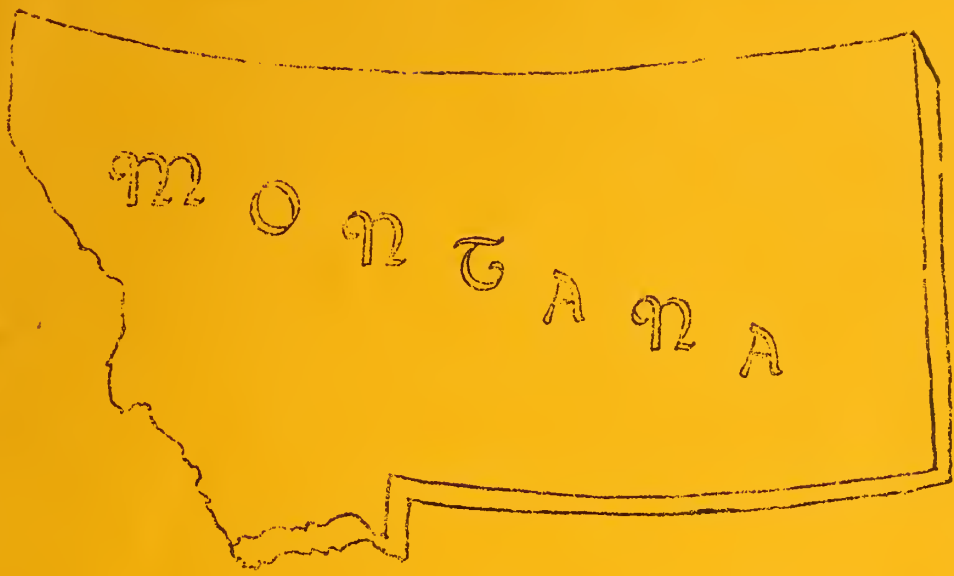


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HANDLING THE RADIATION  
ACCIDENT VICTIM

A GUIDE FOR HOSPITAL PERSONNEL

CIVIL DEFENSE DIVISION

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HANDLING THE RADIATION ACCIDENT VICTIM  
A GUIDE FOR HOSPITAL PERSONNEL

The following is a description of various radiation emergency incidents with which you may be involved as a hospital staff member.

The likelihood of a serious incident occurring is remote. However, in view of the numerous sources of radiation in the State of Montana, it is imperative that all emergency response agencies be prepared to safely handle a radiation incident within the confines of their capabilities.

NOTIFICATION PROCEDURES FOR RADIATION EMERGENCY INCIDENTS:

It is assumed that in most cases proper notification of the Montana Department of Health and Environmental Sciences will have been made prior to the patient's arrival at the hospital. In the event that proper notification has not been made, the hospital administrator or other staff members should immediately do the following:

WHOM TO NOTIFY regarding a radiation emergency incident:

- a) During business hours (8:30 a.m. to 5:00 p.m., Monday through Friday) call the Montana Department of Health and Environmental Sciences, Phone No. 449-3454.
- b) After hours, weekends and holidays call the Montana State Civil Defense Agency, Phone No. 449-3034.

Proper notification is imperative if qualified radiation physicists are to arrive at the hospital in the shortest time possible.\*

Emergency Notification Procedures within the Hospital:

The normal hospital procedure for emergency notification should be utilized in the event of a radiation incident.

TYPES OF RADIATION EXPOSURES

There are four basic types of radiation exposure that hospital personnel should know about.

I. EXTERNALLY EMITTED RADIATION THAT PENETRATES BODY TISSUES.

Examples: X-rays, gamma rays, beta particles and neutrons.

\*Assuming that qualified personnel are not available at the hospital.

Guidelines and Precautions to Observe in Caring for the Patient:

- a) With the possible exception of neutron exposure, the patient is not radioactive and poses no hazard to attending persons. Depending on the degree of exposure the patient may become quite sick and show various symptoms including nausea and vomiting.
- b) From the standpoint of radiation, the patient does not require isolation or special handling procedures.
- c) All of the patient's personal items (e.g. coins, watch, rings, belt, tie clasp, etc.) should be collected and saved. Each object should be labeled with the patient's name, body location, time and date. These objects may be of value in assessing the amount of radiation received by the patient.

