



Radioactive Accidents and Spills

The procedures outlined below may vary with a particular emergency and are intended as general guidelines to avoid further contamination and injury to personnel.

Minor accidents and spills

Where there is no radiation hazard to personnel:

1. Confine the spill immediately. Post the spill area.
 - Liquid spills
 - Wear protective gloves.
 - Drop absorbent paper on the spill.
 - Dry spills
 - Wear protective gloves.
 - Damp wipe with proper solvent, taking care not to spread contamination. (Water may generally be used except where chemical reaction with the water would generate an air contaminant).
2. Notify the following as soon as possible:
 - Radiation Safety Officer - John Goodman
Office phone: (309) 438-8297
Cell phone: (309) 533-3398
 - Environmental Health and Safety
Office phone: (309) 438-8325
After hours: (309) 438-8631
 - Principal Investigator
3. Decontaminate, using procedures outlined in Appendix 2-C of this manual
4. Monitor all persons involved in the spill and clean up operations
5. Permit no person to resume work in the area until a survey by the Radiation Safety Officer has been completed.
6. A copy of the written report of this spill shall be sent to the Safety Office.

Major accidents and spills

Where there is a radiation hazard to personnel:

1. Notify all persons not involved in the spill to evacuate the room at once. Personnel not involved shall:
 1. Give first aid to any injured person first of all.
 2. Evacuate the room.

3. Monitor themselves and decontaminate if necessary.
4. Notify the Radiation Safety Officer.
5. Stand by to assist and limit all access to the affected room
2. Notify the following as soon as possible:
 - Radiation Safety Officer- John Goodman
Office phone: (309) 438-8297
Cell Phone: (309) 533-3398
 - Environmental Health and Safety
Office phone: (309) 438-8325
After hours: (309) 438-8631
 - Principal Investigator
 - Health Services (if needed) Office phone: (309) 438-8655
3. The Radiation Safety Officer will be in complete charge upon notification of the accident or spill.
4. If the spill is liquid and the hands are protected, right the container.
5. If the spill is on the skin, flush thoroughly.
6. If the spill is on the clothing, discard outer or protective clothing at once.
7. Vacate the room, evacuate possibly exposed and/or injured personnel from the accident area, give them urgent first aid, and seal off the area. Remain in the general area so that the contamination is not spread to other areas.
8. Take immediate steps to decontaminate personnel involved, as necessary.
9. Plan the decontamination procedure and obtain the necessary equipment. Do not start the decontamination program until plans have been carefully worked out, the required equipment has been obtained, and the Radiation Safety Officer has authorized the clean up.
10. Decontaminate the entire area. Personnel involved in decontamination must be adequately protected. If air contamination is suspected, an ultrafiltration respirator must be worn.
11. Monitor all persons involved in the spill or accident and all cleaning operations to determine the adequacy of the decontamination.
12. Permit no person to resume work in the area until a survey by the Radiation Safety Officer has been completed.
13. Prepare a complete written history of the accident and subsequent action; as soon as possible evaluate:
 - Personnel exposure.
 - Amount of activity released outside the laboratory.

Health Services

Health Service personnel involved in treating exposed patients should, with the aid of the Radiation Safety Officer, do the following:

1. Confine and survey all contaminated people. Give first aid for traumatic injury and burns if necessary.
2. Evaluate situation in regard to contamination by radionuclides and level of radiation exposure.

3. If contamination is present, perform simple decontamination and resurvey patient.
4. Put the patient to bed. The Health Service's Staff Physician should conduct a brief physical examination.
5. Save all samples of clothes, jewelry, blood, urine, stool, vomitus. Label with name, time, and date.
6. Obtain careful history of accident.

If the exposure is over 100rem or more or if the staff physician so dictates, the patient should be sent to the hospital emergency room for additional treatment or diagnosis.

