

UNITED STATES ATOMIC ENERGY COMMISSION

APPLICATION FOR SOURCE MATERIAL LICENSE

Pursuant to the regulations in Title 10, Code of Federal Regulations, Chapter 1, Part 40, application is hereby made for a license to receive, possess, use, transfer, deliver or import into the United States, source material for the activity or activities described.

1. (Check one) <input type="checkbox"/> (a) New license <input type="checkbox"/> (b) Amendment to License No. _____ <input checked="" type="checkbox"/> (c) Renewal of License No. <u>STB-475</u> <input type="checkbox"/> (d) Previous License No. _____		2. NAME OF APPLICANT Raytheon Company Microwave & Power Tube Operation	
		3. PRINCIPAL BUSINESS ADDRESS Foundry Avenue Waltham, MA 02154	
4. STATE THE ADDRESS(ES) AT WHICH SOURCE MATERIAL WILL BE POSSESSED OR USED Raytheon Company, Microwave and Power Tube Operation Foundry Avenue, Waltham, MA 02154			
5. BUSINESS OR OCCUPATION Electronics		6. (a) IF APPLICANT IS AN INDIVIDUAL, STATE CITIZENSHIP (b) AGE	
7. DESCRIBE PURPOSE FOR WHICH SOURCE MATERIAL WILL BE USED to manufacture cathodes for microwave tubes, the majority of which are for U. S. Government, Department of Defense			
8. STATE THE TYPE OR TYPES, CHEMICAL FORM OR FORMS, AND QUANTITIES OF SOURCE MATERIAL YOU PROPOSE TO RECEIVE, POSSESS, USE, OR TRANSFER UNDER THE LICENSE			
(a) TYPE	(b) CHEMICAL FORM	(c) PHYSICAL FORM (Including % U or Th.)	(d) MAXIMUM AMOUNT AT ANY ONE TIME (in pounds)
NATURAL URANIUM			
URANIUM DEPLETED IN THE U-235 ISOTOPE			
THORIUM (ISOTOPE)	Thorium (232)	Metal Powder (100%) Oxides Powder (82%)	25 pounds 110 pounds
(e) MAXIMUM TOTAL QUANTITY OF SOURCE MATERIAL YOU WILL HAVE ON HAND AT ANY TIME (in pounds)			25 pounds 160 pounds
9. DESCRIBE THE CHEMICAL, PHYSICAL, METALLURGICAL, OR NUCLEAR PROCESS OR PROCESSES IN WHICH THE SOURCE MATERIAL WILL BE USED, INDICATING THE MAXIMUM AMOUNT OF SOURCE MATERIAL INVOLVED IN EACH PROCESS AT ANY ONE TIME, AND PROVIDING A THOROUGH EVALUATION OF THE POTENTIAL RADIATION HAZARDS ASSOCIATED WITH EACH STEP OF THOSE PROCESSES. see Appendix 1			
10. DESCRIBE THE MINIMUM TECHNICAL QUALIFICATIONS INCLUDING TRAINING AND EXPERIENCE THAT WILL BE REQUIRED OF APPLICANT'S SUPERVISORY PERSONNEL INCLUDING PERSON RESPONSIBLE FOR RADIATION SAFETY PROGRAM (OR OF APPLICANT IF APPLICANT IS AN INDIVIDUAL). see Appendix 2			
11. DESCRIBE THE EQUIPMENT AND FACILITIES WHICH WILL BE USED TO PROTECT HEALTH AND MINIMIZE DANGER TO LIFE OR PROPERTY AND RELATE THE USE OF THE EQUIPMENT AND FACILITIES TO THE OPERATIONS LISTED IN ITEM 9. INCLUDE (a) RADIATION DETECTION AND RELATED INSTRUMENTS (including film badges, dosimeters, counters, air sampling, and other survey equipment as appropriate. The description of radiation detection instruments should include the instrument characteristics such as type of radiation detected, window thickness, and the range(s) of each instrument). see Appendix 3			
see Appendix 3			

