

Employee Training

Radioactive Spills

Before using radioactive licensed material, the licensee must develop, document, and implement a radiation protection program (10 CFR 20.1101) <http://www.nrc.gov/reading-rm/doc-collections/cfr/part020/full-text.html#part020-1101> that includes proper response to spills of licensed material. Licensed material now includes accelerator produced radionuclides and RA-226.

The spill procedure developed must include provisions for responding to spills or other contamination events in order to prevent the spread of radioactive material.

Spill procedures should address all types and forms of licensed material used and should be posted in restricted areas where licensed material are used or stored.

Instructions should specifically state the names and telephone numbers of persons to be notified (e.g., RSO, staff, state and local authorities, and NRC, when applicable). Additionally, the instructions should contain procedures for evacuation of the area, containment of the spills and other releases, appropriate methods for reentering, and for decontaminating facilities (when necessary).

The provisions for responding to spills and other contamination events must cover any unique properties of accelerator-produced radionuclides or discrete sources of Ra-226 that the applicant possesses. These radioactive materials are now included in the definition of byproduct material as a result of the 2005 EAct. When producing PET radioactive drugs, the procedures should also address spills or loss of control of curie quantities of material.

Therefore, the following statement should be provided in the initial or renewal license application: *"We have developed and will implement and maintain written procedures for safe response to spills of licensed material in accordance with 10 CFR 20.1101."*

MINIMIZATION OF CONTAMINATION (10 CFR 20.1406) <http://www.nrc.gov/reading-rm/doc-collections/cfr/part020/full-text.html#part020-1406>

This regulation is intended to minimize the potential impact and costs associated with decommissioning activities, beginning with the application process for new licenses. Consideration should be made to:

- Implementing and adhering to good health physics practices in operations
- Minimizing areas, to the extent practical, where licensed materials are used and stored
- Establishing a frequency and scope of surveys that will identify and minimize the spread of contamination
- Choosing short half-life isotopes for use and considering the chemical composition, whenever practical
- Ensuring filtration of effluent streams
- Using non-porous materials in radioactive material use and storage areas
- Employing ventilation stacks and ductwork with minimal lengths and minimal abrupt changes in direction
- Using appropriate plumbing materials with minimal pipe lengths and traps
- Minimizing the number of sites (sinks and drains) where liquid waste is disposed

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SPILL

KITS

<http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1556/v9/r1/sr1556v9r1.pdf>

[collections/nuregs/staff/sr1556/v9/r1/sr1556v9r1.pdf](http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1556/v9/r1/sr1556v9r1.pdf)

An assembled spill kit used for decontamination should be accessible to all areas where radioactive material is used and stored. MPC suggests in its Radiation Protection Manual Template that the following materials be contained in the kit.

- Disposable gloves for the cleaning of the spill. Be sure to have plenty on hand so you can change them frequently to prevent the spread of contamination.
- Disposable shoe coverings and gowns. The gowns are for the patient, in case of clothing contamination. The shoe coverings are for anyone who must enter the area before complete decontamination. They may also be used for the patient walking the treadmill, if decontamination is not possible and readings at waist level are background.
- Absorbent paper and cleaning solution. These are for the decontamination process.
- Tape, to tape down material covering the spill, or to tape a “Do Not Enter” sign on the door.
- Plastic bag to put contaminated absorbent paper, used gloves and shoe coverings into for storage.
- Radioactive Material labeled tape for areas still contaminated.
- Marking pen to recording spill information and making signs.
- Wipes and survey meter to locate the spill and the amount of the spill. and to show progression of decontamination of the spill, with follow-up surveys and wipes.
- Spill Report from MPC binder (see attached).
- Copy of Emergency Spill Procedures, which should be posted in all areas of use and storage.

DETERMINING A MAJOR FROM A MINOR SPILL <http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1556/v9/r1/sr1556v9r1.pdf>

Use the following table to distinguish a major spill from a minor spill.

Radionuclide	Millicurie	Radionuclide	Millicurie
P-32	1	Tc-99m	100
Cr-51	100	In-111	10
Co-57	10	I-123	10
F-18	50	I-125	1
Y-90	1	I-131	1
Co-60	1	Sm-153	10
Ga-67	10	Tl-201	100
Sr-89	1		

Activities less than (in mCi) values listed above = Minor spill

Activities greater than (in mCi) values listed above = Major spill

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The decision to implement a major spill/contamination procedure instead of a minor spill/contamination procedure depends on how many incident-specific variables, such as the number of individuals affected, other hazards present, likelihood of contamination spread, types of surfaces contaminated, and radiotoxicity of the spilled material.

