

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES  
SAFETY EVALUATION OF DEVICE

NO.: C0411D101S

DATE: March 03, 1982

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DEVICE TYPE: Neutron Generator Tube

MODEL: Zetatron

MANUFACTURER/DISTRIBUTOR: Kaman Sciences Corporation  
1500 Garden of the Gods Road  
Colorado Springs, CO 80933

MANUFACTURER/DISTRIBUTOR:

SEALED SOURCE MODEL DESIGNATION: Kaman 1-31A-115781-000 or 1-31A-115782-000

ISOTOPE: Hydrogen-3

MAXIMUM ACTIVITY: 9 curies

LEAK TEST FREQUENCY:

PRINCIPAL USE: General Neutron Source Applications

CUSTOM DEVICE: ☐ YES ☒ NO

8403020267 840209  
PDR FOIA  
HAMMITT84-74 PDR

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DESCRIPTION:

Figure #1 is a scaled drawing of the Zetatron sealed neutron tube. The vacuum walls of the sealed tube are constructed from stainless steel, copper, glass, and ceramic. TIG welds and high temperature braze materials are used in tube fabrication. All braze materials have melting points of 920°C (1778°F) or higher. The reservoir element consists of a porous stainless steel cylindrical tube filled with zirconium deuteride and zirconium tritide (1-2 curies). The target consists of a heavy molybdenum support with a thin film of scandium deuteride and scandium tritide (6-7 curies). Tritium remains in the target as solid scandium tritide to temperatures up to 500°C (932°F).

LABELING:

1. Each tube is labeled with the words:

Zetatron

S.N. \_\_\_\_\_

"Caution - Radioactive Material"

2. The immediate outer container in which the tube is shipped is labeled in accordance with 49 CFR 173.391(b)
3. Due to the fact that the Zetatron must be incorporated into an accelerator head in order to function, no instructions are provided.

DIAGRAM:

See attachment

CONDITIONS OF NORMAL USE:

The Zetatron is operated in a sealed pressure housing which is provided by the customer. The Zetatron is manufactured to meet essentially the same criteria as the Kaman A-3062 neutron generator tube.

PROTOTYPE TESTING:

1. Except for minor design changes, the Zetatron tube is identical to the A-3041 neutron tube which has been manufactured and distributed by Kaman for several years.

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PROTOTYPE TESTING (CONT'D):

2. Each tube is tested to 350°C for 2 hours.

EXTERNAL RADIATION LEVELS:

No beta radiation can be expected to be emitted from the Zetatron tube. Bremsstrahlung radiation was measured with a Victoreen 440 low range Beta/Gamma meter with a minimum sensitivity to Gamma of 6.5 KeV. No detectable radiation was found on contact with the Zetatron tube.

Dose Rates:

167 Rem/hr at 5 cm  
4.66 Rem/hr at 30 cm  
0.42 Rem/hr at 100 cm

Neutron Flux at  $2 \times 10^8$  neutrons per second:

$6.69 \times 10^5$  neutrons/cm<sup>2</sup> per second at 5 cm  
 $1.86 \times 10^3$  neutrons/cm<sup>2</sup> per second at 30 cm  
 $1.67 \times 10^3$  neutrons/cm<sup>2</sup> per second at 100 cm

LIMITATIONS AND/OR OTHER CONSIDERATIONS OF USE:

1. May be distributed to specific licensees only.
2. Licensee does not have access to the radioactive material.

REFERENCES:

The safety review and registration of the Kaman Model Zetatron neutron generator tube is based on the information provided by Kaman Sciences Corporation in their letter and attachments dated July 14, 1981.

Date January 19, 1982

Reviewed By /s/  
Laurence A. Door

Date March 3, 1982

Concurred By /s/  
W. Jacob

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ISSUING AGENCY:

Colorado Department of Health  
Radiation Control Division

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