



West Virginia University

Radiation Safety Department

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137512

NUCLEAR MATERIALS-001

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**Clarifications in responses #2 & #3:**

2) *The calculation of values in Table 8 was determined using the following formula:*

$$P(n \geq 1) = 1 - e^{-\frac{GEd}{60v}}$$

*Where the values used are shown in the table as follows:*

| G   | E    | D | v   | P(n>1) |
|-----|------|---|-----|--------|
| 250 | 0.12 | 7 | 1.5 | 0.903  |

*The changes in parameter values were made to correct for the probe used, i.e. the Ludlum 43-90 detector. Since this probe covers 100 cm<sup>2</sup>, G is the DCGL, or 250. A smaller probe would use only the covered fraction of the DCGL. D is 7 cm, since the 43-90 detector has an active area width of 7 cm. (measured). "v" is the detector speed necessary to achieve the desired level of confidence (> 90%).*

*Considering the number of questions and changes in this report, and the NRC's concerns about the actual conduct of this survey, we believed it was prudent to conduct a confirmatory survey to insure that the final reported data actually represents the final status of the survey area. Such a survey was conducted on January 12, 2006. The confirmatory effort consisted of a scanning survey, using the Ludlum 43-90 detector operating at the required speed shown above, covering 100% for the floor surfaces, and a static measurements survey at the locations shown in the attachment. The results of this survey confirmed that the radiological status of the facility is that which was reported in the initial report.*

3) There was an issue with replicating the results. It is believed that there was an error in the probe surface area when using the Radical software. Since this could not be confirmed with the original surveyor a confirmatory survey was performed.

Since the confirmatory survey provides more current data, we will use it for demonstration purposes. The data was collected using a Ludlum model 43-90 alpha scintillation detector, which has the following operational parameters:

|                           |                     |
|---------------------------|---------------------|
| Instrument                | Ludlum model 12     |
| Detector                  | Ludlum model 43-90  |
| Detector area (open)      | 100 cm <sup>2</sup> |
| Detector Efficiency (4Pi) | 12%                 |
| Background count rate     | 2 cpm               |
| Background count time     | 1 min               |
| Sample count time         | 1 min               |

The results in dpm/100 cm<sup>2</sup>, which using this detector are also dpm/detector, are calculated using the following:

$$\text{dpm}/100\text{cm}^2 = \frac{\text{net cpm}}{\text{efficiency}}$$

As an example, in the survey document, Grid area (C,2) shows 14 gross cpm. This would produce,

$$\frac{14-2}{.12} = 100 \text{ dpm}/100\text{cm}^2$$

As shown in the results column.

Note that the minimum detectable activity (MDA) used in the survey is calculated as follows:

$$\text{MDA}(\text{dpm}) = \frac{4.65 \sqrt{R_b/T_b} + 3}{T_b \cdot \text{Efficiency}}$$

Which in this case, would be 79.8 dpm/100cm<sup>2</sup>.