



September 25, 1998

Mr. John Wray  
U.S. Nuclear Regulatory Commission  
475 Allendale Road  
King of Prussia, PA 19406

**RE: Former EPEC Polymers, Inc. Facility  
Industrial Avenue  
Fords, Middlesex County, New Jersey**

Dear Mr. Wray:

Attached please find one copy of the *Radiological Risk Analysis* report detailing the results of the dose analyses performed for the former EPEC Polymers Inc. (EPI) facility in Fords, Middlesex County, New Jersey. This report has been prepared by SECOR International Inc. (SECOR) on behalf of EPI. As per your telephone conversation on September 23, 1998, with Ravi Gupta of SECOR, EPI would like to schedule a meeting with your project staff during the week of October 26, 1998, to discuss the findings of the risk analysis and other project issues. Setting aside Monday, October 26 as a travel day, our first choice for the meeting date would be October 27 followed by October 28 or October 29. Please get back with me or Ravi Gupta regarding the actual date that NRC can accommodate the meeting.

If you should have any questions, please feel free to contact me at (713) 420-4755 or Mr. Ravi Gupta of SECOR at (609) 259-6424.

Sincerely,

*Roger D. Towe*

Roger D. Towe  
Principal Environmental Engineer

Attachment

cc: Ravi Gupta, SECOR  
Jennifer Moone, NJDEP- RAD Assess. Sec.

B/34

28 May 1997

Dr. Ronald R. Bellamy  
U.S. Nuclear Regulatory Commission  
475 Allendale Rd.  
King of Prussia, PA 19406

**RE: Former EPEC Polymers Inc. Facility  
Industrial Avenue  
Fords, Middlesex County, New Jersey  
Request to Use Soil Contamination Criteria for Depleted Uranium**

Dear Dr. Bellamy:

On behalf of EPEC Polymers Inc. (EPEC), SECOR International Inc. (*SECOR*) has prepared this letter to provide information to the U.S. Nuclear Regulatory Commission (USNRC) supporting EPEC's belief that the soil contamination at the above referenced site is due to depleted uranium. The surface soil sample (ISS-1) used to determine the type of uranium contamination at the site was collected at the southwest corner of Building K-12. The location of ISS-1 has the highest known exposure rate at the site. The following is the calculation used to derive the ratio of the number of atoms of U-235 to the number of atoms of U-235 plus U-238 for soil sample ISS-1:

Specific Activities

U-238 - 0.333  $\mu$ Ci/g of uranium

U-235 - 2.14  $\mu$ Ci/g of uranium

U-234 - 6.15 E+3  $\mu$ Ci/g of uranium

Amount of Uranium per Gram of Sample ISS-1

U-235

$(43.9 \text{ pCi of U-235}) / (\text{g soil})(2.14 \text{ E}+6 \text{ pCi}) = 20.5 \text{ E}-6 \text{ g of U-235/g soil}$

U-238

$(2,653 \text{ pCi of U-238}) / (\text{g soil})(0.333 \text{ E}+6 \text{ pCi}) = 7.97 \text{ E}-3 \text{ g of U-238/g soil}$

U-234

negligible even if in secular equilibrium

Page 2 of 2  
R. Bellamy  
28 May 1997

Atoms Ratio

Moles of U-235 = (2.05 E-5 g of U-235) / (235 g/mole) = 8.72 E-8 moles

Moles of U-238 = (7.97 E-3 g of U-238) / (238 g/mole) = 3.35 E-5 moles

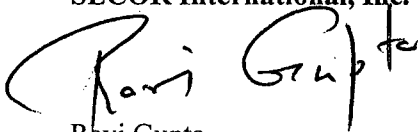
(Atoms of U-235) / (Atoms of U-235 + U-238) =  
(8.72 E-8 moles) / (8.72 E-8 moles + 3.35 E-5 moles) = 0.0026 = 0.26%

The atoms abundance ratio (U-235/Total Uranium) calculated by Oak Ridge for depleted uranium is 0.22%. Since the atoms abundance ratio in ISS-1 is 0.26%, the uranium contamination in ISS-1 can be attributed to depleted uranium.

To confirm the above result and conclusion, a series of 14 samples from the Building K-12 environs were counted and the concentrations of U-235 and U-238 were determined using the gamma spectroscopy system. The activity ratio of U-235-to-U-238 was calculated and the results are provided in Table 1. The U-238 concentration was inferred using the concentration of Pa-234m. The mean activity ratio in these samples is 0.031, with a standard deviation of 0.010; the activity ratio in ISS-1 is 0.017. These ratios are not significantly different, suggesting that the contamination at the site is due to depleted uranium. Therefore, EPEC requests the NRC's approval to use 35 pCi/g as the cleanup criteria at the Fords, New Jersey site.

