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Raytheon

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December 11, 1985

U. S. Nuclear Regulatory Commission
License Management Branch
Division of Fuel Cycle & Material Safety
Washington, D. C. 20555

Attention: Mr. J. Bruce Carrico

Subject: Material Control No. 018901

Gentlemen:

As per our telephone conversation, we respectfully submit, in duplicate, an updated copy of our prior submission dated September 6, 1979 (attached) of the information required under 10CFR32, Section 32.14.

This information covers the continuing distribution of electron tubes manufactured under NRC License #20-01896-03.

There follows in outline form, data requested to be submitted under each of the eight subparagraphs of 10CFR32, Section 32.14, relative to authorization to ship product pursuant to Section 30.15 (a):

- 1.0 "Chemical and physical form and maximum quantity of by-product material in each product."
- 1.1 Nickel 63 is used in two levels per tube of 0.02 and 0.7 microcuries per tube depending upon the tube type involved.
 - 1.1.1 Tubes with levels of 0.02 microcuries per tube are: Type 1058, 1058A, and 7996. Nickel ribbon, irradiated to a level of 0.01 microcuries per milligram, is welded inside the tube envelope.
 - 1.1.2 Tubes with levels of 0.7 microcuries per tube are: Type 1061, 1068, 1069, 1071, 1073, 1075, 1096, 5787A, 6213A and 6542A. Nickel 63 is electroplated on one of the parts which forms the internal mount structure of the tube. The parts are purchased from an outside vendor.
- 1.2 Cesium 137 is procured in an HCl solution with a specified strength of 1mCi/CML . This solution is diluted with binders to produce Raytheon Formulation T.11.1 by the chemical laboratory in accordance with Specification #5638. The diluted Cesium 137 solution, with a maximum strength of 2 millicuries, is applied with a dropper to the internal glass wall of the tube before the final seal is made. The following tube types contain 0.9 microcuries per tube: 1080, 1097 and 1098.

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- 1.3 Krypton 85 is purchased in cylinders mixed with rare gas mixtures. The specified activity is 0.02 millicuries per liter of gas. The gas is injected in a closed system directly into the electron tubes during an exhaust process and a final seal is made on the glass exhaust tip.

Calculations made, based upon the internal volumes and filling pressures of the tubes which use Krypton 85, have yielded activity levels of 0.003 to 0.080 microcuries per tube. Tube types containing Krypton 85 are: OA2, OA2WA, OA3, OB2, OB2WA, OB3A, OC2, OC3A, OC3W, OD3A, OD3W, 5644, 5651, 5651A, 5651WA, 5783, 5783WA, 5787, 5787WA, 6213 and 6542.

- 2.0 "Details of Construction and Design of Each Product" and,
- 3.0 "The method of containment or binding of the by-product material in the product".

As can be seen from the above listing of tube types using the various by-product materials, there are many different construction details. However, there are a number of important construction details that are common and pertinent to these two areas.

All of these tubes are gas discharge tubes employing vacuum tight enclosures with either glass envelopes or metal-ceramic envelopes which are essential to the operation of the product.

The radioactive materials Ni63 and Cs137 are placed within the internal structure of the tube prior to sealing the envelope into the tube. These tubes have the air pumped out, a controlled gas atmosphere is injected and a final vacuum tight seal is made.

In the case of Kr85, the radioactive material is part of the controlled gas atmosphere that is injected during the pumping operation.

All of these tubes are vacuum tight enclosures which contain the radioactive material inside and which will not operate satisfactorily electrically if the integrity of the vacuum tight envelope is disturbed.

- 4.0 "Procedures for, and results of, prototype testing to demonstrate that the material will not become detached from the product and that the by-product material will not be released to the environment under the most severe conditions likely to be encountered in normal use of the product".
- 4.1 All tube types manufactured in our facility, including those which have radioactive materials in them, are operated after the pumping process and then are tested 100% for a wide variety of electrical performance parameters. Should the envelope not be vacuum tight, the electrical characteristics of the tube will be adversely affected and the product will not be shipped. In addition to the 100% electrical tests, a number of other tests are performed on each type on a sample basis prior to the shipment of the manufacturing lot.

These sample tests include such things as shock test, vibration tests and operating life tests at the maximum rated environmental conditions for the tube. The lot of tubes must pass these sample tests before it is released for shipment.

