



Advisory Committee on Radiological Protection

Guidelines on Hospital Emergency Plans for the Management of Minor Radiation Accidents

INFO-0427/Rev. 1

Prepared by the former Atomic Energy Control Board's Group of Medical Advisors as GMA-3

March 2001

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For information on the independent advisory committees contact: Advisory Committees of the Canadian Nuclear Safety Commission, Ottawa, Ontario K1P 5SP.

FOREWARD

Guidelines on Hospital Emergency Plans for the Management of Minor Radiation Accidents is a revision of the document published in 1992 as GMA-3 (INFO-0427). This revision reflects recent changes in the organization responsible for regulating the nuclear industry in Canada, but the guidance provided in the original document has not changed.

This document is intended for hospitals to use when developing their own radiation emergency plans and procedures. It provides guidance on the organizational structure, personnel, facilities, equipment, supplies and treatment principles that are required for the initial care of injured persons who have been exposed to ionizing radiation and who may have been contaminated with radioisotopes.

This document does not address major radiation accidents arising from incidents involving nuclear power reactors since the power utilities already have emergency plans and procedures in effect and have made arrangements with local hospitals for the treatment of contaminated casualties. Calamitous events such as nuclear warfare are also not considered in this document.

A companion document, *GMA-14 (INFO-0709) Guidelines for Community Hospitals in the Handling of Radiation Accident Patients*, published in 1999, is also available. It is intended for hospitals with insufficient resources to train staff, purchase equipment and regularly exercise radiation emergency plans. It provides procedures for the reception, treatment and transfer of patients who may have been contaminated by radioactive materials or exposed to radiation from industrial sources or transportation accidents.

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PART I - PLANNING PRINCIPLES

1.0 PURPOSE

The purpose of this document is to provide guidance on the organizational structure, personnel, facilities, equipment, supplies and treatment principles that are required for the initial care of injured persons who have been accidentally exposed to ionizing radiation and who may be contaminated with radioisotopes. Hospitals are at liberty to adopt these guidelines to suit their particular needs and environment.

Part I of these guidelines is primarily directed at hospital administrators. It provides guidance on principles of planning and preparedness for handling a radiation incident and may be useful for training purposes.

Part II of these guidelines is primarily directed at hospital emergency personnel responsible for treating patients who may be contaminated with radioactive materials. Part II may be incorporated in whole or in part, depending upon the particular needs of each hospital, in a hospital's radiation contingency plan and may also be kept inside the hospital emergency area for quick reference.

Additional information for hospitals with little or no specialized support for radiation accidents can be found in GMA-14 (INFO-0709) *Guidelines for Community Hospitals in the Handling of Radiation Accident Patients*.

2.0 SCOPE

Victims of accidents may have three distinct types of injuries associated with radiation or radioactive contamination:

- The first type of victim, with or without trauma, has been accidentally irradiated with X-rays or gamma rays over the entire body or in localized areas, such as the extremities. Since there is no radioactive residue on or about the body, no special precautions are required for protection of hospital emergency and treatment staff.
- The second type of victim, with or without trauma, has known or suspected radioactive contamination within a wound, within the body, or on the skin. Unless radiation contamination instruments indicate otherwise, it is prudent to assume that these victims are contaminated, and for hospital emergency and treatment staff to observe the basic precautions and treatment principles outlined in this document.

- A third type of victim, with or without trauma, believes he has been exposed and contaminated, but in fact, has neither been exposed nor contaminated. The management and disposition of this individual is also important, because the hospital and medical treatment staff will have to contend with the immediate psychological trauma of the patient. In some cases, extended psychological support and counselling may be required for both the accident victim and his immediate family.

The guidelines presented here are intended to apply to community hospitals, and especially to those hospitals that are likely to receive victims of minor industrial accidents¹ who may have been contaminated with radioactive materials. Examples of minor radiation accidents include road accidents involving vehicles transporting radioactive materials which have resulted in personal injuries and damage to packages or containers of radioactive substances; and burns, cuts or puncture wounds with materials or equipment containing radioactive substances received by technologists in research installations, commercial facilities or university laboratories.

Other tangible examples include hand exposures from radiography sources, splashing of radioactive liquids into the eyes, inhalation of radioactive substances during a fire and overexposures to sterilizers.

No guidance is provided on the immediate first aid to be administered at the accident site, nor on the treatment (undertaken at a tertiary hospital) of acute radiation syndrome¹ and severe trauma.

3.0 OVERVIEW

3.1 General

Radioisotopes and ionizing radiation have many beneficial roles in modern society, including the diagnosis and treatment of disease, the production of electrical power, and in a myriad of other scientific, industrial and consumer applications. However, as more uses for radioisotopes are developed and as more persons become associated with the nuclear industry, the chances for mishaps and human injuries will increase.

¹ Major radiation accidents arising from incidents involving nuclear power reactors are not addressed in this document, since the power utilities already have emergency plans and procedures in effect, and have already made arrangements with local hospitals for the treatment of contaminated casualties arising from a serious reactor accident. Calamitous events, such as nuclear warfare, are also not considered in this document.