Please contact myself or Paul Lazaar at (609) 259-6424 regarding our request.

Sincerely,  
**SECOR International, Inc.**



Ravi Gupta  
Principal-In-Charge

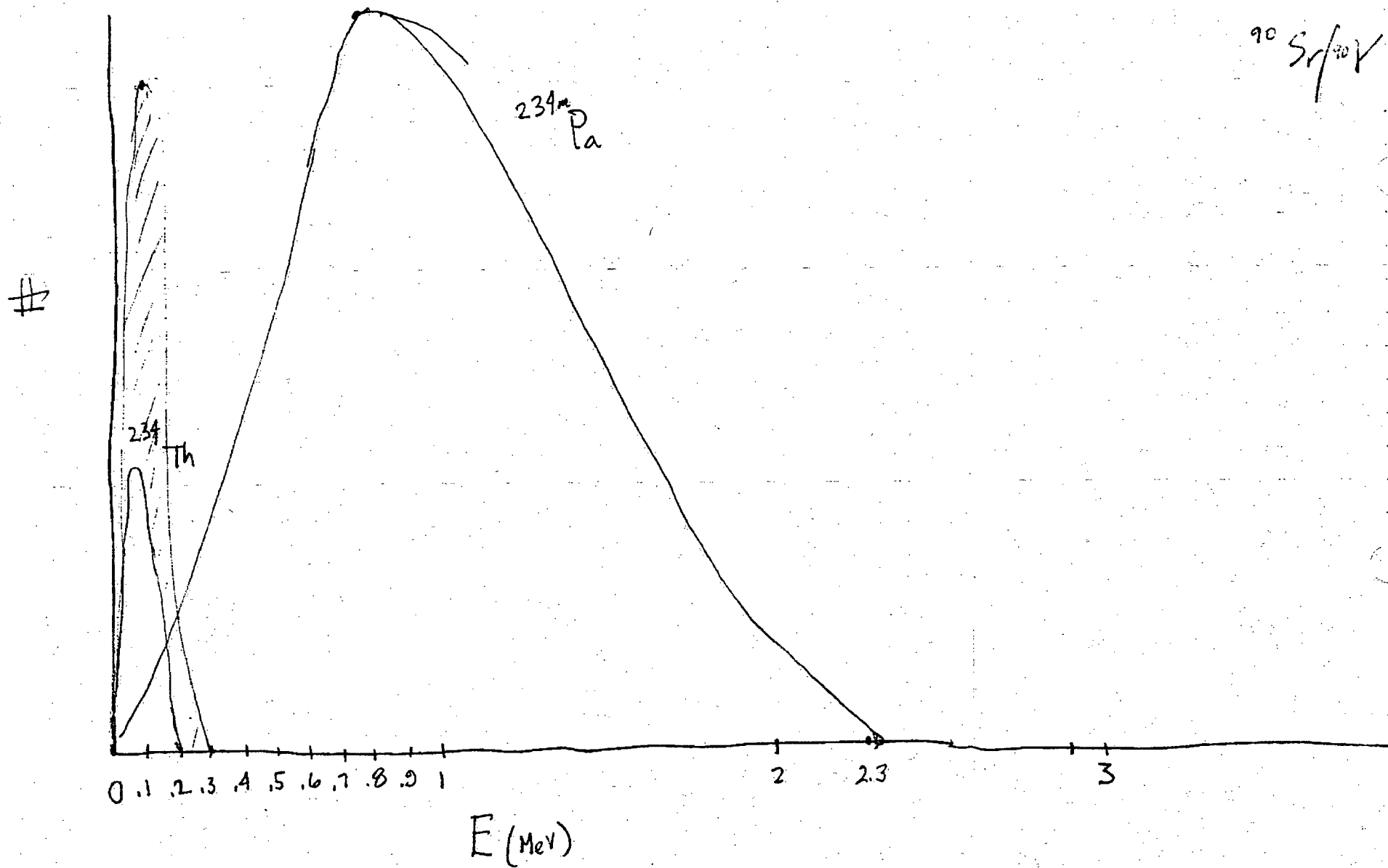
c: Project File  
R. Towe, EPEC  
T. Jackson, USNRC  
J. Wray, USNRC  
P. Lazaar, SECOR

