

131628
37-15765-02NJ-DEP Final Request/TCNJ Response 6-27-02

RAS needs the following documentation before they can recommend that the license amendment be issued:

1. Reports of the surface scans in each room, including the MDCscan. The detector must be able to detect 5000 dpm/100cm² for Co-57 and Na-22. (The 6/24/02 response to comment 4 seems to imply that the uR meter was used to survey surfaces in the rooms. Page 13 of the June 2002 "Final Report" states that "gamma uR-survey meter scanning surveys were done at a waist high level within each area." This is not adequate for a surface scan. A good surveyor may see a fluctuation of 1 uR/hr but how does he/she determine if the measurement is 2.8 uR/hr over background when background is "in the 10-18 uR/hr realm," as stated on page 13 of the Final Report or 10-15 uR/hr as stated on page 15 of the Final Report? In addition, the calculation of 5000 dpm/100 cm² limit in terms of uR/hr does not take into consideration the size of the detector or the scan rate. "Would indicate a level" is not an acceptable submittal. The conversion factor of 175 cpm/uR/hr is found in Ludlum documentation and is for Cs-137 and not for Co-57 or Na-22. The MDCR calculation on page 6-19 of NUREG-1507 is for cpm and not dpm/100cm². Are you referring to equation 6-13 in NUREG-1507? If the uR meter will be the surface scanning instrument, the MDCscan calculations are to be submitted, including all input parameters. RAS agrees with MARSSIM (p.6-42) that the surveyor efficiency of 0.5 is recommended and not 0.75. Which uR meters were used? Survey data sheets state that model 3 serial #34929 for the October 2000 surveys and Model 19 serial #37450 for the 2002 surveys. Are these Ludlum instruments? Should the Model 3 be changed to a model 19? If indeed, a GM was used for the scanning surveys as stated on page 13 of the Final Survey, a MDCscan calculation must be submitted as requested in comment 8 of the June 19, 2002 RAS comments. An α error of 0.05 in the d' calculation is acceptable.)

As a resolution to issues involving the GM-pancake probe scanning measurements, a NaI surface scan was performed on 6-26-02 of Crowell Hall locations where NJDEP licensed material was used in the past. These locations included the survey units of: Room 5, Crowell Hall Annex and Room 203. Additionally, measurements were made in Room 111 to establish a reference area for floor and wall data. Each survey unit used the default value of 30 locations as suggested by the RAS. Each of the thirty locations in each survey unit was measured for an integrated count time of one minute on contact with the surface of the floor and wall. Field calibration checks were done using a one-inch Na-22 button source to verify operability and accuracy of the instrument during the survey program. The survey forms and data have been added to Rev. 1 of the report in Appendix A and are surveys #00-19 through 00-27.

The report has been revised to reflect the NaI measurements and the Scan MDC for these measurements in Section 3.4, "Minimum Detectable Concentrations." The revised report is attached with this response.

The scoping surveys (Appendix A, Surveys 00-01 through 00-11 of the TCNJ D&D Final Report, Rev, 1) for Crowell Hall utilized three Ludlum Instruments: Model 19 μ R-meter, Model 3 with a pancake probe and a Model 3 with a beta scintillator probe.

2. Since no static measurement data have been submitted, the rooms need to be resurveyed with the following provided:

The rooms have been resurveyed and NaI static measurement survey data have been added to the report. Refer to #1 above.

a. Description and justification for the number of survey units proposed. Several rooms may be grouped into one survey unit if justification is provided and accepted.

Room 5 is the former Radioactive Waste Storage Area where concrete was removed from the floor as part of the decontamination goal of achieving background measurements in the room.

The next survey unit, Room 203, was a research lab used for radiobiology teaching and research in the past. Scoping surveys indicated no measurements above background in this area.

Finally, Crowell Hall Annex, which has adjoining suites of similar building materials, was used for the preparation of samples, teaching and research and source storage. Scoping surveys indicated some equipment and items with fixed and/or removable measurable activity above background. These items were disposed as radwaste, e.g, a drawer in a cabinet, sink traps, a can opener, licensed material in storage containers. After the removal of these items and the licensed material, the area was at background levels.

b. Calculation of the number of data points for each survey unit (see MARSSIM page 5-31), including the input parameters. If there was not a sufficient characterization survey to obtain the standard deviation of the data, the default calculation of 30 measurements found in Appendix B (MARSSIM page B-2) may be used.

A default of 30 measurements was used.

c. Calculation of the MDC for the instrument used for the static measurement in each survey unit. Input parameters, instrument used, and calculations are to be included. The sample calculation on MARSSIM page 6-36 may be of help.

The report has been revised to reflect the NaI measurements and the Scan MDC for these measurements in Section 3.4, "Minimum Detectable Concentrations." The revision is:

From MARSSIM (p. 6-37): $MDC = C \times (3 + 4.65\sqrt{B})$

where:

B = ~657 counts/min;

For Ba-133:

$$C = (8.17 \text{ dpm/count})(\text{Bq}/60 \text{ dpm})(1/20.3 \text{ cm}^2 \text{ probe area})(10,000 \text{ cm}^2/\text{m}^2) = 67.2 \text{ Bq/m}^2\text{counts}$$

$$\text{MDC} = 67.2 \times (3 + 4.65\sqrt{657}) = 8198 \text{ Bq/m}^2 \text{ (~4919 dpm}/100 \text{ cm}^2)$$

For Na-22:

$$C = (4.93 \text{ dpm/count})(\text{Bq}/60 \text{ dpm})(1/20.3 \text{ cm}^2 \text{ probe area})(10,000 \text{ cm}^2/\text{m}^2) = 40.5 \text{ Bq/m}^2\text{counts}$$

$$\text{MDC} = 40.5 \times (3 + 4.65\sqrt{657}) = 4939 \text{ Bq/m}^2 \text{ (~2963 dpm}/100 \text{ cm}^2)$$

Since Co-57 efficiencies are generally higher than either Ba-133 or Na-22, Co-57 MDC may be extrapolated to meet the 5,000 dpm/100 cm² requirement.

d. Static measurement data, including survey sheets with locations, instruments used, calibration date, and duration of measurements, and results tabulated or on the survey sheets in dpm/100cm². Locations may be biased to areas that may have been contaminated. If results are above 5000 dpm/100cm², grid patterns may be needed along with sign test procedures found on MARSSIM page 8-12.

The NaI scan survey forms and data have been added to Rev. 1 of the report in Appendix A and are surveys #00-19 through 00-27.

All survey forms have been revised to include calibration date, instrument s used and manufacturer and nature of survey, i.e., scoping or final survey. Surveys 00-01 through 00-11 are scoping surveys and 00-12 through 00-27 are final surveys. Count times listed in comments, e.g., NaI scans-integrated for one minute and are one-second scans for G-M measurements.

No net dpm/100cm² were measured. Measurements are reported in gross counts per minute (cpm). No areas above 5000 dpm/100cm² were measured.

Please call me at 609-984-5542 or Jenny at 609-984-5498 with any questions.

c: Manager Gardner, BER