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(11) VENTILATION EQUIPMENT WHICH WILL BE USED IN OPERATION, WHICH THE DESIGNER HAS PROVIDED FOR OR HAS RECOMMENDED IN PLAN VIEW SHOWING TYPE AND LOCATION OF HOOD AND FILTERS, MINIMUM VELOCITIES MAINTAINED AT HOOD OPENINGS AND PRO

see Appendix 3

(12) DESCRIBE PROPOSED PROCEDURES TO PROTECT HEALTH AND MINIMIZE DANGER TO LIFE AND PROPERTY AND RELATE THESE PROCEDURES TO THE OPERATIONS LISTED IN ITEM 9. INCLUDE: (a) SAFETY FEATURES AND PROCEDURES TO AVOID NONNUCLEAR ACCIDENTS, SUCH AS FIRE, EXPLOSION, ETC., IN SOURCE MATERIAL STORAGE AND PROCESSING AREAS

see Appendix 3

(b) EMERGENCY PROCEDURES IN THE EVENT OF ACCIDENTS WHICH MIGHT INVOLVE SOURCE MATERIAL.

see Appendix 3

(c) DETAILED DESCRIPTION OF RADIATION SURVEY PROGRAM AND PROCEDURES.

see Appendix 3

(13) WASTE PRODUCTS: If none will be generated, state "None" opposite (a), below. If waste products will be generated, check here ☐ and explain on a supplemental sheet:

(a) Quantity and type of radioactive waste that will be generated.

see Appendix 3

(b) Detailed procedures for waste disposal.

(14) IF PRODUCTS FOR DISTRIBUTION TO THE GENERAL PUBLIC UNDER AN EXEMPTION CONTAINED IN 10 CFR 40 ARE TO BE MANUFACTURED, USE A SUPPLEMENTAL SHEET TO FURNISH A DETAILED DESCRIPTION OF THE PRODUCT, INCLUDING:

(a) PERCENT SOURCE MATERIAL IN THE PRODUCT AND ITS LOCATION IN THE PRODUCT.

(b) PHYSICAL DESCRIPTION OF THE PRODUCT INCLUDING CHARACTERISTICS, IF ANY, THAT WILL PREVENT INHALATION OR INGESTION OF SOURCE MATERIAL THAT MIGHT BE SEPARATED FROM THE PRODUCT.

(c) BETA AND BETA PLUS GAMMA RADIATION LEVELS (Specify instrument used, date of calibration and calibration technique used) AT THE SURFACE OF THE PRODUCT AND AT 12 INCHES.

(d) METHOD OF ASSURING THAT SOURCE MATERIAL CANNOT BE DISASSOCIATED FROM THE MANUFACTURED PRODUCT.

CERTIFICATE

(This item must be completed by applicant)

(15) The applicant, and any official executing this certificate on behalf of the applicant named in Item 2, certify that this application is prepared in conformity with Title 10, Code of Federal Regulations, Part 40, and that all information contained herein, including any supplements attached hereto, is true and correct to the best of our knowledge and belief.

Raytheon Company - Microwave & Power Tube Operation
(Applicant named in Item 2)

Dated _____

BY: _____

Howard W. Johnson

Corporate Safety Director

(Title of certifying official authorized to act on behalf of the applicant)

WARNING: 18 U.S.C. Section 1001; Act of June 25, 1948; 62 Stat. 749; makes it a criminal offense to make a willfully false statement or representation to any department or agency of the United States as to any matter within its jurisdiction.

APPENDIX 1

RAYTHEON COMPANY

MICROWAVE AND POWER TUBE DIVISION

PARAGRAPH 9 (Form AEC-2)

