RG&E
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Robert C. Mecredy
Vice President
Nuclear Operations

June 6, 2003

Mr. Robert L. Clark
Office of Nuclear Regulatory Regulation
U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555-0001

Subject: Supplementary Information Associated with the Control Room Emergency Air Treatment System (CREATS) Actuation Instrumentation Change (LCO 3.3.6)
Rochester Gas and Electric Corporation
R.E. Ginna Nuclear Power Plant
Docket No. 50-244

Reference: Letter from Robert C. Mecredy (RG&E) to Guy S. Vissing (NRC), "Application for Amendment to Facility Operating License Control Room Emergency Air Treatment System (CREATS) Actuation Instrumentation Change (LCO 3.3.6)", dated May 3, 2000.

Dear Mr. Clark:

In the above Reference, RG&E submitted a proposed change to the Improved Technical Specifications associated with the Control Room Emergency Air Treatment System (CREATS) Actuation Instrumentation requirements. Subsequent to the submittal, as the result of discussions with the NRC staff, RG&E would like to provide additional information associated with the response of the new CREATS Actuation Instrumentation to high energy (> 1.5 MeV) gamma radiation.

The new CREATS Actuation Instrumentation radiation monitors are based on a Model ZP1320 Geiger-Mueller (GM) tube. This GM tube is equivalent to, and can be cross referenced to, a number of other manufacturer model numbers. Three separate cross reference sources are provided in Attachment 1. Attachment 2 is an energy response curve for a similar Model 713 GM tube. Attachment 3 is a copy of an evaluation of various GM tubes for N-16 gamma radiation response (6 MeV). The Model N117-1 is the equivalent to our GM tube and was provided by the same supplier. The intent of this information is to provide a basis for the ability of the new CREATS Actuation Instrumentation radiation monitors (and GM tubes in general) to conservatively detect radiation at an energy > 1.5 MeV, and thereby bound the analysis previously provided.

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I declare under penalty of perjury under the laws of the United States of America that I am authorized by RG&E to make this submittal and that the foregoing is true and correct.

Any questions concerning this submittal should be directed to Tom Harding at (585) 771-3384.

Very truly yours,

Executed on June 6, 2003

Robert C. Mecredy

Attachment 1 - Cross References of Geiger-Mueller Tubes
Attachment 2 - Model 713 Energy Response
Attachment 3 - The N-16 Gamma Radiation Response of Geiger-Mueller Tubes

xc: Mr. Robert Clark (Mail Stop O-8-C2)
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, MD 20852

Regional Administrator, Region 1
U.S. Nuclear Regulatory Commission
475 Allendale Road
King of Prussia, PA 19406

U.S. NRC Ginna Senior Resident Inspector

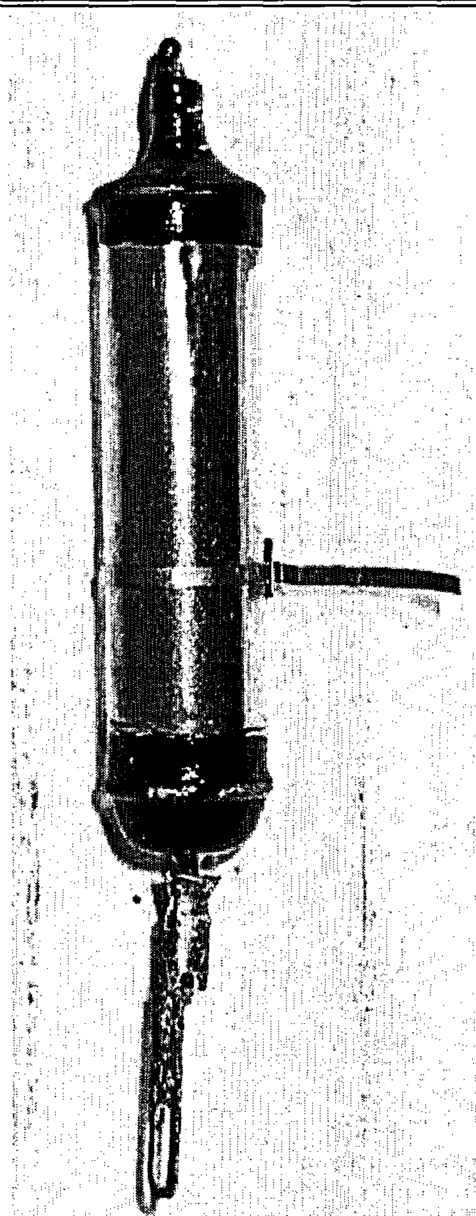
Peter R. Smith, Acting President
New York State Energy, Research, and Development Authority
17 Columbia Circle
Albany, NY 12203-6399

