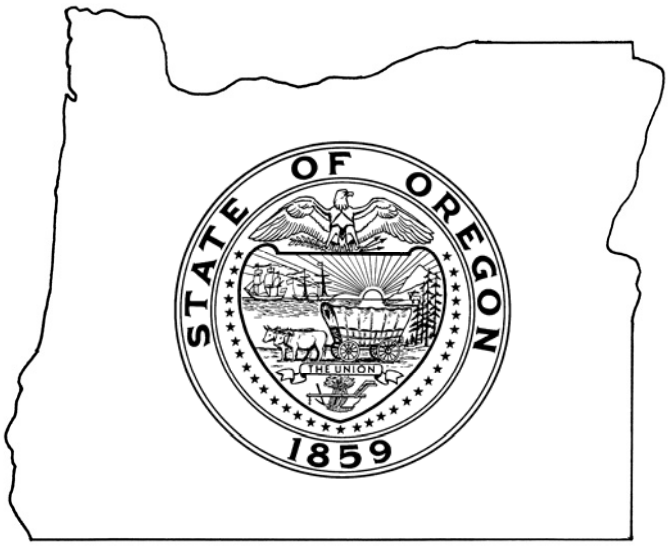
DHS
Oregon Department
of Human Services

Public Health Radiological Emergency Response Plan



August 17, 2007

State of Oregon
Emergency Management Plan
Annex F, Public Health and Medical Services
Hazard Appendix 3

This appendix is part of Annex F of the State of Oregon Emergency Management Plan and should be used in conjunction with the rest of Annex F base plan and hazard specific appendices. It is not a stand-alone plan.

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1 INTRODUCTION

This plan describes the Oregon Department of Human Services, Public Health Division (OPHD) response to a radiological incident. It outlines key assumptions, summarizes relevant authorities, explains the OPHD emergency management organization, and defines a concept of operations for a radiological incident.

The responsibility for radiation incidents is a shared one:

- The Oregon Department of Energy (ODOE) is the lead state agency for incidents that occur during the transport of radioactive materials and for incidents at nuclear reactors or nuclear fuel storage facilities. OPHD provides technical assistance by responding to the scene, as appropriate, and by providing information on the health effects of a radiological incident.
- OPHD is the lead state agency for all other radiological incidents, including a terrorist incident or an accident at a hospital, research lab, or industrial site, as described in this plan.
- OPHD responds to emergencies at the Columbia Generating Station (CGS) in Washington to provide technical assistance to Oregon state workers.

This plan is part of the state of Oregon Emergency Management Plan. It is an appendix to Annex F, Emergency Support Function (ESF) #8—Public Health and Medical Services. This plan is organized as follows:

- This appendix covers the OPHD response to all radiological incidents.
- Tabs to this appendix provide more detailed descriptions of these activities.
- Attachment A describes response activities to a radiological dispersal device.
- Attachment B describes response activities to an improvised nuclear device.

2 PURPOSE AND AUTHORITIES

2.1 Purpose

The purpose of the Radiological Emergency Response Plan is to lessen the health impact on Oregon residents after a release of radioactive material. This plan focuses on elements unique to radiological emergencies. Wherever response is typical to any public health emergency, reference will be made to the appropriate section of Annex F, ESF #8—Public Health and Medical Services. Annex F can be found on the Health Alert Network (HAN) Web site (*https://www.oregonhan.org/*) or can be requested by contacting the OPHD Emergency Preparedness Program (971-673-1308).

2.2 Authorities

Oregon is an "Agreement State" with the Nuclear Regulatory Commission (NRC) and, as such, has accepted responsibility for overseeing the licensing, use and disposal of all radioactive material in the state, except for that in federal or military facilities. Part of this responsibility includes radiological emergency response. Table 1 lists the relevant Oregon statutes for radiological emergencies.

Table 1: Legal Authorities

Oregon Rule or Statute	Title
ORS 453.635	Designates OPHD as the state radiation control agency.
ORS 469.533	Requires OPHD, along with Oregon Department of Energy and Office of Emergency Management, to develop radiological emergency procedures.
ORS 469.611(3)	States that OPHD will maintain a trained and equipped radiation emergency response team.
OAR 333-100 through 123	Oregon Rules for the Control of Radiation

3 SITUATION AND ASSUMPTIONS

3.1 Situation

Radioactive materials are widely used in commercial applications, research laboratories, and in medical care facilities in Oregon. In addition, radioactive materials are found in the two experimental reactors located at Oregon State University (OSU) and Reed College. Radiation could be released as the result of an accident at a site containing radioactive materials or as a deliberate act.

OPHD will lead the state response and will make a radiological health assessment following an industrial accident or a terrorist attack when involvement of radioactive material is suspected by the on-scene Incident Commander or by another appropriate authority. For incidents managed by the ODOE, OPHD provides technical assistance to the Incident Commander and provides information on the health impact of the radioactive materials that were released.

The public health response to the accidental or deliberate release of radiological materials will focus on protecting human health. A timely response is critical in limiting the health impact of public exposure to ionizing radiation, and it is essential in controlling the spread of radiological contaminants. A radiological incident may result in environmental contamination and thus the risk of ongoing human exposure and long-term health

consequences. The incident may have psychological impacts among people who were not actually exposed, but who are still concerned about their health.

Recovery operations involve the cooperative efforts of a number of state, local, federal and private agencies and organizations and are likely to be a long-term, time-consuming task. In large events, a Recovery Committee is convened and is chaired by the Governor or the Governor's designated Recovery Manager. Throughout the remainder of this plan, all references to the Recovery Manager will imply the Oregon Public Health Officer if no Recovery Manager has been designated.

Recovery begins when the incident is stabilized, and the response phase is complete. It is a time of planning, assessment, restoration and return to non-emergency operations.

This plan discusses the following types of radiological incidents:

- Radioactive materials could be released as the result of an accident during the transportation of materials or at an industrial site that uses radioactive materials.
- Radioactive materials could be sprayed into the air, introduced into food or water, or left in public places. Such methods are not likely to produce mass casualties.
- A radiological dispersal device (RDD), or "dirty bomb," is a bomb that combines conventional explosives (such as dynamite or TNT) with radioactive materials. An RDD injures nearby people, damages buildings, and blasts radioactive materials into the area. An RDD attack is more likely to occur than other types of attacks because of the prevalence of commercial radioactive material and the relative ease of constructing an explosive device. Response activities and information specific to an RDD are described in Attachment A.
- An improvised nuclear device (IND) is a high-yield nuclear bomb that produces a nuclear explosion. An IND creates a fireball that emits intense heat and light along with ionizing radiation. An IND could be fabricated from diverted nuclear weapon components or built from scratch using nuclear materials (hence the term "improvised"). Because an IND requires enriched uranium or plutonium and a more sophisticated knowledge of bomb-building, it is less likely to be used in a terrorist attack. Response activities and information specific to an IND are described in Attachment B.

3.2 Assumptions

- OPHD is the lead state agency for all radiological incidents except transportation incidents and incidents at nuclear reactors and nuclear fuel storage facilities, which are managed by the ODOE.
- OPHD provides technical assistance for all radiological incidents, from simple radiological accidents to terrorist incidents.
- The Federal Bureau of Investigation (FBI) leads the criminal investigation if the radiological release was intentional. The FBI is responsible for determining whether an explosion involved radioactive materials.

- Federal agencies, including the U.S. DOE, the Environmental Protection Agency (EPA), and the NRC, will provide resources and coordination when Oregon's resource demands exceed availability or when a radiological incident extends beyond state boundaries.
- The U.S. Centers for Disease Control and Prevention (CDC) is the lead federal agency to support public health actions when state capacity and expertise are exceeded.
- Local health departments have jurisdiction in their communities for public health.
- Local government authorities have response plans in place to deal with a radiological emergency.
- The initial response phase may be complicated by the fact that the incident site could be a mass casualty scene, possibly a life-threatening hazard area, and a crime scene.
- For a crime scene, it will be necessary to preserve the scene so that law enforcement can gather evidence.
- It may be necessary to provide medical treatment to on-scene victims, and victims may need to be decontaminated.
- The incident must be stabilized and the radioactive release stopped prior to initiation of recovery field operations.
- If a radiation plume is existed, recovery operations may not begin until it is dissipated and all significant deposition has occurred.
- Radiation Protection Services (RPS) (in OPHD) and regional hazardous materials (Hazmat) teams (in the State Fire Marshal's office) are the lead state groups for technical radiological and decontamination expertise during recovery.
- Recovery personnel will be subject to the exposure limits for occupational workers in the Oregon Rules for the Control of Radiation (OAR, Chapter 333, divisions 100-123).
- Exposures will be maintained as low as reasonably achievable (ALARA) during recovery.

4 CONCEPT OF OPERATIONS

Annex F, Public Health and Medical Services, Base Plan contains detailed information on incident management and the federal, state and local response systems. For a radiological incident, OPHD would lead the public health response using the base plan concept of operations. The Public Health Emergency Preparedness (PHEP) program will support all other public health programs during the response.

4.1 Notification

Notification of a radiation emergency will likely come from the Oregon Emergency Response System (OERS), which is managed by the Oregon Office of Emergency Management (OEM). Alternatively, OPHD staff may receive notification of an emergency from local health departments, other governmental agencies, or members of the public.

When informed of a radiological emergency:

- OERS staff will notify the state PHEP on-call Duty Officer.
- The PHEP Duty Officer and the RPS Duty Officer will make an initial assessment of severity and scope and will notify the appropriate OPHD staff. See Annex F, SOP B-3, Duty Officer.
- The PHEP Duty Officer and the RPS Duty Officer will recommend to management whether or not to activate the state public health Agency Operations Center (AOC). OPHD will notify OERS if the AOC is activated.

4.2 Operational Priorities

To minimize the health effects of a radiation incident, OPHD will:

- Assess the risk to people and recommend interventions.
- Provide information to the Joint Information Center (JIC) for release to the public.
- Provide technical information about the radiological material released in the incident.
- Identify activities with the potential for a high level of exposure.
- Recommend safety procedures for first responders, including advice on protective gear and exposure limits.
- Assist the on-scene Incident Commander by providing field personnel to monitor the site for radiation levels and monitor first responders for exposure levels.
- Evaluate the long-term health consequences and recommend follow-up actions for environmental decontamination and medical evaluation.

4.3 Activation of the OPHD Emergency Management Organization

This section describes the emergency management structure that OPHD will use during a radiological incident to manage resources under state control. The OPHD response to a radiological incident will comply with the National Incident Management System (NIMS) provisions.

The PHEP Duty Officer (971-246-1789), who receives a call from the Oregon Emergency Response System (1-800- 452-0311), and the RPS Duty Officer (971-673-0515) will determine the initial activation of the OPHD emergency management organization in consultation with OPHD management and technical staff. RPS personnel reporting to the scene of an incident will report to the on-scene Incident Commander for instructions and will typically act as an on-scene advisor throughout the incident. The RPS Section Manager acts as the state Public Health Officer's designee on small events that don't require activation of the AOC.

The Radiological Emergency Response Plan can be activated prior to or without a declaration of a radiological emergency by the governor.

4.4 Agency Operations Center

The AOC is the physical location for OPHD staff to coordinate activities. The AOC is activated for large scale radiation emergencies.

At the AOC, public health staff will:

- Notify, assemble and dispatch emergency response teams.
- Coordinate field team activities.
- Coordinate laboratory testing of environmental and human samples.
- Acquire resources to support local health department field emergency responses through the state Emergency Coordination Center (ECC). All resource requests are forwarded to and filled by the Logistics Section. These include:
  - RPS personnel and equipment
  - Hazmat teams (once activated, these teams become a state resource)
  - Selected personnel from state universities acting on regional radiological field teams
  - OSU Radiation Center
  - Oregon 102nd National Guard Civil Support Team
- Coordinate health information flow to and from:
  - Federal agencies
  - OPHD programs and other state agencies
  - Local health departments
  - Tribal governments
  - Health care organizations
  - Providers of medical care, medical facilities, and medical suppliers
  - The Joint Information System/Joint Information Center (JIS/JIC).

4.5 Recovery

A Unified Command, called the Recovery Committee, will be formed to direct recovery activities pursuant to Volume III, State of Oregon Relief and Recovery Plan. The Unified Commander is the Governor or the Governor's appointee. Membership may include any state, federal, local or private agencies and organizations involved in the recovery effort, and will always include OPHD. As the most directly affected entities, appropriate local governments will be specifically requested to participate in planning and conducting recovery operations.

The Recovery Committee will convene prior to commencement of recovery operations. It will continue to function until all phases of the recovery process are complete. It is tasked with overall recovery coordination and is responsible to:

- Direct the local jurisdiction(s) to establish an Emergency Worker Center

- Direct Hazmat teams or Radiation Protection Services (RPS) to conduct a contamination survey
- Develop a recovery plan
- Restore vital services
- Secure and coordinate resources
- Direct recovery operations
- Prepare necessary documentation
- Coordinate with outside organizations and government agencies.

OPHD will provide technical support and make recommendations regarding the radiological and health aspects of recovery activities to Recovery Committee. When restoration actions exceed the capacity of OPHD, federal assistance will be requested.

The four phases of recovery are re-entry, restoration, return, and relocation. The phases may occur concurrently. Within a specific phase, action items may be undertaken simultaneously or otherwise modified to meet the situation. Routes of exposure during all phases can be external (ground deposition) and internal (inhalation of re-suspended particles).

Recovery Phase	Definition
Re-entry	• A contamination survey is performed. • The results form the basis for protective actions or the release of designated areas to unrestricted use.
Restoration	• Begin reducing exposure rates and concentrations to acceptable levels. • This phase can last from months to years.
Return	• Individuals are permitted to reoccupy their homes and workplaces. • This phase may occur from several days to years after the incident.
Relocation	• Individuals are relocated when the affected areas cannot be restored for unrestricted use. • Decisions on whether to restore or relocate are based on both technological and economic considerations. • People are excluded for an indefinite period from the affected areas to avoid chronic radiation exposures in excess of established limits. • This phase can last from several months to several years.

Prior to termination of recovery, the Recovery Committee will direct the preparation of an after-action report describing recovery activities and making recommendations for improvement.

5 ROLES AND RESPONSIBILITIES

This section outlines the roles and responsibilities of the federal, state and local agencies involved in the preparation for and response to a radiological incident.

5.1 Federal Agencies

- The FBI is the lead federal agency for a radiological terrorist incident.
- The U.S. DOE provides federal radiological support with both equipment and personnel when called by the FBI for a terrorist incident or upon request from the state for a radiological accident.
- The NRC provides technical assistance and ensures compliance with the legal use of radiological material for any incident involving a radiological licensee or a nuclear power plant.
- The EPA provides technical assistance during the recovery phase of a radiological disaster. The EPA responds when called by the FBI for a terrorist incident or upon request from the state for a radiological accident that affects a large area, waterways or federal land.
- The CDC is the lead consulting agency in the collection of human clinical samples to test for heavy metal or chemical exposure.
- A federal representative, from FEMA, the EPA, or the U.S. DOE, will be on the Recovery Committee.
- In large scale incidents, a Federal Radiological Monitoring Assessment Center (FRMAC) will be established.

Other federal agencies that have a support role in the response to or recovery from a radiological incident are outlined in the U.S. Department of Homeland Security *National Response Plan*. (See *http://www.epa.gov/radiation/rert/nuclearannex.htm*)

5.2 State Agencies

This section outlines the roles and responsibilities of the state agencies involved in a radiological emergency.

5.2.1 Oregon Public Health Division (OPHD)

OPHD will staff the ESF #8 incident command positions (see Annex F, Attachment B, OPHD Emergency Management). Within OPHD, Radiation Protection Services is the lead program for the state public health response to a radiological emergency. This section describes the roles and responsibilities of the OPHD programs involved in a radiological emergency.

5.2.1.1 Preparedness

All staff

- Participate in preparing plans.
- Participate in exercises.
- Participate in appropriate training.

Radiation Protection Services

- Maintain radiological equipment:
  - Inventory equipment on a quarterly basis
  - Replace or maintain equipment as needed.
- Form radiological emergency response teams (ERTs) and conduct training at least twice a year (see Tab 1 for training materials)
- Conduct refresher training for the state Hazmat teams at least once every 18 months.
- Update state radiological plans and standard operating procedures (SOPs) every other year.
- Review and distribute exposure guidelines for first responders (see Tab 2).
- Offer planning assistance to first response agencies (e.g., police, fire, and ambulance personnel).
- Coordinate planning and training with other agencies and assets.

Public Health Emergency Preparedness

- Coordinate public health planning, response, and recovery.
- Encourage local health department planning.
- Coordinate the design and evaluation of exercises.
- Standardize statewide response protocols.
- Act as point of contact with OERS.

Environmental Toxicology

- In coordination with RPS, provide chemical and radiological training to first responders.
- Coordinate with public health programs and other agencies on the radiological emergency response plan and threat assessments.

Environmental and Occupational Epidemiology

- Create or expand role of pre-established networks of physicians and systems to detect unusual census or unexpected radiological syndromes.

- Increase the number of physicians and other providers with experience and skills in the diagnosis and treatment of diseases or conditions possibly resulting from a radiological terrorist incident.

Oregon State Public Health Laboratory (OSPHL)

- Ensure appropriate facilities receive key documents and training on how to respond to a radiological emergency when the public seeks medical care, including:
  - CDC's protocols for phlebotomy and urine collection and packaging and shipping human clinical samples.
  - OSPHL's protocols for receiving human clinical samples.

Drinking Water Program

- Maintain an updated inventory of public water systems that use surface water sources or have uncovered reservoirs, along with contact information.
- Investigate the possibility of coordinating with Oregon's Department of Environmental Quality and Water Resources Department on developing water-related geographic information system (GIS) databases.

Food Health and Safety

- Review and distribute protective action guides.
- Review and distribute derived intervention levels.
- Coordinate with RPS on the development of protective action guides and derived intervention levels.

Public Information/Risk Communication

The Risk Communication Team consists of the Oregon DHS Public Health Information Officer, the OPHD Risk Communication Section, and a content expert from RPS. The Risk Communication team will:

- Prepare messages that focus on radiation response activities for state and local public health, hospitals, businesses, individuals and families, community organizations, and schools.
- Prepare communication materials on a variety of radiological agents for distribution to health care providers, emergency responders, the media, and the public during a radiation emergency.
- Participate in communication planning and exercises with radiation emergency response partners.
- Incorporate radiation events into JIS/JIC exercises.

For more information, see Annex F, Attachment C, Public Information and Risk Communication.

5.2.1.2 Response

All staff

- Participate in the AOC (if activated) and coordinate deployment of appropriate public health resources.

Radiation Protection Services

- Staff the RPS Duty Officer position and, with the PHEP Duty Officer, form an initial assessment of the incident (see Tab 3).
- Lead public health activities during a radiological incident.
- Act as the OPHD Director's designee on smaller events not requiring the activation of the AOC or the state ECC.
- Lead the risk assessment process.
- Send RPS emergency response teams to the incident location as appropriate to become part of the operations and to provide technical assistance to the Incident Commander (see Tab 4).
- If the AOC is activated, designate a Radiological Branch Director and a Dose Analyst to report to the ESF-8 Incident Manager (see Tabs 5 and 6).
- Activate radiation laboratories to support any needed laboratory work. Lab facilities are located at OSU Radiation Center and RPS.
- Advise on appropriate personal protective equipment for the type and intensity of the radioactivity.
- Advise on Protective Action Recommendations (PARs).