<u>PROCESS</u>	<u>POTENTIAL HAZARD</u>	<u>PRECAUTIONS</u>	<u>MAXIMUM USAGE AT ANY ONE TIME</u>
Receiving & Storage	Breakage; fire	Maximum acceptable package 25 pounds, glass or metal container, which are stored in a lead lined box	160 pounds (storage)
Sieve, weigh, mix, and roll	Dust; spillage	Enclosed, locked, labeled and adequately ventilated room. Quantity is small for any one operation (max. 25 pounds). Stored in metal cabinet. Room used approximately 5 hours per week	25 pounds
Compact (dilute with other powders to 50% Thorium)	Dust	Ventilated, exhausted, and labeled area.	9 pounds
Coat (dilute and apply; amount Thorium per component-very small	Dust; spillage	Ventilated area with hoods and vacuum cleaners. Strict control of personal hygiene (no food or smoking); disposable protective garments used.	3 pounds
Heat Treatment	Dust; fumes	Good general area ventilation. Furnace atmosphere is diluent and suppressant. Small quantities Thorium involved.	3 pounds
Machine & component assembly	Dust	Ventilated and posted area. Individual pieces of equipment exhausted. Quantity of Thorium involved is only small percent of each component and total is also small. Average component weight is less than 2 grams and the Thorium amounts to approx- imately 50%.	3 pounds
Fabricate into final product		Thorium content now becomes very small fraction of assembly. Final products are labeled in accordance with MIL-M-19590-D and fall into Class I, indicating 5.0 microcuries or less.	

Resume of Training and Experience of
Corporate Radiation Safety Officer

Purpose:

The following information is submitted for use in applying for an NRC license for source material.

Corporate Safety Director:

Name: Howard W. Johnson

Location: Corporate Safety Office, Raytheon Company
141 Spring Street, Lexington, MA 02173

Education: Lincoln Technical Institute - Northeastern University, ASME
Registered Professional Engineer - Commonwealth of Massachusetts

<u>Type of Training:</u>	<u>Where Trained</u>	<u>Duration</u>	<u>On The Job</u>	<u>Formal Course</u>
A. Principles and practices of radiation protection	Raytheon Co. Liberty Mutual Ins. Co.	16 years 11 years	Yes Yes	No Yes
B. Radioactivity measurements standardization and monitoring techniques and instruments	Raytheon Co. Liberty Mutual Ins. Co.	16 years 11 years	Yes Yes	No Yes
C. Mathematics and calculations basic to the use and measurement of radioactivity	Raytheon Co. Liberty Mutual Ins. Co.	16 years 11 years	Yes Yes	No Yes
D. Biological effects of radiation	Raytheon Co. Liberty Mutual Ins. Co.	16 years 11 years	Yes Yes	No Yes

Experience with Radiation

<u>Isotope:</u>	<u>Max. Amount</u>	<u>Where Exp. was Gained</u>	<u>Duration</u>	<u>Type of Use</u>
Thorium	1000 pounds	Raytheon Company	1 year	Process & Control
Cobalt 60	30 m ^C	Raytheon Company	1 year	Protection
Varied Isotopes		Liberty Mutual Ins. Co.	11 years	Protection

X-ray Devices:

<u>Device</u>	<u>Where Exp. was Gained</u>	<u>Duration</u>	<u>Type of Use</u>
X-ray Machines	Raytheon Company	16 years	Insp. & Monitoring
X-ray Installation	Liberty Mutual Ins. Co.	11 years	Prot. & Monitoring
Microwave Devices	Raytheon Company	16 years	Prot. & Monitoring
Microwave Devices	Mitre Corp.	1½ years	Prot. & Monitoring

Resume of Training and Experience of
Division Radiation Safety Officer

Purpose:

The following information is submitted for use in applying for an NRC license for source material.

MPTD Division Safety Manager:

Name: Walter W. Hartford, Jr.

Location: Microwave & Power Tube Division, Raytheon Company
190 Willow Street, Waltham, MA 02154

Education: Northeastern University, BSEE and MBA
Various related State-of-the-Art courses and seminars with C.E.U. credits

<u>Type of Training:</u>	<u>Where Trained</u>	<u>Duration</u>	<u>On The Job</u>	<u>Formal Course</u>
A. Principles and practices of radiation protection	Raytheon Co. Liberty Mutual Ins. Co. & HEW, Public Health, FDA	12 years 16 hours	Yes	No Yes
B. Radioactivity measurements standardization and monitoring techniques and instruments	Raytheon Co. Liberty Mutual Ins. Co. & HEW, Public Health, FDA	12 years 16 hours	Yes	No Yes
C. Mathematics and calculations basic to the use and measurement of radioactivity	Raytheon Co. Liberty Mutual Ins. Co. & HEW, Public Health, FDA	12 years 16 hours	Yes	No Yes
D. Biological effects of radiation	Raytheon Co. Liberty Mutual Ins. Co. & HEW, Public Health, FDA	12 years 16 hours	Yes	No Yes

