

January 17, 2014

ATTN: Document Control Desk
Director, Office of Federal and State Materials
and Environmental Management Programs
U.S. Nuclear Regulatory Commission,
Washington, DC 20555-0001

This letter is written to comply with the amended sections of Title 10 CFR Part 32, Specific Domestic Licenses to Manufacture or Transfer Certain Item containing by Product material, effective December 17, 2007.

Licensee: Detector Electronics Corporation License Number: 22-18199-02E
6901 West 110th
Minneapolis, MN 55438

Authorized use:

Pursuant to Section 32.14, 10 CFR Part 32, "Specific Domestic Licenses to Manufacture or Transfer Certain Items Containing Byproduct Material"; the licensee is authorized to distribute electron tubes containing not more than 30 microcuries of krypton-85 to persons exempt from licensing pursuant to Section 30.15, 10 CFR Part 30, or equivalent provisions of the regulation of any Agreement State. See attached license item # 9.

Product Description:

This Product Transfer report is for our gas filled source tube which is the only radioactive item we transfer to customers. It is used for generating ultraviolet light in our fire detection systems. The following amount of Krypton 85 was transferred since our last reporting period.

Radionuclide per tube:

Each source tube contains approximately 1 microcurie of Krypton 85 gas. See attached Mass Spectrometry Analysis.

Number of source tubes transferred since the last report:

See attached spread sheet.



Tim Ellis
Production Manager

FSMED3

U.S. NUCLEAR REGULATORY COMMISSION

MATERIALS LICENSE

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974 (Public Law 93-438), and Title 10, Code of Federal Regulations, Chapter I, Parts 30, 31, 32, 33, 34, 35, 36, 39, 40, and 70, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, possess, and transfer byproduct, source, and special nuclear material designated below; to use such material for the purpose(s) and at the place(s) designated below; to deliver or transfer such material to persons authorized to receive it in accordance with the regulations of the applicable Part(s). This license shall be deemed to contain the conditions specified in Section 183 of the Atomic Energy Act of 1954, as amended, and is subject to all applicable rules, regulations, and orders of the Nuclear Regulatory Commission now or hereafter in effect and to any conditions specified below.

Licensee	In accordance with letter date August 6, 2012,
1. DETECTOR ELECTRONICS CORPORATION	3. License number 22-18199-02E is amended in its entirety to read as follows:
2. 6901 West 110 th Street Minneapolis, Minnesota 55438	4. Expiration date November 30, 2022
	5. Docket No. 030-17824 Reference No.

6. Byproduct, source, and/or special nuclear material	7. Chemical and/or physical form	8. Maximum amount that licensee may possess at any one time under this license
A. Krypton-85	A. Gas	A. Not Applicable (See License Condition No. 10)

9. Authorized use:

Pursuant to Section 32.14, 10 CFR Part 32, "Specific Domestic Licenses to Manufacture or Transfer Certain Items Containing Byproduct Material"; the licensee is authorized to distribute electron tubes containing not more than 30 microcuries of krypton-85 to persons exempt from licensing pursuant to Section 30.15, 10 CFR Part 30, or equivalent provisions of the regulations of any Agreement State.

CONDITIONS

10. This license does not authorize possession or use of licensed material.
11. The licensee shall submit periodic material transfer reports as specified in Section 32.16, 10 CFR Part 32.
12. The licensee is authorized to distribute only from its facilities located at 6901 West 110th Street, Minneapolis, Minnesota; 10901 Louisiana Avenue, Bloomington, Minnesota; and 7213 West 128th Street, Savage, Minnesota.

**MATERIALS LICENSE
SUPPLEMENTARY SHEET**License Number
22-18199-02EDocket Number
030-17824

Amendment No. 04

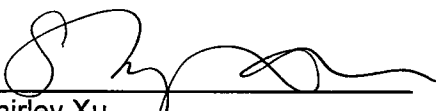
CONDITIONS

13. Except as specifically provided otherwise by this license, the licensee shall conduct its program in accordance with the statements, representations, and procedures contained in the documents, including any enclosures, listed below. The U.S. Nuclear Regulatory Commission's regulations shall govern unless the statements, representations, and procedures in the licensee's application and correspondence are more restrictive than the regulations.
- A. Application dated August 6, 2012 (ML12233A508).

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

Date November 13, 2012

By


_____Shirley Xu
Licensing Branch
Division of Materials Safety and State Agreements
Office of Federal & State Materials &
Environmental Management Programs
Washington, DC 20555

Detector Electronics

Kr-85 Electron Tube Characteristics

1. Kr-85 Tube Activity

Activity of the Kr-85 in a tube is best determined by determining the amount of Kr-85 introduced into the tube and not by measurement of the radiation emitted from the Kr-85 in the tube.