Public Health Emergency Preparedness

- Serve as OPHD Duty Officer.
- If the AOC is activated, staff the AOC and direct its operation.
- Provide liaisons to the state ECC and to hospitals and health care systems.
- Issue appropriate Oregon HAN alerts
- Support state and local health department activities.
- Develop and coordinate preparedness related educational material.

Environmental Toxicology

Provide input on personal protective equipment and safety procedures for both first responders and first receivers.

- In collaboration with Environmental and Occupational Epidemiology, provide toxicological prognosis to the public for the short-term, mid-term and long-term health effects of exposure.
- Assist with sampling plans.
- Coordinate the issuance of appropriate advisories for food, air and water.

Environmental and Occupational Epidemiology

- Identify cohorts (groups of people) at risk of subsequent health effects and find out how to reach them for follow-up.
- Document the mortality and disposition of people acutely affected by radiation.
- Conduct ongoing community surveillance to document short-term, mid-term and long-term health effects using standard epidemiological methods.
- Document the identity and exposure factors of acutely affected subjects who were exposed but are not yet acutely symptomatic.
- In collaboration with the state toxicologist, provide toxicological prognosis to the public for the short-term, mid-term and long-term health effects of exposure.
- Send information using a variety of media (print, television, radio) to inform the public about their risk of exposure and to provide guidance on when to contact their medical providers.
- Work with partner agencies and the state Public Information Officer (PIO) to develop risk communication strategies and disseminate to community stakeholders.

Oregon State Public Health Laboratory

- Work in consultation with the CDC to determine whether clinical samples will be collected for the Rapid Toxic Screen laboratory test.
- Provide technical assistance to various public and private medical facilities throughout the state to collect, package and ship human clinical samples from potentially exposed and legitimately concerned victims who report for evaluation and treatment.
- At CDC's direction, receive and process nonradioactive human clinical samples from various public or private medical facilities throughout the state.
- At CDC's direction, retrieve non-radioactive human clinical samples from various public or private medical facilities throughout the state.
- Coordinate all human clinical sample data processing functions between CDC, Level 1 and Level 2 state surge laboratories, local health departments, medical facilities, and other governmental agencies.

Drinking Water Program

- Provide locations of public water systems that use surface water or have uncovered reservoirs that might be subject to fallout contamination to the AOC or to RPS as needed.
- Assist public water systems with public notification, water sampling, emergency interim measures, and treatment/operational considerations appropriate to the radioactive element in question.

Food Health and Safety

- Direct the issuance of advisories for food safety.
- Initiate recall procedures as necessary.

- Provide input on food safety procedures for first responders and first receivers.
- Review recommended derived intervention levels.

Public Information/Risk Communication

- Activate the public health JIS/JIC to ensure information flow to local health departments, medical providers and other health care partners.
- Send technical information about the radiological materials and decontamination procedures to local health departments, hospitals and clinicians.
- Distribute fact sheets, FAQs and other informational materials via the news media, e-mail lists, HAN, the JIS/JIC and the public health emergency broadcast fax system. (See Tab 7 and Tab 8)
- Focus messages on who is likely to be affected (based on geographical proximity to the radiological incident, wind speed and direction, health and age vulnerability and other factors), actions necessary to prevent or mitigate the effects of exposure, availability and location of treatment, and the numbers of confirmed illnesses or deaths.

5.2.1.3 Recovery

Radiation Protection Services

All phases

- Coordinate actions of the RPS ERTs (see Tab 4).
- Provide guidance to the Recovery Committee regarding health physics, radiation safety, decontamination methods and materials, exposure limits, regulatory requirements, and disposal of radioactive materials.
- Control contamination and manage exposure to radiation.
- Provide technical support to utilities.
- Provide technical background for public information.
- Ensure that supervisors and emergency workers know that exposures are subject to the occupational worker limits expressed in the Oregon Rules for Control of Radiation (OAR, chapter 333, divisions 100-123).

Re-entry Phase

- Provide technical assistance to the Recovery Committee and agencies overseeing re-entry.

Restoration Phase

- Review the Recovery Plan and issue a license for its performance (see OAR-333-102), if needed.
    - Evaluate the professional and technical qualifications of people and/or firms providing services prior to issuance of a license.

  - Approve or disapprove (for cause) the radiological portions of contracts to perform work under the license
  - Perform periodic inspections to ensure compliance.
  - Ensure that all decontamination license conditions are met.
- Determine areas, structures and equipment that need to be decontaminated.
- Follow progress of restoration by sample collection and analysis.
- Assure monitoring and decontamination, as necessary, of people, vehicles and equipment leaving the relocation zone.
- Assure decontamination of essential facilities and their access routes. Perform periodic contamination checks and assure decontamination as needed.
- Require that radioactive waste be packaged, stored, shipped, and disposed of in accordance with applicable regulations. Inspect as necessary to ensure compliance.
- Perform post-decontamination surveys as appropriate. Use the results to determine whether Return Phase exposure guidelines and decontamination plan requirements have been met.
- Release areas, buildings, equipment, etc. to unrestricted use when Oregon Rules for Control of Radiation and decontamination plan license requirements are met.
- Recommend release of portions of the relocation zone to unrestricted use when Return Phase exposure guidelines and decontamination plan license requirements are met.
- Advise city and county officials regarding the temporary return of area residents and local workers to relocation zone.
- Monitor worker performance to assure compliance with radiation work permit requirements, exposure limits and radiation safety.
- Periodically monitor areas adjacent to restricted zones to determine the effectiveness of contamination control measures in the environment.
- Coordinate actions with the Recovery Committee.
- Recommend medical screening, examination and diagnosis of exposed personnel, and medical reassurance to people not exposed.
- Monitor relocation zone boundaries in order to detect the spread of contamination. Take required actions to prevent the spread of contamination.

Return Phase

- If directed by the Recovery Committee, survey each dwelling, work space or accessible area prior to the return of evacuees.
- Use results of the survey will be used to project first, second, and fifty-year dose commitments.
- Provide guidance to the Recovery Committee regarding the return of people to former relocation zone areas. Recommend limitations as appropriate to meet return phase exposure guidelines.
- Ensure that use restrictions are posted in the relocation zone and other affected areas. Update restrictions when conditions change.

- Monitor areas adjacent to remaining relocation zone areas in order to determine if contamination is being spread beyond zone boundaries. Require decontamination as necessary to maintain exposures within return exposure guidelines and ALARA.
- Monitor occupied areas and buildings to verify dose projections and determine the need for additional protective action recommendations.

Relocation Phase

- Ensure that use restrictions are posted in affected areas. Update restrictions when conditions change.
- Ensure that residents and local workers are provided dosimetry and appropriate protective clothing (if necessary) when entering the relocation zone, and that all people entering the zone receive a briefing on radiological conditions prior to entry. Escorts will be provided by the local government.
- Assure that contaminated materials are not removed from the relocation zone except for the purpose of decontamination or proper disposal.
- Monitor people, vehicles and other items leaving the relocation zone. Ensure that appropriate decontamination is performed prior to release.
- Monitor relocation zone areas and buildings periodically in order to determine when access control is no longer warranted.
- Monitor areas adjacent to the relocation zone in order to determine whether contamination has spread beyond zone boundaries. Require decontamination, as necessary, to maintain exposures in those areas within return exposure guidelines and ALARA.
- Coordinate actions with the Recovery Committee.

Public Health Emergency Preparedness

- Provide subject matter expertise to the state Medical Examiner's Office for the handling and disposition of contaminated bodies (*http://www.bt.cdc.gov/radiation/pdf/radiation-decedent-guidelines.pdf*).

Environmental Toxicology

All Phases

- Continue to coordinate the assessment of the risk to humans and recommend interventions.
- Work with the Public Information Officer on the development of information for the public on how to decontaminate themselves and their possessions.
- Work with the Public Information Officer on the development of information concerning any risks of breastfeeding children of exposed mothers and any risks to the fetus of exposed mothers.
- Help provide an assessment of longer-term effects from acute exposures and extended periods of personal contamination to members of the public and first responders.

- Participate as a member on the Recovery Committee.

Environmental and Occupational Epidemiology

All Phases

- Actively support and participate in the Recovery Committee.
- Conduct on-going community surveillance to document short-term, mid-term and long-term health effects using standard epidemiological methods.
- Establish a registry of exposed individuals for the purpose of long-term cohort tracking to characterize and mitigate health impacts (e.g., genetic counseling).

Oregon State Public Health Laboratory

All Phases

- Make clinical results available to patients, physicians and other agencies as needed and permitted.

Drinking Water Program

All Phases

- Continue to work with public water systems on public notification, water sampling, emergency interim measures, and treatment/operational considerations until the danger is past.

Public Information/Risk Communication

All Phases

- Continue JIC operations to assure that affected people receive periodic information updates.
- Participate in the process of establishing when it is safe to return to residences and businesses and communicate that to the public.
- Continue to communicate information to the public regarding any on-going risks or long-term health effects of radiation exposure, and availability of treatment, as necessary.
- Continue to disseminate any information regarding long-term health effects and availability of treatment, as necessary.

5.2.2 Governor's Office

5.2.2.1 Recovery

Recovery Committee

The Governor (or his/her designate) convenes the Recovery Committee and serves as the Unified Commander. The Recovery Committee will convene prior to commencement of recovery operations.

All phases

- Provide oversight and coordination of outside resources.
- Determine the need for personal protective equipment appropriate to the health risk
- Coordinate emergency worker entry into restricted zones with local officials.

Re-entry Phase

- Assess the extent of contamination by performing a contamination survey
  - Develop the survey methodology.
  - Direct either a Hazmat team or RPS to conduct a detailed contamination survey.
  - Review contamination survey techniques, area and equipment prior to performing the survey.
  - Use standard radiological precautions and limitations during the contamination survey (see Tabs 1 and 2).
  - Use data from the response phase to help determine how best to proceed with the contamination survey.
  - Using the results of the contamination survey, begin the development of the Recovery Plan.
- Create a Recovery Plan based on the results of the survey. Survey results will form the basis for decontamination and the ultimate release for unrestricted use (return phase), or the long-term relocation of people from the area, dwelling, and building (relocation phase). An area will be considered as exceeding return exposure guidelines if environmental monitoring results and/or laboratory analysis of radionuclides show that direct exposure and inhalation of re-suspended particles will result in a combined dose greater than 2 rem during the first year, 0.5 rem during the second year, or a 0-50 year cumulative dose in excess of 5 rem.
- In the Recovery Plan, make recommendations and, with the Governor, decide which areas or properties will be decontaminated and reoccupied, or which areas or properties will be condemned and the occupants permanently relocated.
- Recommend that evacuated areas be temporarily designated relocation zones until assessment actions are complete and restoration plans made. At that time, decisions regarding the status of the areas will be made.

- If the incident affects private dwellings, recommend interim relocation of general and special populations whose homes are inside areas where the dose rate exceeds 230 microrems per hour.

Restoration Phase

After the relocation zone is established and areas of radiological contamination defined, the process of restoring it to unrestricted use by reducing radiation levels in affected areas can begin. During this phase, people may enter the zone for a number of reasons, including recovery operations, security patrol, operation of vital services, and retrieval of property.

- Using the result of the contamination survey, develop a decontamination plan as part of the Recovery Plan and utilize it to direct restoration activities.
- Give high priority to decontamination of buildings, roadways, and vital service areas to enable people access to the area for employment.
- Finalize the Recovery Plan.

Return Phase

In this phase, return restricted zones to full use.

- Direct Hazmat teams or RPS to survey each dwelling, workspace, or accessible area prior to the return of evacuees.
- Assure that detailed contamination survey results are available to the public for all areas and buildings to be released for unlimited use.
- Develop a comprehensive long-term monitoring program to determine actual environmental exposure levels. Results of the monitoring will be used to estimate exposure of occupants and verify dose projections. They may also provide the basis for additional protective actions.
- Remove access control restrictions from restricted zone when return phase exposure guidelines are no longer exceeded.

Relocation Phase

Homes and businesses are relocated when it has been determined that further decontamination of buildings or areas is not possible or is impractical.

- Make appropriate recommendations regarding temporary re-entry by residents and local workers.
- Assure that contamination survey results are available for all areas maintained as the relocation zone. Make the results known to affected residents and workers.

Termination

Activities of the Recovery Committee may be terminated once the following conditions have been met.

- The relocation zone has been surveyed.
- Work under the decontamination plan has been completed to a stage where continued effort does not appear to be cost effective.

- Long-term exposures have been calculated for residences and places of employment where some significant potential for exposure continues to exist.
- Occupancy or use limitations have been posted for all buildings and areas where continued restrictions are necessary.
- Residents and workers have been given the opportunity to return to all areas for which restrictions have been lifted.
- Relocation to permanent or long-term temporary facilities has been accomplished for those people who could not be allowed to return following completion of work under the formal decontamination plan.

5.2.3 Oregon Department of Energy

- Is the lead state agency for transportation-related radiological incidents in Oregon. It is also the lead state agency in the case of an incident at the two nuclear research reactors in Oregon (at Reed College and Oregon State University).
- Supports OPHD in all other radiological events occurring in Oregon.

5.2.4 Oregon State Fire Marshal

5.2.4.1 Preparedness

- Establish and maintain the statewide Hazardous Materials Emergency Response system, which includes 15 regionally located response teams with specialized training and equipment.

5.2.4.2 Response

- When requested through OERS, send Hazmat response teams to serious incidents involving radiological materials when the incident exceeds first responder training and equipment.

5.2.5 Oregon Office of Emergency Management

- Coordinate state agency response through OERS and the ECC.
- Coordinate state agency support to the Recovery Committee.
- Provide access to the Oregon Civil Support Team if needed.

5.2.6 Oregon Poison Center

5.2.6.1 Response

- Provide technical and clinical expertise to assist in hazard assessment and patient management, including real-time assistance with patient diagnosis, treatment and antidotal therapy.
- Provide medical consultation to health care workers in local and regional hospitals, clinics and offices.
- Provide immediate toxicological information to OPHD to help with scientific and risk communication for the public.

5.2.6.2 Recovery

- Provide medical consultation to organizations concerning occupational exposures to radiological material during recovery.

5.2.8 Oregon Department of Agriculture

5.2.8.1 Preparedness

- Advise on county animal evacuation plans, including transportation, shelter and care of domestic animals.

5.2.8.2 Response

- Serve as the lead support agency in issues involving evacuation, shelter and care of domestic animals.

5.2.8.3 Recovery

- Assist county governments with their recovery efforts involving the transportation, shelter and care of domestic animals.

5.3 Local Emergency Operations Centers

5.3.1 Preparedness

- Plan and exercise for radiological incidents.

5.3.2 Response

- Call RPS Duty Officer (971-673-0515)
- Aid RPS and law enforcement in control of site.
- Manage Emergency Worker Center, including finding emergency workers.
- Ensure that anyone entering the relocation zone receives appropriate dosimetry and protective clothing (to include respiratory protection).
- Assure that monitoring and if necessary decontamination of people and vehicles is conducted when they leave the affected zone.

5.3.3 Recovery

All Phases

- Ensure that anyone entering the relocation zone receives appropriate dosimetry and protective clothing (to include respiratory protection).
- Assure that monitoring and if necessary decontamination of people and vehicles is conducted when they leave the affected zone.

Re-entry Phase

During this phase, area residents and local workers may be allowed to briefly re-enter the relocation zone under controlled conditions to retrieve property. Permission to enter the relocation zones will be obtained from the applicable county EOC. People working inside the relocation zone should not exceed the exposure control limits prescribed for occupational workers.

- Set up an Emergency Worker Center. Responsibilities for the Center include:
  - Designate contamination control team members to provide necessary briefings and dosimetry, as well as required exit monitoring.
  - Check people in to and out of the relocation zone. Authorize entry by verification (radio check, access roster, entry permit, etc.).
  - Ensure that people wear prescribed protective clothing, use appropriate dosimetry, and comply with worker safety and radiation worker job requirements.
  - Decontaminate people, clothing, equipment, etc. if necessary.

Return Phase

- Provide assistance to the local population once it is deemed safe to return to homes and businesses

Relocation Phase

- Ensure that assistance from all relevant agencies is available to all residents needing relocation.

5.4 Local Health Departments

Oregon's public health system relies on the authority and responsibility of local health departments (LHDs) for public health preparedness and response.

5.4.1 Preparedness

- Write an emergency response plan that includes a radiological annex.
- Develop a hazard vulnerability assessment for known radioactivity sources for the jurisdiction. (See Tab 9).
- Develop and maintain standard operating procedures for the public health response to a radiological incident. (See the sample SOP in Tab 9)
- Include local stakeholders and volunteer groups in planning and training for a radiological emergency.
- Ensure telephone numbers and points of contact are current, including:
  - Local emergency management
  - Hazmat
  - Fire/police
  - Public utilities
  - Local hospitals, nursing homes, clinics, and other health care facilities
- Provide training to appropriate LHD personnel regarding radiation response.
- Participate in training, exercising and coordinating with the county emergency manager and state agencies to ensure everyone's plans interrelate appropriately.

5.4.2 Response

5.4.2.1 General Emergency Response

- Follow your SOPs for radiation emergencies.
- Call RPS Duty Officer (971-673-0515)
- Provide public health updates to key agencies as requested.
- Coordinate all activities with the local Emergency Operations Center (EOC).
- Ensure that public health messages are routed through the Joint Information Center.
- If the LHD building is considered contaminated, evacuate the building and leave all supplies in the building to prevent the spread of radioactive materials.
- Instruct public health employees who might be contaminated with radioactive material to seek decontamination at the hospital or other designated location and not to report to work.
- If requested, assist with monitoring potentially contaminated people. Ensure that staff members wear appropriate personal protective equipment.

- Work with the Oregon Public Health Laboratory to collect, package and ship clinical samples to the CDC (and other state chemical terrorism laboratories at the direction of CDC or OSPHL).

5.4.2.2 Epidemiology

- Collect exposure data on those impacted.
- Receive and manage the data from the clinical samples and advise medical facilities accordingly.

5.4.2.3 Environmental Services

- Provide guidance on the monitoring of public and private water sources.
- Inspect food services, including those provided at mass care centers.
- Issue advisories on food preservation, disposal and consumption.

5.4.2.4 Communications

- Send a Public Information Officer to the county EOC to help provide public health updates and gather information for the public and for medical providers and hospitals in the county.
- At the direction of the Incident Commander, provide a 24/7 public information hot line that will allow 1% of the county population to receive information in a 48-hour period.

5.4.2.5 Strategic National Stockpile (SNS)—Activation and Point of Dispensing[1]

- If necessary, request activation of the Strategic National Stockpile to obtain drugs and supplies to treat radiation exposure. Requests will come from the Incident Commander through the Public Health Administrator and the local emergency manager.
- Administer prophylaxis to all people determined to need it.

5.4.2.6 Vulnerable Populations

- Identify vulnerable populations in the county and develop methods for locating and communicating with each group.

[1] The SNS contains very few radioactivity countermeasures, so its use during a radioactive incident will probably be more for injuries from an explosion than from radioactive exposure. However, the SNS does contain potassium iodide for iodine exposure, Prussian blue for cesium or thallium exposure, and calcium and zinc DPTA for transuranium elements (e.g., americium).

5.4.3 Recovery

- Assess capability of resuming normal public health functions and delivery.
- Assess local capacity to resume normal health care delivery.
- Report results of assessments to local governments and OPHD.
- Identify potential/continuing hazards affecting public health.
- Conduct syndromic surveillance in collaboration with OPHD.
- Identify potential or continuing hazards affecting public health and offer appropriate guidance for mitigation of harmful effects.
- Evaluate LHD response in the after-action report and incorporate needed changes into plans.
- Participate in the local Recovery Committee activities.