For some spills of radionuclides with half-lives shorter than 24 hours and in amounts less than five times the lowest amount listed on the table, an alternative spill/contamination procedure may be to restrict access pending complete decay.

MINOR SPILLS OF LIQUIDS AND SOLIDS (1556 Apx.N) <http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1556/v9/r1/sr1556v9r1.pdf>

1. Notify persons in the area that a spill has occurred.
2. Prevent the spread of contamination by covering the spill with absorbent paper.
3. Wear gloves and protective clothing such as a lab coat and booties, and clean up the spill using absorbent paper, moving from the outer area of the spill to the middle of the spill to avoid further contamination. Carefully fold the absorbent paper with the clean side out and place in a "caution radioactive material" labeled bag for transfer to a radioactive waste storage area. Also put contaminated gloves and other contaminated disposable material in the bag.
4. Survey the area with a low-range radiation detection survey instrument sufficiently sensitive to detect the radionuclide. Check for removable contamination (wipe test) to ensure contamination levels are below trigger levels. Check the area around the spill. Also check hands, clothing, and shoes for contamination.
5. Complete the MPC spill report with the above information.
6. Report the incident to the RSO and have the spill report signed and dated at that time.

MAJOR SPILLS OF LIQUIDS AND SOLIDS (1556 Apx.N) <http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1556/v9/r1/sr1556v9r1.pdf>

1. Clear the area. Notify all persons not involved in the spill to vacate the room.
2. Prevent the spread of contamination by covering the spill with absorbent paper labeled "caution radioactive material", but do not attempt to clean it up. To prevent the spread of contamination, clearly indicate the boundaries of the spill and limit the movement of all personnel who may be contaminated.
3. Shield the source if possible. Do this only if it can be done without further contamination or a significant increase in radiation exposure.
4. Close the room and lock or otherwise secure the area to prevent entry.
5. Notify the RSO immediately.

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6. Decontaminate personnel by removing contaminated clothing and flushing contaminated skin with lukewarm water, then washing with mild soap. If contamination remains, the RSO may consider inducing perspiration. Then wash the affected area again to remove any contamination that was released by the perspiration.

SPILL POSTINGS (10 CFR 19.11(a,3)) <http://www.nrc.gov/reading-rm/doc-collections/cfr/part019/full-text.html#part019-0011>

Each licensee shall post current copies of the following documents: *the operating procedures applicable to licensed activities*.

If posting of a document is not practicable, the licensee may post a notice which describes the document and states where it may be examined.

Postings shall appear in a sufficient number of places to permit individuals engaged in licensed activities to observe them on the way to or from any particular licensed activity location to which the document applies.

REPORTING CONTAMINATION TO THE NRC (10 CFR 30.50) <http://www.nrc.gov/reading-rm/doc-collections/cfr/part030/full-text.html#part030-0050>

Each licensee shall notify the NRC as soon as possible but no later than 4 hours after the discovery of an event that prevents immediate protective actions necessary to avoid exposures to radiation or radioactive materials that could exceed regulatory limits or releases of licensed material that could exceed regulatory limits (such as fires, explosions, toxic gas releases, etc.).

These reports must be telephoned to the NRC Operations Center and must include the caller's name, call back number, description of event, including date, time, exact location of event, isotopes, quantities, and chemical and physical form of material involved and any personnel radiation exposure data available. A written report, containing the same information and corrective actions taken or planned, must follow within 30 days

Each licensee shall notify the NRC within 24 hours after the discovery of any of the following events involving licensed material:

- An unplanned contamination event that requires access to the contaminated area, by workers or the public, to be restricted for more than 24 hours by imposing additional radiological controls or by prohibiting entry into the area.
- An unplanned contamination event that involves a quantity of material greater than five times the lowest annual limit on intake specified in appendix B of 10 CFR Part 20.1001-20.2401; and
- An unplanned contamination event that has access to the area restricted for a reason other than to allow isotopes with a half-life of less than 24 hours to decay prior to decontamination.
- An event that requires unplanned medical treatment at a medical facility of an individual with spreadable radioactive contamination on the individual's clothing or body.

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- An unplanned fire or explosion damaging any licensed material or any device, container, or equipment containing licensed material when the material involved is greater than five times the lowest annual limit on intake specified in appendix B of 10 CFR Part 20.1001-20.2401 **and** the damage affects the integrity of the licensed material or its container.