Mr. Paul Eddy
NYS Department of Public Service
3 Empire Plaza
Albany, NY 12223-1350

Attachment 1

Cross References of Geiger-Mueller Tubes

18550/ZP1320/MX164



Old type number	18550
New type number	ZP1320
Mullard type	MX164
Detects	beta & gamma radiation
Effective range	0,001-100 R/h
Plateau	500-650 V
Cathode	28% Cr, 72% Fe
Filling	Neon, Argon, Halogen
Height	44 mm
Diameter	10 mm
Weight	
Symbol	

BACK

LND, INC.

Phone : 516-678-6141 - - Fax : 516-678-6704 - - E-mail : info@lndinc.com

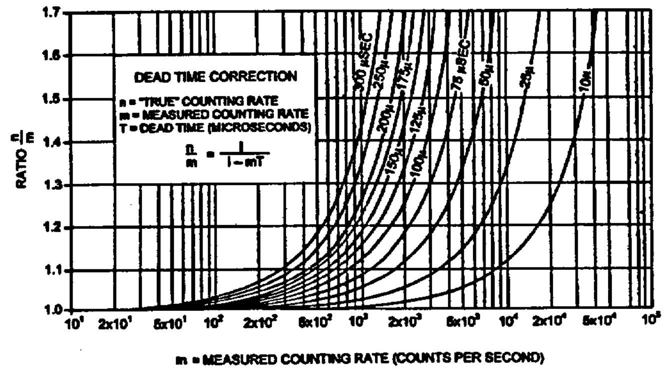
Geiger Tube Cross Reference Chart

Use the chart below to convert other manufacturer's part numbers to*LND* part numbers.

LND, INC	CENTRONICS	MULLARD	PHILLIPS/ AMPEREX	TGM DETECTORS
7121	ZP1200	MX146	18503	N/A
71210	ZP1201	N/A	N/A	N/A
78016	ZP1210	MX120	18520	N/A
78017	ZP1220	MX145	18545	N/A
7807	ZP1221	N/A	N/A	N/A
716	ZP1300	MX163	18529	N115-1 / C1300
7165	ZP1301	N/A	N/A	N115-1S1 / C1301
714	ZP1310	MX151	18509	N116-1 / C1310
71412	ZP1311	MX189	N/A	N116-1SE / C1312
7149	ZP1313	N/A	N/A	N/A
713	ZP1320	MX164	18550	N117-1 / C1320
71322	ZP1321	N/A	N/A	N117-1S / C1321
7139	ZP1324	N/A	N/A	N/A
72118	ZP1330	MX177	18555	N/A
7124	ZP1400	MX147	18504	N/A
712	ZP1401	N/A	N/A	N/A
71210	ZP1402	N/A	N/A	N/A
7224	ZP1410	MX148	18505	N/A
72314	ZP1430	MX169	18526	N/A
72327	ZP1431	MX149	18506	N/A
7242	ZP1441	MX152	18515	N/A
72412	ZP1442	N/A	N/A	N/A

Geiger Müeller Tubes

Dead Time Correction
GM tubes using conventional counting circuitry all exhibit counting losses due to the dead time factor, T. The factors cited in the Canberra tube data tables are based on the recommended operating voltages and test circuits. The chart below enables the user to estimate the counting losses due to the dead time factor at high count rates.