When compared to other types of mishaps, hazardous incidents involving ionizing radiation are extremely rare events. Nonetheless, a community hospital may be called upon to treat such victims; hence, it is important that all hospitals establish plans for handling these emergencies, produce written emergency protocols and rehearse on a periodic basis.

3.2 Treatment of Radiation Accident Victims

The primary consideration is to treat severe physical trauma using the “A, B, C’s” of emergency treatment. Airways, breathing and circulation should receive the highest priority before other medical care or decontamination is attempted. However, the patient should be decontaminated as soon as possible after he has stabilized.

For most types of radiological accident scenarios addressed by this guideline, radiation effects will not be discernible either at the time of admission of the patient nor in the immediate days that follow. The effects of radiation injuries may eventually become manifest over a period of time depending on the dose received. Except for the removal of radionuclides, there is no treatment that can interrupt this injury process. Therefore, treatment should be symptomatic and directed toward the sequelae effects of the radiation damage (e.g. infection resulting from severe skin burns).

3.3 Health Hazards from Radiation Accident Victims

Victims of radiation accidents may sustain serious radiation injuries, but only rarely have such injuries involved a risk to those who care for these patients. For example, the highest recorded absorbed dose in the United States to a medical person treating patients from a commercial reactor accident has been 0.14 mSv (1). This is less than what would be received from an abdominal X-ray (13).

For the types of radiation accidents covered by these guidelines, injuries due to ionizing radiation will rarely be life-threatening to the victim and will not pose a clinically significant risk to hospital emergency and treatment staff. However, medical staff should try to prevent the spread of radioactive contamination to themselves, to other persons, and to the environment. As a general precaution, female medical and treatment staff in whom pregnancy has been confirmed should not be involved in handling radioactively contaminated patients.

3.4 Importance of Advance Planning

Hospitals committed to accepting radiation accident victims should plan and prepare well in advance in order to receive and provide care for these patients. These hospitals will find it useful to undertake a survey of possible types of radiation accidents within the referral area of the hospital.

A documented radiation contingency plan is an essential element of the planning and preparedness process for coping with radiation casualties. A hospital emergency plan for handling of radiation accidents must define the organization, lines of authority and responsibilities of all groups and individuals involved; outline the facilities, equipment, exposure controls and treatment principles that are to be used; and stipulate the training requirements of hospital personnel. Insofar as possible, prior arrangements and agreements should be made with other hospitals, physicians, ambulance services and local police and fire departments to provide necessary assistance.

3.5 Exposure controls

Radiation accident victims who have only been irradiated by a sealed radiation source (or exposed to X-rays) are not contaminated with radioactive material. Since these irradiated patients are not a source of radiation exposure for the hospital staff, they can be handled as any other patient.

Without an appropriate contamination meter, it is not possible to determine whether a victim exposed to loose radioactive material is contaminated or not contaminated. Consequently, it is prudent to assume that these victims are contaminated and for hospital emergency and treatment staff to observe special precautions and treatment principles. The purpose of these precautions is to provide exposure controls to eliminate or reduce radiation doses to patients and hospital staff. This can be achieved by preventing the transfer of contamination to emergency and treatment staff and subsequently, to other areas of the hospital. Several basic principles, such as containment (e.g. use of the Radiation Treatment and Decontamination Area); contamination control (e.g. segregation of articles worn by the victim and other items in contact with patients or his/her clothing); use of protective clothing; control of personnel access and movement (performed by hospital security); and radiation monitoring will provide adequate protection to the hospital staff involved in the admission and treatment of accident victims contaminated by radioactive material. Further guidance on contamination and exposure controls is provided in Appendix J.

4.0 ORGANIZATION, ROLES AND RESPONSIBILITIES

Hospitals committed to accepting radiation accident victims must first establish an adequate organization which is supported by an appropriate infrastructure to ensure an adequate and effective program for the management of a radiation accident. Of paramount importance is the need for the senior hospital management to demonstrate its commitment to establishing such a program. This can be realized by:

- formally documenting its commitment in a corporate policy;
- designating key personnel and delegating sufficient authority;
- producing appropriate protocols and procedures to be followed during a radiation emergency;
- training designated hospital treatment and emergency staff for a radiation emergency²;
- providing internal resources for facilities and equipment for a radiation emergency;
- maintaining the capability and state of readiness of the emergency plan, by undertaking annual rehearsals or periodic practices of the radiation contingency plan, preferably with appropriate provincial agencies or departments;
- establishing appropriate arrangements with outside agencies who can provide assistance during a radiation emergency; and
- undertaking an independent and objective review of the hospital radiation contingency plan on a regular basis.

