be carried out to determine the integrity and efficiency of the absolute filters. These tests will be either (2) of the DOP type, or (b) utilize uranine in an aerosol as outlined in a paper by A.J. Breslin. (Personnel at Argonne National Laboratory indicate the uranine technique is an acceptable one.*)

4. The pressure in the operating area of the Hot Lab will be at least 0.5" H_2O above the pressure in the hot cells.

5. The pressure in the operating area will be 0.2" H_2O lower than atmospheric pressure. Administrative procedures will be used to assure maintenance of this pressure differential.

   It is realized that the requested license will not be in effect until these pressure differentials are obtained. Until that time we wish our present licenses to remain valid.

6. Reference: Page 6, 1st paragraph and Figure 7 - Hazards Report. The ventilation flow folumes are: Supply fan SF-2 - 11,000 cfm; Supply fan SF-3 - 14,000 cfm; Supply fan SF-4 - 5,000 cfm. The total supply volume is 30,000 cfm. Exhaust fan EF-12 now has a capacity of 30,000 cfm against 7.5" H_2O.

   If an additional 2,000 cfm is supplied from fan SF-4 for a future laboratory, then the setting of exhaust fan EF-12 can be changed to accommodate this additional flow volume.

7. Reference: Page 6, 3rd paragraph.
   In the event of failure of the exhaust fans, supply fans automatically shut down.

8. Reference: Page 4, Section 4, 3rd paragraph.
   A linear velocity of 100 ft/min. shall be maintained at the openings of all hoods in the Radiochemical Laboratory. These hoods are Keewaunee Airflow Supreme Fume Hoods.

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* Private communication with W.L.Cheever's group at Argonne National Laboratory, September 13, 1962.

ACKNOWLEDGED

Work with Alpha Emitters

9. Reference: Page 28, 2nd Paragraph.
All work with alpha emitters conducted in the Radiochemical Laboratory will be done in glove boxes and a negative pressure will be maintained in the box with respect to the laboratory. The exhaust air from such a glove box will pass through absolute filters located at the glove box. This exhaust also will pass through the normal absolute filter servicing the Hot Lab.

10. Reference: Page 28, 2nd paragraph.
All work with alpha emitters carried out within the cells and involving more than 0.1 grams of plutonium-239 or equivalent will be carried out in glove boxes in the cells. The pressure within these glove boxes will be maintained at a lower pressure than the cell. The exhaust air from such glove boxes will pass through absolute filters located at the glove box.

Spent Fuel Elements

11. Reference: Appendix C, pages C-1 and C-2.
Four spent fuel elements from the Union Carbide Research Reactor will be utilized after appropriate cooling period in any of the cells as a source of gamma photons. Calculations in Appendix C show that for four spent fuel elements there will be 1.1×10^{16} mev/sec. If an average energy per disintegration of 0.7 is assumed, then there will be 4.2×10^{5} curies in the four spent elements after one day's cooling.

12. Reference: Page 13, 4th paragraph.
Spent fuel elements when not in use in the reactor as a source of gamma photons in the cell will be stored in the canal. (Storage of fuel elements in the canal has already been approved under Reactor Operating License R-81).

4 Fresh elements will contain 7849 total

13. Reference: Page 13, 3rd Paragraph.
Spent fuel elements. No reprocessing of spent fuel elements will be carried out under this license.

Fissionable Material

14. Reference: Appendix A, page A-10, Item T; Page 28, Section 6, 2nd paragraph.
Not more than 1 kilogram of fissionable material in the form of fuel in spent fuel elements will be used in-cell as a source of gamma photons. No other fissionable material will be used in the cell with spent fuel elements at the same time.

No

15. Reference: Page 21, Section 4, 1st paragraph.
Not more than 250 grams of U-235, 10 grams of U-233, and 10 grams of Pu-239 or equivalent will be used in any cell at one time.

Unsealed Solids

16. Reference: Page 24, Section 2, a and b.
Up to 10,000 curies of cobalt-60 and 5,000 curies of gold-198 will be handled in such a manner as to prevent any external radiation hazard and/or any contamination problem. No processing or dissolution of these materials will be done.

Machine Shop

17. Work in the machine shop in the Nuclear Laboratory will be done on materials that may be contaminated or that have a low level of radiation. However, any contamination or radiation will be incidental to the prime purpose of working with the material in the machine shop. Health Physics approval will be obtained prior to working with such material in the machine shop. No machining or cutting will be done on source or fissionable material in this shop.

Meteorology

18. Wind speed and direction of wind are recorded every two hours when the reactor is in operation. These data will be recorded whenever Hot Lab operations are being conducted and the reactor is inoperative.