Experience with Radiation:

<u>Isotope:</u>	<u>Max. Amount</u>	<u>Where Exp. was Gained</u>	<u>Duration</u>	<u>Type of Use</u>
Thorium	625 pounds	Raytheon Company	5 years	Process & Control
Cobalt 60	30 m ^C	Raytheon Company	4 years	Protection
Varied Isotopes		Raytheon Company	5 years	Protection

X-ray Devices

X-ray Machines, Industrial	Raytheon Company	5 years	Insp. & Monitoring
X-ray Installation, Industrial	Raytheon Company	5 years	Prot. & Monitoring

Microwave Devices/Systems

High Energy Microwave Linear	Raytheon Company,	5 years	Equip. & Facility
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Resume of Training and Experience of
Operation Radiation Safety Officer

Purpose:

The following information is submitted for use in applying for an NRC license for source material.

Operation Safety Engineer:

Name: William V. Smith

Location: Microwave Tube Operation Safety Office, Raytheon Company
190 Willow Street, Waltham, MA 02154

Education: University of Massachusetts, BS Physics
Registered Professional Engineer, Commonwealth of Massachusetts

<u>Type of Training:</u>	<u>Where Trained</u>	<u>Duration</u>	<u>On The Job</u>	<u>Formal Course</u>
A. Principles and practices of radiation protection	Raytheon Co. Boston Univ.	28 yrs. 2 semesters	Yes Yes	No Yes
B. Radioactivity measurements standardization and monitoring techniques and instruments	Raytheon Co. Boston Univ.	28 yrs. 2 semesters	Yes Yes	No Yes
C. Mathematics and calculations basic to the use and measurements of radioactivity	Raytheon Co. Boston Univ.	28 yrs. 2 semesters	Yes Yes	No Yes
D. Biological effects of radiation	Raytheon Co.	28 yrs.	Yes	No

Experience with Radiation:

<u>Isotope</u>	<u>Max. Amt.</u>	<u>Where Exp. was Gained</u>	<u>Duration</u>	<u>Type of Use</u>
Thorium	130 lbs.	Raytheon Company	1 year	Process & Control

X-ray Devices

X-ray Machines	Raytheon Company	28 years	Insp. & Monitoring
Microwave Devices	Raytheon Company	28 years	Prot. & Monitoring

APPENDIX 3

RAYTHEON COMPANY

MICROWAVE AND POWER TUBE DIVISION

PARAGRAPH 11: (Form AEC-2)

- (a) The bulk of the operations will be concentrated in a special area constructed for this purpose (see enclosed drawings labeled Power Tube, Second Floor, Bldg. 41).

External radiation exposure will be kept at a minimum at work stations by limiting the quantities on hand at any one time. In storage areas the material is kept in lead lined containers. The area is occupied approximately 10% of the work week.

A Victoreen Instrument Company Low Energy Survey Meter, Model 440, will be utilized to check for beta and gamma radiation. This model is capable of indication down to approximately 0.25 milliroentgens per hour.

Eberline Instrument Gas Proportional Alpha Counter, Model PAC-4G, with a resolution of 50CPM will be used to test for surface contamination.

Wipe samples will be counted in a NMC Model PG-4 Gas Flow Alpha and Beta Proportional Counter.

Air sampling is accomplished by using a Millipore Air Sampler, pump, restricting orifice, and 0.45 micron filter paper. Samples are counted by Liberty Mutual Company's Hopkinton Research Center using an NMC-PC4 proportional counter.

- (b) The calibration of instrumentation will be conducted in-house using two standard Thorium sources (to provide a minimum of two calibration levels for each scale) up to 10,000 CPM and/or by the manufacturers of the specific instrumentation used. It shall be done quarterly or in the event of servicing of the specific instrument.
- (c) The bulk of activities involving the licensed material will be conducted in one area equipped with two separate exhaust systems. One is a high velocity low air volume central vacuum cleaner installation (Lamson Vacuum Pump with a high efficiency filter collector, 5 inches of static pressure with 35 HP capacity) to perform three distinct functions:
1. To exhaust ventilate the production units doing machining operations.
 2. To provide convenient outlets for vacuum cleaning the work areas and contents.
 3. To provide a suitable source of suction for monitoring air samples.