The size and nature of the radiation emergency organization outlined in the radiation contingency plan will vary from one hospital to another, depending upon the types of services and facilities available at the hospital. For most hospitals, the radiation emergency organization should be an integral part of the general disaster organization. (For the special case of very large hospitals with tertiary care facilities, a separate disaster group dedicated to radiation accidents (i.e. a Radiation Emergency Coordinating Committee) may be feasible).

2 Hospital management must not only ensure that groups are trained to perform their duties, but that their duties and workload are commensurate with their training and capabilities. In addition, consideration must be given to providing alternates or substitutes in the event that these groups or individuals are unavailable or indisposed during an emergency.

In small hospitals, the radiation emergency organization may consist of a much smaller group, comprised of representatives from nursing, emergency physicians and an individual trained in radiation safety (such as a nuclear medicine or radiology technologist).

5.0 PERSONNEL

To ensure an adequate and effective program for the management of a radiation emergency, the hospital must identify the groups (or individuals) needed to perform the various duties and tasks outlined in the radiation contingency plan, from the moment it is activated until the emergency is declared to be over.

It is important that each of the groups or individuals involved in implementing a radiation emergency plan be aware of their own specific functions and the roles of others. An example of the roles, responsibilities and functions of a hospital radiation emergency team is provided below.

A RADIATION EMERGENCY TEAM should be designated in advance and headed by the most qualified individual who is knowledgeable of these procedures. (If time permits, the emergency team should be reassembled for briefing before the arrival of radiation accident victims). Within the radiation emergency team a predetermined line of authority and individual responsibilities are needed to ensure an efficient implementation of these procedures. The team needs not be limited to, but may consist of the following members:

- The EMERGENCY NURSE in charge or designate, determines the number of persons requiring treatment, the nature of injury or illness, the extent and type of contamination, and the estimated time of arrival at hospital. The nurse will first verify the call and then assign an appropriate number of registered nurses to the treatment area based on an assessment of the situation. The nurse will also notify the Nursing Supervisor.
- The TELEPHONE/SWITCHBOARD OPERATOR will announce the code for activation of the radiation emergency plan upon notification by the emergency nurse in charge. The operator is also involved in the notification of members of the radiation emergency team (i.e., doctors, maintenance, security and housekeeping). Any inquiries that are received through the switchboard are referred to the appropriate group.
- The SUPPLY NURSE or designate prepares the Radiation Treatment and Decontamination Area.

- The EMERGENCY PHYSICIAN, or designate, provides medical treatment and decontamination of the victim. He should offer continued reassurances to the patient regarding medical care and radiation exposure.
- The EMERGENCY DEPARTMENT NURSES assist in the treatment and decontamination of the patient. There should be one nurse circulating in the adjacent buffer area to coordinate needs in the Radiation Treatment and Decontamination Area, incoming supplies, and outside services. The nurses should be familiar with the emergency plan.
- The RADIATION SAFETY MONITOR (radiation safety officer, medical physicist, nuclear medicine technologist, radiology technician or most appropriate hospital staff) monitors patients, personnel, and materials leaving the Radiation Treatment and Decontamination Area. The radiation safety monitor is also in charge of radiation monitoring equipment, contamination and exposure control, and decontamination.
- HOSPITAL SECURITY evacuates all non-essential persons from the Radiation Treatment and Decontamination Area and entrance route. Security is responsible for maintaining an exclusion area surrounding the radiation accident victims under the direction of the emergency department personnel and the radiation safety monitor. In addition, they should secure the ambulance until it has been monitored and found to be free of contamination.
- A SENIOR HOSPITAL ADMINISTRATOR ensures that all necessary resources, including an updated telephone list of emergency personnel are in place for the implementation of the radiation emergency protocols. The administrator should also be prepared to receive all enquiries pertaining to the incident and review any statements before being released to the public.
- Other MEDICAL SUPPORT SPECIALISTS (i.e., X-ray and laboratory technicians) remain on stand by and provide service as required.

6.0 FACILITIES

For the types of radiation accident victims governed by the scope of these guidelines, it is not necessary for the hospital to reserve a dedicated Radiation Treatment and Decontamination Area solely for the admission and treatment of radiation accident victims. It is necessary, however, for the hospital to identify a section of the admission and treatment areas that can be converted into a Radiation Treatment and Decontamination Area. (Appendix D and Figure 1 provide an example of the preparation and set-up for a Radiation Treatment and Decontamination Area).

When a radiation accident victim arrives at the hospital, it is important for the hospital staff to determine the severity of the injuries not related to radiation which were sustained by the victim. If the injuries are life-threatening and the Radiation Treatment and Decontamination Area is not yet set-up, the patient should be immediately treated using “universal precautions”, in conjunction with the treatment principles outlined in Appendix E. Radiation control and decontamination measures are performed after life-saving medical protocols are complete.

In the event that the injuries are not life-threatening, the treatment of a patient known or suspected to be contaminated should be delayed until the Radiation Treatment and Decontamination Area is set up.

Special facilities for temporary storage of contaminated radiation clothing worn by the radiation victim and hospital staff are not required. These items can be stored in any small closet or room that can be secured.