5.5 Hospitals and Health Care Systems

See Tab 10 for suggested radiation incident protocols for hospital emergency services departments.

5.5.1 Preparedness

Hospitals and health care systems are expected to develop plans for radiological emergencies that describe how the organization will:

- Ensure the safety of health care workers by providing information on personal protective equipment and proper decontamination procedures.
- Train health care workers to treat and stabilize patients with life-threatening injuries before decontaminating them.
- Train health care workers to recognize radiological illness or injury

5.5.2 Response

- Establish decontamination areas, decontaminate patients, and safely dispose of contaminated materials.
- Handle large numbers of frightened people. Non-injured patients who were exposed to radiation may need to be referred to a location outside the hospital.

5.5.3 Recovery

- Assess capacity to resume normal health care delivery.
- Report results of assessments to local governments and OPHD.

6 TRAINING AND EXERCISES

6.1 Training

Regional training of first receivers and first responders will be conducted every 1-3 years depending on their needs.

6.2 Exercises

PHEP, in collaboration with RPS, will design and deliver an orientation, tabletop, functional or full-scale exercise as described in the OPHD exercise schedule. OPHD also participates annually in the CGS/U.S. DOE full-scale exercise.

7 VULNERABLE POPULATIONS

Radioactive materials that pose health risks to adults in the general population pose a significantly higher risk to some vulnerable populations because of the potential for longer exposures, pre-existing medical conditions, and the likelihood of not understanding disaster preparedness. Vulnerable populations should be given the highest priority for evaluation, shelter-in-place removal, and medical attention due to the high probability that these individuals would perish without immediate attention in a radiological emergency.

For radiation emergencies, children and pregnant women are at particular risk because children and fetuses are more sensitive to radiation than adults. Children are growing more rapidly, so there are more cells dividing and a greater opportunity for radiation to disrupt the process. The affect of radiation on a fetus depends on the developmental stage of the fetus:

- During the first 2 weeks of pregnancy, the radiation-related health effect of greatest concern is the death of the fetus. Of the fetuses that survive, few will have birth defects related to the exposure, regardless of how much radiation they were exposed to.
- Large radiation doses to the fetus between weeks 2 and 15 of pregnancy can cause birth defects, especially to the brain.
- Between the 16th week of pregnancy and birth, health effects due to radiation exposure are unlikely unless the fetus receives an extremely large dose of radiation. At these higher doses, the mother would also be showing signs of acute radiation syndrome.
- After the 26th week of pregnancy, the radiation sensitivity of the fetus is similar to that of a newborn.

8 PLAN MAINTENANCE

This appendix was developed by and will be maintained by the RPS Section of OPHD. It will be reviewed once every two years, coincident with the review of the *Oregon State Public Health Procedures for CGS and Hanford Emergency Response*.

9 WEB SITES

The links in this section were correct as of August 2007.

Environmental Protection Agency

Manual of Protective Action Guides and Protective Actions for Nuclear Incidents:
http://www.epa.gov/radiation/docs/er/400-r-92-001.pdf

Centers for Disease Control and Prevention

Radiation emergencies: *http://www.bt.cdc.gov/radiation*

Guidelines for Handling Decedents Contaminated with Radioactive Materials:
http://www.bt.cdc.gov/radiation/pdf/radiation-decedent-guidelines.pdf

U.S. Department of Health and Human Services

Radiation Event Medical Management: *http://remm.nlm.gov*

U.S. Department of Homeland Security

National Incident Management System:
http://www.fema.gov/emergency/nims/index.shtm

U.S. Nuclear Regulatory Commission

http://www.nrc.gov

Oregon Department of Human Services

Oregon Health Alert Network: *https://www.oregonhan.org*
(Note that the HAN Web site requires a user account and password.)

Oregon State Public Health Laboratory: *http://www.oregon.gov/DHS/ph/phl*

Laboratory Response Network, chemical incident page:
http://www.oregon.gov/DHS/ph/lrn/chemical.shtml

Oregon Laboratory Response Network: *https://lrn.hr.state.or.us/home/h_prepare.cfm*
(Note that the OLRN Web site requires a user account and password.)

State of Oregon

Oregon Emergency Management Plan:
http://www.oregon.gov/OOHS/OEM/docs/library/or_emp_volum_2_emerg_oper.pdf

Oregon Revised Statutes: *http://www.leg.state.or.us/ors*

Radiation Emergency Assistance Center/Training Site (REAC/TS)

http://www.orau.gov/reacts/

Radiation Protection Services

http://www.oregon.gov/DHS/ph/rps

Health Physics Society

http://www.hps.org

American Humane Society

http://www.americanhumane.org

Animal Management in Disasters

http://www.animaldisasters.com

American Veterinary Medical Association

http://www.avma.org

North Carolina State Animal Response Team (SART)

http://www.ncsart.org

10 ACRONYMS

ALARA	as low as reasonably achievable
AOC	Agency Operations Center
CDC	Centers for Disease Control and Prevention
CGS	Columbia Generating Station
DHS	Department of Human Services
ECC	Emergency Coordination Center
EOC	Emergency Operations Center
EPA	Environmental Protection Agency
ERT	Emergency response teams
ESF	Emergency Support Functions
FAQ	Frequently Asked Question
FBI	Federal Bureau of Investigation
FRMAC	Federal Radiological Monitoring Assessment Center
GIS	Geographic Information System
HAN	Health Alert Network
Hazmat	Hazardous materials
IND	improvised nuclear device

JIC	Joint Information Center
JIS	Joint Information System
LHD	Local Health Department
NIMS	National Incident Management System
NRC	Nuclear Regulatory Commission
OAR	Oregon Administrative Rules
ODOE	Oregon Department of Energy
OEM	Office of Emergency Management
OERS	Oregon Emergency Response System
OPHD	Oregon Public Health Division
OSPHL	Oregon State Public Health Laboratory
OSU	Oregon State University
PAR	Protective action recommendations
PHEP	Public Health Emergency Preparedness Program
PIO	Public Information Officer
REAC/TS	Radiological Emergency Assistance Center/Training Site
RDD	radiological dispersal device
RPS	Radiation Protection Services
SOP	standard operating procedure
USDOE	United States Department of Energy

11 GLOSSARY

A

Absorbed dose: The amount of energy deposited by ionizing radiation in a unit mass of tissue.

Activity (radioactivity): The rate of decay of radioactive material expressed as the number of atoms breaking down per second measured in units called Becquerel or curies.

Acute exposure: An exposure to radiation that occurred in a matter of minutes rather than in a longer continued exposure over a period of time.

Acute Radiation Syndrome (ARS): Also called radiation sickness. An illness caused by receiving a dose greater than 50 rads of penetrating radiation to the body in a short time (usually minutes). The earliest symptoms are nausea, fatigue, vomiting, and diarrhea. Hair loss, bleeding, swelling of the mouth and throat, and general loss of energy may follow. If the exposure has been approximately 1,000 rads or more, death may occur within 2 to 4 weeks.

Airborne radioactivity: Radioactive material in any form contained or suspended in air.

Air burst: A nuclear weapon explosion that is high enough in the air to keep the fireball from touching the ground. Because the fireball does not reach the ground and does not pick up any surface material, the radioactivity in the fallout from an air burst is relatively insignificant compared with a surface burst.

Alpha, beta, gamma: Types of ionizing radiation. Alpha and beta are particles. Gamma is an electromagnetic wave.

Alpha particle: The nucleus of a helium atom, made up of two neutrons and two protons. Alpha particles generally carry more energy than gamma or beta particles, and deposit that energy very quickly while passing through tissue. Alpha particles can be stopped by a thin layer of light material, such as a sheet of paper, and cannot penetrate the outer, dead layer of skin. Therefore, they do not damage living tissue when outside the body. When alpha-emitting atoms are inhaled or swallowed, however, they are especially damaging because they transfer relatively large amounts of ionizing energy to living cells.

Atom: The smallest particle of an element that can enter into a chemical reaction.

B

Background radiation: Ionizing radiation from the following natural sources:

- Naturally occurring radioactive materials, which have not been technologically enhanced.
- Cosmic sources
- Global fallout as it exists in the environment (such as from the testing of nuclear explosive devices)
- Radon and its daughters in concentrations or levels existing in buildings or the environment which have not been elevated as a result of current or prior activities
- Consumer products containing small amounts of radioactive material or producing small amounts of radioactive material

Beta particles: Electrons ejected from the nucleus of a decaying atom. Although a thin sheet of aluminum can stop them, beta particles can penetrate the dead skin layer, potentially causing burns. They can pose a serious direct or external radiation threat and can be lethal depending on the amount received. They also pose a serious internal radiation threat if they are ingested or inhaled.

C

Calibration:

The process of adjusting or determining either:

- The response or reading of an instrument relative to a standard or to a series of conventionally true values; or
- The strength of a radiation source relative to a standard or conventionally true value.

Carcinogen: A cancer-causing substance.

Chronic exposure: Exposure to a substance over a long period of time.

Contamination: The presence of unwanted radioactive material on the surface of structures, areas, objects or people (where it may be external or internal).

Contamination (radioactive): The presence of unwanted radioactive material on the surfaces of structures, areas, objects, or people (where it may be external or internal).

Cosmic radiation: Radiation produced in outer space when heavy particles from other galaxies bombard the earth.

Cohort: In a clinical study, a well-defined group of subjects or patients who have had a common experience or exposure and are then followed up for the incidence of new diseases or events, as in a cohort study.

Cpm: Counts per minute; the number of events detected or recorded by the detector system (radiation meter).

Critical mass: The minimum amount of fissile material that can achieve a self-sustaining nuclear chain reaction.

D

Daughters: Many radioactive materials decay into other radioactive materials called "daughter" products, which may have very different physical, chemical and radiological properties from the parent radioactive material.

Decay, radioactive: Disintegration of the nucleus of an unstable atom by the release of radiation.

Decontamination: The reduction or removal of radioactive contamination from a structure, object, animal, or person.

Derived intervention levels (DILs): Allowed levels of radionuclide concentration in food.

Dirty Bomb: A device designed to spread radioactive material by conventional explosives when the bomb explodes. Such bombs could be miniature devices or as large as a truck.

Dose Assessment: Process of estimating radiological dose through the use of exposure scenarios, bioassay results, monitoring data, source term information and pathway analysis.

Dose (radiation): The amount of radiation absorbed by a person's body.

Dose Rate. The radiation dose delivered per unit of time.

Dosimeter: A small portable instrument (such as a film badge or pocket dosimeter) for measuring and recording the total accumulated dose of ionizing radiation a person receives.

Dosimetry: The measurement of doses in matter and tissue from ionizing radiation.

E

Electron: An elementary particle with a negative electrical charge and a mass 1/1837 that of the proton. Electrons surround the nucleus of an atom because of the attraction between their negative charge and the positive charge of the nucleus. A stable atom will have as many electrons as it has protons. The numbers of electrons that orbit an atom determine its chemical properties.

Embryo/Fetus: Developing human organism from conception until birth. It is the same as unborn child.

Emergency Support Function (ESF): A functional area of response activity established to facilitate the delivery of federal assistance required during the immediate response phase of a disaster to save lives, protect property and public health, and to maintain public safety.

Exposure (radiation): A measure of ionization in air caused by x-rays or gamma rays only. The unit of exposure most often used is the roentgen.

Exposure pathway: A route by which a radioactive material can enter the body. The main exposure routes are inhalation, ingestion, absorption through the skin, and entry through a cut or wound in the skin.

Exposure rate: A measure of the ionization produced in air by x-rays or gamma rays per unit of time (frequently expressed in roentgens per hour).

External exposure: Exposure to radiation outside of the body.

F

Fallout (nuclear): Minute particles of radioactive debris that descend slowly from the atmosphere after a nuclear explosion.

First receivers: Clinicians, including physicians, nurses and other health care professionals, who provide emergency care in a hospital setting following a radiological incident.

First responders: People in the early stages of an incident who are responsible for the protection and preservation of life, property, evidence and the environment. This typically includes police, fire departments, emergency management, public health, clinical care, public works, and other skilled support personnel (such as equipment operators).

Fissile material: Any material in which neutrons can cause a fission reaction. The three primary fissile materials are uranium-233, uranium-235, and plutonium-239.

Fission (fissioning): The splitting of a nucleus into at least two other nuclei that releases a large amount of energy. Two or three neutrons are usually released during this transformation

Fusion: A reaction in which at least one heavier, more stable nucleus is produced from two lighter, less stable nuclei. Reactions of this type are responsible for the release of energy in stars or in thermonuclear weapons.

G

Gamma rays: High-energy electromagnetic radiation emitted by certain radioactive materials. These rays have high energy and a short wave length. Gamma rays penetrate tissue farther than do beta or alpha particles. Gamma rays are very similar to x-rays.

Geiger counter: A radiation detection and measuring. Geiger counters are the most commonly used portable radiation detection instruments.

Geographic Information System (GIS): A collection of computer hardware, software and geographic data for capturing, managing, analyzing, and displaying all forms of geographically referenced information.

Genetic effects: Hereditary effects (mutations) that can be passed on through from parent to child.

H

Half-life: The time any substance takes to decay into half of its original amount.

Health Alert Network (HAN): An Internet program used to communicate health and emergency messages.

Hormesis: All living things exist in a sea of ionizing radiation, much of which is internal. It is a general belief that low doses of ionizing radiation produce detrimental effects proportional to the effects produced by high-level radiation. Over the past decades, however, some pioneer scientists reported that low-dose ionizing radiation is not only a harmless agent but often has a beneficial effect. That is, low-level ionizing radiation may be essential for life. This idea is called hormesis.

I

Incident Command System (ICS): A standardized on-scene emergency management system that enables multiple agencies and jurisdictions to respond to single or multiple incidents using an integrated organizational structure.

Incident Commander: The individual responsible for all incident activities, including the development of strategies and tactics and the ordering and release of resources. The

Incident Commander has overall authority and responsibility for conducting incident operations and is responsible for managing all incident operations at the incident site.

Ingestion: In the case or radioactive materials, swallowing them by eating or drinking.

Inhalation: In the case of radioactive materials, the breathing in of radioactive materials.

Internal exposure: Exposure to radioactive material that has entered into the body.

Iodine: There are both radioactive and non-radioactive types of iodine. Radioactive types of iodine are widely used in medical applications. Radioactive iodine is a fission product and is the largest contributor to people's radiation dose after an accident at a nuclear reactor.

Ion: An atom that has fewer or more electrons than it has protons causing it to have an electrical charge and, therefore, be chemically reactive.

Ionization: The process of adding one or more electrons to, or removing one or more electrons from, atoms or molecules, thereby creating ions. High temperatures, electrical discharges, or radiation can cause ionization.

Ionizing radiation: Any radiation capable of removing electrons from atoms, thereby producing ions.

Irradiation: Exposure to radiation.

Isotope: One of two or more atoms with the same atomic number but with different numbers of neutrons (or mass numbers).

J

Joint Information Center (JIC): A facility established to coordinate all incident-related public information activities. It is the central point of contact for all news media.

Joint Information System (JIS): Integrates incident information and public affairs into a cohesive structure to provide consistent, coordinated, timely information during an incident.

K

Kiloton. The energy of an explosion that is equivalent to an explosion of 1,000 tons of TNT.

M

Milli: One-thousandth of a unit, for example millirem (mrem or mR).

Molecule: A combination of two or more atoms that are chemically bonded. A molecule is the smallest unit of a compound that can exist by itself and retain all of its chemical properties.

N

National Incident Management System (NIMS): A system that provides a consistent nationwide approach for governments (federal, state, local, and tribal), private-sector businesses, and nongovernmental organizations to work effectively and efficiently together to prepare for and respond to incidents.

Neutron: A small atomic particle possessing no electrical charge typically found within an atom's nucleus. Neutrons are neutral in their charge (they are positively nor a negatively charged). A neutron has about the same mass as a proton.

Non-ionizing radiation: Radiation that has lower energy levels and longer wavelengths than ionizing radiation. It is not strong enough to affect the structure of atoms it contacts but is strong enough to heat tissue and can cause harmful biological effects. Examples include radio waves, microwaves, visible light, and infrared from a heat lamp.

Nuclear energy: The heat energy produced by the process of nuclear fission within a nuclear reactor or by radioactive decay.

Nuclear Reactor: A device in which a fission chain reaction can be initiated, maintained and controlled.

Nuclear Regulatory Commission (NRC): Federal agency responsible for regulating the use of radioactive material.

Nucleus: The central part of an atom that is positively charged and contains protons and neutrons. The nucleus is the heaviest part of the atom and contains almost all of its mass.

P

Pathways: The routes by which people are exposed to radiation or other contaminants. The three basic pathways are inhalation, ingestion, and direct external exposure

Penetrating radiation: Radiation that can penetrate the skin and reach internal organs and tissues. Photons (gamma rays and x-rays), neutrons, and protons are penetrating radiations. However, alpha particles and all but extremely high-energy beta particles are not considered penetrating radiation.

Photon: Discrete "packet" of pure electromagnetic energy. Photons have no mass and travel at the speed of light. The term "photon" was developed to describe energy when it acts like a particle (causing interactions at the molecular or atomic level), rather than a wave. Gamma rays and x-rays are photons.

Plume: The material spreading from a particular source and traveling through environmental media, such as air or ground water. For example, a plume could describe the dispersal of particles, gases, vapors, and aerosols in the atmosphere, or the movement of contamination through an aquifer.

Prenatal radiation exposure: Radiation exposure to an embryo or fetus while it is still in its mother’s womb. At certain stages of the pregnancy, the fetus is particularly sensitive to

radiation and the health consequences could be severe above 5 rads, especially to brain function.

Protective action guides (PAGs): Guidelines developed to help state and local authorities make radiation protection decisions during emergencies.

Protective action recommendations (PARs): Recommendations developed to help state and local authorities make radiation protection decisions during emergencies.

R

Rad (radiation absorbed dose): A unit of absorbed radiation dose. It is a measure of the amount of energy absorbed by the body.

Radiation: Energy moving in the form of particles or waves. Non-ionizing forms are heat, light, radio waves, and microwaves. Ionizing radiation is a very high-energy form of electromagnetic radiation.

Radiation sickness: *See* acute radiation syndrome (ARS)

Radiation warning symbol: A symbol prescribed by the U.S. Code of Federal Regulations. It is a magenta or black trefoil on a yellow background. It must be displayed where certain quantities of radioactive materials are present or where certain doses of radiation could be received.

Radioactive contamination: The deposition of unwanted radioactive material on the surfaces of structures, areas, objects, or people. It can be airborne, external, or internal.

Radioactive decay: The spontaneous disintegration of the nucleus of an atom.

Radioactive half-life: The time required for a quantity of a radioactive material to decay by half.

Radioactive material: Material that contains unstable (radioactive) atoms that give off radiation as they decay.

Radioactivity: The process of emission of radiation from a material. The process of spontaneous transformation of the nucleus, generally with the emission of alpha or beta particles often accompanied by gamma rays. The rate of decay of radioactive material expressed as the number of atoms breaking down per second measured in units called Becquerel or curies.

Radiological or radiologic: Related to radioactive materials or radiation. Radiological sciences focus on the measurement and effects of radiation.

Radiological dispersal device (RDD): A device that disperses radioactive material by conventional explosive or other mechanical means, such as a spray.

Rapid Toxic Screen: A chemical analysis performed by the CDC on human blood and urine to detect exposure to heavy metals or toxic chemicals.

Rem: A unit of equivalent dose. Because not all radiation has the same biological effect, rem relates the absorbed dose in human tissue to the effective biological damage of the radiation.