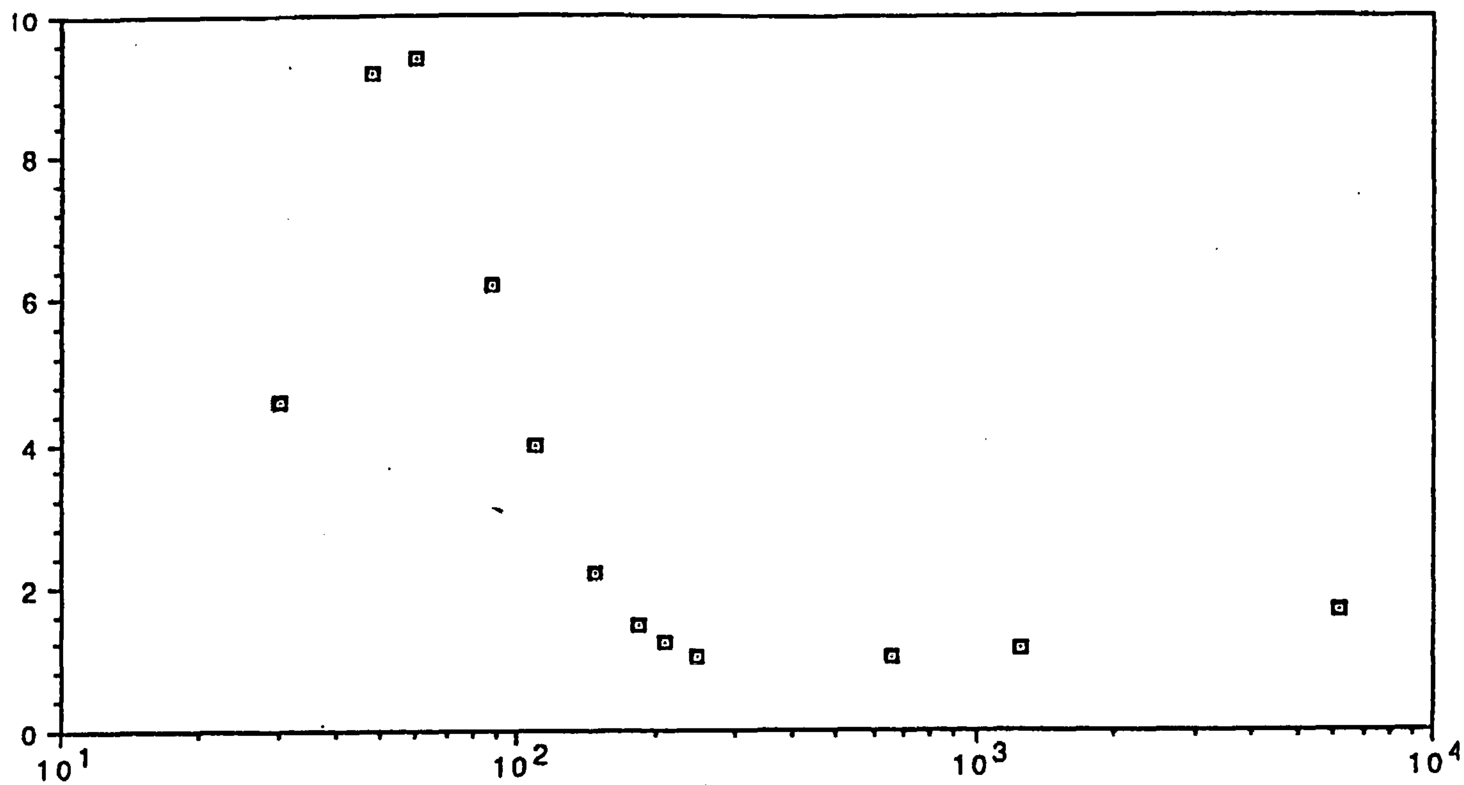


The Right Tube for Your Application
Direct or Near Equivalent Matrix

	Canberra Tube	Military Spec	LND	TGM	Centronic
2000 Series Pancake	2000	8767	7311	N1002	
	2001			N1002-1	
	2006		73118	N1006	
	2011		7231	N1004	ZP1450
2100 Series MICA End Window	2100			N202	
	2106	7616 Equiv.			
	2111				ZP1400
	2112		712	N205	ZP1401
	2121		7224	N206	ZP1410
	2123			N204	
	P2123			N204/MHV	
	2126	5979 Equiv.	722	N201	
	2131		723	N210	
	P2131		7232	N210/BNC	
	2135		72314		
2200 Series Thin Wall Beta	2200		719	N107	
	2202		721	N106	
	2206		720	N114	
	2211		725	N112	
	2216			N119	
2300 Series Thick Wall Gamma	2300		72610		
	2305			N305	ZP1200
	2306			N320	
	2311			N309	
	2314				
	2316		743	N310	
	2350		7802/78017		
2400 Series Miniature	2406		716	N115-1	ZP1300
	2411		714	N116-1	ZP1310
	2416		713	N117-1	ZP1320
	2420	Equivalent to Eurisys Mesures Model 4G60M			
	2422	Equivalent to Eurisys Mesures Model 3G10			
	2423	Equivalent to Eurisys Mesures Model 4G15			

Attachment 2

Model 713 Energy Response



Photon Energy Response of 713 "thin wall" GM tube, normalized to unity at 662 keV with beam perpendicular to detector wall.

Attachment 3

The N-16 Gamma Radiation Response of Geiger-Mueller Tubes

[Note: This article is reproduced from: Proceedings of the Eighth International Congress of the International Radiation Protection Association (IRPA8), May 17 - 22, 1992, Montreal, Canada, pages 652 - 655.]

The N-16 Gamma Radiation Response of Geiger-Mueller Tubes

D. J. Allard, A. M. Nazarali and C. E. Chabot

Arthur D. Little, Inc., Acorn Park, Cambridge, MA 02140; WIPP, P.O Box 2078, Carlsbad, NM 88220; University of Lowell, 1 University Ave., Lowell, MA 01854

ABSTRACT - This paper describes an evaluation of various Geiger-Mueller (GM) tubes for N-16 gamma radiation response. The work is an extension of investigations regarding the various radiation response characteristics of these devices. Previously acquired photon energy response data were from 10 kev to 1.25 MeV. Utilizing the 6 MeV gamma ray of N-16, the pair production interaction response with different GM tube styles was studied. The new relative response ratios of N-16 to Cs-137 are presented with a discussion of results. Additionally, two full energy response curves are presented.

INTRODUCTION AND METHODS