7.0 EQUIPMENT

7.1 Protective Clothing

For the types of radiation accident victims governed by the scope of these guidelines, it should be noted that hospital clothing (uniforms, gowns, surgical clothing, latex gloves) normally worn by hospital emergency and treatment staff will provide adequate protection against radioactive contamination. Although inhalation or ingestion of radionuclides is not a significant exposure pathway, hospital emergency and treatment staff should wear surgical masks.

If the hospital clothing worn by the emergency and treatment staff becomes contaminated, a few basic precautions performed during subsequent undressing (see Appendix J) will prevent transfer of contamination to the skin (and to other areas of the hospital). Even if cross-contamination is not suspected, it is good practice to follow these same precautions to prevent inadvertent spread of contamination to other areas of the hospital.

7.2 Supplies

Most, if not all, of the items required for the handling of a radiation accident victim consist of standard supplies found in the hospital. The suggested supplies list (given in Appendix I) contains some recommended items for the Radiation Treatment and Decontamination Area.

7.3 Radiation Instruments

For the types of radiation scenarios outlined in this document, radiation detection instruments³ play a useful role. The main purpose of these instruments (such as contamination survey meters) is to assist in:

- identification and prevention of spread of contamination to other areas of the hospital;
- monitoring the effectiveness of skin decontamination⁴; and
- possible subsequent determination of skin and organ doses received by the victim.

Hospitals with nuclear medicine or radiology departments are likely to have portable instruments for detecting radiation and a list of resource persons trained in using radiation survey instruments. If contamination meters are available, they should also be used to monitor radiation accident victims. In cases where the patient has life-threatening injuries, these measurements should be delayed until the emergency medical treatment has been performed.

Radiation measurements should ideally be performed by trained staff using instruments that are appropriately calibrated. Staff who perform radiological measurements should consider the type of radioisotopes involved, including their chemical and physical properties. If trained staff are not available, nurses, engineering staff and housekeeping personnel should be encouraged to learn to use contamination survey meters. Emergency guidance may be obtained from the Canadian Nuclear Safety Commission's Emergency Duty Officer (613-995-0479).

3 A thin-window Geiger counter will serve the needs outlined in this document and is commercially available for approximately \$800.00. Hospitals that do not have such instruments should make arrangements for provision of these measurements with other hospitals or local agencies (such as universities) etc.

4 Patient decontamination can be performed without radiation detection instruments by removal of clothing and showering after treatment of wounds. Open wounds are decontaminated by using normally accepted cleaning procedures, followed by prolonged irrigation of the wound.

8.0 PROTOCOLS

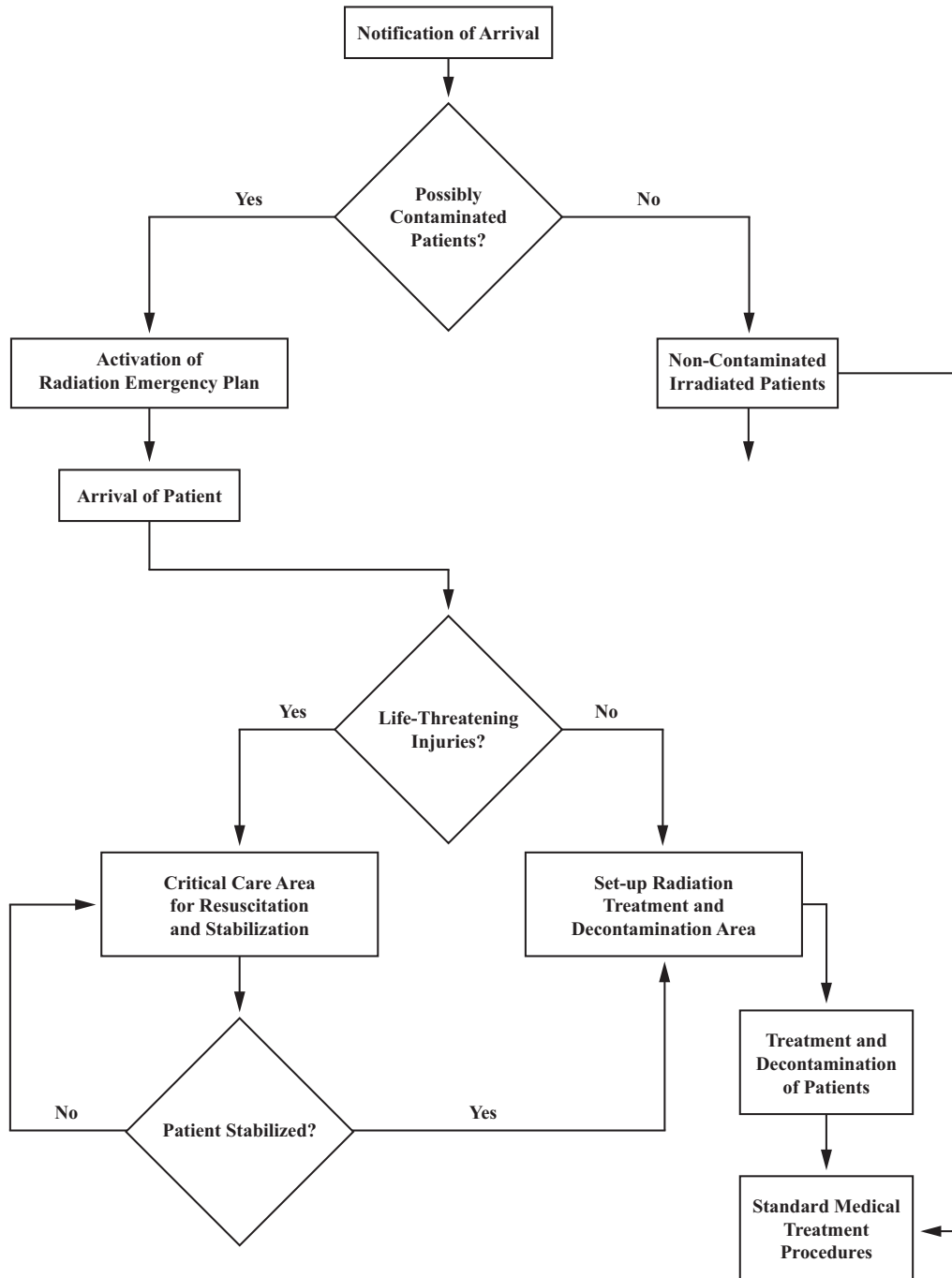
Protocols (written procedures) are an integral part of a hospital's emergency plan for the management of a radiation accident. These protocols may be separate from, or combined with, the hospital's general disaster plan. In either case, these protocols should be prepared by each hospital after discussion between the hospital's emergency staff and the radiation safety representative. The hospital should also avail itself of the expertise and services of various hospital staff, such as medical physicists, nuclear medicine technologists, radiology technologists, etc., during the preparation of these protocols. (In larger hospitals, it is suggested that these discussions include representation from appropriate standing committees, such as the emergency coordinating committee, the radiation safety committee, and the health and safety committee).