Risk: The probability of injury, disease, or death under specific circumstances and time periods. Risk can be expressed as a value that ranges from 0% (no injury or harm will occur) to 100% (harm or injury will definitely occur). Risk can be influenced by several factors: personal behavior or lifestyle, environmental exposure to other material, or inborn or inherited characteristic known from scientific evidence to be associated with a health effect. Because many risk factors are not exactly measurable, risk estimates are uncertain.

Risk assessment: An evaluation of the risk to human health or the environment by hazards. Risk assessments can look at either existing hazards or potential hazards.

Roentgen (R): A unit of exposure to x-rays or gamma rays. One roentgen is the amount of gamma or x-rays needed to produce ions carrying 1 electrostatic unit of electrical charge in 1 cubic centimeter of dry air under standard conditions.

S

Shielding: Any material which, when placed between a radiation source and a potentially exposed person, reduces their exposure.

Special nuclear material: Plutonium or uranium that is usable in nuclear weapons

Surface burst: A nuclear weapon explosion that is close enough to the ground for the radius of the fireball to vaporize surface material. Fallout from a surface burst contains very high levels of radioactivity.

Surveillance: The collection, analysis and dissemination of data about a disease.

T

Terrestrial radiation: Radiation emitted by naturally occurring radioactive materials, such as uranium, thorium, and radon in the earth.

Thermonuclear device: A “hydrogen bomb.” A device with explosive energy that comes from fusion of small nuclei, as well as fission.

Thyroid Blocking Agent: A substance taken as a protective measure to reduce the uptake by the thyroid of radioactive iodine, primarily potassium iodine is used.

Thermoluminescent dosimeter (TLD): A device used to measure radiation exposure by measuring the amount of visible light emitted from a crystal in the detector when the crystal is heated. The amount of light emitted is dependent upon the radiation exposure.

U

Unstable nucleus: A nucleus that contains an uneven number of protons and neutrons and seeks to reach a stable state through radioactive decay.

W

Whole body exposure: An exposure of the body to radiation, in which the entire body, rather than any one part, is irradiated by an external source.

X

X-ray: Electromagnetic radiation caused by deflection of electrons from their original paths, or inner orbital electrons that change their orbital levels around the atomic nucleus. X-rays, like gamma rays can travel long distances through air and most other materials. X-rays can penetrate the body and thus require more shielding. X-rays and gamma rays differ primarily in their origin: x-rays originate in the electron shell; gamma rays originate in the nucleus.

12 REFERENCES

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13 RECORD OF CHANGES

Date	Summary of Change	Initials
12/20/06	Initial release of 2006 plan.	NN
8/13/07	Incorporated Attachment C – Recovery Operations into the main plan; removed Attachment D – Oregon State Public Health Procedures for CGS & Hanford Emergency Response; removed former Tab 2 – RDD Pocket Guide, and incorporated former Tab 10 – Radiation Glossary into the glossary in the main plan under section 11.	NN/BC/RPS

TAB 1
SAMPLE TRAINING RADIOLOGICAL PROCEDURES FOR FIRST RESPONDERS

This document was developed by the Oregon Department of Energy and OPHD Radiation Protection Services in coordination with the state Fire Marshal, Oregon State Police, and other first responders. It is used for first responder training throughout Oregon.

Radioactive Material
Emergency Field Procedures

O regon
E mergency
R esponse
S ystem

24-hour phone

1-800-452-0311 (in state)

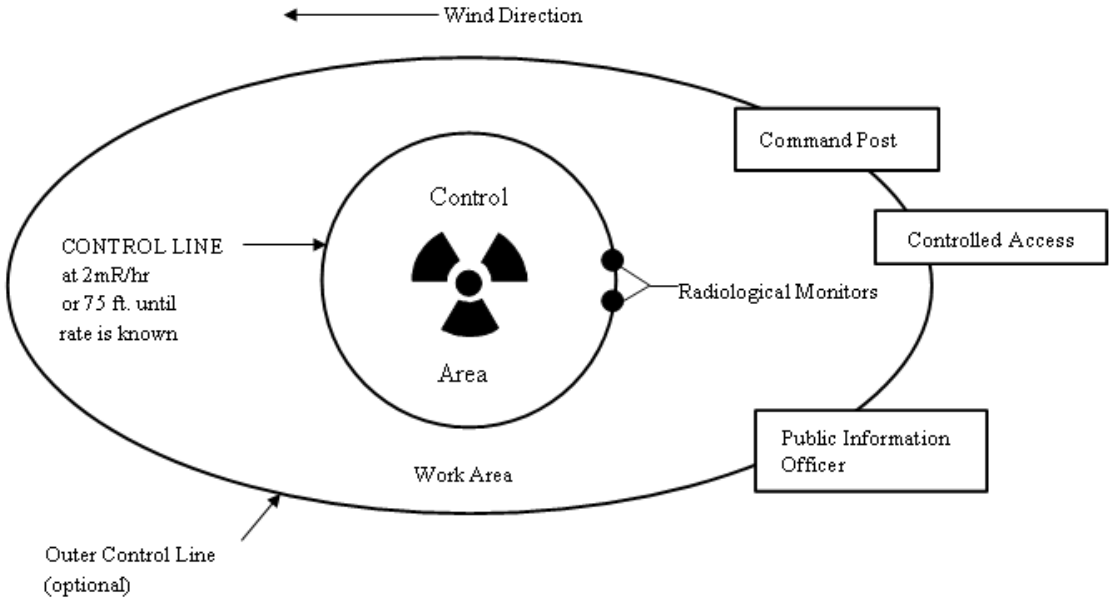
503-378-6377 (out of state)

The OERS number is the one number to call to notify the state of Oregon for all hazardous materials emergencies, including radioactive material incidents. This one call will get you access to a radiation specialist and activate the State Radiation Emergency Response Team if it is needed for field assistance.

Approach all hazardous materials incidents cautiously! First, identify **all** hazards. Then, remember "FIRST" for radiation incidents:

F irst aid and life-saving rescue
I nform and notify that radioactive materials are involved
R estrict access to control exposure and contamination
S top fires – stop runoff
T hat's all! (Wait for radiation specialists)

NOTE: This guide is to be used with the **Emergency Response Guidebook**.



Emergency Action Checklist

☐ Rescue

Remember: Time – Distance – Shielding – reduce your exposure

- ► Life-saving takes priority over dealing with radioactivity
- ► Approach with survey meter and dosimeter, if available and you know how to use them
- ► If not endangering the patient, move away from source as soon as possible
- ► Move patient based on medical condition only, not low-level radiation

☐ Notifications and Technical Help

Alert Dispatch Center

- ➔ Local notifications
- ➔ State agencies: OERS (1-800-452-0311 – Request help from radiation specialists)

Useful Information (If available without being exposed)

- ► Your name, agency, and call-back number
- ► Materials involved
- ► Severity (injuries, contamination, exposure)
- ► Location
- ► Actions taken and underway
- ► On-scene contact (incident commander) and how to reach this person
- ► Carrier, shipper, and receiver (from shipping paper or package)

☐ Secure Site and Control Access

☐ Establish Incident Command

- ► Determine who is on-scene Incident Commander
- ► Establish field Command Post
- ► Assign jobs (distribute inserts)

☐ Identify the Hazard

- ► Observe placards and I.D. numbers on vehicle
- ► Obtain shipping papers
- ► Observe container markings, colors, and labels
- ► Talk with driver, train crewmember, or plant radiation safety officer

☐ Assign Public Information Officer

- ► Establish media area, prepare briefing (see enclosed handout for specific job duties)
- ► Establish communications with state PIO

☐ Contamination Control

- ► Check people and equipment. If contaminated and not injured, do not let people leave unless necessary for personal safety. If people must leave because of weather, shelter them until monitored by regional Hazmat teams or state specialists. If unsure, wait for guidance before beginning decontamination.

Incident Commander

Set up your command staff and structure. The size will depend on your incident size and needs. The Incident Commander is responsible for any job that is not delegated to someone else.

The Incident Commander determines the strategic goals and tactical objectives. He or she evaluates the resources needed to do the job.

☐ **1.** ***Approach Cautiously*** – resist the urge to rush in.

☐ **2.** ***Identify Hazards –*** look for clues, such as placards, container labels, markings and colors, ask driver or crew, etc. If at an industrial facility, contact the Radiation Safety Officer.

☐ **3.** ***Decide On Site Entry –*** Enter **only** for life-saving rescue and first aid. If radiation is the only identified hazard, rescue can be performed before detection equipment is available or ready, if necessary. Remember – TIME – DISTANCE – SHIELDING.

☐ **4.** ***Set up Command System.***

- ► Establish Command Post.
- ► Assign Safety Officer.
- ► Set up other positions in command structure as needed.

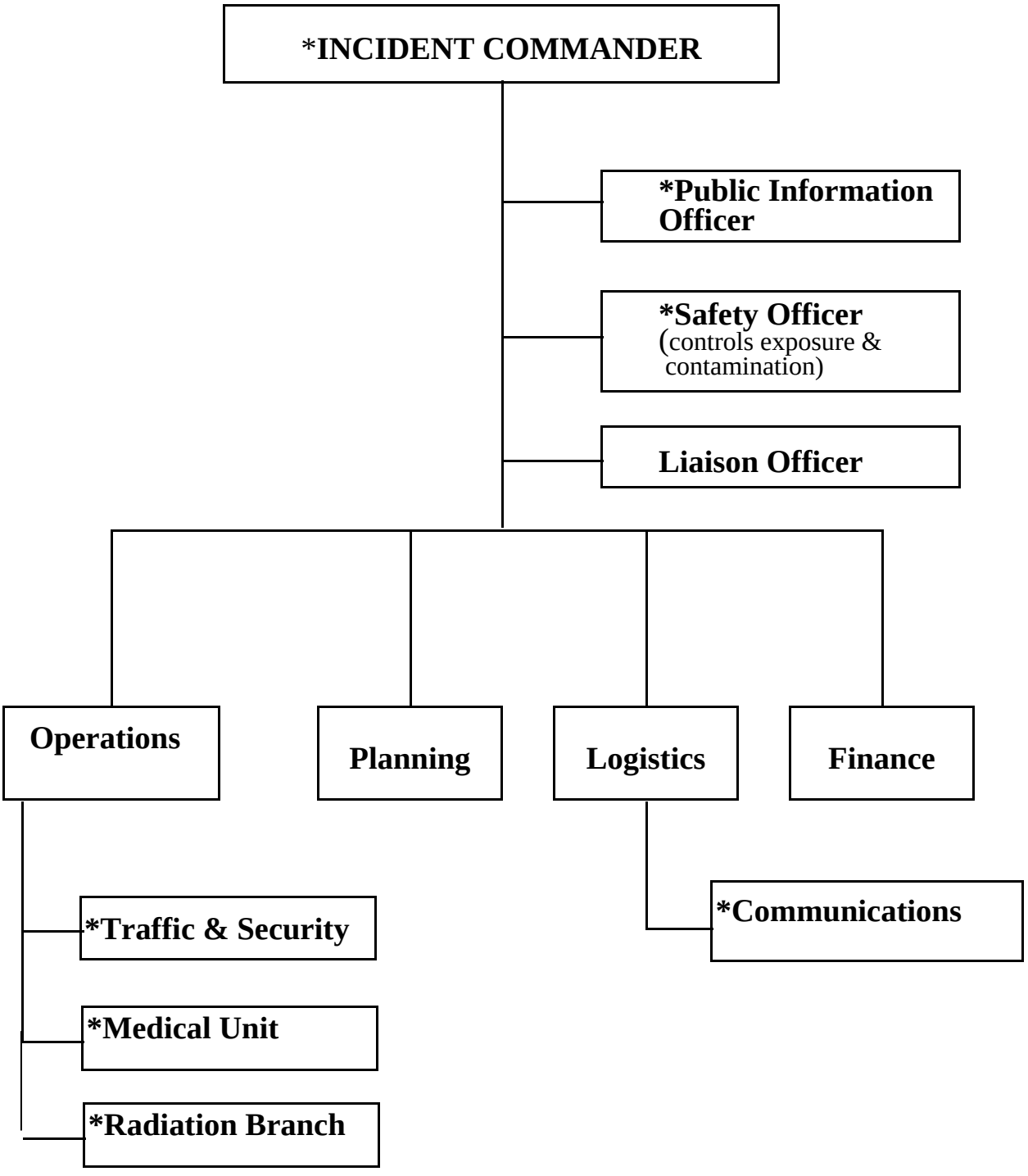
☐ **5.** ***Obtain Help*** – notify Oregon Emergency Response System (OERS). The number is 800-452-0311.

- ► Tell them you have a radiation incident.
- ► Notify dispatch of the need for Emergency Medical Services and additional medical units on scene, if necessary.
- ► Notify local law enforcement for help with scene control and possible evacuation.

☐ **6.** ***Secure the Scene –*** isolate the area. Establish perimeter. Deny entry.

Incident Command System

The critical jobs for a major radioactive material incident are marked with an asterisk



Safety Officer

☐ **1**. With Incident Commander, ***determine restricted area*** — 75 feet initially (if no radiation detection equipment available) or to 2mR/hr. Refer to the current Emergency Response Guidebook for more information.

☐ **2**. ***If*** radioactive material is involved in ***fire, evacuate*** people in all directions to distance smoke travels. Consider shelter in place. If material becomes airborne, it is a respiratory hazard and a potential source of internal contamination.

☐ **3.** Assure that proper ***protective equipment is being used***. If radioactive material is spilled or involved in a fire, respiratory protection should be used. Structural firefighters' protective clothing should be worn in all cases.

☐ **4**. Implement ***pre-operational checks*** on radiation detection equipment (see manual in boxes, or refer to equipment insert).

☐ **5**. ***Distribute pocket dosimeters*** and a radiation survey meter to rescue staff. Record dosimeter reading if you do not have time to set them to zero. Distribute radiation meter to radiation monitors.

☐ **6**. Establish ***Contamination Control*** procedures:

- ► Secure scene—set up scene perimeters and work with security to deny entry.
- ► Limit the number of people on scene.
- ► Establish entrance and exit points.
- ► Survey all personnel as they pass exit point.
- ► Do not allow eating, drinking or smoking.

☐ **7.** If contamination is present or suspected, ***do not let equipment or people leave scene*** unless necessary for public or personnel safety. Any personnel leaving the scene should be checked for contamination. If weather is severe, consider a bus for shelter or transport to decontamination site.

☐ **8**. **Field Decontamination:** Help is available via telephone from: state Radiation Protective Services (971-673-0490) and Oregon Poison Control (800-222-1222).

Final Decontamination: The state Radiological Emergency Response program and the regional Hazmat teams have sensitive radiation detection equipment. They will do the final decontamination checkout.

☐ **9.** ***Keep a log*** of people going in and out of the hot zone. This log should include their name, agency and time in hot zone. Record dosimeter readings or collect dosimeter. Record names of all personnel on scene.

Medical Unit

☐ **1**. Enter control area **only** to save life or provide necessary first aid. Limit entry to shortest possible time. Remember: **Time – Distance – Shielding**

☐ **2**. ***Life-saving first aid takes priority over dealing with radiation***. Symptoms related to radiation exposure will be delayed. Treat other medical or trauma conditions by normal protocol.

☐ **3.** Wear respiratory protection, gloves, and protective clothing, if available.

☐ **4**. Approach victims with radiation detection equipment, if available and you know how to use it.

☐ **5**. Move victim away from radiation source, if possible without endangering the patient.

☐ **6**. Contamination Control Procedures:

CAUTION - ***External contamination may become internal contamination***.

- ► Wipe around the patient's mouth before applying oxygen mask or respirator. Be cautious if intubating this patient.
- ► For intravenous therapy, use uncontaminated area on patient, if possible.
- ► Gently brush away dry particles and blot with absorbent material any excess liquids that are present.
- ► Field decontamination should normally be limited to removal of clothing, jewelry, and shoes. Further field decontamination should only be attempted by trained personnel. In no case should decontamination delay other emergency response actions.
- ► Bag & Tag removed articles.
- ► Wrap patient using two blanket method (see diagram on back). Rescue crew should pass patient over control line to ambulance drivers.

☐ **7.** Notify hospital of contaminated victims as early as possible. Use entrance directed by hospital.

☐ **8**. ***It's possible you have also been contaminated***. Notify hospital and remain in ambulance. Allow hospital personnel to unload patient.

☐ **9.** **Do not return to service** until you and the ambulance have been fully monitored for contamination and shown to be clean.

Public Information Officer (PIO)

- ☐ **1**. Report to the Incident Commander at the field command post and obtain a briefing from the Incident Commander.
- ☐ **2**. Work with law enforcement to establish a media area. This should be located away from the Incident Commander and the command post.
- ☐ **3.** Prepare initial information summary as soon as possible after arrival.
- ☐ **4**. Inform the media that all information at the scene will be coordinated through you. Point out to them the areas that have been cordoned off.
- ☐ **5**. ***Obtain approval for release of any information from the Incident Commander prior to its release.***
- ☐ **6**. Information that should be provided to the media includes details of the incident, the health or environmental risk (if any), and the response agencies and actions. ***Do not speculate.*** Be clear about the level of hazard. If there have been any deaths or injuries, do not release names before the families have been notified.
- ☐ **7.** Work with the state PIO to coordinate the release of information. (Contact the state PIO through OERS).
- ☐ **8**. Provide escort service to the media and VIPs.
- ☐ **9.** Take notes about response actions and who you told what. The notes will help you later.

Radiation Safety

Radiation exposures should be "As Low As Reasonably Achievable." Women who are pregnant should attempt to avoid radiation exposure, if at all possible.

Allowable Emergency Doses

Life-saving rescue or protecting large populations	Greater than 25,000 mR (25 R)—**by informed volunteers ONLY**
Life-saving rescue or protecting large populations	Up to 25,000 mR (25 R)
Non life-saving, for protecting valuable property, authorized by the State Technical Assistant and/or the Incident Commander	Up to 10,000 mR (10 R)
Non life-saving, no specific authorization	Up to 5,000 mR (5 R)

EPA Manual of Protective Action Guides and Protective Actions for Nuclear Incidents (EPA 400-R-92-001, May 1992)

1 rem (R) = 1,000 millirem (mR)

Radiation Dose Rates

Less than 2 mR/hr	**Very low level**—acceptable for the public for intermittent and/or short exposure.
Between 2 mR/hr and 50 mR/hr	**Low to medium level**—acceptable for emergency life-saving and first aid. Keep public out.
Above 50 mR/hr	**Higher level**—pay careful attention to stay time if life-saving and first aid is necessary

To calculate radiation exposure, multiply the dose rate by the time of the exposure. For example, if the dose rate is 10 m/R/hr, four hours of exposure will result in a dose of 40 mR.

For more information, training or equipment maintenance/calibration, contact:

Oregon Office of Energy Nuclear Safety Division	503-378-4040
Oregon State Public Health Division Radiation Protection Services	971-673-0490
Oregon State University Radiation Center	541-737-2341

TAB 2
EXPOSURE GUIDANCE FOR EMERGENCY RESPONDERS

The following information about emergency responder limitations regarding exposure to ionizing radiation was taken from Table 2-2 of EPA 400-R-92-001, *Manual of Protective Action Guides and Protective Actions for Nuclear Incidents*. Measurements are made with several types of equipment that are carried by radiation response teams.

Dose limit during an emergency response (rem)	Emergency Activity	Limitation
5	Any	All reasonable achievable actions have been taken to minimize dose.
10	Saving lives or protecting valuable property by preventing the spread of radiation (e.g., fighting fires, diking contaminated water)	Exceeding 5 rem unavoidable and all appropriate actions taken to reduce dose. Monitoring available to project or measure dose.
25	Saving lives or protection of large populations	Exceeding 5 rem unavoidable and all appropriate actions taken to reduce dose. Monitoring available to project or measure dose.
>25	Saving lives or protection of large populations	Only on a voluntary basis to persons fully aware of the risks involved.