Table 1  
Gamma Spec Sample Log  
Former EPEC Polymers Inc. Facility  
Industrial Avenue  
Fords, Middlesex County, New Jersey

Concentration (pCi/g)			U-235/Pa-234m
Sample ID	U-235	Pa-234m <sup>1</sup>	
DRM1-20B	(2.3 +/- 0.4) E+0	(9 +/- 2) E+1	0.026
DRM1-21A	(1.0 +/- 0.7) E+1	(5.7 +/- 0.3) E+2	0.018
DRM1-22A	(9.0 +/- 0.6) E+0	(3.9 +/- 0.5) E+2	0.023
DRM1-22B	(5.0 +/- 0.3) E+0	(1.5 +/- 0.2) E+2	0.033
DRM1-24B	(1.00 +/- 0.06) E+1	(3.9 +/- 0.5) E+2	0.025
DRM1-25A	(8.6 +/- 0.5) E+0	(3.3 +/- 0.3) E+2	0.026
DRM1-25B	(4.2 +/- 0.3) E+0	(1.5 +/- 0.3) E+2	0.028
DRM1-26A	(4.7 +/- 0.3) E+0	(2.0 +/- 0.3) E+2	0.024
DRUM2-2A	(3.5 +/- 0.3) E-1	(1.3 +/- 0.6) E+1	0.027
DRUM2-2B	(5.7 +/- 0.5) E-1	(1.3 +/- 0.7) E+1	0.044
DRUM2-3A	(8.1 +/- 0.5) E-1	(2.2 +/- 0.6) E+1	0.037
DRUM2-3B	(1.1 +/- 0.9) E+0	(3.2 +/- 1.1) E+1	0.037
DRUM2-4A	(6.7 +/- 0.5) E-1	(1.9 +/- 0.7) E+1	0.035
3-4	(3.9 +/- 0.4) E-1	(8 +/- 6) E+0	0.049

<sup>1</sup> Pa-234m is the isotope used to infer the U-238 concentration.

$^{99}\text{Tc}$   
 $^{90}\text{Sr}/^{90}\text{Y}$



6/5/97

To: Andy Schwartz

From: Jim Johnson

Subject: Detection Limit for Ludlum  
 Model-12 end window GM

Surface Contamination Limit is  $\frac{5000 \text{ dpm}}{100 \text{ cm}^2}$

If GM Efficiency is 10% then

$$\tilde{B} = \frac{5000 \text{ dis}}{\text{min } 100 \text{ cm}^2} \times \frac{2\pi}{\text{dis}} \times \frac{0.10 \text{ c}}{\text{dis}} \times 6.4 \text{ cm}^2 = \frac{115 \text{ c}}{\text{min}}$$

∴ Use 100 cpm as limit for average  
 over 1 m<sup>2</sup>

50 SHEETS  
 100 SHEETS  
 150 SHEETS  
 200 SHEETS



10/14/97

Backscatter factor,  $f_b$   
Aluminum  $\equiv$  Concrete

$$^{234m}\text{Pa} \quad E_{\beta\text{max}} = 2.2 \text{ MeV}$$

1.28

$$^{234}\text{Th} \quad E_{\beta\text{max}} = 0.19 \text{ MeV}$$

1.08

$$\therefore \bar{f}_b = \frac{2.36}{2} = 1.18$$

Recalculation of surface count rate limit

C.Y. Data from 7/11/97 ( $^{90}\text{Sr}-\gamma$ )

$$\frac{3251 \text{ c min}}{\min (2) 7820 d (1.18)} = 17.6\%$$

$$\text{LIMIT} = \frac{5000 \cancel{\text{d}} \left( \frac{2 \beta \text{ dis}}{\cancel{\text{d dis}}} \right) 0.176 \cancel{\text{c}}}{\min} \frac{15.2 \text{ cm}^2}{100 \text{ cm}^2} =$$

$$= \frac{267 \text{ c}}{\min}$$

if averaged over  $1 \text{ m}^2$ 

$$\frac{800 \text{ c}}{\min}$$

for any "hot spot"