It is essential that these protocols be compatible and consistent with other hospital (emergency) protocols and that they address all essential functions to be performed during a radiation emergency. Regardless of who is designated to write the protocols for the management of radiation accidents, it is important that the emergency protocols be independently reviewed by each involved group. Individual hospital staff involved in executing emergency protocols should be trained to carry out their duties and periodic practices should be held on an annual basis (preferably with government, industry or university representatives) to permit staff to maintain their level of training and preparedness.

Finally, it is important that an individual or a group be designated to update and maintain the hospital radiation emergency protocols. This will help ensure, in keeping with good quality assurance practices, that these protocols are periodically reviewed, revised, updated and distributed to all groups involved in a radiation emergency.

PART II - TREATMENT PRINCIPLES

A. Flow Sheet of Protocol for Community Hospital Radiation Emergency Response



B. General Precautions

1. It is extremely unlikely that radioactive contamination on the patient will pose a clinical hazard to the hospital emergency and treatment staff.
2. Hospital clothing (uniforms, surgical clothing, gowns, latex gloves) will provide adequate protection against radioactive contamination.
3. Covering the contaminated casualty with a blanket will prevent inadvertent transfer of contamination from the patient during the transfer from the ambulance to the treatment and decontamination area.
4. Anything that the patient comes in contact with should be considered to be contaminated.
5. Hospital and treatment staff who have inadvertently contaminated the skin on their hands (or other parts of the body) should wash the contaminated areas with soap and water to remove the contamination. Hot water should not be used to decontaminate the skin.
6. Clothing and effects from the contaminated patient should be segregated from hospital clothing and artifacts associated with medical treatment of the radiation casualty. These items should be placed in plastic bags and stored in a secure area until their disposal is accomplished.
7. As a general precaution, female emergency and treatment staff in whom pregnancy has been confirmed should not be involved in handling radioactively contaminated patients.

C. Admission of Radiation Accident Victims

1. The hospital is informed of imminent or actual arrival of radiation accident victims. The hospital obtains available information on the number of casualties, their medical condition and the extent and type of contamination.
2. The hospital radiation emergency plan is activated, appropriate personnel are notified and the Radiation Treatment and Decontamination Area is set up.
3. Upon arrival of the victim(s), hospital staff determine the severity of the injuries sustained by the victim(s).
4. If the injuries are life-threatening, and if the Radiation Treatment and Decontamination Area is not available, the patient(s) should be immediately treated using “universal precautions”, in conjunction with the treatment principles outlined in Appendix E.
5. If the injuries are not life-threatening, the patient’s treatment should be delayed until the Radiation Treatment and Decontamination Area is prepared (see Appendix D).
6. The patient’s clothing should be removed at the earliest opportunity.
7. If the injuries are not serious and if the patient is mobile, the patient should proceed to the shower for decontamination.