Additional Guidance

Exposure

- Turn-back dose (lifesaving) - 200 rad/hr or 10 rems total exposure

Decontamination

"Unlike many chemical and biological agents, radioactive material contamination rarely represents an immediate danger to the health of the victim or the responder. This reduces the immediacy of the need for decontamination and allows the emergency response

community greater flexibility in selecting decontamination options." -National Council on Radiation Protection and Measurements (NCRP) Commentary 19

- Trigger for beta or gamma radiation – 2000 dpm (~200 cpm) from a radiation-monitoring instrument on a human surface
- Priority decontamination should be given to patient's with spot levels of 2.2Ebdpm.
- "Individuals with spot contamination greater than 2.2×10^6 dpm should be a priority for decontamination." -NCRP
    - Efforts should be made to reduce contamination on any one spot to 2.2×10^5 dpm for compliance with FEMA-REP-22.
    - Surface body contamination levels should be reduced to 10,000 dpm.
- Trigger for alpha radiation – Any measurable increase above background levels on a radiation-monitoring instrument on a human surface
    - Alpha radiation can be distinguished from gamma or beta radiation by using shielding. Alpha particles can be stopped by a sheet of paper placed between the contamination site and the detector.

TAB 3
SOP- RPS DUTY OFFICER

Standard Operating Procedure (SOP)

Section	Title
Hazard Appendix 3 - Radiological Emergency Response	RPS Duty Officer Procedures

Number	Approved By	Revision Date
Tab 3	***DRAFT***	3/29/07

Purpose	Provide guidelines for the Radiation Protection Services (RPS) Duty Officer to assess the initial stages of a radiological incident, contact the appropriate personnel, and respond to the scene (if appropriate).
Responsibility and Scope	Radiation Protection Services is responsible for staffing an RPS Duty Officer who is the contact for the Oregon Emergency Response System (OERS) for radiological incidents. The Duty Officer position is staffed 24 hours a day, 7 days a week.

Procedures	**1. Assess the incident** • Begin a log for the incident and record information. • Get call-back numbers to the scene. • Call the RPS Section Manager or their designee and inform them of incident (if responding to the scene). • Call the on-scene Incident Commander and offer help. Make sure to identify yourself as the state's technical advisor for a radiological incident. Tell the Incident Commander that you are available to provide technical advice as needed. • Notify the RPS Section Manager if more assistance is needed. • Determine who else needs to be notified (Public Information Officer, Oregon Dept. of Energy, Public Health Division Director). The following questions must be addressed: • What radioactive material is involved? (specific radionuclide, physical and chemical form, specific device?) • Are there shipping papers, ID numbers on the vehicle, MSDS forms, placards/UN numbers, etc.? • When did the accident occur (time and date)? • When was the event reported to RPS (time and date)? • Who reported the event (name, company, phone number)? • Where did the event occur?

- Was there a release of radioactive material?
- Were any people exposed to radiation?
- Was anyone contaminated with radioactive material?
- Did any radiation-related injuries occur?
- Has access been restricted to the site?

When you contact the scene, consider asking the following questions:

- What assistance is needed?
- What radioactive material is involved? Are there shipping papers, ID numbers on the vehicle, MSDS forms, placards/UN numbers, etc.?
- When did the accident occur?
- Is there a fire?
- Does anyone at the scene have radiation detection instruments and know how to use them? What kind are they?
- Do they need on-scene help from a Hazmat team? From RPS?
- Does anyone need to go near the accident scene (e.g., rescue, fire control, spill control, or traffic coordinators)?

2. Respond according to the severity of the incident.

Incident type:
A minor incident that could or does involve radioactive material (RAM). No radiation has been released or is likely to be released. Public health and safety and the environment are not threatened.

Example:
Truck carrying RAM with a flat tire.

Actions:

- Call the RPS Section Manager and ask if there is any need to go to the scene.
- Make sure that things are back to normal ASAP.
- Contact the driver, carrier or shipper.
- Make sure that equipment is parked away from the public.

Incident type:
An accident or incident involving RAM. No radiation has been released. Public health and safety and the environment are not threatened, however, the incident could escalate.

Example:
A sealed radioactive source falls from a fixed gauge.

Actions:
- If first responders have a detection meter, confirm with the Incident Commander that there has been no release of RAM.
- Notify the RPS Section Manager and discuss putting the Emergency Response Team (ERT) on standby.
- Respond to the scene and assess risks. Contact the RPS Section Manager with a verbal report.
- Head the ERT if it is sent to the scene.

Incident type:
An accident or incident has released radiation and requires evacuation or sheltering of nearby residents or businesses.

Actions:
- Notify the RPS Section Manager of the incident.
- Activate a partial AOC (through the OERS duty officer for the state Emergency Coordination Center).
- Ensure that regional Hazmat teams are activated.
- Help on-scene crews
- Active the ERT.
- Coordinate on-scene actions with state/local emergency operations centers.
- Coordinate with local authorities on re-entry concerns.
- Coordinate public information.
- See that the site is restored ASAP.

Incident type:
A radiological terrorist incident involving the deliberate release of RAM.

Example:
The detonation of a dirty bomb.

Actions:
- Work closely with the on-scene Incident Commander as a technical resource, coordinating regional Hazmat efforts as well.
- The FBI will likely become the on-scene Incident Commander as soon as they arrive.
- Immediately notify the RPS Section Manager.

	• Remain in close contact with RPS to keep personnel informed and to receive direction. **3. Perform On-Site Actions:** • Ensure that emergency medical care is provided immediately for serious injuries and to preserve vital functions. Minor injuries can wait until after initial radiation survey has been completed. • Ensure individuals are removed from contaminated radiation area. See Tab 2 for levels of radiation exposure that are permissible in normal and emergency settings. Teams can be used in relays to remove injured people from high radiation areas if necessary. **REMEMBER**: You are only a technical advisor to the Incident Commander. The Incident Commander decides what actions will be taken. • Make sure all clothing is removed at the scene, and wrap victim. • Make sure victim is surveyed for surface contamination levels, if time. • Decontamination should be done at the scene with advice and assistance from the Hazmat team and yourself. If it is decided that lifesaving is paramount over decontamination, victim(s) should be sent to the nearest hospital that will admit a radiologically contaminated patient. • If decontamination is done at scene, be sure to survey victim after being decontaminated to ensure they are "clean." They should still be double wrapped to ensure no contamination is spread, and surveyed at the hospital again before admitting them. • Alert the hospital and tell them whether a decontaminated or contaminated victim is headed their way. Recommend that they survey patient before admitting even if they have been decontaminated. • Identify the radionuclide involved in the incident, including its chemical form. • Keep careful notes (a log) of the incident from your perspective, from beginning to end. • Ensure dosimetry is provided to first responders as soon as possible. • Keep the Incident Commander informed; RECOMMEND, don't tell!

Standard Operating Procedure (SOP)

Recovery and Re-entry Procedures	**Recovery:** • After the incident has stabilized and all contaminated/injured personnel have been cared for, recovery can begin. This phase is a time of planning, assessment, restoration and a return to non-emergency operations. • The RPS Section Manager will convene a Recovery Committee, to be chaired by the manager or their designated representative. Other members of this committee will include but not be limited to the following: o Representatives of the affected community o Representatives of the cleanup organization o Representatives from all other concerned local, state and federal agencies • The objective of the Recovery Committee will be to restore the area to a condition where normal activities can be resumed, with as little impact as possible to the (1) local citizens, (2) environment and (3) the neighboring industry, in that order. • Cleanup will be performed by an organization authorized to perform such activities, as directed by RPS and in coordination with the Oregon Department of Energy. • An appropriate survey plot will be used to conduct the monitoring to ensure the best possible cleaning of the area is done. **Re-entry:** • Re-entry into the spill site will be controlled by specific authorization by the Recovery Committee. • Review protective actions implemented during the course of the incident to assist in a rapid assessment of current offsite conditions. • Evacuees (if any) will be allowed to return once the affected area is deemed safe for the general public. Recovery and re-entry will be complete only after thorough review and a written statement to that effect is issued by the Recovery Committee chairperson.
Equipment	The RPS Duty Officer will be provided: • A monitoring kit to keep at the residence after hours while on call. • A soft carrying case that contains the equipment necessary to respond to most incidents in a limited manner. Additional equipment is located in the Emergency Response cabinets in RPS. • A duty officer book that contains generic procedures and contact numbers, as well as other pertinent information.

TAB 4
SOP- RPS EMERGENCY RESPONSE TEAM

Standard Operating Procedure (SOP)

Section	Title
Hazard Appendix 3 - Radiological Emergency Response	RPS Emergency Response Team

Number	Approved By	Revision Date
Tab 4	***DRAFT***	8/16/07

Purpose	Provide guidelines for Radiation Protection Services (RPS) Emergency Response Teams (ERT) to respond to the scene of a radiological incident.
Responsibility and Scope	RPS is responsible for staffing Emergency Response Teams who will report to the on-scene Incident Commander for radiological incidents to provide technical assistance. RPS is also responsible for the safety of the ERT, including providing appropriate personal protective equipment.
Procedures	**Response Team Captain Responsibilities** • Receive initial notification of an incident, usually from the Oregon Emergency Response System (OERS), the Oregon Department of Energy Duty Officer, or the PHEP Duty Officer. • Notify, assemble, and organize the radiological Emergency Response Team. • Inform the PHEP Duty Officer of the imminent deployment of the ERT. • If necessary, request activation of the AOC and, provide information for the log to be kept of all activities. • Direct all ERT activity, which includes the following: o Advise first responders of safety precautions and radiological aspects of accident response. o Arrange for control of contamination of transported radioactive materials. o Measure in-air gross gamma and gamma plus beta and alpha (if necessary) radiation exposure rates. o If the accident involves a fire, obtain air particulate samples and perform initial analyses on these samples. o Transmit sample data to the AOC or to the state Emergency Coordination Center (ECC). o As directed by OPHD, transport or arrange for transport of collected samples to a designated laboratory. o Collect data and samples for site recovery analyses. o Fill out the accident on-scene checklist.

	• Evaluate and forward protective action recommendations to OPHD for response activities and emergency-worker dose control. • Request that the AOC notify the U.S. Department of Energy Richmond Operations for federal assistance, if necessary (1-509-373-3800). • Ensure that protective actions are consistent with the nature of the accident and the public health and safety. • Keep the ERT members and the OPHD informed of the accident status. **Emergency Response Team preparation** • Assemble items on the ERT checklist. • Test all instruments for proper operation before leaving for the accident site. • Place dosimeters and TLDs in shirt pocket and initiate dose-control record-keeping. • Obtain and load state vehicle. • Obtain specific instructions from the ERT Captain. • Proceed to vicinity of accident site as directed by the ERT Captain. • Begin dose and contamination control: o Read all dosimeters every half hour. o Notify the ERT Captain and leave the accident vicinity if any team member receives 5 rems (general response activities) or greater than 25 rems (life-saving activities). o Make every effort to keep dose ALARA (As Low As Reasonably Achievable) **CAUTION:** Airborne radioactivity may interfere with the contamination survey. Perform an additional survey with the probe near the ground but pointed toward the sky. If the readings from the ground and from the air are identical or similar, report to the ERT Captain that a contamination survey is not possible due to radioactivity interference. **On-Site Emergency Checklist** • Medical assessment and treatment of a patient takes priority. Secondary concerns such as radiological contamination may be addressed after the patient is stabilized. • Ensure individuals are removed from the contaminated radiation area. 10 rems may be permitted for life-saving purposes or up to 5 rems for less urgent needs. Teams may be used in relays to remove injured persons from very high radiation areas.

	• Survey individual for surface contamination levels. • Get nasal smears. Do this before the victim showers! • Remove victim's contaminated clothes and replace with clean ones, or wrap in blanket. Take victim to an area where skin decontamination or showering can be done if needed. (The majority of external contamination is removed when external clothing is removed) • Cover contaminated wounds with sterile dressings. Replace dressings after cleansing skin. **(Note: Contaminated material such as bandages may be taken as a laboratory sample and used for nuclide identification. ERT should maintain control over contaminated materials.)** • Decontaminate skin. Remove all transferable contamination if possible by cleansing contaminated skin and by showering. • Alert hospital and call for ambulance service as soon as it is determine that it is needed. Apprise them of the situation if their help is required. • Identify radionuclides involved in the accident and, if possible, ascertain its chemical form, solubility and presumed particle size (e.g., check the shipping papers in transportation accidents). • Send personnel radiation dosimeters for processing, if appropriate. • Get complete history of accident, especially as it relates to the activities of the victims. Where were they? What were they doing? What was their exit path? What are their symptoms? • Evaluate possibility of penetrating radiation exposure. • If the situation warrants, advise victims on collection of all excreta. Provide sterile containers. Save other contaminated materials. • Be sure someone has assumed responsibility for management of the accident area. Is radiological assistance needed? Who will request it? From whom? • Report your initial responses and evaluation to the Incident Commander. • Take victims to the hospital if injuries require surgical care not available on the scene or if further medical or dosimetric evaluation and treatment is required. • Take precautions to prevent spread of contamination before release from hospital area.
Communications	The team is equipped with a cellular telephone. Accident site communications can also be arranged by using the state police, Search and Rescue, Highway Division, Forestry Department or other communications systems. If this is necessary, request support through the RPS or PHEP Duty Officer or through OERS.

Standard Operating Procedure (SOP)

Recovery Procedures	• After the event has stabilized and all contaminated or injured personnel have been cared for, recovery can begin. This phase is a time of planning, assessment, restoration and a return to non-emergency operations. • The RPS Section Manager will convene a Recovery Committee, to be chaired by the manager or their designated representative. Other members of this committee will include but not be limited to the following: o Representatives of the affected community o Representatives of the cleanup organization o Representatives from all other concerned local, state and federal agencies • The objective of the Recovery Committee will be to restore the area to a condition where normal activities can be resumed, with as little impact as possible to the (1) local citizens, (2) environment and (3) the neighboring industry, in that order. • Cleanup will be performed by an organization authorized to perform such activities, as directed by RPS and in coordination with Oregon Department of Energy. • An appropriate survey plot will be used to conduct the monitoring to ensure the best possible cleaning of the area is done.
Re-entry Procedures	• Re-entry into the incident site will be controlled by specific authorization by the Recovery Committee. • Protective actions should be reviewed during the course of the event to assist in a rapid assessment of current offsite conditions. • Evacuees will be allowed to return only when the affected area is deemed safe for the general public. Recovery and re-entry will be complete only after thorough review and a written statement to that effect is issued by the Recovery Committee chairperson.
Contact Numbers	RPS Duty Officer: 971-673-0490 PHEP Duty Officer: 971-246-1789 OERS: 800-452-0311 U.S. Department of Energy, Richmond Operations: 1-509-373-3800

Standard Operating Procedure (SOP)

ERT CHECKLIST

The following items or others with equivalent capability or purpose are to be obtained before the ERT departs the Portland State Office Building.

Instruments for team:

- ❑ Micro R survey meter, Ludlum model 192 or 19.
- ❑ Ion chamber survey meter, Eberline PIC-6A
- ❑ Portable scaler, Ludlum model 2000 with NaI detector and counting shield
- ❑ Ludlum model 12 with pancake probe

Dose control items for each member:

- ❑ 0-200mR pocket dosimeter, 0-5R pocket dosimeter
- ❑ Dose control form
- ❑ Potassium Iodide (KI) tablets will be provided by Washington State if the team is requested to enter Washington; otherwise they are not needed.

Field Sampling Team Kits:

- ❑ Logbook
- ❑ Disposable Gloves and Shoe Covers
- ❑ Permanent marking pens, other pens, and pencils
- ❑ Plastic sampling bags
- ❑ Labeling tape and Masking Tape
- ❑ Cubitainers, 1qt. Size
- ❑ Trowel
- ❑ Grass clippers
- ❑ Disposable wipes (wet and dry)
- ❑ Soil and Gardening Forks
- ❑ Chain of Custody tags

Air Sampling Kit:

- ❑ Low-volume portable air sampler
- ❑ Cartridge/filter holder for low-volume air sampler
- ❑ Radioiodine cartridge, charcoal
- ❑ Radioiodine cartridge, silver zeolite
- ❑ High-volume particulate filter
- ❑ High-volume portable air sampler

- ❑ Low-volume particulate filter
- ❑ Cartridge/filter holder for high-volume air sampler
- ❑ Portable generator (gas)

Field (Radiological) Response Kits:

- ❑ Logbook
- ❑ Disposable Coveralls, lab jackets, shoe covers, gloves
- ❑ Permanent marking pens, other pens & pencils
- ❑ Plastic bags
- ❑ Labeling tape, masking tape, and duct tape
- ❑ Half-face air purifying respirator w/ Type H cartridges
- ❑ Signs, labels, tie-tags for radioactive materials and radiation areas
- ❑ Barrier tape
- ❑ Filter paper, 1” & Petri dishes
- ❑ Survey meter check source (lantern mantle)
- ❑ Energizing Response Guidebook
- ❑ Q & A booklet, transport of RAM Incident Response
- ❑ Disposable wipes (wet & dry)
- ❑ Chain of custody tags
- ❑ Sample handling tongs
- ❑ Sample containers, 1 pt. size
- ❑ Sample Data cards

Field Documentation/Accessing Kits:

- ❑ Standard Operating Procedures
- ❑ Worksheets (Dose Control Forms, Air Sampling, Environmental Sample Log Sheets, Recovery/Reentry measurements, Plume measurement, Food Control Pass/Fail & Truck Form) and accordion file
- ❑ Clipboards, notepads, rulers
- ❑ Permanent marking pens, other pens & pencils
- ❑ Pocket Dosimeters, 0-20R and 0-5R for each member and pocket dosimeter charger
- ❑ KI tablets (as stated on previous page)
- ❑ Barrier tape (1”)
- ❑ Large Signs (CRA and CRAM)
- ❑ Whistles
- ❑ Atlases (OR and WA)

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TAB 5
ESF 8 RADIATION BRANCH DIRECTOR POSITION DESCRIPTION AND CHECKLIST

DHS
Oregon Department of Human Services

ICS Section: Operations
Radiation Branch
Reports to: Operations Section Chief
Location: DHS AOC

Radiation Branch Director

******Read This Entire Position Checklist Before Taking Action******

REMEMBER – SAFETY FIRST

Job Description

The Radiation Branch Director serves as the radiation expert and advisor to the Operations Chief by providing up-to-date scientific information about the radiation release and the risks to people and the environment.

Responsibilities

- Provide the hazardous properties of the substance, both radiological and chemical.
- Provide information on health effects, including information contained in any relevant data sheet provided by the supplier of the radioactive material.
- Determine the level, type and duration of exposure.
- Determine the circumstances of the incident, including the amount of substance involved.
- Define activities where there is the potential for a high level of exposure (e.g., victim extrication).
- Determine the relevant occupational exposure standard limit as shown in Tab 2.
- Determine the effect of preventive and control measures which have been or will be taken in accordance with the regulations.
- Monitor personnel exposure.

Qualifications

- Operational level proficiency in ICS/NIMS.
- Operational level proficiency with the public health aspects of radiological emergency response.
- Awareness level of proficiency with OPHD AOC functions.
- Management/supervisory skills.