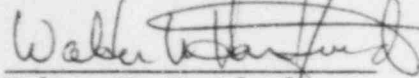
- 5.0 "Quality control procedures to be followed in the fabrication of production lots of the product and the quality standards the product will be required to meet".
- 5.1 This is covered in 4.1 above. It might be pointed out that the majority of our products are manufactured to military specifications for government end use. All of our products are manufactured under a rigorous QC inspection, in-process sample checks of products, 100% electrical characteristic testing, sample tests under maximum rated shock vibration, temperature and operating life condition, and then re-inspection on a sample basis for electrical and mechanical characteristics prior to shipment of the product.
- 6.0 "The proposed method of labeling or marking each unit, except time-pieces or hands or dials containing tritium or promethium-147, and its container with the identification of the manufacturer or importer of the product".
- 6.1 The Raytheon name or the Raytheon manufacturing source number (280), assigned by the Electronic Industries Association, is marked on all of these tubes and on the individual tube packaging containers. The symbol for the appropriate by-product material (Ni63, Kr85 or Cs137) is added to the individual tube marking and to that of the individual tube package.
- 7.0 "For products for which limits on levels of radiation are specified in 30.15 of this chapter, the radiation level and the method of measurement."
- 7.1 30.15(a)(8) specifies that, in order for these electron tubes to qualify for exemption, the levels of radiation from each electron tube containing by-product material shall not exceed one millirad per hour at one centimeter from any surface when measured through seven milligrams per square centimeter of absorber.
- 7.2 Additional measurements were made on sample tubes of the types which are being converted to Krypton 85 from Cobalt 60 as well as the one type (1096) which was added to the Nickel 63 list. As before, this data was taken with a TracerLab Model SU14TW Alpha-Beta-Gamma Survey Meter using a TGC-9 mica window geiger tube with a window thickness of less than 2 milligrams per square centimeter. The tubes were read at a distance of one centimeter from the tube surface with no absorber between the tube and the mica window. The observed background was 0.05mr/hour. The following types were tested, all with the same result, no measurable radiation above the background level was found: 1096, 0A2, 0A2WA, 0A3A, 0B2, 0B2WA, 0B3A, 0C2, 0C3A, 0C3W, 0D3A, 0D3W, 5644, 5783, 5783WA, 6213, 6542.

- 8.0 "Any other information, including experimental studies and tests, required by the Commission to facilitate a determination of the safety of the product".

This information given above includes a number of significant points which should be reviewed in summary. All of these tubes contain quantities of by-product material well below the 1 mr/hr specified in 30.15(a)(8). All of the tubes are vacuum tight enclosures with the radioactive materials contained inside and these tubes will not operate electrically if there should be any leaks in the enclosure. All product is tested 100% prior to shipment and sample tests are performed for lot acceptance under maximum rated environmental conditions. These points, in addition to the fact that we have been authorized to manufacture these tubes under our specific license and to distribute these tubes to general licensees for many years, should provide an adequate basis for the immediate authorization to distribute these tubes under the provisions of Sections 30.15(a)(8) and 32.14.

Very truly yours,

RAYTHEON COMPANY
MICROWAVE & POWER TUBE DIVISION



Walter W. Hartford
Division Safety Manager

WWH:bam

Encs.

CONVERSATION RECORD

TIME

DATE

12/5/85

TYPE

☐ VISIT

☐ CONFERENCE

☐ TELEPHONE

☐ INCOMING

☐ OUTGOING

ROUTING

NAME/SYMBOL INT

Location of Visit/Conference:

NAME OF PERSON(S) CONTACTED OR IN CONTACT WITH YOU

ORGANIZATION (Office, dept., bureau, etc.)

TELEPHONE NO.

Walter Hartford

Raytheon

(617)
642-4291

SUBJECT

license application to replace
No. 20-01896-05E & letter dated 11/25/85

SUMMARY

- I called Mr. Hartford to explain what info. is needed to issue the distribution license as requested in his 11/25/85 letter.

- Mr. Hartford said he understood what was needed and would submit the info. ASAP.

ACTION REQUIRED

- entered as a telephone def.

NAME OF PERSON DOCUMENTING CONVERSATION

SIGNATURE

DATE

J. Bruce Carter

12/5/85

ACTION TAKEN

SIGNATURE

TITLE

DATE