Contaminated Water

19. Reference: Page 7, Section 3.
Any major loss or leakage of contaminated water from the lines or tanks in the Hot Laboratory would collect in the cell under the main floor of the Hot Laboratory. If the concrete-lined cell should also leak, the water would percolate through a considerable distance of soil before being able to enter the Indian Kill water system. The cell is 15' below grade and approximately 1200 feet from the nearest point of the water system.

An additional safety feature to insure against the release of contaminated water from the area is an emergency retention dam with a holding capacity of 300,000 gal. in the valley running parallel to Long Meadow Road. This dam is uphill from Indian Kill and in the natural drainage of surface water released from any of the work areas at the Research Center. The emergency dam is also described in the Final Hazards Summary Report, UCNC Research Reactor, November 1960, Docket 50-54 in support of Reactor Operating License No. R-81.

Health Physics and Radiation Control

20. Emergency Breathing Equipment: Two Scott pressure-demand air-paks are located at the entrance to the Hot Lab for emergency use. In addition

there are six M.S.A. "All-Service" gas masks located in various areas throughout the building. Six additional Scott "Air-Paks" and twenty M.S.A. "All-Service" gas masks are located in other buildings on site and would be readily available for emergency use.

21. The State Police, local Fire Department and Divil Defense authorities have toured the facilities. During the tours each group was briefed on the unusual problems which they might encounter during an emergency.

22. It is the policy of the Union Carbide Nuclear Research Center to ensure that each person who is assigned work involving radiation is suitably trained in radiation protection methods and procedures so that he may perform his job in a safe, responsible, and approved manner. In addition, this initial training is continuously supplemented with on-the-job training. The employees are continuously encouraged to ask questions and to bring all problems concerning ionizing radiation to the attention of the Health Physics Department. An outline of the Basic Radiation Safety Training Program is attached. Health Physics approval is required for work with radioactive materials which involve dose rates in excess of 100 mr/hr measured at one foot from the source.

23. Emergency Procedure: It is difficult to give an exact definition of an emergency, but the Laboratory would rather have employees err on the side of reporting too many incidents than to have a really serious emergency develop because someone delayed too long in deciding whether or not a situation might be an emergency.

Should the emergency involve a spill of radioactive material the person responsible for the spill will usually take the first steps in bringing the situation under control. The general procedures to be followed are:

a. Warn other occupants in the area; hold your breath; leave the area. The person should keep in mind that his primary responsibility is the safety of himself and those in the area. Possible loss of materials or data is entirely secondary. If there is time, an effort should be made to prevent the spread of contamination such as: right containers, or drop absorbant paper on liquids.

b. The area should be blocked off to prevent entry until a proper hazard sign is posted. Re-entry into the area shall be permitted only under the supervision of Health Physics or the Hot Lab Supervisor.

c. Personnel involved in the incident should wash and flush any radioactive material from their skin. The emergency shower should be used is necessary.

d. While personnel are still washing, the details and location of the incident shall be reported to the Health Physics Section and the Hot Lab Supervisor.

e. No personnel involved in the incident shall be permitted to leave the building until they have been monitored.

f. Cleaning of the area contaminated by the spill shall be done with the approval of the Health Physics Section or the Hot Lab Supervisor.

24. During each working day a wipe test survey is made on the floor areas in the Hot Laboratory. All areas are maintained as contamination-free as possible. Contamination levels above 10,000 dpm of removable beta or gamma activity per 100 cm^2 of surface area cause an area to be appropriately marked as a "Contamination Area." Shoe covers or other protective clothing is required in the area until it is decontaminated. In areas where there is a possibility of alpha contamination wipe samples will be counted in either a windowless 2π flow counter or a zinc sulfide scintillation counter. Removable alpha contamination in restricted areas shall not exceed 10,000 dpm for natural or depleted uranium, natural thorium, U-235, U-238, or Th-232 or 1000 dpm from any other alpha emitter.

25. Off-Site Monitoring: Rain water samples, air particulate filter paper samples, and gummed paper fall-out samples are collected monthly at three permanent monitoring stations. One of these stations is located at the northeast corner of our 100 acre site, one is located about 2-1/2 miles south-southeast of the reactor site, and the third is located about two miles southwest of the site in Tuxedo Park. Stream samples are also collected monthly at the following locations:

a. Indian Kill outlet at Long Meadow Road.
b. Warwick Brook at Four Corners.
c. Ramapo River at Tuxedo Park.
d. Indian Kill inlet at Route 210.
e. The spring at Jones' house on Long Meadow Road.
f. Sterling Lake outlet.