Position Checklist

Activation Phase

- ❑ Check in with the AOC Manager/Incident Manager upon arrival at the AOC.
- ❑ Report to the Operations Section Chief, or other assigned supervisor, and receive or confirm position and duties.
- ❑ Set up workstation and review position responsibilities.
- ❑ Establish and maintain a unit log that chronologically describes actions taken during the shift.
- ❑ Determine resource needs, such as a computer, phone, plan copies, and other reference documents.
- ❑ Inform the Operations Section Chief of the potential of the radionuclides to harm people and the environment.

Operational Phase

- ❑ Respond to requests for technical information from local health departments, public, media, and all other partners impacted by the radiological emergency.
- ❑ Review protective action recommendations and decisions for the public and for emergency workers.
- ❑ Discuss requests by emergency workers to exceed the recommended dose limit (5 rem) with the Radiation Branch Director, who can approve them (in consultation with the Oregon Public Health Officer). Refer to Tab 2, "Exposure Guidance for Emergency Responders" – Protective Action Guide (PAG).
- ❑ Make sure that offsite emergency worker exposure records are tracked and maintained.
- ❑ Obtain and review laboratory data from Oregon State University Radiation Center.
- ❑ Coordinate data and response efforts with the OSU Radiation Center.
- ❑ Monitor the event for changes in the wind and potential for more people to be exposed.
- ❑ Determine the impact of long-term exposure of people and the environment to radiation.
- ❑ If the emergency will require food or water control measures, consult with the appropriate technical specialists from the Office of Environmental Public Health.
- ❑ Help develop a recovery plan describing decontamination, human health safety exposure levels, and tracking of exposed populations in conjunction with Environmental and Occupational Epidemiology.
- ❑ If another person is relieving you, ensure they are thoroughly briefed before you leave your workstation.
- ❑ Ensure that all logs, lists and paper work are complete and passed on.

- ❑ Do not leave until a qualified person relieves you and the Incident Manager dismisses you.

Forms for this Position

- ❒ AOC Sign In Sheet
- ❒ ICS 204 Division Assignment List (Review and modify for Divisions within the Branch)
- ❒ ICS 214 Unit/Activity Log
- ❒ ICS 214a Individual Log

Demobilization Phase

- ❑ Deactivate your assigned position and close out logs when authorized by the Incident Manager.
- ❑ Complete all required forms, reports, and other documentation. All forms should be submitted through your supervisor to the Planning/Intelligence Section, as appropriate, prior to your departure.
- ❑ Make sure that emergency worker exposure records are filed in the AOC.
- ❑ Be prepared to provide input to the after-action report.
- ❑ Clean up your work area before you leave.
- ❑ Leave a forwarding phone number where you can be reached.

TAB 6
DOSE ANALYST POSITION DESCRIPTION AND CHECKLIST

DHS
Oregon Department of Human Services

ICS Section: Operations
Radiation Branch
Reports to: Radiation Branch Director
Location: DHS AOC

Dose Analyst

******Read This Entire Position Checklist Before Taking Action******

REMEMBER – SAFETY FIRST

Job Description

The Dose Analyst keeps track of dose projections and measurements and advises the Radiation Branch Director.

Position Checklist

Activation Phase

- ❑ Check in with the AOC Manager/Incident Manager upon arrival at the AOC.
- ❑ Report to the Radiation Branch Director, or other assigned supervisor, and receive or confirm position and duties.
- ❑ Set up workstation and review position responsibilities.
- ❑ Establish and maintain a unit log that chronologically describes actions taken during the shift.
- ❑ Determine resource needs, such as a computer, phone, plan copies, and other reference documents.

Operational Phase

- ❑ Review and evaluate the following information and provide recommendations to the Radiation Branch Director:
  - ❑ Field team sampling plan
  - ❑ Calculations of potential doses to the public
  - ❑ Recommended protective actions
- ❑ Assess the need for public protective actions based on radiological measurements in the field. Provide your conclusions to the Radiation Branch Director.
- ❑ Distribute dosimeters and track & record the dosimeter information. Receive and evaluate dosimeter information.
- ❑ **Personnel Dosimetry:**

- ❒ Issue dosimetry
- ❒ Track dosimetry and evaluate dose
- ❒ Assure timely receipt of data (field workers must check dosimeters, and report data, etc.)

❒ **Radiation Area Dose Assessment:**

- ❒ Collect survey data from field teams
- ❒ Collate and analyze data to determine work zones (either crude zones, or a dose isoline map)
- ❒ Calculate worker dose based on work zone and time in the zone

❒ **Plume Calculations:**

- ❒ Collect survey data, and sample data from field teams
- ❒ Coordinate samples with labs
- ❒ Disseminate data to OSU Radiation Center
- ❒ Collect plume and model data from OSU Radiation Center
- ❒ Relay plume/modeled data to the Radiation Branch Director

❑ Collect area survey data from field teams. Analyze data to determine work zones. Use work zone data to determine doses based on work zone levels and worker time in zone.

❑ Collect plume and model data from OSU and analyze. Report to Radiation Branch Director and PIO.

- ❒ Collect survey data and sample data from field teams.
- ❒ Coordinate sample with labs.
- ❒ Disseminate data to OSU Radiation Center.
- ❒ Collect plume and model data from OSU Radiation Center.
- ❒ Relay plume/modeled data to the Radiation Branch Director, or appropriate individual.

❑ Keep track of and advise emergency workers on how to keep dose rates as low as reasonably achievable. Forward emergency worker requests to exceed dose limits and your recommendations to the Radiation Branch Director.

❑ Work with the appropriate food and drinking water specialists from the Office of Environmental Health on actions to be taken to protect food, milk and water supplies.

❑ Maintain the maps used to plot high dose areas and protective action boundaries.

❑ Keep apprised of federal field team and laboratory assistance.

❑ If another person is relieving you, ensure they are thoroughly briefed before you leave your workstation.

❑ Ensure that all logs, lists, and paper work are complete and passed on.

- ❑ Do not leave until a qualified person relieves you and the Incident Commander dismisses you.

Forms for this Position

- ❒ AOC Sign In Sheet
- ❒ ICS 214a Individual Log

Demobilization Phase

- ❑ Deactivate your assigned position and close out logs when authorized by the Incident Manager.
- ❑ Complete all required forms, reports, and other documentation. All forms should be submitted through your supervisor to the Planning/Intelligence Section, as appropriate, prior to your departure.
- ❑ Be prepared to provide input to the after-action report.
- ❑ Clean up your work area before you leave.
- ❑ Leave a forwarding phone number where you can be reached.

TAB 7
RADIATION FACT SHEETS

This tab contains information about radiation and radiation emergencies that was compiled by members of Radiation Protection Services and can be used to create a variety of FAQs and fact sheets.

DHS
Oregon Department of Human Services
Public Health Division

Radiological Dirty Bomb Facts

For more information, contact your local public health agency or the following:

Oregon Department of Human Services Radiation Protection Services:
971-673-0490

Oregon Poison Center, Toll-Free:
1-800-222-1222

Centers for Disease Control & Prevention, Toll-Free:
1-800-CDC-INFO (232-4636)
1-888-232-6348 TTY
E-mail: cdcinfo@cdc.gov

Radiation Emergency Assistance Center/Training Site (REAC/TS):
1-865-576-3131

You can also visit the following Web sites for the latest information about dirty bombs:

Centers for Disease Control and Prevention:
http://www.bt.cdc.gov/radiation

REAC/TS:
http://www.orau.gov/reacts

If you suspect a terrorist event, immediately notify local law enforcement or the Federal Bureau of Investigation:
503-224-4181 (Portland)

or visit:
http://portland.fbi.gov

About dirty bombs

- A radiological "dirty bomb" is a mix of explosives, such as dynamite, with radioactive powder or pellets. When the dynamite or other explosives are set off, the blast carries radioactive dust and smoke into the surrounding area.
- A dirty bomb is ***not*** a nuclear bomb like the ones dropped on Hiroshima and Nagasaki. It does not produce a huge release of energy that can flatten cities. However, it can injure people and damage buildings near the explosion.

Dangers of a dirty bomb

- Most of the injuries from a dirty bomb will come from the explosion itself. People may have burns, cuts or broken bones.
- People who are very close to the explosion may be covered with radioactive dust. The dust must be removed to prevent illness caused by exposure to radiation.
- People who are near the explosion could inhale radioactive dust or smoke.
- If you are not very close to the explosion, you are not likely in any immediate danger.

If you are outside and close to the explosion

- Cover your nose and mouth with a cloth to reduce the risk of breathing in radioactive dust or smoke.
- Don't touch objects thrown by the explosion–they might be radioactive.
- Quickly go into a building where the walls and windows have not been broken. The building will shield you from radiation that might be outside.
- Once you are inside, stay in the building until authorities arrive and can determine if you have been exposed to radiation.
- If appropriate, take off your outer layer of clothing and seal it in a plastic bag if available. Put the cloth you used to cover your mouth in the bag, too. Removing your outer clothes gets rid of most of the radioactive dust.
- Put the plastic bag where others will not touch it, and keep it until authorities tell you what to do with it.
- If you have facilities, shower or wash with soap and water. Be sure to wash your hair. Showering removes the rest of the dust.
- Tune to the local radio or television news for more instructions.

Local Health Departments

Baker	541-523-8211
Benton	541-766-6835
Clackamas	503-655-8430
Clatsop	503-325-8500
Columbia	503-397-4651
Coos	541-756-2020
	ext. 510
Crook	541-447-5165
Curry	541-247-3300
Deschutes	541-322-7400
Douglas	800-234-0985
Gilliam	541-384-2061
Grant	541-575-0429
Harney	541-573-2271
Hood River	541-386-1115
Jackson	541-774-8209
Jefferson	541-475-4456
Josephine	541-474-5325
Klamath	541-882-8846
Lake	541-947-6045
Lane	541-682-4041
Lincoln	541-265-4112
Linn	541-967-3888
Malheur	541-889-7279
Marion	503-584-4870
Morrow	541-676-5421
Multnomah	503-988-3674
Polk	503-623-8175
Sherman	541-506-2600
Tillamook	503-842-3900
Umatilla	541-278-5432
Union	541-962-8801
Wallowa	541-426-4848
Wasco	541-506-2600
Washington	503-846-8881
Wheeler	541-763-2725
Yamhill	503-434-7525

If you have a disability and need this document in an alternate format, call
(971) 673-1222
(971) 673-0372 TTY

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If you are inside and close to the explosion

- If the walls and windows of the building are not broken, stay in the building. To keep radioactive dust from getting inside, shut all windows, outside doors and fireplace dampers. Turn off fans and heating and air conditioning systems.
- If the walls and windows of the building are broken, go into an interior room, and do not leave.
- If the building has been heavily damaged, leave the building and quickly go into a building where the walls and windows have not been broken. If you must go outside, cover your nose and mouth with a cloth. Once you are back inside, take off your outer layer of clothing and seal it in a plastic bag, if available. Store the bag where others will not touch it.
- If you have facilities, shower or wash with soap and water to remove any remaining dust. Be sure to wash your hair.
- Tune to local radio or television news for more instructions.

If you are in a car near the explosion

- Close the windows and turn off the air conditioner, heater and vents.
- Cover your nose and mouth with a cloth to avoid breathing radioactive dust or smoke.
- If you are close to your home, office or a public building, go there immediately, and go inside quickly.
- If you cannot get to your home or another building safely, pull over to the side of the road and stop in the safest place possible.
- Turn off the engine, and listen to the radio for instructions.
- Stay in the car until you are told it is safe to get back on the road.

If you have children and family

- If your family is with you, stay together. Take the same actions to protect your whole family that you do for yourself.
- If your family is in another building, they should stay there until you are told it is safe to travel.
- If your children are at school, they should stay there and follow the school's emergency plan. Do not go to the school until you are told it is safe to travel.

If you are not sure whether you have been exposed to radiation

- Police, firefighters and health officials have special equipment to check for radiation. They will determine how much radiation is present and whether it poses any danger in your area.
- If you were in the area of a dirty bomb, and you develop nausea, vomiting, diarrhea, and swelling or redness of the skin, contact your doctor or health care provider.

DHS Oregon Department of Human Services
Public Health Division

Radiological Dirty Bomb Facts
for Clinicians

For more information, contact your local public health agency or the following:

Oregon Department of Human Services Radiation Protection Services:
971-673-0490

Oregon Poison Center, Toll-Free:
1-800-222-1222

Centers for Disease Control & Prevention, Toll-Free:
1-800-CDC-INFO (232-4636)
1-888-232-6348 TTY
E-mail: cdcinfo@cdc.gov

Radiation Emergency Assistance Center/Training Site (REAC/TS):
1-865-576-3131

You can also visit the following Web sites for the latest information about dirty bombs:

Centers for Disease Control and Prevention:
http://www.bt.cdc.gov/radiation/#clinicians

REAC/TS:
http://www.orau.gov/reacts

Department of Health and Human Services Radiation Event Medical Management:
http://remm.nlm.gov

If you suspect a terrorist event, immediately notify local law enforcement or the Federal Bureau of Investigation:
503-224-4181 (Portland)

or visit:
http://portland.fbi.gov

Introduction
A radiological "dirty bomb" is a traditional explosive device that is wrapped around, or attached to, radioactive material. The majority of injuries produced will be traumatic due to the explosion. People close to or downwind from the blast site will be covered with dust and debris containing radioactive particles that must be removed. They may also have inhaled or ingested particles.

Symptoms
Victims of a radiological dirty bomb will not have radiation-related injuries upon arrival to health care and should be assessed for traumatic injuries first. Radiation-related injury may develop over hours to days if radioactive particles are inhaled, ingested, or incorporated through traumatic wounds. Radiation injuries may also develop if particles remain in close proximity to the skin and mucous membranes for a period of time.

Triage
Triage patients according to their traumatic injuries:
- **Significant trauma:** Treat patients in the emergency department after removing their clothing and placing a surgical cap on them. Stabilize patients, survey them for contamination, and then decontaminate them if necessary.
- **Stable injuries or no symptoms:** Survey patients for radioactive particles and decontaminate them only if the radiation is higher than two times the area's baseline, or if you find focal contamination.

Diagnosis
- Survey patient with a radiation survey meter to detect radioactive particles on skin and clothing; note location and level of radiation.
- If patient was exposed to airborne particles, survey nasal and pharyngeal swabs with the survey meter to determine possible inhalation or ingestion of particles.

Personal Protective Equipment (PPE)
Health care workers are ***not*** at risk of radiation burns or sickness, as long as you do not inhale or ingest particles or have prolonged contact with particles on your bare skin. However, if you are handling contaminated patients:
- Use Standard Precautions (e.g., cap, gown, booties, surgical mask, eye shield and gloves).
- Tape gloves to the gown and tape booties to the gown or pants to prevent runoff of contaminated water into gloves and boots.
- Wear a second pair of gloves and change them frequently.
- While surgical masks are adequate, N95 masks, if available, are recommended.
- Survey your own hands and clothing frequently with a survey meter.

Local Health Departments

Baker	541-523-8211
Benton	541-766-6835
Clackamas	503-655-8430
Clatsop	503-325-8500
Columbia	503-397-4651
Coos	541-756-2020
	ext. 510
Crook	541-447-5165
Curry	541-247-3300
Deschutes	541-322-7400
Douglas	800-234-0985
Gilliam	541-384-2061
Grant	541-575-0429
Harney	541-573-2271
Hood River	541-386-1115
Jackson	541-774-8209
Jefferson	541-475-4456
Josephine	541-474-5325
Klamath	541-882-8846
Lake	541-947-6045
Lane	541-682-4041
Lincoln	541-265-4112
Linn	541-967-3888
Malheur	541-889-7279
Marion	503-588-5621
Morrow	541-676-5421
Multnomah	503-988-3674
Polk	503-623-8175
Sherman	541-506-2600
Tillamook	503-842-3900
Umatilla	541-278-5432
Union	541-962-8801
Wallowa	541-426-4848
Wasco	541-506-2600
Washington	503-846-8881
Wheeler	541-763-2725
Yamhill	503-434-7525

If you have a disability and need this document in an alternate format, call
(971) 673-1222
(971) 673-0372 TTY

8/16/2007

Decontamination

- Cut off all patient clothing and carefully roll away from the face. Remove jewelry and eyeglasses. Double-bag, seal and label clothing and store outside the emergency department.
- Wash head first with patient bending forward, if possible.
- Wash face next; flush eyes, nose and ears, and rinse mouth.
- Wash wounds with saline or water.
- Carefully wash intact skin with soap and water for 3 to 5 minutes. Do not abrade skin.
- Resurvey patient and repeat washing until readings are less than two times the area's baseline and no focal contamination is found.
- Double-bag towels and store outside the emergency department.

Treatment

- Contact the hospital radiation safety officer or REAC/TS.
- Treat patient's traumatic injuries as required.
- If internal contamination of patients is suspected, collect samples of patient feces, vomitus and urine to determine the level of contamination and the type of isotope.
- Treat pulmonary contamination with bronchoalveolar lavage.
- Treat GI contamination with activated charcoal (1g/kg up to 50 g PO).
- Once the isotope has been identified, treat internal contamination and absorption into organs and tissues with the appropriate antidote:
  - **Iodine:** Potassium iodide 130 mg PO x 1
  - **Uranium:** Bicarbonate (2 amps NA Bicarb in 1 L NS at 125 cc/hour)
  - **Cesium/Thallium:** Prussian blue 1 gram PO TID
  - **Tritium:** IV normal saline
  - **Plutonium/Yttrium:** Ca-DTPA (or Zn-DTPA) 1 gram in 250 cc D5W over 1 hour

For more information about treatment options, discuss the case with the Oregon Poison Center (1-800-222-1222).

Patient Monitoring

Monitoring is based on the patient's traumatic injuries, not on radiation.

Discharging Patients

- Admit patients with traumatic injuries that require hospitalization.
- Admit patients with significant internal contamination who may require pulmonary or gastrointestinal decontamination or may require an antidote.
- Discharge patients who have no internal or external contamination (either by history or survey) and do not require admission for traumatic injuries.

FACT SHEET

Acute Radiation Syndrome: A Fact Sheet for Physicians

Acute Radiation Syndrome (ARS) (sometimes known as radiation toxicity or radiation sickness) is an acute illness caused by irradiation of the entire body (or most of the body) by a high dose of penetrating radiation in a very short period of time (usually a matter of minutes). The major cause of this syndrome is depletion of immature parenchymal stem cells in specific tissues. Examples of people who suffered from ARS are the survivors of the Hiroshima and Nagasaki atomic bombs, the firefighters that first responded after the Chernobyl Nuclear Power Plant event in 1986, and some unintentional exposures to sterilization irradiators.

The required conditions for Acute Radiation Syndrome (ARS) are:

- **The radiation dose must be large** (i.e., greater than 0.7 Gray (Gy)[1,2] or 70 rads).
  - Mild symptoms may be observed with doses as low as 0.3 Gy or 30 rads.
- **The dose usually must be external** (i.e., the source of radiation is outside of the patient's body).
  - Radioactive materials deposited inside the body have produced some ARS effects only in extremely rare cases.
- **The radiation must be penetrating** (i.e., able to reach the internal organs).
  - High energy X-rays, gamma rays, and neutrons are penetrating radiations.
- **The entire body** (or a significant portion of it) must have received the dose.[3]
  - Most radiation injuries are local, frequently involving the hands, and these local injuries seldom cause classical signs of ARS.
- **The dose must have been delivered in a short time** (usually a matter of minutes).
  - Fractionated doses are often used in radiation therapy. These large total doses are delivered in small daily amounts over a period of time. Fractionated doses are less effective at inducing ARS than a single dose of the same magnitude.