The specific activity of the Kr-85 in the supply tank is 50 mCi/L at atmospheric pressure (760 Torr). The tube in which the Kr-85 is introduced is evacuated to 4 microTorr (a virtual vacuum), and the tube is backfilled to 10 Torr of Kr-85.

The universal gas law applies: $PV=nRT$ where

P=pressure

V=volume

n=quantity (Kr-85 activity) of gas

R=gas constant plus unit conversions

T=Temperature

For the supply tank - Equation 1:

$$760 \text{ Torr} \times 1 \text{ L} = 50 \text{ mCi} \times RT$$

For the tube – Equation 2, where the tube volume is 0.6 ml and A is the activity in the tube:

$$10 \text{ Torr} \times 0.6 \text{ ml} = A \times RT$$

The temperature T will be constant during the transfer. Dividing Equation 2 by Equation 1 the result is:

$$A = 0.4 \text{ } \mu\text{Ci Kr-85}$$

A supply tank of Kr-85 will last for no longer than nine months. The half life of Kr-85 is 10.765 years. The activity of Kr-85 will have decreased 4.7% over the nine month use period. Therefore, the tubes should be within $\pm 3\%$ activity range, but the transportation values will be based on highest activity manufactured.

2. Specific Activity of Kr-85 in Electron Tube

The electron tube described above filled with 10 Torr of Kr containing Kr-85 is backfilled to a pressure of 30 Torr with an 80% Neon and 20% Hydrogen gas mixture. Assuming an ambient temperature of 72^o F and 0.6 ml volume then the mass of the gas mixture in which the Kr-85 is uniformly distributed is 38.5 μg . Thus, the specific activity of the 0.4 μCi Kr-85 in the electron tube is 10,600 $\mu\text{Ci/g}$.

Detector Electronics

Kr-85 Electron Tube Characteristics

3. Radiation Units

For the purposes of this report 1 Roentgen = 1 rem since Kr-85 is a beta and gamma emitter.

4. Occupational Services Report

4.1. Radiation Levels: Kr-85 Tubes at 1 cm

Radiation levels were measured for 10 Kr-85 tubes at 1 cm through 7 mg/cm² using a Fluke 450B ion chamber. The results are shown in the attached Occupational Services report in Table 2, and are summarized below.

1 cm	
Ten Tubes	mR/hr
Average	0.18
Maximum	0.20
Minimum	0.14

Thus the Kr-85 electron tubes meet the NRC 10 CFR 30.15(a)(8) requirements that the radiation levels do not exceed 1 millirad per hour at 1 centimeter from any surface when measured through 7 milligrams per square centimeter of absorber, since the millirad to millirad conversion is less than one.

4.2. Radiation Levels at 10 cm

4.2.1. Kr-85 Electron Tubes

Radiation levels were measured for 10 Kr-85 tubes at 10 cm through 7 mg/cm² using a Fluke 450B ion chamber. The results are shown in the attached Occupational Services report in Table 2, and are summarized below.

10 cm	
Ten Tubes	mR/hr
Average	0.04
Maximum	0.05
Minimum	0.02

4.2.2. Kr-85 Modules

Occupational Services reported no detectable of radiation at 10 cm from each of the two modules.

Detector Electronics

Kr-85 Electron Tube Characteristics

- 4.2.3. Ultra Violet Test Lamp
Occupational Services reported no detectable of radiation at 10 cm from the Ultra Violet Test Lamp

4.3. Package Surface Radiation Levels

Maximum radiation levels were measured on the surfaces of four packages as shown in Table 1 of the attached Occupational Services report and below:

Instrument	Package Surface Exposure Rate mR/hr				
	Background	Package of 10 tubes 0024005-001	Package 1 Module 003240-001	Package 2 Module 007450-003	Package of Ultra Violet test lamp.
Fluke 450B	0.01	0.20	0.01	0.01	0.01
Ludlum 3 with 44-9 Pancake Detector	0.015	0.45	0.015	0.015	0.015

The above table demonstrates that the four maximum package surface radiation levels do not exceed 0.5 mrem/hr for the four packages, and therefore meet the maximum package surface radiation level criteria for a radioactive material excepted package. The difference between the Fluke ion chamber reading of 0.20 mR/hr and the corresponding pan cake probe reading of 0.45 mR/hr is because of the difference in detector size and the over response to low energy photon gamma radiation by a GM tube.

2013	QUANTITY SHIPPED ≤ 1 Microcurie per tube	TOTAL MILLICURIES Kr 85
January	773	0.773
February	861	0.861
March	308	0.308
April	193	0.193
May	578	0.578
June	345	0.345
July	164	0.164
August	468	0.468
September	296	0.296
October	414	0.414
November	319	0.319
December	109	0.109
Total	4828	4.828