II. RADIOACTIVE MATERIAL DEPOSITED ON THE SKIN AND/OR CLOTHING

Examples: May emit alpha, beta, gamma or neutron radiation (or any combination thereof) and be in the form of a solid (e.g. powder), liquid or gas.

Guidelines and Precautions to Observe in Caring for the Patient:

- a) Establish and secure a decontamination area as described in Appendix A.
- b) Anyone touching the patient or handling his clothing may become contaminated.
- c) Rubber gloves, shoe covers and a lab coat should be worn by all attending persons. Respiratory equipment may also be desirable depending on the chemical properties of the contaminating substance.
- d) Following treatment and decontamination of the patient, the gloves, shoe covers and lab coat should be removed and discarded into a radioactive waste container followed eventually by proper cleaning or disposal.
- e) A thorough washing and scrubbing to remove any possible skin contamination should be performed on all attending personnel following care of the patient. Care should be taken not to break the skin during this procedure.

It should be noted that contamination (particularly of the feet and hands) can spread amazingly fast. Refer to Appendix C for information regarding the use of radiation survey meter.

- f) In Appendix A, a list of decontamination procedures is given. If possible, a person trained in the use of simple radiation survey instrumentation should be present with his instruments during the decontamination.
- g) All contaminated objects (i.e. instruments, clothing, patient's personal items, etc.) should be labeled with the time, date and patient's name. These objects should then be stored in a radioactive waste container that clearly displays the label: "CAUTION RADIOACTIVE - DO NOT DISCARD".
- h) Whenever possible remote handling instruments (e.g. tongs) should be utilized when handling contaminated objects.

### III. RADIOACTIVE MATERIAL INHALED, INGESTED OR INTERNALLY DEPOSITED THROUGH A WOUND

Examples: Alpha, beta, gamma, and neutron (or any combination thereof) emitting substances in a solid, liquid, or gaseous form may be involved.

#### Guidelines and Precautions to Observe in Caring for the Patient:

- a) Normally inhaled, ingested or wound deposited radioactive materials, in the absence of external contamination, do not constitute a serious hazard to attending persons. The quantities deposited are normally low. Contamination problems may arise when vomiting and/or bleeding occurs and releases the radioactive material from the body. If this occurs the patient should be handled as if he were externally contaminated with a radioactive liquid.
- b) If the patient is contaminated with a vaporizing or sublimating material (e.g. tritium and iodine) there may be an airborne radiation hazard. The patient should be showered as quickly as possible and his clothes placed in a sealed container (i.e. polyethylene bags) where the possibility of further airborne contamination is eliminated.

If there is the possibility that the ventilation system will spread the airborne radioactivity to other areas of the hospital, the system should be shut down and/or the intake vents sealed off.

- c) Label and save all of the patient's personal objects and all urine, fecal, and vomitus material.

### IV. RADIOACTIVE MATERIAL IN A SOLID FORM THAT IS IMBEDDED WITHIN BODY TISSUES

Examples: Pieces of metal, glass or wood. This type of contamination usually follows an explosion and may involve particles that emit greater amounts of radiation than the previously mentioned forms of contamination. Gamma, beta, alpha, and neutron radiations (or any combination thereof) are possible.

#### Guidelines and Precautions to Observe in Caring for the Patient:

- a) This type of accident is the rarest of the four listed but could be the most hazardous to attending persons should it occur.
- b) The imbedded object(s) may be highly contaminated or radioactive in itself and should be removed from the patient as soon as possible. Depending on survey meter readings, remote handling tools and limited personnel exposure periods may be advised.
- c) Obviously many problems and questions arise with this type of contamination. The most important point to stress is that a person trained in the use of simple radiation survey instrumentation should be present with his instruments to assess the radiation levels emanating from the patient.
- d) Label and save all of the patient's personal objects and all urine, fecal, and vomitus material.

APPENDIX A: DECONTAMINATION PROCEDURES\*

Decontamination Procedure - Skin (Unbroken)

Step I Evaluation

1. Read radiation marking tag.
2. Determine which areas will be decontaminated and in what order giving priority to skin breaks and highest levels of contamination.
3. Remove covering of contaminated areas to be cleaned.
4. Survey area with a GM counter.
5. Record survey results.