The three classic ARS Syndromes are:

- **Bone marrow syndrome** (sometimes referred to as hematopoietic syndrome)**:** the full syndrome will usually occur with a dose greater than approximately 0.7 Gy (70 rads) although mild symptoms may occur as low as 0.3 Gy or 30 rads.[4]
  - The survival rate of patients with this syndrome decreases with increasing dose. The primary cause of death is the destruction of the bone marrow, resulting in infection and hemorrhage.
- **Gastrointestinal (GI) syndrome:** the full syndrome will usually occur with a dose greater than approximately 10 Gy (1000 rads) although some symptoms may occur as low as 6 Gy or 600 rads.

---

1 The Gray (Gy) is a unit of absorbed dose and reflects an amount of energy deposited into a mass of tissue (1 Gy = 100 rads). In this document, the referenced absorbed dose is that dose inside the patient's body (i.e., the dose that is normally measured with personal dosimeters).

2 The referenced absorbed dose levels in this document are assumed to be from beta, gamma, or x radiation. Neutron or proton radiation produces many of the health effects described herein at lower absorbed dose levels.

3 The dose may not be uniform, but a large portion of the body must have received more than 0.7 Gy (70 rads).

4 Note: although the dose ranges provided in this document apply to most healthy adult members of the public, a great deal of variability of radiosensitivity among individuals exists, depending upon the age and condition of health of the individual at the time of exposure. Children and infants are especially sensitive.

DEPARTMENT OF HEALTH AND HUMAN SERVICES
CENTERS FOR DISEASE CONTROL AND PREVENTION
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  - Survival is extremely unlikely with this syndrome. Destructive and irreparable changes in the GI tract and bone marrow usually cause infection, dehydration, and electrolyte imbalance. Death usually occurs within 2 weeks.
- **Cardiovascular (CV) / Central Nervous System (CNS) syndrome:** the full syndrome will usually occur with a dose greater than approximately 50 Gy (5000 rads) although some symptoms may occur as low as 20 Gy or 2000 rads.
  - Death occurs within 3 days. Death likely is due to collapse of the circulatory system as well as increased pressure in the confining cranial vault as the result of increased fluid content caused by edema, vasculitis, and meningitis.

The four stages of ARS are:

- **Prodromal stage (N-V-D stage):** The classic symptoms for this stage are nausea, vomiting, as well as anorexia and possibly diarrhea (depending on dose), which occur from minutes to days following exposure. The symptoms may last (episodically) for minutes up to several days.
- **Latent stage:** In this stage, the patient looks and feels generally healthy for a few hours or even up to a few weeks.
- **Manifest illness stage:** In this stage, the symptoms depend on the specific syndrome (see Table 1) and last from hours up to several months.
- **Recovery or death:** Most patients who do not recover will die within several months of exposure. The recovery process lasts from several weeks up to two years.

These stages are described in more detail in Table 1.

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(continued from previous page)

Table 1. Acute Radiation Syndromes

Syndrome	Dose*	Prodromal Stage	Latent Stage	Manifest Illness Stage	Recovery
Hematopoietic (Bone marrow)	> 0.7 Gy (> 70 rads) *(mild symptoms may occur as low as 0.3 Gy or 30 rads)*	• Symptoms are anorexia, nausea and vomiting. • Onset occurs 1 hour to 2 days after exposure. • Stage lasts for minutes to days.	• Stem cells in bone marrow are dying, although patient may appear and feel well. • Stage lasts 1 to 6 weeks.	• Symptoms are anorexia, fever, and malaise. • Drop in all blood cell counts occurs for several weeks. • Primary cause of death is infection and hemorrhage. • Survival decreases with increasing dose. • Most deaths occur within a few months after exposure.	• In most cases, bone marrow cells will begin to repopulate the marrow. • There should be full recovery for a large percentage of individuals from a few weeks up to two years after exposure • Death may occur in some individuals at 1.2 Gy (120 rads). • The $LD_{50/60}$ † is about 2.5 to 5 Gy (250 to 500 rads).
Gastrointestinal (GI)	> 10 Gy (> 1000 rads) *(some symptoms may occur as low as 6 Gy or 600 rads)*	• Symptoms are anorexia, severe nausea, vomiting, cramps, and diarrhea. • Onset occurs within a few hours after exposure. • Stage lasts about 2 days.	• Stem cells in bone marrow and cells lining GI tract are dying, although patient may appear and feel well. • Stage lasts less than 1 week.	• Symptoms are malaise, anorexia, severe diarrhea, fever, dehydration, and electrolyte imbalance. • Death is due to infection, dehydration, and electrolyte imbalance. • Death occurs within 2 weeks of exposure.	• The LD_{100} ‡ is about 10 Gy (1000 rads).
Cardiovascular (CV)/ Central Nervous System (CNS)	> 50 Gy (5000 rads) *(some symptoms may occur as low as 20 Gy or 2000 rads)*	• Symptoms are extreme nervousness and confusion; severe nausea, vomiting, and watery diarrhea; loss of consciousness; and burning sensations of the skin. • Onset occurs within minutes of exposure. • Stage lasts for minutes to hours.	• Patient may return to partial functionality. • Stage may last for hours but often is less.	• Symptoms are return of watery diarrhea, convulsions, and coma. • Onset occurs 5 to 6 hours after exposure. • Death occurs within 3 days of exposure.	• No recovery is expected.

* The absorbed doses quoted here are "gamma equivalent" values. Neutrons or protons generally produce the same effects as gamma, beta, or X-rays but at lower doses. If the patient has been exposed to neutrons or protons, consult radiation experts on how to interpret the dose.
† The $LD_{50/60}$ is the dose necessary to kill 50% of the exposed population in 60 days.
‡ The LD_{100} is the dose necessary to kill 100% of the exposed population.

DEPARTMENT OF HEALTH AND HUMAN SERVICES
CENTERS FOR DISEASE CONTROL AND PREVENTION
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Cutaneous Radiation Syndrome (CRS)

The concept of cutaneous radiation syndrome (CRS) was introduced in recent years to describe the complex pathological syndrome that results from acute radiation exposure to the skin.

ARS usually will be accompanied by some skin damage. It is also possible to receive a damaging dose to the skin without symptoms of ARS, especially with acute exposures to beta radiation or X-rays. Sometimes this occurs when radioactive materials contaminate a patient's skin or clothes.

When the basal cell layer of the skin is damaged by radiation, inflammation, erythema, and dry or moist desquamation can occur. Also, hair follicles may be damaged, causing epilation. Within a few hours after irradiation, a transient and inconsistent erythema (associated with itching) can occur. Then, a latent phase may occur and last from a few days up to several weeks, when intense reddening, blistering, and ulceration of the irradiated site are visible.

In most cases, healing occurs by regenerative means; however, very large skin doses can cause permanent hair loss, damaged sebaceous and sweat glands, atrophy, fibrosis, decreased or increased skin pigmentation, and ulceration or necrosis of the exposed tissue.

Patient Management

Triage: If radiation exposure is suspected:

- Secure ABCs (airway, breathing, circulation) and physiologic monitoring (blood pressure, blood gases, electrolyte and urine output) as appropriate.
- Treat major trauma, burns, and respiratory injury if evident.
- In addition to the blood samples required to address the trauma, obtain blood samples for CBC (complete blood count), with attention to lymphocyte count, and HLA (human leukocyte antigen) typing prior to any initial transfusion and at periodic intervals following transfusion.
- Treat contamination as needed.
- If exposure occurred within 8 to 12 hours, repeat CBC, with attention to lymphocyte count, 2 or 3 more times (approximately every 2 to 3 hours) to assess lymphocyte depletion.

Diagnosis

The diagnosis of ARS can be difficult to make because ARS causes no unique disease. Also, depending on the dose, the prodromal stage may not occur for hours or days after exposure, or the patient may already be in the latent stage by the time they receive treatment, in which case the patient may appear and feel well when first assessed.

If a patient received more than 0.05 Gy (5 rads) and three or four CBCs are taken within 8 to 12 hours of the exposure, a quick estimate of the dose can be made (see Ricks, et. al. for details). If these initial blood counts are not taken, the dose can still be estimated by using CBC results over the first few days. It would be best to have radiation dosimetrists conduct the dose assessment, if possible.

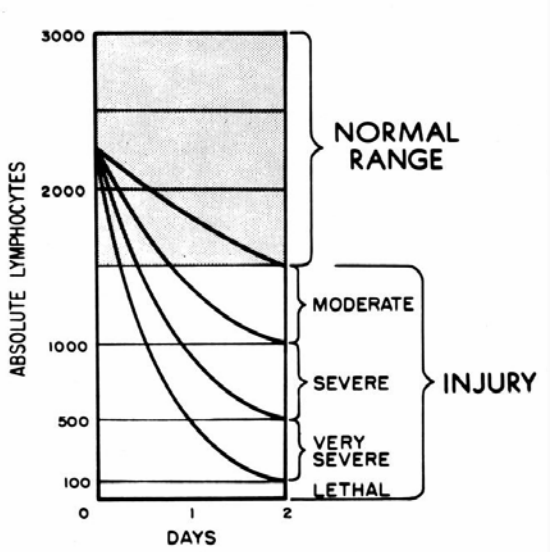
If a patient is known to have been or suspected of having been exposed to a large radiation dose, draw blood for CBC analysis with special attention to the lymphocyte count, every 2 to 3 hours during the first 8 hours after exposure (and every 4 to 6 hours for the next 2 days). Observe the patient during this time for symptoms and consult with radiation experts before ruling out ARS.

If no radiation exposure is initially suspected, you may consider ARS in the differential diagnosis if a history exists of nausea and vomiting that is unexplained by other causes. Other indications are bleeding, epilation, or white blood count (WBC) and platelet counts abnormally low a few days or weeks after unexplained nausea and vomiting. Again, consider CBC and chromosome analysis and consultation with radiation experts to confirm diagnosis.

Initial Treatment and Diagnostic Evaluation

Treat vomiting[5] and repeat CBC analysis with special attention to the lymphocyte count every 2 to 3 hours for the first 8 to 12 hours after exposure (and every 4 to 6 hours for the following 2 or 3 days). Sequential changes in absolute lymphocyte counts over time are demonstrated below in the Andrews Lymphocyte Nomogram (see Figure 1). Precisely record all clinical symptoms, particularly nausea, vomiting, diarrhea, and itching, reddening or blistering of the skin. Be sure to include time of onset.

Figure 1: Andrews Lymphocyte Nomogram



From Andrews GA, Auxier JA, Lushbaugh CC. *The Importance of Dosimetry to the Medical Management of Persons Exposed to High Levels of Radiation.* In *Personal Dosimetry for Radiation Accidents*. Vienna: International Atomic Energy Agency; 1965.

Note and record areas of erythema. If possible, take color photographs of suspected radiation skin damage. Consider tissue, blood typing, and initiating viral prophylaxis. Promptly consult with radiation, hematology, and radiotherapy experts about dosimetry, prognosis, and treatment options. Call the Radiation Emergency Assistance Center/Training Site (REAC/TS) at (865) 576-3131 (M-F, 8 am to 4:30 am EST) or (865) 576-1005 (after hours) to record the incident in the Radiation Accident Registry System.

After consultation, begin the following treatment (as indicated):

- supportive care in a clean environment (if available, the use of a burn unit may be quite effective)
- prevention and treatment of infections
- stimulation of hematopoiesis by use of growth factors
- stem cell transfusions or platelet transfusions (if platelet count is too low)
- psychological support
- careful observation for erythema (document locations), hair loss, skin injury, mucositis, parotitis, weight loss, or fever
- confirmation of initial dose estimate using chromosome aberration cytogenetic bioassay when possible. Although resource intensive, this is the best method of dose assessment following acute exposures.
- consultation with experts in radiation accident management

[5] Collect vomitus in the first few days for later analysis.

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For More Help

Technical assistance can be obtained from the Radiation Emergency Assistance Center/Training Site (REAC/TS) at (865) 576-3131 (M-F, 8 am to 4:30 pm EST) or (865) 576-1005 (after hours), or on their web site at www.orau.gov/reacts, and the Medical Radiobiology Advisory Team (MRAT) at (301) 295-0316.

Also, more information can be obtained from the CDC Health Alert Network at www.bt.cdc.gov or by calling (800) 311-3435.

References

Berger ME, O'Hare FM Jr, Ricks RC, editors. The Medical Basis for Radiation Accident Preparedness: The Clinical Care of Victims. REAC/TS Conference on the Medical Basis for Radiation Accident Preparedness. New York: Parthenon Publishing; 2002.

Gusev IA, Guskova AK, Mettler FA Jr, editors. Medical Management of Radiation Accidents, 2nd ed., New York: CRC Press, Inc.; 2001.

Jarrett DG. Medical Management of Radiological Casualties Handbook, 1st ed. Bethesda, Maryland: Armed Forces Radiobiology Research Institute (AFRRI); 1999.

LaTorre TE. Primer of Medical Radiobiology, 2nd ed. Chicago: Year Book Medical Publishers, Inc.; 1989.

National Council on Radiation Protection and Measurements (NCRP). Management of Terrorist Events Involving Radioactive Material, NCRP Report No. 138. Bethesda, Maryland: NCRP; 2001.

Prasad KN. Handbook of Radiobiology, 2nd ed. New York: CRC Press, Inc.; 1995.

Radiological Terrorism

Emergency Management Pocket Guide for Clinicians

Centers for Disease Control and Prevention
2005

Emergency Management Pocket Guide
This pocket guide is designed for clinicians, including physicians, nurses, and other health care professionals, who will provide emergency care in a hospital setting following a radiological terrorism incident. This guide is designed as a supplement to the CDC training program *Radiological Terrorism: Just in Time Training for Hospital Clinicians.*

ADDITIONAL RESOURCES

Radiation Emergency Assistance Center/Training Site (REAC/TS)
Phone: (865) 576-3131
M-F, 8am – 4:30pm EST
(865) 576-1005 (after hours)
Web: www.orau.gov/reacts

Centers for Disease Control and Prevention (CDC)
Phone: (800) CDC-INFO
Web: www.bt.cdc.gov/radiation

Armed Forces Radiobiology Research Institute, Medical Radiobiology Team
Phone: (301) 295-0530
Web: www.afrri.usuhs.mil

State and Local Emergency Response (record below):

RADIATION PRINCIPLES

Radiation cannot be detected by the human senses. A radiological survey conducted with specialized equipment is the only way to confirm the presence of radiation. If a terrorist event involves the use of radioactive material, both patient exposure and contamination must be assessed.

Exposure occurs when a person is near a radiation source. People exposed to a source of radiation can suffer radiation illness if their dose is high enough, but they do not become radioactive. For example, an x-ray machine is a source of radiation exposure. A person does not become radioactive or pose a risk to others following a chest x-ray.

Contamination occurs externally when loose particles of radioactive material are deposited on surfaces, skin, or clothing. Internal contamination occurs when radioactive particles are inhaled, ingested, or lodged in an open wound.

Contaminated patients should be decontaminated as soon as possible, without delaying critical care. Patients who have been exposed to radiation, but are not contaminated with radioactive material, do not need to be decontaminated.

MEDICAL MANAGEMENT PRINCIPLES

- Addressing contamination issues should not delay treatment of life-threatening injuries.
- It is highly unlikely that the levels of radioactivity associated with a contaminated patient would pose a significant health risk to care providers.
- In certain rare instances, the presence of imbedded radioactive fragments or large amounts of external contamination may require expedited decontamination.
- Include in-house radiation professionals on the response team.

STAFF PROTECTION GUIDELINES

Establish an ad hoc triage area.
- Base the location on your hospital's disaster plan and the anticipated number of casualties.
- Establish a contaminated area and clean area separated by a buffer zone.
- Remove your contaminated outer garments when leaving the contaminated area.
- Have your body surveyed with a radiation meter when exiting a contaminated area.

Use standard precautions to protect staff.
- Follow standard guidelines for protection from microbiological contamination.
- Surgical masks should be adequate.
- N95 masks, if available, are recommended.
- Survey hands and clothing at frequent intervals with a radiation meter.
- Due to fetal sensitivity to radiation, assign pregnant staff to other duties.

DECONTAMINATION GUIDELINES

Survey the patient with a radiation meter.
- Perform surveys using consistent technique and trained personnel.
- Note exceptionally large amounts of surface or imbedded radioactive material.
- Handle radioactive objects with forceps and store in lead containers.
- Record location and level of any contamination found.

Remove patient clothing.
- Carefully cut and roll clothing away from the face to contain the contamination.
- Double-bag clothing using radioactive hazardous waste guidelines, label, and save as evidence.
- Repeat patient survey and record levels.

Cleanse contaminated areas.
- Wash wounds first with saline or water.
- If facial contamination is present, flush eyes, nose, and ears, and rinse mouth.
- Gently cleanse intact skin with soap and water, starting outside the contaminated area and washing inward.
- Do not irritate or abrade the skin.
- Resurvey and note levels.
- Repeat washing until survey indicates radiation level is no more than twice background or the level remains unchanged.
- Cover wounds with waterproof dressing.
- Dispose of waste water through normal channels.
- For mass casualties, consider establishing separate shower areas for ambulatory and non-ambulatory patients.

RADIATION-RELATED ILLNESS/INJURY

Acute radiation syndrome (ARS)
ARS is caused by high doses of radiation being rapidly delivered to large portions of the body. The most probable terrorist events, such as the use of a dirty bomb, will likely generate low levels of radiation exposure. If ARS cases are seen, small casualty numbers are likely.

- Time of exposure, distance from radioactive source, and duration of exposure should be noted.
- Patients can present individually if exposed to radioactive sources hidden in the community.
- Symptoms can be immediate or delayed, mild or severe, based on radiation dose.
- Nausea, vomiting may occur minutes to days after exposure. Time of onset of vomiting is a major factor in diagnosis and dose estimation (See Table 1).
- Early onset of vomiting followed by symptoms of bone marrow suppression, gastrointestinal destruction, and/or cardiovascular/central nervous system effects is indicative of acute illness.
- Depending on the stage of illness, a patient may be asymptomatic.

Diagnosis and treatment

- Perform sequential CBCs with differential to assess progressive declines in lymphocyte levels (See Andrews Lymphocyte Nomogram).
- Monitor for fluid and electrolyte balance and evidence of hemodynamic instability.
- Treat symptomatically with focus on prevention of infection, including antibiotics.
- Consider cytokines, e.g. Neupogen®, and hematopoietic growth factors.
- Perform surgical interventions within the first 48 hours or delay until after hematopoietic recovery.
- Consider use of biodosimetry dose assessment software from www.afrri.usuhs.mil.

Cutaneous radiation injury (CRI)
CRI is acute radiation injury to the skin.

- Skin damage can manifest within hours, days, or weeks after radiation exposure.
- Transient itching, tingling, erythema, or edema may be seen within hours or days after exposure, and is usually followed by a latent period.
- Lesions may not be seen for weeks to months post exposure, but then can be debilitating or even life-threatening.
- Delayed occurrence of lesions is a differentiating factor from thermal burns.
- Note time of occurrence of signs and symptoms and progressive changes in appearance.
- Treat localized injuries symptomatically, focusing on pain and infection control.

Internal contamination
Internal contamination should be considered if persistently high survey readings are noted following decontamination. Internal contamination generally does not cause early symptoms.
Nose or mouth contamination may indicate inhalation or ingestion.

- Assessment may include analysis of urine, blood, and fecal samples or whole body counts. Consult with radiation experts.
- Radiation experts may recommend early administration of radionuclide-specific decorporation agents such as Prussian Blue, DTPA, or Bicarbonate.
- Gastric lavage, antacids, and cathartics assist in clearing ingested contaminants.

