

APPENDIX K

RADIATION SURVEY PROGRAM

General Information

Radioactive Material Licensees are required to make radiation surveys of potential radiological hazards in the workplace. Paragraph RH-8408 establishes the requirements for ambient radiation dose rate and contamination surveys. It also specifies that the Licensee shall establish “action levels” and requirements for notification of the Radiation Safety Officer if the survey results exceed the action levels.

There are many different kinds of surveys that must be performed by the licensee, including:

- Contamination (Fixed and Removable)
- Water Effluent
- Air Effluent
- Leak Test of Sealed Sources
- Bioassays
- Air Samples
- Area Surveys (Restricted Areas and Unrestricted Areas)
- Personnel (during use, transfer, or disposal of radioactive material)

Radiological surveys are required when it is reasonable under the circumstances to evaluate a radiological hazard and when it is necessary for the licensee to comply with the appropriate regulations. The most important types of surveys are as follows:

- Surveys for radioactive contamination that could be present on surfaces of floors, walls, laboratory furniture, and equipment,
- Measurements of radioactive material concentrations in air for areas where radiopharmaceuticals are handled or processed in unsealed form and where operations could expose workers to the inhalation of radioactive material (e.g., radioiodine) or where radioactive material is or could be released to unrestricted areas,
- Bioassays to determine the kinds, quantities, or concentrations, and in some cases, the location of radioactive material in the human body. Radioiodine uptake in a worker’s thyroid gland is commonly measured by external counting using a specialized thyroid detection probe,

- Surveys of external radiation exposure levels in both restricted and unrestricted areas, and,
- Surveys of radiopharmaceutical packages entering (e.g., from suppliers) and departing (e.g., returned radiopharmaceuticals to the supplier).

The frequency of routine surveys depends on the nature, quantity, and use of radioactive materials, as well as the specific protective facilities, equipment, and procedures that are designed to protect workers and the public from external and internal exposure. Also, the frequency of the survey depends on the type of survey. Later in this Appendix, the Section, **Additional Guidance**, contains model procedures that represent one acceptable method of establishing survey frequencies for ambient radiation level and contamination surveys.

For example, licensees are required to perform daily surveys in all areas used for the preparation and administration of radiopharmaceuticals. Licensees must perform surveys after the patient's release. Licensees must perform surveys prior to the release of the room for unrestricted use. Licensees must be cognizant of the requirement to perform surveys to demonstrate the public dose limits are not exceeded.

In addition, licensees must also perform the following surveys:

- Immediately following implantation or administration, areas of public access in and around the patient's room (in order to demonstrate compliance with public dose limits),
- The therapy patient's bed linens before removing them from the patient's room,
- All trash exiting the patient's room.

Because therapy sealed sources (including applicators and catheters) may become dislodged during implantation or after surgery, and inadvertently lost or removed, the following surveys shall be performed:

- Immediately after implanting sources in a patient or a human research subject, the licensee shall make a survey to locate and account for all sources that have not been implanted,
- The operating room and the patient's room after source implantation,
- Immediately after removing the last temporary implant source from a patient or human research subject, the licensee shall make a survey of the patient or human research subject with a radiation detection survey instrument to confirm that all sources have been removed.

Additional Guidance

This model provides acceptable procedures for performing area radiation surveys. Applicants may either adopt these model procedures or develop alternative procedures to meet the requirements of RH-1004, RH-1300, and RH-8408. Guidance for developing alternate trigger levels for contamination in restricted areas is also included.

Ambient Radiation Level Surveys

Procedures for ambient radiation level surveys (reference RH-1004, RH-1300, and RH-8408):

- Perform surveys of dose rates in locations where:
 - Workers are exposed to radiation levels that might result in radiation doses in excess of 10% of the occupational dose limits; or
 - An individual is working in an environment with a dose rate of 2.5 mrem/hour or more (5 rem/year divided by 2,000 hour/year).
- Paragraph RH-1208 requires that the TEDE to an individual member of the public from the licensed operation does not exceed 0.1 rem (1 mSv) in a year, and that the dose in any unrestricted area from external sources does not exceed 0.002 rem (0.02 mSv) in any one hour. Appropriate surveys will be conducted to assure that the requirements of RH-1208 are met.

Perform radiation level surveys with a survey meter sufficiently sensitive to detect 0.1 millirem (mrem) per hour in the following areas, at the frequency specified:

- Survey at the end of each day of use all radiopharmaceutical elution, preparation, assay and administration areas.
- Survey monthly all laboratory areas where only small quantities of gamma-emitting radioactive material are used (< 200 μ Ci at a time).
- Survey weekly all radionuclide use, storage, and waste storage areas. If diagnostic administrations are occasionally made in patients' rooms (e.g., bone scan injections, Tc-99m heart agents) and special care is taken to remove all work materials, those rooms need not be surveyed.
- Survey quarterly all sealed source and brachytherapy source storage areas.
- If trigger levels are exceeded, follow internal procedures for responding and investigating what caused the trigger to be tripped. Example trigger levels for restricted and unrestricted areas are presented in Table K-1.

