



Radioactive Material FAQs

Most receiver protector tubes (TR tubes and Pre-TR tubes) contain a small amount of radioactive material. This paper answers some common questions regarding its use and handling. At the end of the FAQs, there is additional data, conversion charts and calculators on the radioisotopes that we use.

1. Why do receiver protector tubes contain radioactive material?

The radioactive material is used as a means of “priming” the gas to ensure stable firing on every pulse. The active element in receiver protector (RP) tubes is a gas, or mixture of gases, which protect the receiver from high power pulses by ionizing in the presence of a high power signal. Gas discharges are inherently unstable. They require some means of “priming” in order to ensure that a stable discharge occurs on every pulse. A small amount of radioactive material is a clean, effective, reliable way to accomplish this.

2. Which radioisotopes are used? How much?

Each tube will contain one of the following isotopes: Tritium (H_3), Promethium 147, Cobalt 60. The amounts used vary from product to product, however, they will always be below the following maximum limits:

- * Tritium (Specific Activity: 3.57×10^5 gBq/g) ----- 150 millicuries
- * Promethium 147 (Specific Activity: 3.48×10^4 gBq/g) -- 30 microcuries
- * Cobalt 60 (Specific Activity: 4.18×10^4 gBq/g) ----- 1.0 microcurie

3. Where is the material located?

In a body filled TR tube, the material is located inside the TR tube waveguide body. In a pre-TR tube, the radioactive material is located inside the pre-TR bulb. In all cases, the radioactive source is completely sealed within the vacuum tube.

4. How dangerous are these tubes?

Under normal conditions of use and handling, there is no danger to personnel working with or in proximity to these products. Of course, as with any electronic device, common sense precautions should be observed. The Tritium and Promethium isotopes emit low energy beta particles. Their energy is so low that it will not penetrate the walls of the tube. No radiation is detectable on the outside of such devices. Thus, they are quite safe to handle. Cobalt 60 emits gamma radiation. Some radiation may be detectable outside the unit, but it is a very small amount, well within safe limits. The level of radiation emanating from each unit will not exceed 1 millirad per hour at one centimeter from any surface when measured through 7 milligrams per square centimeter of absorber, as required by NRC and Commonwealth of Massachusetts regulations.

5. How is the use of radioactive material controlled?

CPI is licensed by the U.S. Nuclear Regulatory Commission (NRC) and the Commonwealth of Massachusetts. Its licenses allow it to use radioactive material in its products up to the limits described above in question 2. CPI strictly adheres to the terms of its licenses.

6. Are there any special handling or storage requirements?

CPI's products are exempt articles as defined in 10CFR30.15. This means that under NRC regulations our customers have no requirement for special handling, storage, or disposal of receiver protectors purchased from CPI. As always, common sense precautions should be applied. Also, each customer should make himself aware of any local laws or regulations which may apply to him.

7. How do I dispose of units which have reached their end of life?

As stated above, controlled disposal is not required under NRC regulations. Local or organizational regulations could differ from NRC regulations. It is the responsibility of the user to be aware of any such regulations that may apply. The most stringent regulations must be followed.

8. What do I do if a unit containing radioactive material breaks?

As always, common sense precautions are the most important thing. Damaged or broken pieces should be picked up using tools so as to prevent cuts and other injuries to workers. The areas which came into contact with the broken pieces should be scrubbed clean. Disposal of the broken pieces should be made per question 7, above.

9. Are there any special shipping considerations?

Federal Transportation Regulations, 49CFR173.424, exempts instruments and articles containing small amounts of radioactive material from special shipping requirements. All TR tubes manufactured by CPI meet the definition of instruments and articles as defined in 49CFR173.403 and the requirements of 49CFR173.424. Products should be packaged to prevent damage in the course of normal shipping and handling.

10. What is the half life of the radioisotopes used in receiver protectors?

Tritium -- 12.3 years; Promethium 147 -- 2.6 years; Cobalt 60 -- 5.3 years

11. How do I convert from Curies to Bequerels?

1.0 microcurie = 37kBq

1.0 millicurie = 37MBq

Engineering Data

Radioisotope Information

Curies (uC)	Becquerels (kBq)	Curies (mC)	Becquerels (MBq)
1.0 microCurie = 37 kBq		1.0 milliCurie = 37 MBq	
0.25	9.3	1	37
0.50	18.5	5	185
0.75	28	10	370
1.0	37	30	1,110
5.0	185	50	1,850
10	370	100	3,700
30	1,110	150	5,550
50	1,850		
100	3,700		
500	18,500		

Radioactive Half- Life	
Tritium (H3)	12.3 Years
Promethium 147	2.3 Years
Cobalt 60	5.3 Years

Calculators

Enter value in shaded cell. Read across for result.

MilliCuries – MegaBecquerels

mC		
MBq		

Residual Radioactivity

Amount	Years	H3	Pm147	Co60