Recently evaluations for radiation response characteristics of GM tubes with respect to beta energy, dose rate, photon polar, and photon energy response have been performed in conjunction with the NRPB in the UK (Allard 1987). That work investigated photon energy response from 10 kev to 1.25 MeV. The dominant interactions in this energy range are photoelectric and compton scattering. An investigation presented herein extended the photon energy testing into the 6 MeV range using an N-16 source. At this energy the pair production interaction will become more apparent with respect to detector response. Various styles of "pancake", mica end window, thin wall, thick wall and energy compensated GM tubes were included in this study. The mechanical aspects of the various styles are noted in Table 1 and TGM Detectors' product specifications. In this evaluation a portable high voltage supply/digital scaler was set up adjacent to the N-16 source at the University of Lowell's research reactor facility. This source has been fully characterized for the specific purpose of measuring response of portable radiation protection instruments (Neault, 1980). It should be noted that a 1.5 inch thick iron plate was placed in front of the source to attenuate the high energy beta component and provided secondary electron buildup. This arrangement also furnished an exposure scenario that is similar to what is encountered in a nuclear power plant. The various GM tubes were irradiated with the N-16 source at known exposure rates, and observed counts and times recorded. Efforts were made to obtain at least 10,000 counts for statistics. Similarly, the same detectors were irradiated with a calibrated Cs-137 source, The background was measured in each area and corrections applied. Collected data were then used to determine a count rate per unit exposure rate value. A response ratio of N-16 to Cs-137 was then calculated in order to fold this information into the previously acquired photon energy response measurements made at NRPB.

RESULTS AND DISCUSSION

Table 1 is a summary of the N-16 to Cs-137 response ratios. As noted, the relative response ratio varied from nearly unity to about two. Considering the interactions and number of secondary charged particles produced, this would be expected. If one were to plot photon fluence versus photon energy, a peak would be observed below 200 keV. This is mentioned in that GM tubes are basically photon counters, and will more or less exhibit the same generally shaped curve. However, differences in GM tube construction does cause notable discrepancies at high photon energies and variable peak spread at low photon energies. Figures 1 and 2 are energy response curves for a bare and energy compensated version of a GM tube. The data presented are a combination of the NRPB and this study's results (i.e. N-16 data point).

