

UNITED STATES GOVERNMENT

Memorandum

TO : Files

DATE: October 2, 1962

FROM : *Robert L. Layfield*
Robert L. Layfield
Source & Special Nuclear Materials Branch, DL&R

SUBJECT: HAZARDS SUMMARY ANALYSIS FOR THE UNION CARBIDE NUCLEAR COMPANY,
RESEARCH CENTER, TUXEDO PARK, NEW YORK - SOURCE AND SPECIAL
NUCLEAR MATERIALS PORTION: DOCKET NO. 40-6857 and 70-687

Application dated July 11, 1962, for an AEC license authorization was received from the subject Company to possess and use (1) sealed solid sources; (2) unsealed radioactive solids; (3) a limit of 100 curies each of elements 3 through 83, inclusive; (4) special nuclear material; (5) source material; and (6) spent reactor fuel elements. These materials would be possessed and used within the applicant's Hot Lab Facility at Tuxedo Park, New York. The Isotopes Branch has separately evaluated that portion of the application concerning the materials enumerated above as (1), (2), and (3), except that (1) does not include the sealed Pu-Be neutron sources. This Hazards Summary Analysis will cover only that material designated as (4), (5), and (6), and includes the Pu-Be neutron sources.

Spent Fuel Elements

The applicant proposes to utilize a maximum of four (4) spent fuel elements as sources of gamma photons. The elements will be obtained from the applicant's associated research reactor and will be transferred from the reactor area to any cell within the Hot Lab via an inter-connecting subsurface water canal. It is calculated that four spent fuel elements will contain approximately 4.2×10^5 curies of fission product activity. Conservative point source shielding calculations for four elements suspended 25 feet in front of the lead glass window have shown that the radiation from such elements will be reduced to less than 2.0 mr/hr at the external surface of the window. This calculation assumes 146 day irradiation and one day cooling. Longer cooling periods or greater source to wall distances will be observed when handling elements with longer irradiation histories.

The applicant will not allow any fissionable material other than the four (4) fuel elements to be in a cell at any one time. The fuel elements will be stored in the transfer canal when not in use. This storage is covered under the Union Carbide facility license. The presence of the 784 grams of U-235 contained in fuel elements of this type, in any array, will be safe from the standpoint of accidental criticality. The critical mass for the Carbide research reactor was 3720 grams of U-235.

Calculations have shown that the temperature (163°F) at the surface of a fuel element after 146 days of irradiation and one (1) day cooling, will be well below the melting point of the aluminum cladding (1260°F). Care will be taken to assure that the elements are at all times suspended separately and vertically. Longer cooling times will be allowed when handling fuel elements with longer irradiation histories.

The applicant has stated that there will not be any cutting or dissolution of these fuel elements.

Discussion and Recommendations

In view of the foregoing analyses, approval is recommended for the possession and use of the four (4) spent fuel elements in accordance with the procedures submitted hereto. License authorization will be required for the byproduct material and special nuclear material contained in these elements.

Special Nuclear Materials

The applicant requests authorization to possess and use two hundred and fifty (250) grams of U-235 and ten (10) grams each of plutonium-239 and uranium-233. Included here is the Pu-239 and the U-233 produced by the neutron irradiation of the source materials requested and discussed below. The applicant presently possesses Special Nuclear Material License No. SNM-221 which authorizes the possession and use of 250 grams of U-235. Briefly, this license authorizes the incorporation of the special nuclear material into glass fibers for subsequent irradiation and determination of chemical synthesis induced by fission fragments. This license will supersede License No. SNM-221, the uses of such material will remain the same. The Pu-239 and U-233 will not be possessed in the form of powder or unclad metal.

Discussion and Recommendations

The Pu-239 and U-233 will be used in unspecified research problems, however, considering that all work with these materials prior to irradiation will be done in filtered dry boxes, and considering the air and smear survey programs, little difficulty is anticipated. When not being used, all unirradiated special nuclear material will be kept in a locked steel cabinet in the Radiochemical Laboratory. The U-233 will be stored in a shielded container. Applicant is apparently aware of U-232 buildup. Work within the hot cells with more than 0.1 gram of Pu-239 will be performed in glove boxes. Air samples will be taken and evaluated prior to any cell entry, where the possibility of airborne radioactivity exists.

Approval is recommended for the possession and use of two hundred and fifty (250) grams of U-235, ten (10) grams each of Pu-239 and U-233 in accordance with the procedures submitted hereto.

Plutonium-Beryllium Neutron Sources

The applicant proposes to possess and use ten curies (160 grams) of plutonium encapsulated as Pu-Be neutron sources. The applicant has bound himself to the use of these neutron sources within a hot cell. Leak tests by the wipe technique will be performed at six (6) months intervals.

Discussion and Recommendation

Approval is recommended for the possession and use of the 10 curies (160 grams) of plutonium encapsulated as Pu-Be neutron sources. However, it is recommended that the applicant be alerted to the fact that this authorization does not extend to the use of the neutron sources outside of a hot cell.

Source Materials

The applicant requests authorization to possess and use one hundred (100) pounds each of Thorium-232 and Uranium-238. The applicant requests that the use of these materials extend to laboratory research, sample preparation and irradiation via sealed sources or reactor.

Discussion and Recommendations

All work with these materials prior to irradiation will be done in dry boxes. Post irradiation handling will be performed in the hot cells.

Approval is recommended for the possession and use of one hundred (100) pounds each of Uranium-238 and Thorium-232 in accordance with the procedures submitted hereto. License authorization will be required for the byproduct and special nuclear materials produced by the irradiation of these materials. The applicant has requested that the Pu-239 and U-233 produced by the irradiation of these materials be included as part of the ten (10) grams each of Pu-239 and U-233 requested and discussed above.

Corporate Data

The corporate data required in 70.22(a)(1) has been submitted and recorded in their application for Special Nuclear Material License No. SNM-221, Docket No. 70-238.