Radioactive dusts, mists, fumes, organic vapors, & gases

1. Hold breath and do whatever is possible to confine the activity as time permits.
2. Notify all other persons to vacate the room immediately.
3. Vacate the room. Close the door and remain at the doorway. Remove protective clothing and monitor or be monitored thoroughly for contamination. If skin or hair is significantly contaminated, proceed to adjacent radioisotope laboratory and begin decontamination. The Radiation Safety Officer will take nasal smears and saliva samples.
4. Notify the following as soon as possible:
 - Radiation Safety Officer- John Goodman
Office phone: (309) 438-8297
Cell Phone: (309) 533-3398
 - Environmental Health and Safety
Office phone: (309) 438-8325
After hours: (309) 438-8631
 - Heating Plant: (309) 438-5656. Inform them that there is a radiation problem, and they need to shut down the general ventilation system in that building.
5. Ascertain that all doors giving access to the room are closed and post conspicuous warnings or guards to prevent accidental opening of doors.
6. Radiation Safety Officer shall collect smears and saliva samples from all personnel involved. Keep all personnel in one area until all are monitored.
7. Wear protective clothing and respiratory protection to evaluate contamination. Determine the cause of contamination and rectify the condition if contamination is escaping from a primary source.
8. Plan the decontamination procedure and assemble equipment. Do not decontaminate until plans have been worked out, the required equipment has been obtained and the Radiation Safety Officer has authorized the cleanup.
9. Decontaminate the area working from "clean" to "warm" to "hot" areas.
10. Monitor all persons suspected of contamination.
11. Prepare a complete written history of the accident and subsequent events. Evaluate as soon as possible:
 - Personnel exposure.
 - Amounts of activity released outside the laboratory.

Other Emergency Procedures

1. Principle Investigators that have more specific details for emergencies or have special procedures for accidents should have them written out and posted in their laboratories. A copy should be sent to the Radiation Safety Officer and Environmental Health and Safety.
2. The Radiation Safety Committee shall review these specific or special procedures for comment or revision.

Decontamination

For a summary of Decontamination Methods refer to the Radiological Health Handbook.

Equipment

1. If equipment is contaminated it should be washed with a suitable cleaning solution as determined by the contaminant and rinsed as a routine procedure. The use of acid on metal tools may unnecessarily corrode them causing greater difficulty in future decontamination procedures. If it is necessary to dismantle any equipment prior to decontamination procedures, careful survey should be made during the operation. Contaminated equipment shall not be released from the control of the laboratory for repair, or for any other purpose, until there is no detectable transferable contamination measurable with the survey meter. In many cases, if the items are cheap or easily replaced, it may be simpler to dispose of such equipment. Equipment that is contaminated with long-lived isotopes, and that cannot be satisfactorily decontaminated must be regarded as radioactive waste. Decay must be considered one of the best decontaminating agents for short-lived materials.
2. Glass and porcelain articles may be cleaned with detergents, mineral acids, ammonium citrate, trisodium phosphate, cleaning solution (chromic acid) or ammonium bifluoride. Metal objects may be decontaminated with detergents, dilute mineral acids (nitric), a 10% solution of sodium citrate, or ammonium bifluoride.
3. Where radioactive materials may be present, or where danger of personal contamination exists, workers involved in decontamination shall wear protective clothing; footwear, gloves, and self-contained breathing apparatus as the circumstances dictate.
4. Where contamination of room air has occurred, thorough ventilation is required, with passage of air from uncontaminated areas through the contaminated areas to the out-of-doors. This should be done preferably by discharging the air into a hood that has a filtered exhaust system.

Skin

1. Extreme personal cleanliness is the first rule in preventing contamination of the skin. Persons working with radioactive materials should wash exposed parts of the body frequently, as a matter of routine while on the job. Thorough washing and monitoring shall be mandatory whenever leaving the area.
2. Thorough washing with soap and water is the best general method of decontamination of the hands and other parts of the body regardless of the contaminant. If the contamination is localized, it is often more practical to mask off the affected area and cleanse with swabs, before risking the danger of spreading the contaminant by general washing.
3. If the exact nature of the contaminant is known, it may sometimes be more effective to immerse the hands in a suitable reagent immediately after contamination. Thorough washing in tepid water with mild soap and thorough rinsing in clean water should follow this. Detergents and wetting agents may also prove useful, although sometimes a specific one may be required for a particular contamination problem in order to secure maximum cleaning efficiency. A list of detergents and wetting agents that have been used successfully to remove some contaminants is presented in section E of this appendix.