Table 1. Ratio of N-16 Gamma Response Relative to Cs-137

GM Tube	Ratio	Comments
N1002/8767	1.88	Through mica window.
N1002/BNC	1.90	Through mica window.
N1003	1.96	Through mica window.
N201	1.71	Through 0.047" SS wall.
N205	1.90	Through 0.010" SS wall.
N210/BNC	1.58	Through 0.109" SS wall.
H220/7840	1.90	Through mica window.
N107	1.61	Through 30 mg/sq.cm SS wall.
N112	1.65	Through 30 mg/sq.cm SS wall.
N114	1.73	Through 30 mg/sq.cm SS wall.
N115-1	1.09	Through 80 mg/sq.cm SS wall.
N115-1S1	1.42	Through 80 mg/sq.cm SS wall with high Z filter.
N116-1	1.24	Through 80 mg/sq.cm SS wall.
N116-1SE	1.63	Through 80 mg/sq.cm SS wall with high Z filter.
N117-1	1.74	Through 30 mg/sq.cm SS wall.
N1l7-1S	1.73	Through 30 mg/sq.cm SS wall with high Z filter.
N118-1	1.03	Through 120 mg/sq.cm SS wall.
N118-1S	1.49	Through 120 mg/sq.cm SS wall with high Z filter.
N302	1.76	Through 0.020" SS wall.
N305	1.82	Through 0.010" SS wall.

N305S	1.99	Through 0.010" SS wall with high Z filter.
NP315-6	1.52	Through 0.020" SS wall, platinum plated inside.
NP334-6	1.48	Through 0.012" SS wall, platinum plated inside.
NP358-6	1.69	Through 0.009" SS wall, platinum plated inside.

GM tubes will respond to any charged particle that enters their sensitive volume. A discharge may be produced by charged particles directly entering the tube through a mica window or thin cathode wall. Alternately a discharge may result from secondary electrons; thus, the construction of any given GM tube will greatly influence an energy response curve by the complex contribution of primary photon transmission/attenuation and secondary particle production/attenuation at various depths in the GM tube window, wall or outer energy compensation filter. Again, the data shown in Figures 1 and 2 are the relative response values for the GM tube on an exposure rate basis. Because Cs-137 is a very common calibration source, by convention 662 keV is used as the normalization point. This allows comparison of tubes that may have quite different gamma ray sensitivities due to overall size.

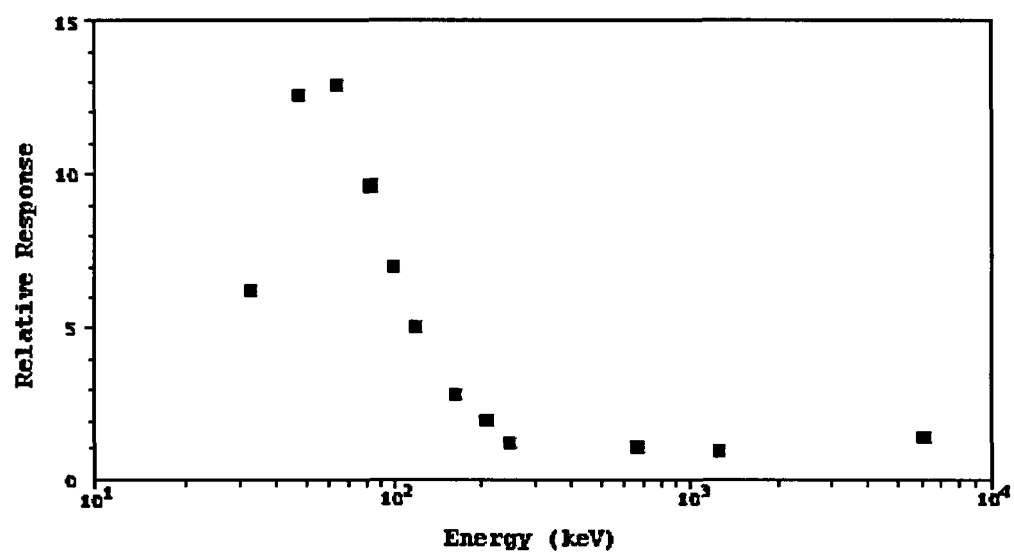


Fig. 1: Photon Energy Response of N116-1 miniature "thin wall" GM tube, normalized to unity at 662 keV with beam perpendicular to detector wall.