Step II Decontamination - Intact Surface

1. Localize area of contamination with plastic sheet and tape to prevent further contamination of patient.
2. Gently wipe off loose contamination with gauze moistened with pHisoHex or equivalent.
3. Discard contaminated gauze into waste disposal bag.
4. Prepare Schubert's solution.

SCHUBERT'S SOLUTION FOR SKIN DECONTAMINATION

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Tartaric acid	3.0 gm/l	(0.2M)
Citric acid	4.2	(0.2M)
Disodium DTPA or EDTA**	8.0	(0.2M)
Calcium chloride	2.2	(0.3M)

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Adjusted to pH = 7 with concentrated NaOH.

5. Scrub area with Schubert's solution or a chelating agent. Care should be taken not to break the skin.
6. Survey.
7. If contamination persists, repeat 5.
8. Repeat cleansing until contamination is removed or until level of contamination does not decrease appreciably.
9. After removal of contamination apply Nivea cream or equivalent and cover area.

Decontamination Procedure - Skin Breaks

Step I

1. Survey the skin and record findings.

\* Note: It is probable that some decontamination and/or first aid will have been performed at the incident site.

\*\* DTPA - Diethylenetriamine Tetraacetic Acid.

EDTA - Ethylenediamine Tetraacetic Acid.

Step I (Continued)

2. Irrigate wound with copious amounts of water making sure no contamination is washed into the wound.
3. Carefully decontaminate intact skin surface around wound (see Decontamination Procedure - Skin).
4. Resurvey wound and record.
5. Continue irrigation with water and survey until radioactivity is undetectable.
6. Treat wound in usual medical fashion.
7. Cover wound and seal with plastic and tape - make sure covering is waterproof.

Do not flush wound with antiseptics unless this is a part of usual medical treatment. Do not flush wound with chelating agents, such as Schubert's solution.

8. If wound contamination persists, continue to Step II.

Step II

1. Be certain irrigation is no longer effective in decontaminating the wound.
2. Have the Health Physicist evaluate the internal body burden expected from the residual contamination.
3. The Health Physicist in conjunction with a surgeon determines the feasibility and necessity of removing contaminated tissue.
4. If surgery is decided upon, the area around the wound is decontaminated completely.
5. If possible a "block dissection" of the wound is done.
6. All tissue removed is surveyed.
7. The wound is closed and covered.

Note: At times it has been necessary to close the contaminated wound and return at a later date for excision.

Decontamination Procedure - General Body

Step I

1. Survey entire body and record.
2. Visibly mark (e.g. with lipstick) very high level areas to receive priority.
3. Contaminated persons should shower using pHisoHex or equivalent.
  - a) make effort not to contaminate hairy areas if free of radioactivity initially.
  - b) use precautions to prevent contamination from entering body openings.
4. Survey entire body again marking highest levels found.
5. Repeat 1, 2, 3, and 4.
6. Repeat 5 until contamination is removed or continue to Step II.

Step II

1. For general body contamination with high levels of radioactivity, localized areas of contamination usually remain. When showering becomes ineffective and localized areas of contamination remain, shift to localized skin decontamination technique.
2. Repeat surveys and record results frequently.

Decontamination Procedure - Eyes

Step I

1. Irrigate with copious amounts of water. Shift to normal saline as soon as possible.
2. Survey irrigation fluid at frequent intervals and record results.
3. After decontamination, treat irrigation induced conjunctivitis as usual.

Decontamination Procedure - Body Entrance Cavities

Step I

1. Survey and record results.
2. Make sure that cavity is really contaminated and not surrounding area.
3. Evaluate and decontaminate surrounding area.
4. Irrigate with copious amounts of water or normal saline.
5. Gently swab with moistened cotton tipped applicator.
6. Resurvey.
7. Repeat 4 and 5.
8. Resurvey.
9. If necessary and not irritating, use cotton tipped applicator moistened with pHisoHex or equivalent.
10. Do not injure or break mucosa.

Decontamination Procedure - Hair Areas

Step I

1. Survey and record.
2. Wrap or position patient to avoid spread of contamination.
3. Wash with pHisoHex or equivalent.
4. Dry with clean uncontaminated towel. DO NOT SHAVE HAIR\* - if necessary, hair may be cut, but do not injure skin.
5. Resurvey and record.
6. Repeat 2 to 5 until decontaminated.