D. Preparation of Radiation Treatment and Decontamination Area

1. Set up the Radiation Treatment and Decontamination Area (see Figure 1), using rope, tape, traffic cones or warning signs to demarcate areas that are off-limits to spectator traffic and to hospital staff not involved in the admission and treatment of radiation accident victims.
2. Ensure that appropriate equipment and supplies (see Appendix I) are available within the Radiation Treatment and Decontamination Area.
3. Assist hospital staff to dress in hospital clothing (uniforms, surgical clothing, gowns, latex gloves).
4. Remove all non-essential supplies and equipment from the Radiation Treatment and Decontamination Area. If removal is not possible, cover these items to prevent possible contamination.
5. Cover the floor of the Radiation Treatment and Decontamination Area with paper or non-slide plastic. Note: Not an essential step, as non-porous floors are easily cleaned.
6. Place a strip of tape or a step-over barrier at the entrance to the Radiation Treatment and Decontamination Area to delineate the “contaminated side” from the “non-contaminated side”.
7. Evacuate all non-essential personnel from the Radiation Treatment and Decontamination Area before the radiation casualty arrives.
8. To help prevent inadvertent transfer of contamination, security personnel may be posted at the control points to control access of personnel to this area.
9. Follow the basic precautions outlined in Appendix B.
10. If contamination survey meters are available, monitor personnel and materials leaving the Radiation Treatment and Decontamination Area. If no contamination survey meters are available, hospital clothing (uniforms, surgical garb, gowns) should be laundered (as per normal procedures), and equipment and materials should be set aside for subsequent monitoring by outside agencies.

E. Treatment Principles for Life-Threatening Situations

1. In a life-threatening case, medical treatment has priority over all other considerations, including decontamination.
2. The primary consideration is to treat severe physical trauma using the “A, B, C’s” of emergency treatment. Airways, breathing and circulation should receive the highest priority before other medical care or decontamination is undertaken.
3. If the Radiation Treatment and Decontamination Area is not available, the patient(s) should be immediately treated using “universal precautions”.
4. Using standard procedures, remove clothing and place into a plastic bag for subsequent monitoring, decontamination or disposal (if required).
5. After the patient has stabilized, transfer the patient to the Radiation Treatment and Decontamination Area and decontaminate the patient using the principles outlined in Appendix H.

F. Treatment Principles for Non Life-Threatening Situations

1. If the injuries are not life-threatening, the patient's admission to the hospital should be delayed until the Radiation Treatment and Decontamination Area has been prepared (see Appendix D). The patient's clothing should be removed at the earliest opportunity.
2. Treatment of severe wounds or burns should receive the first priority if life-threatening treatment measures are not required.
3. Treatment of contaminated wounds or burns receives the next priority (see Appendix G).
4. Decontamination of the patient is only to be undertaken after open wounds or burns have been dressed, using the principles outlined in Appendix H.
5. If the injuries are not serious, and if the patient is mobile, the patient should proceed to the shower for decontamination.

G. Treatment of Contaminated Wounds and Burns

1. After life-threatening treatment measures have been completed, treatment of contaminated wounds or burns should have first priority.
2. Treatment of contaminated intact skin (i.e. decontamination of the patient) is only to be undertaken after open wounds or burns have been dressed.
3. Contaminated wounds or burns should be cleaned and irrigated to remove contamination and to help prevent subsequent infection. Irrigation can be performed using normal emergency room procedures. Irrigation water can be poured down the drain since it does not pose a radiation hazard, due to dilution.
4. If radiation instruments are not available, the wound should be irrigated for approximately 15 minutes with normal sterile saline using standard techniques. A final cotton swab gently applied to the wound before closing the wound may subsequently be used to provide an indirect (and crude) estimation of residual contamination. The cotton swabs and gauzes used are to be set aside in a clean container.
5. If radiation instruments are available, they should be used to find residual contamination. Repeated irrigation and monitoring provides some measure of the progress of decontamination. Use a medical report form (see Figure 2) to record the location of injuries, contamination and associated contamination levels.
6. If the wound or burn is grossly contaminated with radioactive materials and there is concern that the wound has not been satisfactorily decontaminated, the wound can be left open and the patient can be transferred to a referral hospital where thorough decontamination can be carried out.
7. Collect and segregate all clothing and contaminated materials, place in plastic bags and store in a secure area for subsequent monitoring and disposal.
8. Standard clean-up hospital procedures can be applied at the end of the emergency, followed by radiological monitoring to verify effectiveness of clean-up operations.