As can be noted in Figure 1, the "thin wall" style GM tube with an 80 mg/sq. cm window provides excellent transmission for low energy photons below 100 keV. However, relative to Cs-137 it does over-respond by nearly a factor of 13 at 70 keV. This results from the high photon fluence being transmitted through the cathode wall, a high interaction probability, and the subsequent discharge events being counted. In the intermediate energies the response is relatively flat, but does begin to increase slightly above 1 MeV. The latter is due to the increase in number of secondary charced particles from pair production. Over-response below about 200 keV may be reduced by adding a thin layer filter of high atomic number metal over the tube with an appropriate open area. This effectively attenuates a portion of the low energy photon fluence. With proper engineering, one can easily obtain a +/-20% response from 50 keV to 1.25 MeV using a "thin wall" GM tube and energy compensation filter. However, as can be noted by comparing the response curves in Figures 1 and 2, the high atomic number filter actually causes an increased over-response in the 6 MeV range compared to the bare tube. This is no doubt due to energetic secondaries produced in the energy compensation filter, passing through the GM tube cathode wall and causing a discharge.

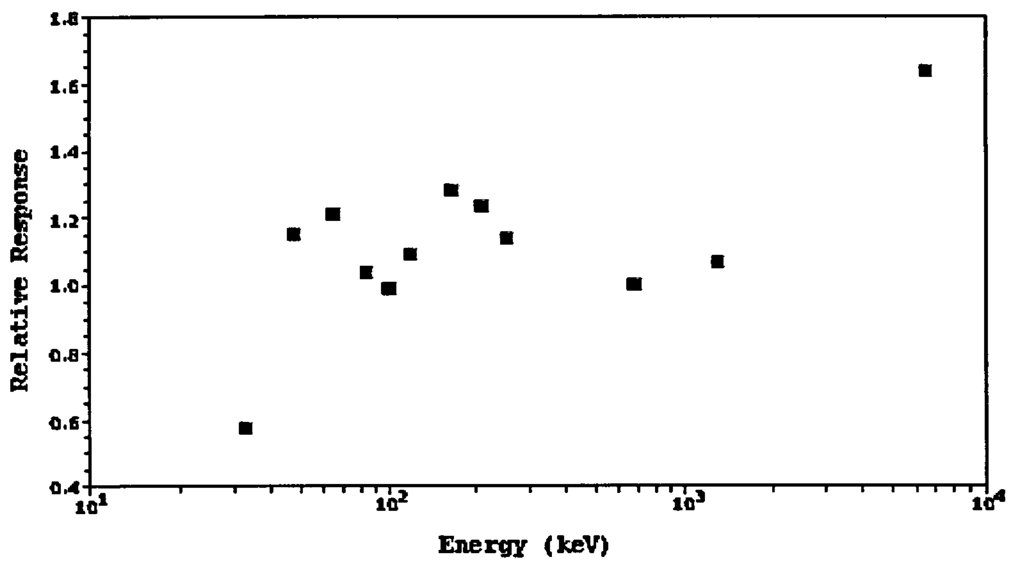


Fig. 2: Photon Energy Eesponse of N116-1SE energy compensated miniature "thin wall" GM tube, normalized to unity at 662 keV, same geometry.

Acknowledgement - The authors wish to thank TGM Detectors, Inc. (Waltham, MA, U.S.A.) and Centronic Limited (Croydon, U.K.) for their financial support of this project.

REFERENCES

1. Allard, D.J., Geiger-Mueller Tube Radiation Response Characteristics, Proceedings of the Health Physics Society's 21st Midyear Topical Meeting on Power Reactor Health Physics, Miami, FL, 1987.

2. Neault, P.J., The Dosimetry of Nitrogen-l6, University of Lowell Masters Thesis, 1980.