SECTION 12

INSTRUMENTATION AND EQUIPMENT

12.1 CALIBRATION AND OPERATIONAL CHECKS. Each survey meter will be calibrated with a radioisotope traceable to NIST which has an energy close to the energy of the radioactive material to be surveyed. If this condition cannot be achieved, an instrument response as a function of energy must be obtained so a correction factor can be applied, if necessary.

12.2 An *efficiency* factor will be developed for alpha and beta instruments to correlate the meter reading to the actual radioactivity traceable to NIST. All NIST traceable sources should be decay corrected at time of efficiency determinations.

$$efficiency = \frac{(cpm - Bkg)}{dpm}$$

(A) A conversion factor will be applied to extrapolate from the probe surface area to a normalized 100 cm^2 surface area.

$$\frac{\text{Active Probe Area}}{100\ cm^2}$$

(B) The efficiency value of the instrument coupled with the conversion factor will record the final reading into standardized regulatory criteria expressed in dpm/100 cm^2.

12.3 The sensitivity, i.e., minimum detectable activity (MDA) will be established for each type of instrument and documented. For the purpose of this SP the MDA and the LLD are used interchangeably. A comparison of MDA with regulatory limits will be made to ensure that the MDA is at most 75% of the guideline or regulatory limits. See NUREG/CR-5849 for equations to calculate the MDA values.

12.4 All portable survey meters will be calibrated at least quarterly and labelled properly to include the date of the last calibration.

12.5 All portable survey meters will be checked for operability prior to packaging and shipping to the survey site. The operability check will include a review of the calibration data sheet and an operability verification (calculate the

efficiencies) using a check source. Correlate instruments of similar type to read the same background on the lowest scale.

12.5.1 The Calibration Data Sheet should, at a minimum, be reviewed to ensure the instruments will be calibrated for the entire survey.

12.5.2 A minimum of five background radiation readings will be recorded and averaged over a 2 minute period. All instruments of similar type should read approximately the same baseline background. If not, check the instrument to make sure it is working properly. Should there be any question of it malfunctioning, do not use and acquire another instrument.

12.5.3 The efficiencies of the instruments will be determined in accordance with paragraph 12.2. The average background radiation reading will be subtracted from the reading with the check source. The net check source reading will be recorded on the data collection form along with all other pertinent information for each instrument. The check source(s) will then be shipped along with the instrument(s) and data collection sheet for use at the survey site.

12.6 An operational check of the type in subsection 12.5 above, to include background radiation readings, will be performed and recorded after shipment to the TDY station and prior to entering the survey site. Operational checks will be made at least three times daily (at the beginning, half-way through the day, and at the end of the day) and recorded on the data collection sheet.

12.7 Portable Instrumentation Preparation. It is important to compare the Instruments LLD and/or MDA with the release limits of interest.

12.7.1 An alpha instrumentation survey will be performed with an Eberline Model PAC-1SA survey meter mated with an alpha scintillation detector (or equivalent).

12.7.2 A beta-gamma instrumentation survey will normally be performed with an Eberline Model E-520 survey meter (or equivalent) mated with a 30 mg/cm^2 window GM detector (or equivalent). In some situations, a tissue equivalent 7 mg/cm^2 window GM detector is more appropriate. For those radioisotopes which emit low energy beta radiation, such as tritium, carbon or

DU, a Berthold Model LB 1210B survey meter (or equivalent) mated with a windowless gas flow detector (or equivalent) is required for optimum detection efficiency.

12.7.3 A gamma instrumentation survey will be performed with a μR/hr survey meter such as a Victoreen Model 190 survey meter (or equivalent) mated with a Victoreen Model 489-120, 2 inch by 2 inch NaI scintillation detector (or equivalent) for radioisotopes with gamma radiation energies greater than 0.1 million electron volts (MeV).

12.7.4 For gamma energies less than 0.1 MeV, the survey meter should be mated to a low energy gamma detector such as Victoreen Models LEG, PG-1 or PG-2 thin NaI scintillation detector (or equivalent). This type of detector has a sensitivity about 12 times below the regulatory limit of 5 μR/hr and meets the recommended criteria of being no more than 75% of the guideline or regulatory limit.