Table K-1 Ambient Dose Rate Trigger Levels		
Type of Survey	Area Surveyed	Trigger Level
Ambient Dose Rate	Unrestricted	2 x Background Radiation Level
Ambient Dose Rate	Restricted	2.0 mR/hr

Contamination Surveys

Facilities and equipment for contamination surveys:

To ensure achieving the required sensitivity of measurements, analyze survey samples in a low-background area. Table F-1 entitled “Stationary Instruments Used to Measure Wipe, Bioassay, and Effluent Samples” in Appendix F provides examples of appropriate instruments.

Perform contamination surveys using instruments suitable for removable and fixed contamination to identify areas of contamination that might result in doses to workers or to the public. Removable contamination can be detected and measured by conducting a wipe test of the surface, counted in an appropriate counting instrument, such as a liquid scintillation counter, a sodium iodide or germanium gamma counter, or a proportional alpha/beta counter.

Procedures for contamination surveys:

- Contamination surveys are performed in areas where unsealed forms of materials are used:
 - To evaluate radioactive contamination that could be present on surfaces of floors, walls, laboratory furniture, and equipment;
 - After any spill or contamination event;
 - When procedures or processes have changed;
 - To evaluate contamination of users and the immediate work area, at the end of the day, when licensed material is used;
 - In unrestricted areas at frequencies consistent with the types and quantities of materials in use, but not less frequently than monthly;
 - In areas adjacent to restricted areas and in all areas through which licensed materials are transferred and temporarily stored before shipment.
- Use methods for conducting surveys for removable contamination that are sufficiently sensitive to detect contamination at the levels listed in Tables K-2 for restricted areas and K-3 for unrestricted areas. Removable contamination survey samples should be measured in a low-background area.

- The following areas and frequencies should be followed:
 - Removable contamination surveys weekly for radiopharmaceutical elution, preparation, assay, and administration areas. If diagnostic administrations are occasionally made in patients' rooms (i.e., bone scan injections, Tc-99m heart agents, etc.), with special care taken to remove all work materials, those rooms need not be surveyed.
 - Removable contamination surveys monthly of laboratory areas where only small quantities of photon-emitting radioactive material are used (<200 microcuries at a time).
 - Removable contamination surveys weekly for radionuclide storage and radionuclide waste storage areas.
 - A radioactive source with a known amount of activity should be used to convert sample measurements (usually in cpm) to dpm.
- The area should be decontaminated, shielded, or posted and restricted from use if it cannot be decontaminated.
- If trigger levels are exceeded, follow internal procedures for responding and investigating what caused the trigger to be tripped. Example trigger levels are presented in Table K-2 and Table K-3. Contamination found in unrestricted areas and on personal clothing will be immediately decontaminated to background levels.

Table K-2 Surface Contamination Levels in <u>Restricted Areas</u> (dpm/100 cm²)	
Location/Item	Any Radionuclide
Restricted Areas Or Item	2200

Table K-3 Surface Contamination Levels in <u>Unrestricted Areas</u> (dpm/100 cm²)	
Radionuclide	Maximum Removable
Any	220

NOTES FOR CONTAMINATION LEVEL SURVEYS FOR TABLE K-3

1. As used in this table, dpm means the rate of emission by radioactive material, as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.
2. The contamination level applies to an area of not more than 100 cm².
3. The amount of removable radioactive material per 100 cm² of surface area should be determined by wiping that area with filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.
4. The average and maximum radiation levels associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 millirad/hour at 1 centimeter and 1.0 millirad/hour at 1 centimeter, respectively, measured through not more than 7 milligrams per square centimeter of total absorber.

Establishing Alternate Trigger Levels for Restricted Areas

The following guidance is provided for those applicants who plan to develop procedures for surveying and controlling contamination using action levels for controlling contamination that differ from those provided in Tables K-1 and K-2:

Alternate action levels for cleanup of contamination restricted areas may be developed without prior Department approval if

- acceptable unrestricted area trigger levels are implemented (e.g., Tables K-1 and K-3);
- the action levels maintain occupation doses ALARA;
- the action levels meet all other regulatory requirements (e.g., they should also be designed to minimize, to the extent practicable, contamination of the facility, and the environment; facilitate eventual decommissioning; and minimize, to the extent practicable, the generation of radioactive waste).

Contents of Survey Records

- A diagram of the area surveyed;
- A list of items and equipment surveyed;
- Specific locations on the survey diagram where wipe tests were taken;
- Ambient radiation levels with appropriate units;
- Contamination levels with appropriate units;
- Make and model number of instruments used;
- Calibration dates of instruments used;
- Background levels;
- Name of the person making the evaluation and recording the results and date.

Record contamination levels observed and procedures followed for incidents involving contamination of individuals. Include names of individuals involved, description of work activities, calculated dose, probable causes (including root causes), steps taken to reduce future incidents of contamination, times and dates, and the surveyor's signature.