50 SHEETS  
22-141  
100 SHEETS  
22-142  
200 SHEETS  
22-144

①

10 | 13 | 97

 $^{90}\text{Sr} - ^{90}\text{Y}$  source

$$6.02 \times 10^3 \text{ pG} @ 6 | 24 | 75 \rightarrow 10 | 13 | 97$$

$$\begin{array}{r} 97 \\ 75 \\ \hline \end{array}$$

$$22 \text{ years} + 6 \text{ J}$$

$$31 \text{ J}$$

$$31 \text{ A}$$

$$30 \text{ S}$$

$$130$$

$$111 \text{ days} = 0.304 \text{ y}$$

$$e^{-\frac{693 (22.304)}{27.74}} \text{ y}$$

$$= 0.572$$

$$\boxed{e^{-\frac{693 (22.304)}{28.1}} = 0.577}$$

$$6.02 \times 10^3 \text{ pG} \times 0.572 = 3.44 \times 10^3 \text{ pG}$$

$$= 7.644 \times 10^3 \frac{\text{d}}{\text{min}}$$

 $^{90}\text{Y}$ 

$$E_{\beta \text{ max}} = 2.27 \text{ MeV}$$

$$\bar{E}_{\beta} = 0.93 \text{ MeV}$$

 $^{90}\text{Sr}$ 

$$\bar{E}_{\beta \text{ max}} = 0.546 \text{ MeV}$$

$$\bar{E}_{\beta} = 0.182 \text{ MeV}$$

$$\text{BKG} = 40 \text{ cpm}$$

$$E = 1000 - 40 = \frac{960 \text{ cpm}}{7644 \text{ dpm}} = 0.126 \frac{\text{c}}{\text{dis}}$$

 22-141 50 SHEETS  
 22-142 100 SHEETS  
 22-144 200 SHEETS




(2)

$$f_b \text{ for Al @ } 2.27 \text{ MeV} = 1.29$$

$$\therefore \text{ including back scatter } S(2\pi) = 7644 \frac{\text{d}}{\text{m}} \times 1.29$$

$$= 9861 \text{ dpm}$$

$$E_{\text{eff}} = \frac{960 \text{ cm}}{9861 \text{ dpm}} = 0.097$$

$$= \underline{\underline{9.7\%}} \text{ for } ^{90}\text{Y}$$

$$1\% \text{ include } ^{90}\text{Sr} / = / \underline{\underline{19.4\% / p}}$$

44-Z  
Model 12if include  $^{90}\text{Sr}$ 

$$\frac{^{90}\text{Sr}}{^{43}\text{Ca}} = \frac{1,400 \text{ cpm}}{66,100 \text{ dpm}} = \underline{\underline{2.1\%}}$$

including back scatter

$$f_b \text{ stainless} = 1.2$$

$$\bar{E}_{\beta \text{ max}} = 0.292$$

$$\bar{E}_\beta = 0.097$$

$$E_{\text{eff}} = \frac{1400 \text{ cpm}}{(66,100)(1.2)} = \underline{\underline{1.8\%}}$$

44-Z  
Model 1222-141 50 SHEETS  
22-142 100 SHEETS  
22-144 200 SHEETS

(3)

SECOR 44-40

<sup>90</sup>Sr

$$E_{ff} = \frac{5682 c}{(2)_{min} \left( \frac{7,710 d}{m} \right) (1.29)} = 28.4\%$$

not including backscatter = (36.8%)

should be 44%

BKG	=	$\frac{410 c}{10}$	$\frac{44-40}{408 c}$
			$\frac{10}{10}$

<sup>99</sup>Tc

$$\frac{9558 c_{\text{mg}}}{66,100 d_{\text{mg}}} = 15.1\%$$

with backscatter 12.6%

Endium 38%

22-141 50 SHEETS  
22-142 100 SHEETS  
22-144 200 SHEETS

10/13/97

(4)

SECOR Ludlum Model 44-9

$$^{90}\text{Sr} \ 6.02 \times 10^3 \text{ pCi} \times \frac{2.22 \text{ d}}{m - \text{pCi}} \ 0.577 =$$

$$= 7,710 \frac{\text{d}}{m}$$

Tc

$$E_{\text{eff}} = \frac{10,156}{66,100 (1.2)} = 12.8\%$$

(on support)

Should be 38%

$$4\pi = \frac{1}{2} 2\pi$$

15.4 ~~100~~% = no backscat $^{90}\text{Sr}$ 

$$E_{\text{eff}} = \frac{5,879}{(2)_m \frac{7,710 \text{ d}}{m} (1.29)} \frac{c}{m} = \underline{\underline{29.5\%}}$$

(Should be 45%)

 $^{90}\text{Sr} - ^{90}\text{Y}$ 

$$E_{\text{eff}} = \frac{5879}{(2)_m (2) \left( \frac{7,710 \text{ d}}{m} \right) / 1.29} = \underline{\underline{14.75\%}}$$