Gross beta analysis is performed on all of these samples. A more complete analyses shall be performed in the event of a suspected release of activity.

26. This license shall supersede the following licenses:

Byproduct Material
License No. 31-3334-2
License No. 31-3334-3

Special Nuclear Material
License No. SNM-221

Source Material
License No. SMB-470

27. In areas where alpha activity is being worked with all air samples and wipe tests will be counted with either a windowless 2π flow counter or a zinc sulfide scintillation alpha counter. In areas where there is a possibility of alpha air activity small air samplers are operated continuously and counted for alpha activity after each work day. In addition, we have a Victoreen alpha survey meter to monitor these work areas.

28. Prior to personnel entry into any cell where there is a possibility or air borne radioactivity, an air sample shall be taken to determine the need for respiratory equipment.

BASIC RADIATION SAFETY

COURSE OUTLINE

I. Introduction to Health Physics

A. Where did the necessity for a radiation safety specialist first arise?

1. The discovery of radioactivity and the consequences to early users.

a. X-rays
b. Radium
c. Radium dial painters

2. The Manhatten Project

B. How was the need for protection met?

1. The first Radiation Safety Officers.
2. The need for an uninvolved party.
3. The need for specialists in the field of radiation safety.
4. The need for each individual to be aware of the hazards involved when working with radioactive materials.

II. Basic Atomic Structure

A. The parts of the atom. (See Chart 1)

1. Electron
2. Proton
3. Neutron
4. Energy

B. The structure of the atom. (See Chart 2)

1. The relative sizes of the electron, proton, neutron.
2. The intra-atomic distances.

III. Atomic Radiations

A. The origin of Radiations.

B. The types of radiations.

1. Alpha
2. Beta
3. Gamma
4. Neutron

a. The fast neutron
b. The slow neutron

C. The role of the slow neutron as a building block of matter and in radioactivity. (See Chart 3)

1. Beta decay
2. Alpha decay
3. Gamma decay

IV. Properties of Radiations

A. The effect of radiations on photographic emulsions.

B. The effect of radiations on certain types of crystals.

C. The effect of radiations on matter in general.

1. The alpha particle ionizes by attraction or orbital electrons.
2. The beta particle ionizes by repulsion of orbital electrons.
3. The gamma ray ionizes by collision with orbital electrons.
4. The fast neutron ionizes by collision with the neucleus.

D. Factors concerning the ability of the various types of radiations to produce ions.

1. Distance
2. Time
3. Size
4. Charge

E. Specific ionization (See Chart 4)

F. Half-life (See Chart 5)

G. Background Radiation

V. Units of Radioactivity and Radiation Dose

A. Roentgen
B. Rem
C. Rad
D. RBE
E. Curie

VI. Effects of Radiation on the Human Body. (See Chart 6)

A. Genetic effects
B. Visible effects
C. Latent effects

VII. Standards for Protection Against Radiation

A. Permissible doses, levels and concentrations.

1. Exposure to individuals in restricted areas.
2. Permissible levels of radiation in unrestricted areas.
3. Concentrations in effluents to unrestricted areas.

B. Factors concerning external exposure.

1. Distance (See Chart 7)
2. Time (See Chart 8)
3. Shielding

C. Factors concerning internal exposure

1. Ingestion
2. Inhalation
3. Wounds

D. Precautionary procedures

1. Radiation surveys
2. Personnel monitoring
3. Caution signs, labels and signals

VIII. Methods of Detecting Radiations

(Including demonstrations and instructions on the use and limitations of radiation detection instruments)

A. Ionization chambers

1. The cutie-pie
2. The high-level cutie-pie
3. The dosimeter
4. The self-reading dosimeter
5. The "R" chambers

B. G-M Detectors

1. The portable G-M detector
2. The G-M counter
3. The ratemeter
4. The hand and foot counter
5. The personel radiation monitor with audible alarm

C. Scintillation detectors

1. The portable scintillation detector
2. The scintillation alpha counter

D. Area radiation monitors

1. The area monitor
2. The air monitor
3. The stack effluent monitor

E. Film badges

IX. Experiment with RaBe Source to Illustrate

A. Use of instruments
B. Inverse square law
C. Effect of various types of shielding materials

X. Laboratory Counting Techniques

A. Preparation of liquid samples
B. Counting of wipe samples

XI. Radiation Accident Procedures

A. Spills of radioactive materials and decontamination procedures.

B. Evacuation procedures

1. Location and use of emergency monitoring equipment
2. Location and use of Scott Air Packs and Gas Masks

NOTE: The charts referenced above are not attached to this outline.