Step II

1. Repeat Step I using another detergent such as Tide, Dreft, Hemosol, etc.

Step III

1. Repeat Step I using diluted Hydrochloric Acid.

WASTE DISPOSAL

- a. Contaminated water should be flushed into the ordinary drains.\*\* Faucets should be left open to insure adequate dilution.

\* For surface contamination from an alpha-emitter, such as plutonium, shaving as a last resort can be extremely effective.

\*\* Assuming that the quantity of radioactivity disposed of, if diluted, by the average daily quantity of sewage released into the sewer by the hospital, will result in an average concentration not greater than the limits specified in RH 4.21, Appendix A, Table I, Column 2 or ten times the quantity of such material specified in RH 4.22, Appendix B of the State of Colorado Rules and Regulations Pertaining to Radiation Control. (For further details please refer to RH 4.13, pages 66-67 of the Regulations.)



- b. Contaminated disposable supplies should be put into plastic bags for disposition.
- c. Contaminated equipment should remain in the control area until decontaminated.

APPENDIX B: ESTABLISHING A DECONTAMINATION AND TREATMENT AREA

The following items should be considered in establishing a radioactive material decontamination and treatment area:

- a. The patient receiving area and entrance should not interfere or block entry by patients who are not contaminated with radioactive material.
- b. The decontamination and treatment area should be situated where radiation exposure to other patients is negligible.
- c. Procedures for roping off and securing the decontamination and treatment areas should be formulated.
- d. "Caution - Radioactive Material," "Caution - Radiation Area," and "Caution - Airborne Radioactivity Area" signs should be available for posting when and where appropriate.
- e. A shower facility where the patient can be decontaminated should be established.
- f. A special room or area should be available where the patient has access to a bed and toilet facilities.
- g. A radioactive waste container labeled with a "Caution - Radioactive - Do Not Discard" sign should be available for use.
- h. If possible, security measures should be formulated to control interested bystanders, spectators, and reporters.
- i. A public information officer should be appointed whose responsibilities would include releasing information and talking with interested spectators and reporters about the incident.

APPENDIX C: CARE AND USE OF A GEIGER-MULLER  
(G.M.) SURVEY METER

If possible the hospital should possess or have access to at least one (1) operable G.M. Survey meter. This instrument is useful in detecting areas of gamma and/or beta radiation contamination. The instrument should only be used by a qualified individual who is responsible for keeping the instrument operable and calibrated.

The following procedures should be followed when using a G.M. survey meter to detect contamination:

- a. Be certain the instrument's batteries are good before using.\*
- b. Be certain the instrument is properly calibrated before using.\*
- c. Enclose the instrument and probe in a thin plastic bag when surveying areas where airborne contamination is possible.
- d. Be certain that the beta shield is removed when surveying for beta radiation.
- e. Avoid touching the G.M. detector probe to contaminated material.
- f. Move the probe slowly over areas of suspected contamination.
- g. Keep a written record of all surveys and their locations.

\* The establishment of a regular maintenance and calibration schedule is vital to the proper operation of the instrument (i.e. six (6) month intervals.)

APPENDIX D: ESSENTIAL MATERIALS TO MAINTAIN  
RELATIVE TO A RADIATION INCIDENT

Obtaining and storing the items listed below will provide adequate supplies necessary for use in radiation contamination incident with a minimum cost to the hospital.

<u>ITEM</u>	<u>USE</u>
G.M. Survey Meter	Surveys for contamination
Spare batteries	For use in G.M. survey meter
Plastic bags of all sizes	For disposing of contaminated materials
Plastic Sheet	Covering ventilation ducts, if necessary, and covering contaminated areas
Remote handling tongs	For handling contaminated objects
Radiation warning rope or ordinary rope, chord, etc.	For roping off and securing contaminated areas
Radiation caution signs and labels	For labeling contaminated areas and objects
Containers of various volumes	For collecting contaminated materials (i.e. liquids)
Masking tape	For sealing plastic bags and other containers, etc.
Schubert's Solution (see appendix A)	For skin decontamination
Soap and Water	For decontamination
Cotton swabs	For decontamination
Absorbent materials	For decontamination
Waste containers (lined with removable plastic bags)	For radioactive waste disposal
Rubber gloves	For handling contaminated material
Shoe covers	For avoiding contamination of shoes