50 SHEETS  
22-141 100 SHEETS  
22-142 200 SHEETS  
22-144

t-It Fax Note

7671

Date 5/27/97 # of pages 1

TIM KOTTAN

From Syd Porter

Dept NRC

Co. PCI

no #

Phone # 896-5353

# 337-5269

Fax # 896-5353

**from The Trenches**

with David Wyatt

from: Ludlum Newsletter

Dec 1994

Notes: This is part 1 of a 3 part series covering MDA time constants. Part 1 addresses linear ratemeters controlled by conventional resistor-capacitor (RC) integration components. Part 2 encompasses logarithmic ratemeters. Part 3 addresses microprocessor controlled ratemeters.

## DETERMINING LINEAR ANALOG RATEMETER TIME CONSTANTS FOR MDA EQUATIONS

The following information applies to the Minimum Detectable Activity (MDA) equation (95% confidence) for linear analog ratemeter instruments - portable friskers, hand-held contamination monitors, etc.

$$\text{MDA (dpm/100 cm}^2\text{)} = \frac{4.65 \sqrt{R_B / (2T)}}{E \cdot (A/100)}$$

where  $R_B$  = background rate (cpm),  $T$  = counter time constant (minutes),  $E$  = counter efficiency (counts/disintegration) and  $A$  is the probe area ( $\text{cm}^2$ )<sup>1</sup>

### DEFINITIONS

**\*response time:** the time interval required for the instrument reading to change from 10% to 90% of the final reading (or vice versa) following a step change in the radiation field (i.e., signal) at the detector.<sup>2</sup>

\*Note: All LMI specified response times are measured by injecting a fixed pulse rate from a pulse generator.

**time constant:** the time involved in the charging or discharging of an inductor or capacitor. One time constant is the length of time required to reach 63 percent of the full charge or discharge.

The specification related to time constant in the counter instruction manual is specified as **response time** - 10% to 90% of final reading. There are 2 methods of calculating the required "counter time constant" for the MDA equation as shown below in Method A and Method B.

#### Method A

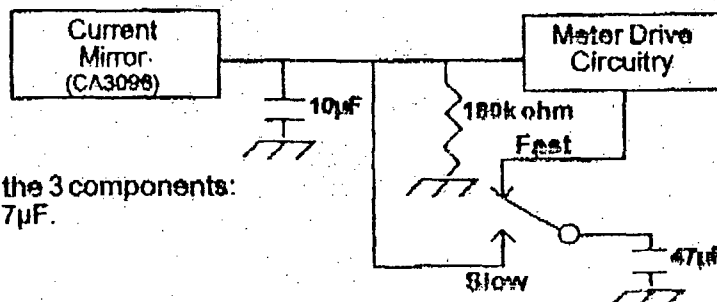
An approximate "rule of thumb" conversion from the specified response time to the required time constant is to multiply the response time data by 0.44.

**Example:** The Slow response position on a Ludlum Model 3 is specified at 22 seconds.  
 $22 \times 0.44 \sim$  time constant of 9.7 seconds = 0.16 minutes for  $T$ .

#### Method B

The integration RC time constant can be calculated by multiplying  $R \times C$ . There are 3 components associated with this calculation.

**Example:** The illustration shows the 3 components:  
 $10\mu\text{F}$ ,  $180\text{k ohm}$ , and  $47\mu\text{F}$ .



In the Fast response position the RC time constant is  $10\mu\text{F} (10 \times 10^{-6}) \times 180,000 \text{ ohms} = 1.8$  seconds or 0.03 minutes for  $T$ . For the Slow position, the  $47\mu\text{F}$  parallels with the  $10\mu\text{F} = 57\mu\text{F}$  ( $57 \times 10^{-6}$ )  $\times 180,000 \text{ ohms} = 10.3$  seconds or 0.17 minutes for  $T$ .

Locate the integration RC components by tracing the Fast/Slow response switch or current mirror to the components or by referring to the circuit "Theory of Operation" in the Instruction Manual.

#### References:

<sup>1</sup>Gollnick, D. A.; *Basic Radiation Protection Technology*, 3rd Edition. Altadena, CA: Pacific Radiation Corporation; April, 1984.

<sup>2</sup>American National Standard Performance Specifications for Health Physics Instrumentation - *Portable Instrumentation for Use in Normal Environmental Conditions*. New York: Institute of Electrical and Electronic Engineers; ANSI N42.17A-1989.