The operations not exhausted by the vacuum cleaner system are ventilated by means of low velocity large volume enclosures and hoods. A Buffalo blower with a Cambridge Area Solve 95-Filter Bank is installed, having a capacity of 13,400 C.F.M.

PARAGRAPH 12: (Form AEC-2)

- (a) The bulk of material utilized is in the form of Thoria and, as such, is relatively inert.

All areas where storage or processing is conducted are sprinkled. Besides, the operations involving any processing of the Thorium materials are isolated from other operations.

- (b) The work is conducted in buildings which are protected by fire and evacuation alarms, fire and evacuation brigades, and emergency equipment under the direction of professional fire fighters at all times. Instrumentation will be available to check for area contamination.

The following notice is posted in all areas where Thorium is used:

TO: All Employees Working in the Thorium Rooms

FROM: The Division Safety Office

The following rules and procedures must be adhered to whenever you enter an area where Thorium is used.

Thorium, in the quantities used in tube manufacturing, does not present an extreme external radiation hazard. Internal exposure by inhalation over a prolonged period must be prevented. Therefore, the following hygiene requirements must be posted and adherence enforced by heads of affected departments:

1. No food, beverages, or smoking articles are to be brought into the areas posted.
2. When handling materials containing thorium, gloves are to be worn.
3. All cuts or skin punctures are to be covered at all times.
4. Prior to leaving the area for rest periods, lunch, and at quitting time, hands, face, and arms are to be washed thoroughly.
5. The best possible housekeeping should be maintained at all times.

These requirements can only be effective if the work places are clean and free of loose particles of thorium, hence, good housekeeping practices are our best defense.

- (c) All personnel involved in this work are given pre-assignment physicals. They are instructed in the need of personal hygiene as their best control. Smoking articles, food, and beverages are not allowed in the areas. Facilities for washing are provided at the exit from the areas. Rules specifying adherence to these controls are posted.

Air sampling of breathing zones of each worker or work station, general air zones, and stack exhaust are taken semi-annually.

Surface wipe samples are taken and all samples are evaluated to determine the effectiveness of the specific ventilation involved. This is done at least every six months.

PARAGRAPH 13 (Form AEC-2)

- (a) Waste consists primarily of wipes (cloth and paper), disposable garments, filters, scrap parts, and minute amounts of powder in greatly reduced mixtures. This is collected in metal containers with covers as provided by the Interex Corporation, 3 Strathmore Road, Natick, MA 01760.
- (b) Containers are picked-up by the Interex Corporation for disposal in a manner prescribed by their license for this disposal. A new container is left to replace those they picked-up.

Emergency Procedures: In the case of fire or other disaster, the area containing Thorium will be cordoned off and signs posted to restrict unauthorized entrance. Then the area will be checked with a G-M or scintillation survey meter to determine degree of activity and location.

If no contamination exists, the radioactive materials will be checked for leakage and placed in a labeled restricted storage facility.

If contamination exists, an operator wearing disposable protective clothing and using a survey meter will locate the source and place it in a shielded container and proceed with the spill decontamination procedure.

When the clean-up has been completed, the operators will be monitored for any radioactive material on their clothing or bodies and the same procedures followed as in the event of a spill.

Persons to be notified in case of an emergency are Walter W. Hartford, Jr. and/or William V. Smith, extension 4291.

Spill Procedure: The powder sources will be Thoria or Thorium. In the case of a spill the operator will be checked to see if his clothing or body has become contaminated. If the worker is not contaminated, he may proceed with cleaning up the area, by vacuuming up the spilled material with a portable Spencer vacuum cleaner and placing it in a shielded container for disposal by Interex. A commercial cleaner will also be used to assure complete removal of the contamination, and the area and operator checked with a survey meter.

If it is found that the operator's clothing is contaminated, clothing will be removed and body checked for radioactivity. Radioactive areas will be washed with soap and water, scrubbing with a soft brush. A cleaner suitable for use on the skin may be used. Waste water will be held for disposal by Interex.

The contaminated clothing should be placed in a shielded container for disposal by Interex.