H. Principles of Patient Decontamination

1. Decontamination of skin should only be started after alleviation of life-threatening conditions created by traumatic injury. Hospital clothing (uniforms, surgical clothing and masks, gowns, latex gloves) will provide adequate protection against radioactive contamination.
2. Except when urgent wound care is required, decontamination is performed in the following order: (i) head, face and hands (to prevent internal contamination); (ii) wounds and adjacent skin; and (iii) other skin areas.
3. Decontamination should be undertaken from highest levels of contamination (if known) outside the wound to the lowest.
4. Removal of clothes and shoes will likely remove most of the contamination. If injuries are not life-threatening, and the patient is mobile, the patient should proceed to the shower for decontamination.
5. Collect and segregate all clothing and contaminated materials, place in plastic bags, label the bags and store in a secure area for subsequent monitoring and disposal.
6. For intact skin, dry decontamination methods (such as use of adhesive tapes to strip removable particulate matter on the skin) may be used. Liquid decontaminants (detergents or other mild chemical agents that facilitate removal) are equally suitable for decontamination of the intact skin but may not always be appropriate for wound cleansing or irrigation of body orifices. Hot water should not be used to decontaminate the skin.
7. Usually, decontamination is most effective in the earliest stages, i.e., most of the radioactive material is removed during the first decontamination effort. Continued decontamination may show diminished effectiveness. At some point, a decision has to be made to either accept some residual contamination, or proceed with the use of more potent decontaminants. Do not abrade the skin.
8. If contamination survey meters are available, monitor periodically to measure progress of decontamination.
9. If possible, take swabs from nostrils, ears, mouth and other orifices to be counted for radioactivity. If inhalation is suspected, collect nose blow or cough samples.

10. Decontamination should be performed carefully so as to prevent transfer of contamination from the patient to hospital emergency and treatment staff, and to other areas of the hospital.
11. If severe internal contamination is suspected, the patient should be referred to a tertiary center. If expertise is available, the following treatments should be initiated prior to patient referral: gastric lavage for any acute ingestion (as for poisoning); iodide or perchlorate for radioiodine inhalation or ingestion; fluid diuresis for phosphate ingestion, and Gaviscon for metal isotopes.

I. Equipment and Supplies for Preparation of Radiation Treatment and Decontamination Area

- (1) Rope, tape, traffic cones or warning signs for marking routes and controlled areas.
- (2) Radiation warning signs and placards.
- (3) 2-4 ft wide paper or non-skid plastic roll for covering floors (optional).
- (4) Absorbent padding.
- (5) 2-inch wide roll of masking tape.
- (6) Disposal bins lined with plastic bags.
- (7) Plastic bags.
- (8) Labels for identifying contents of material and samples.
- (9) Dosimeters (if available)
- (10) Rubber or plastic aprons.
- (11) Any of: Sodium hypochlorite (bleach), Provioidine iodine solution or other surgical soap, soft scrub brush, powdered detergent, 3% hydrogen peroxide solution, shampoo or betadine solution (Note: use from current stores).
- (12) Contamination survey meter (if available).

J. Contamination and Exposure Controls

1. If possible, cover the wound, then cover the contaminated accident victim with a blanket to help prevent inadvertent transfer of contamination from the patient during the transfer to the Radiation Treatment and Decontamination Area from the ambulance.
2. Wear hospital clothing (uniforms, surgical clothing, gowns, latex gloves) to provide protection against radioactive contamination.
3. Treat the contaminated patient in the Radiation Treatment and Decontamination Area unless life-threatening intervention is required to be performed in some other area.
4. Remove clothing and personal effects from the contaminated patient after life-threatening intervention has been completed. If injuries are not serious, and if the patient is mobile, the patient should proceed to the shower for decontamination.
5. Limit the time spent around contaminated person(s) or materials.
6. Maximize distance from contaminated materials.
7. Segregate contaminated waste from non-contaminated waste and store contaminated waste in a secure area until disposal.
8. If contamination survey meters are available, perform periodic radiological surveys.
9. If radiation dosimeters are available, they should be worn to estimate any radiation doses received by the hospital emergency and treatment staff.
10. Hospital and treatment staff who have inadvertently contaminated the skin on their hands (or other parts of the body) should wash the contaminated areas with soap and water to remove the contamination. Hot water should not be used to decontaminate the skin.
11. After the emergency, radiological monitoring should be undertaken in affected areas of the hospital to identify possible spread of radioactive contamination and after clean-up of radioactive contamination.
12. All radioactive contamination should be cleaned up as soon as it is identified, and followed up by radiological monitoring to verify effectiveness of clean-up operations.
13. As a general precaution, female emergency and treatment staff in whom pregnancy has been confirmed should not be involved in handling radioactively contaminated patients.

K. Ambulance Attendants

1. If a contamination survey meter is available, ambulance attendants should be monitored by the radiation safety monitor or his designate. If required, ambulance attendants will be given instructions regarding personnel decontamination.
2. If a contamination survey meter is not available, ambulance attendants should wash with soap and be given new clothing. Their clothes should be placed into a labelled plastic bag for subsequent radiological assessment and possible decontamination.
3. The ambulance should be locked until it has been monitored. If required it should be decontaminated by a radiation specialist called upon the scene.

NOTE: For ambulance attendance training, refer to Manual "Emergency Care", Chapter 17, Section "Radiation Accidents", from H.D. Grant, R.H. Murray, Jr., and J.D. Bergeron.