The skin may become sensitive following repeated application of detergents to the same area, therefore, care should be taken to avoid this practice. In any case, one must avoid the use of organic solvents that may increase the probability of the radioactive materials penetrating through the pores of the skin. The recommended procedures for washing hands are as follows:

1. Wash for not less than two minutes with a mild pure soap in tepid water with a good lather, covering the entire affected area thoroughly. Give special attention to areas between the fingers and around the fingernails. The outer edges of the hands are readily contaminated and often neglected in washing. Do not use highly alkaline soaps or abrasives. Rinse thoroughly and repeat, as monitoring indicates, until the desired degree of decontamination is achieved.
2. If the above procedure is not sufficient to remove the contamination, scrub the hands with a soft brush using a heavy lather and tepid water. This scrubbing is primarily to agitate the cleansing agent, therefore, and hence prolonged scrubbing without change of reagent is of questionable value. For this reason, at least three washes, including rinses, should be made within eight minutes of which at least six minutes should be devoted to scrubbing. Only light pressure should be applied to the brush not sufficient to bend the bristles out of shape or to scratch or erode the skin. Rinse thoroughly and monitor.
3. Apply lanolin or hand cream to prevent chapping. Chemicals may be used for cleaning other parts of the body or the hands, if the above procedures do not successfully remove the contamination. There are two processes in general use. Procedure (1) following has been used successfully for heavy contamination; however, if this procedure is unsuccessful, it may be followed by (2).
4. Apply a liberal portion of titanium dioxide paste to the hands. Work this paste over the affected surface and adjacent areas of the skin for at least two minutes. Use water sparingly to keep the paste moist. Rinse with warm water, and follow by thorough washing with soap, brush and water. Be sure that no paste is allowed to remain around the nails. Monitor, and repeat the entire process, if necessary. It should be noted that the condition of the titanium dioxide paste is very important. In order to be effective, the

paste must be prepared by mixing precipitated titanium dioxide (a very thick slurry, never permitted to dry) with a small amount of lanolin.

5. Mix equal volumes of a saturated solution of potassium permanganate and .2 N sulfuric acid. Pour this over the wet hands, rubbing the entire surface and using a hand brush for not more than two minutes. (Note: this application will remove a layer of skin if allowed to remain on contact with the hands too long; consequently, the times stated here should not be exceeded for any single application).
6. Be sure that all areas are thoroughly covered. Rinse with warm water and then apply a freshly prepared 5% solution of sodium acid sulfite (NaHSO_3) in the same manner as above, using a hand brush and tepid water for not more than two minutes. Wash with soap and water, and rinse thoroughly.

The above procedure may be repeated several times as long as the permanganate solution is not applied for more than two minutes during any one washing. Application to other parts of the body than the hands may be facilitated by the use of swabs steeped in the solution. Lanolin or hand cream should be applied after washing.

Wounds

Extreme precautions must be taken to avoid cuts or puncture wounds. In the event that the skin is broken in accidents while working with radioactive substances, immediate action should be taken to remove possible contamination. Wash the wound under large volumes of running water immediately (within 15 seconds) and spread the edges of the gash to permit flushing action by the water. Light tourniquet action to stop venous return (but not to restrict arterial flow) may be desirable to stimulate bleeding. Report all wounds to the responsible medical or radiological officer as soon as emergency precautions have been taken.

Clothing

Contaminated clothing shall not be released to a general service laundry. Clothing contaminated with radioactive material having short half-lives may be labeled and stored for decontamination by decay. Clothing contaminated with long-lived material shall be disposed of or sent to a laundry that is licensed by the NRC or IDNS if local decontamination is not successful.