LIST OF EMERGENCY EXTERNAL RESOURCES**1. Canadian Nuclear Safety Commission**

CNSC Duty Officer (24 hours)

(613) 995-0479

The CNSC Duty Officer provides initial technical advice on immediate safety measures to be taken to minimize exposures, to control spread of contamination and to assess radiological hazards. Acts as a co-ordinator and effects liaison with other agencies and departments until responsible CNSC Officer assumes responsibility.

2. Health Canada

Medical Liaison Officer to CNSC

(613) 954-6647 or 941-3320

(08:00-16:00 hrs)

The CNSC's Medical Liaison Officer provides medical advice concerning radiation exposures during normal business hours.

3. Transport Canada

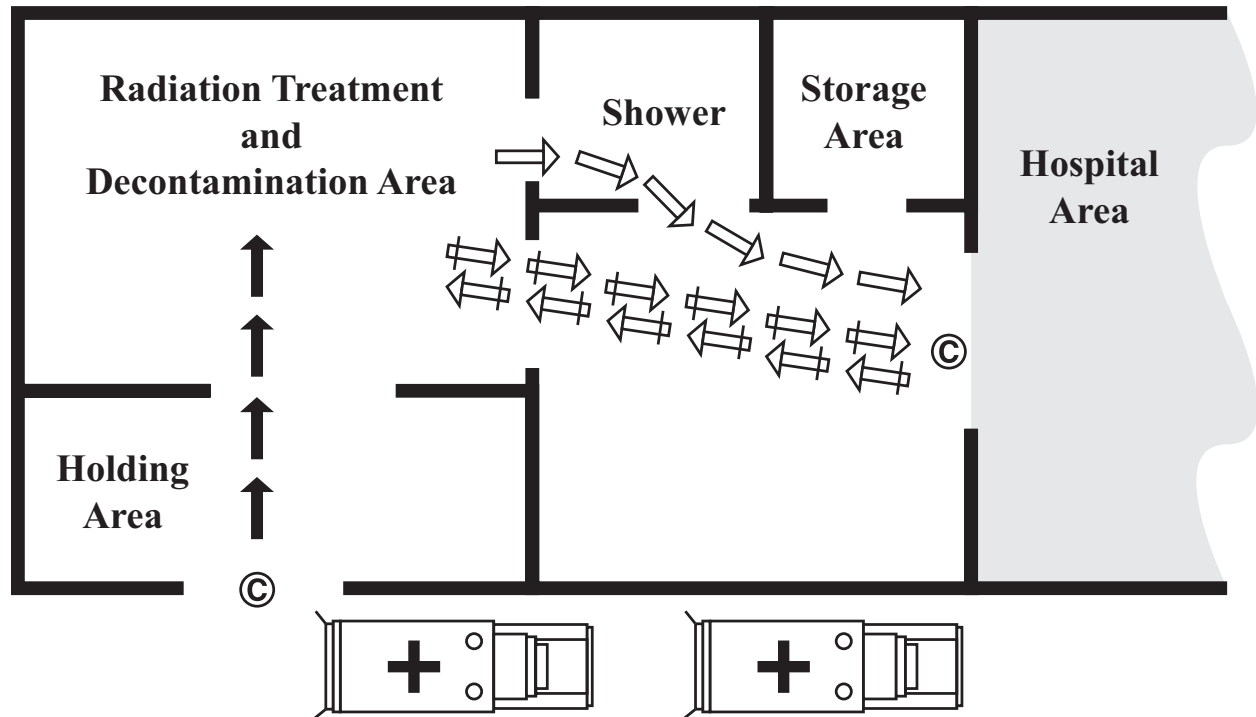
CANUTEC

(613) 996-6666 (24 hours)

(Call collect)

CANUTEC is the Canadian Transport Emergency Centre. This national bilingual advisory centre assists emergency response personnel in handling all types of dangerous goods accidents. Acts as a communications centre permitting access to industry, emergency response personnel and other government agencies and departments.

FIGURE 1
Radiation Treatment and Decontamination Area



Legend

- Contaminated Patient →
- Decontaminated Patient ⇨
- Hospital Emergency and Treatment Staff ⇄
- Access Control and Radiological Monitoring Point ©

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Members of GMA Working Group 2 (for GMA-3)

E. Callary

R.A. Copes

J.P. Goyette

M. W. Lupien

All the members of the former Group of Medical Advisers to the Atomic Energy Control Board

REVIEW PANEL MEMBERS AND ORGANIZATIONS (for GMA-3)

R.K. Lo (Ontario Hydro)

D.E. Drum (Harvard Medical School)

C.B. Jankowski (Brigham and Women's Hospital)

P. Wise (Ottawa General Hospital)

Canadian Radiation Protection Association (CRPA)

The Canadian Organization of Medical Physicists (COMP)

The Canadian Association of Nuclear Medicine (CANM)

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