Psychosocial issues

- In urban areas, hundreds to thousands may seek care. The majority will self-refer to the nearest hospital. Many will need decontamination. Many may seek radiological screening, but will not be contaminated. Many will simply seek reassurance.
- Psychogenic illness symptoms, such as nausea or vomiting, may manifest.
- Vomiting due to radiation exposure is usually recurrent rather than episodic.
- Include mental health professionals on the response team.
- Have radiation exposure fact sheets available for patients and families.
- Pregnant patients require special counseling.
- Separate areas for radiation screening and counseling could be needed for patients with minimal risk of exposure or injury.

MANAGEMENT OF DECEASED

- If exposed to a lethal dose of radiation without contamination, a patient is not radioactive and no special precautions are needed.
- Special precautions may be necessary for contaminated deceased.

Table 1.

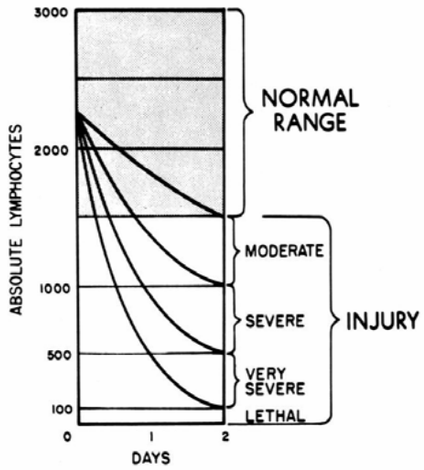
Estimation of External Radiation Dose Related to Onset of Vomiting*

Vomiting Post Incident	Estimated Dose	Degree of ARS
Less than 10 minutes	> 8 Gy	Lethal
10-30 minutes	6-8 Gy	Very Severe
Less than 1 hour	4-6 Gy	Severe
1-2 hours	2-4 Gy	Moderate
More than 2 hours after	Less than 2 Gy	Mild

* For acute external exposures only.
Gray (Gy) is the SI unit of measurement for radiation absorbed dose.

Adapted from: Berger ME, Leonard RB, Ricks RC, Wiley AL, Lowry PC. *Hospital Triage in the First 24 Hours After a Nuclear or Radiological Disaster*. REAC/TS (Radiation Emergency Assistance Center/ Training Site); http://www.orau.gov/reacts: 2004.

Andrews Lymphocyte Nomogram



From: Andrews GA, Auxier JA, Lushbaugh CC. *The Importance of Dosimetry to the Medical Management of Persons Exposed to High Levels of Radiation.* In *Personal Dosimetry for Radiation Accidents*. Vienna: International Atomic Energy Agency; 1965.

Pocket Guide Web Access:
www.bt.cdc.gov/radiation/pocket.asp.

Questions or requests for additional copies of Pocket Guide:
Send an email message to cdcinfo@cdc.gov. Include name, mailing address, phone number, and number of copies.

DHS Oregon Department of Human Services
Public Health Division

Americium-241 Facts for Clinicians

For more information, contact your local public health agency or the following:

Oregon Department of Human Services Radiation Protection Services:
971-673-0490

Oregon Poison Center, Toll-Free:
1-800-222-1222

Centers for Disease Control & Prevention, Toll-Free:
1-800-CDC-INFO (232-4636)
1-888-232-6348 TTY
E-mail: cdcinfo@cdc.gov

Radiation Emergency Assistance Center/Training Site (REAC/TS):
1-865-576-3131

You can also visit the following Web sites for the latest information about Am-241:

Centers for Disease Control and Prevention:
http://www.bt.cdc.gov/radiation/#clinicians

http://www.bt.cdc.gov/radiation/isotopes/americium

http://www.atsdr.cdc.gov/toxprofiles/tp156.html

REAC/TS:
http://www.orau.gov/reacts

Department of Health and Human Services Radiation Event Medical Management:
http://remm.nlm.gov

If you suspect a terrorist event, immediately notify local law enforcement or the Federal Bureau of Investigation:
503-224-4181 (Portland)

or visit:
http://portland.fbi.gov

Introduction

Americium-241 (Am-241) is a radioactive isotope that is used in a variety of industrial and commercial devices that measure density and thickness. Tiny Am-241 sources are also present in smoke detectors. Am-241 emits both alpha and weak gamma radiation. It is a solid silver-white metal that may appear as a small metal disk or cylinder (commercial or medical use) or as a fine powder.

Although people may be exposed to the isotope by a medical or industrial source, they are most likely to be exposed due to the explosion of a radiological dirty bomb. A “dirty bomb” is a conventional weapon that spreads radioactive materials when detonated. People who are close to or downwind from the blast will be covered with radioactive dust and debris that must be removed. They may also have inhaled or ingested radioactive particles.

Symptoms

Victims of a dirty bomb will not have radiation-related injuries upon arrival to health care and should be assessed for traumatic injuries first. Radiation injuries may develop if radioactive particles are inhaled, ingested, incorporated through wounds or left on skin or mucous membranes.

Am-241 in powdered form is well absorbed through the lungs and poorly absorbed through the gastrointestinal tract. Am-241 is not absorbed through the skin but is absorbed through wounds. Once absorbed, Am-241 is excreted via urine and feces. Absorbed Am-241 may concentrate in the liver and in bones.

Triage

Triage patients according to their traumatic injuries:

- **Significant trauma:** Treat patients in the emergency department after removing their clothing and placing a surgical cap on them. Stabilize patients, survey them for contamination, and then decontaminate them if necessary.
- **Stable injuries or no symptoms:** Survey patients for radioactive particles and decontaminate them only if the radiation is higher than two times the area’s baseline or if you find focal contamination.

Diagnosis

- Survey patient with a radiation survey meter (pancake probe) that detects alpha emissions to search for radioactive particles on skin and clothing; note location and level of radiation.
- Survey nasal and pharyngeal swabs with the meter to determine possible inhalation or ingestion of particles.

Local Health Departments

Baker	541-523-8211
Benton	541-766-6835
Clackamas	503-655-8430
Clatsop	503-325-8500
Columbia	503-397-4651
Coos	541-756-2020
	ext. 510
Crook	541-447-5165
Curry	541-247-3300
Deschutes	541-322-7400
Douglas	800-234-0985
Gilliam	541-384-2061
Grant	541-575-0429
Harney	541-573-2271
Hood River	541-386-1115
Jackson	541-774-8209
Jefferson	541-475-4456
Josephine	541-474-5325
Klamath	541-882-8846
Lake	541-947-6045
Lane	541-682-4041
Lincoln	541-265-4112
Linn	541-967-3888
Malheur	541-889-7279
Marion	503-588-5621
Morrow	541-676-5421
Multnomah	503-988-3674
Polk	503-623-8175
Sherman	541-506-2600
Tillamook	503-842-3900
Umatilla	541-278-5432
Union	541-962-8801
Wallowa	541-426-4848
Wasco	541-506-2600
Washington	503-846-8881
Wheeler	541-763-2725
Yamhill	503-434-7525

If you have a disability and need this document in an alternate format, call (971) 673-1222

(971) 673-0372 TTY

8/16/2007

Personal Protective Equipment (PPE)

Health care workers are ***not*** at risk of radiation burns or sickness, as long as you do not inhale or ingest particles or have prolonged contact with particles on your bare skin. However, if you are handling contaminated patients:

- Use Standard Precautions (e.g., cap, gown, booties, surgical mask, eye shield and gloves).
- Tape gloves to the gown and tape booties to the gown or pant to prevent runoff of contaminated water into gloves and boots.
- Wear a second pair of gloves and change them frequently.
- While surgical masks are adequate, N95 masks, if available, are recommended.
- Survey your own hands and clothing frequently with a survey meter.

Decontamination

- Cut off all patient clothing and carefully roll away from the face. Remove jewelry and eyeglasses. Double-bag, seal and label clothing and store outside the emergency department.
- Wash head first with patient bending forward, if possible.
- Wash face next; flush eyes, nose and ears, and rinse mouth.
- Wash wounds with saline or water.
- Carefully wash intact skin with soap and water for 3 to 5 minutes. Do not abrade skin.
- Resurvey patient and repeat washing until readings are less than two times the area's baseline and no focal contamination is found.
- Double-bag towels and store outside the emergency department.

Treatment

- Contact the hospital radiation safety officer or REAC/TS.
- Treat patient's traumatic injuries as required.
- If internal contamination of patients is suspected, collect samples of patient feces, vomitus and urine to determine the level of contamination.
- Treat with Ca-DTPA, Zn-DTPA, or EDTA within the first 24-48 hours of inhalation exposure

Patient Monitoring

Monitoring is based on the patient's traumatic injuries, not on radiation.

Discharging Patients

- Admit patients with traumatic injuries that require hospitalization.
- Admit patients with significant internal contamination who may require pulmonary or gastrointestinal decontamination or may require an antidote.
- Discharge patients who have no internal or external contamination (either by history or survey) and do not require admission for traumatic injuries.

DHS
Oregon Department of Human Services
Public Health Division

Cesium-137 Facts for Clinicians

For more information, contact your local public health agency or the following:

Oregon Department of Human Services Radiation Protection Services:
971-673-0490

Oregon Poison Center, Toll-Free:
1-800-222-1222

Centers for Disease Control & Prevention, Toll-Free:
1-800-CDC-INFO (232-4636)
1-888-232-6348 TTY
E-mail: cdcinfo@cdc.gov

Radiation Emergency Assistance Center/Training Site (REAC/TS):
1-865-576-3131

You can also visit the following Web sites for the latest information about dirty bombs and Cs-137:

Centers for Disease Control and Prevention:
http://www.bt.cdc.gov/radiation/#clinicians

http://www.bt.cdc.gov/radiation/isotopes/cesium.asp

REAC/TS:
http://www.orau.gov/reacts

U.S. Department of Health and Human Services Radiation Event Medical Management:
http://remm.nlm.gov

If you suspect a terrorist event, immediately notify local law enforcement or the Federal Bureau of Investigation:
503-224-4181 (Portland)

or visit:
http://portland.fbi.gov

Introduction

Cesium-137 (Cs-137) is a radioactive isotope that is used in medical radiation therapy. Cs-137 emits both beta and gamma radiation. It may be a liquid or a powder, which may glow.

Although people may be exposed to the isotope by a medical source, they are most likely to be exposed due to the explosion of a radiological dirty bomb. A "dirty bomb" is a conventional weapon that spreads radioactive materials when detonated. People who are close to or downwind from the blast will be covered with radioactive dust and debris that must be removed. They may also have inhaled or ingested radioactive particles.

Symptoms

Victims of a dirty bomb will not have radiation-related injuries upon arrival to health care and should be assessed for traumatic injuries first. Radiation injuries may develop if radioactive particles are inhaled, ingested, incorporated through wounds or left on skin or mucous membranes.

Cs-137 is well absorbed through the lungs, gastrointestinal tract and through wounds. Cs-137 is not absorbed through the skin. Once absorbed, Cs-137 is excreted via urine. Cs-137 can cause skin burns if in proximity to the skin. If a significant amount of Cs-137 is absorbed, the patient may have an increased risk of cancer or fetal effects in pregnant women. Significant absorption is considered unlikely in a dirty bomb scenario.

Triage

Triage patients according to their traumatic injuries:

- **Significant trauma:** Treat patients in the emergency department after removing their clothing and placing a surgical cap on them. Stabilize patients, survey them for contamination, and then decontaminate them if necessary.
- **Stable injuries or no symptoms:** Survey patients for radioactive particles and decontaminate them only if the radiation is higher than two times the area's baseline or if you find focal contamination.

Diagnosis

- Survey patient with a radiation survey meter to detect radioactive particles on skin and clothing; note location and level of radiation.
- Survey nasal and pharyngeal swabs with the meter to determine possible inhalation or ingestion of particles.

Personal Protective Equipment (PPE)

Health care workers are ***not*** at risk of radiation burns or sickness, as long as you do not inhale or ingest particles or have prolonged contact with particles on your bare skin.

Local Health Departments

Baker	541-523-8211
Benton	541-766-6835
Clackamas	503-655-8430
Clatsop	503-325-8500
Columbia	503-397-4651
Coos	541-756-2020
	ext. 510
Crook	541-447-5165
Curry	541-247-3300
Deschutes	541-322-7400
Douglas	800-234-0985
Gilliam	541-384-2061
Grant	541-575-0429
Harney	541-573-2271
Hood River	541-386-1115
Jackson	541-774-8209
Jefferson	541-475-4456
Josephine	541-474-5325
Klamath	541-882-8846
Lake	541-947-6045
Lane	541-682-4041
Lincoln	541-265-4112
Linn	541-967-3888
Malheur	541-889-7279
Marion	503-588-5621
Morrow	541-676-5421
Multnomah	503-988-3674
Polk	503-623-8175
Sherman	541-506-2600
Tillamook	503-842-3900
Umatilla	541-278-5432
Union	541-962-8801
Wallowa	541-426-4848
Wasco	541-506-2600
Washington	503-846-8881
Wheeler	541-763-2725
Yamhill	503-434-7525

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(971) 673-0372 TTY

8/16/2007

However, if you are handling contaminated patients:

- Use Standard Precautions (e.g., cap, gown, booties, surgical mask, eye shield and gloves).
- Tape gloves to the gown and tape booties to the gown or pant to prevent runoff of contaminated water into gloves and boots.
- Wear a second pair of gloves and change them frequently.
- While surgical masks are adequate, N95 masks, if available, are recommended.
- Survey your own hands and clothing frequently with a survey meter.

Decontamination

- Cut off all patient clothing and carefully roll away from the face. Remove jewelry and eyeglasses. Double-bag, seal and label clothing and store outside the emergency department.
- Wash head first with patient bending forward, if possible.
- Wash face next; flush eyes, nose and ears, and rinse mouth.
- Wash wounds with saline or water.
- Carefully wash intact skin with soap and water for 3 to 5 minutes. Do not abrade skin.
- Resurvey patient and repeat washing until readings are less than two times the area's baseline and no focal contamination is found.
- Double-bag towels and store outside the emergency department.

Treatment

- Contact the hospital radiation safety officer or REAC/TS.
- Treat patient's traumatic injuries as required.
- If internal contamination of patients is suspected, collect samples of patient feces, vomitus and urine to determine the level of contamination.
- Treat pulmonary contamination with bronchoalveolar lavage.
- Treat GI contamination with activated charcoal (1g/kg up to 50 g PO).
- If advised by the Oregon Poison Center or REAC/TS, treat internal contamination and absorption into organs and tissues with Prussian Blue, an ion exchange resin (1 gram PO TID).

Patient Monitoring

Monitoring is based on the patient's traumatic injuries, not on radiation.

Discharging Patients

- Admit patients with traumatic injuries that require hospitalization.
- Admit patients with significant internal contamination who may require pulmonary or gastrointestinal decontamination or may require an antidote.
- Discharge patients who have no internal or external contamination (either by history or survey) and do not require admission for traumatic injuries.

DHS
Oregon Department of Human Services
Public Health Division

Cobalt-60 Facts for Clinicians

For more information, contact your local public health agency or the following:

Oregon Department of Human Services Radiation Protection Services:
971-673-0490

Oregon Poison Center, Toll-Free:
1-800-222-1222

Centers for Disease Control & Prevention, Toll-Free:
1-800-CDC-INFO (232-4636)
1-888-232-6348 TTY
E-mail: cdcinfo@cdc.gov

Radiation Emergency Assistance Center/Training Site (REAC/TS):
1-865-576-3131

You can also visit the following Web sites for the latest information about dirty bombs and Co-60:

Centers for Disease Control and Prevention:
http://www.bt.cdc.gov/radiation/#clinicians

http://www.bt.cdc.gov/radiation/isotopes/cobalt.asp

REAC/TS:
http://www.orau.gov/reacts

U.S. Department of Health and Human Services Radiation Event Medical Management:
http://remm.nlm.gov

If you suspect a terrorist event, immediately notify local law enforcement or the Federal Bureau of Investigation:
503-224-4181 (Portland)

or visit:
http://portland.fbi.gov

Introduction

Cobalt-60 (Co-60) is a radioactive isotope that is used in medical radiotherapy, commercial food irradiators and industrial x-ray machines. Co-60 emits both beta and gamma radiation. Co-60 is a solid that may appear as small metal disks or tubes (medical radiotherapy source) or as a powder.

Although people may be exposed to the isotope by a medical or industrial source, they are most likely to be exposed due to the explosion of a radiological dirty bomb. A “dirty bomb” is a conventional weapon that spreads radioactive materials when detonated. People who are close to or downwind from the blast will be covered with radioactive dust and debris that must be removed. They may also have inhaled or ingested radioactive particles.

Symptoms

Victims of a dirty bomb will not have radiation-related injuries upon arrival to health care and should be assessed for traumatic injuries first.

Co-60 in powdered form is well absorbed through the lungs and poorly absorbed through the gastrointestinal tract (5%). Little Co-60 is retained in the lungs after inhalation. Once absorbed, Co-60 may concentrate in the bones as well as the liver and kidneys and may increase the risk of cancer in these organs. Co-60 can cause radiation burns if left in proximity to skin for a period of time. Patients who have absorbed Co-60 or have been exposed to large amounts may have an increased risk of cancer or fetal effects in pregnant women. Significant absorption is considered unlikely in a dirty bomb scenario.

Triage

Triage patients according to their traumatic injuries:

- **Significant trauma:** Treat patients in the emergency department after removing their clothing and placing a surgical cap on them. Stabilize patients, survey them for contamination, and then decontaminate them if necessary.
- **Stable injuries or no symptoms:** Survey patients for radioactive particles and decontaminate them only if the radiation is higher than two times the area’s baseline or if you find focal contamination.

Diagnosis

- Survey patient with a radiation survey meter to detect radioactive particles on skin and clothing; note location and level of radiation.
- Survey nasal and pharyngeal swabs with the meter to determine possible inhalation or ingestion of particles.

Local Health Departments

Baker	541-523-8211
Benton	541-766-6835
Clackamas	503-655-8430
Clatsop	503-325-8500
Columbia	503-397-4651
Coos	541-756-2020
	ext. 510
Crook	541-447-5165
Curry	541-247-3300
Deschutes	541-322-7400
Douglas	800-234-0985
Gilliam	541-384-2061
Grant	541-575-0429
Harney	541-573-2271
Hood River	541-386-1115
Jackson	541-774-8209
Jefferson	541-475-4456
Josephine	541-474-5325
Klamath	541-882-8846
Lake	541-947-6045
Lane	541-682-4041
Lincoln	541-265-4112
Linn	541-967-3888
Malheur	541-889-7279
Marion	503-588-5621
Morrow	541-676-5421
Multnomah	503-988-3674
Polk	503-623-8175
Sherman	541-506-2600
Tillamook	503-842-3900
Umatilla	541-278-5432
Union	541-962-8801
Wallowa	541-426-4848
Wasco	541-506-2600
Washington	503-846-8881
Wheeler	541-763-2725
Yamhill	503-434-7525

If you have a disability and need this document in an alternate format, call
(971) 673-1222
(971) 673-0372 TTY

8/16/2007

Personal Protective Equipment (PPE)

Health care workers are ***not*** at risk of radiation burns or sickness, as long as you do not inhale or ingest particles or have prolonged contact with particles on your bare skin. However, if you are handling contaminated patients:

- Use Standard Precautions (e.g., cap, gown, booties, surgical mask, eye shield and gloves).
- Tape gloves to the gown and tape booties to the gown or pant to prevent runoff of contaminated water into gloves and boots.
- Wear a second pair of gloves and change them frequently.
- While surgical masks are adequate, N95 masks, if available, are recommended.
- Survey your own hands and clothing frequently with a survey meter.

Decontamination

- Cut off all patient clothing and carefully roll away from the face. Remove jewelry and eyeglasses. Double-bag, seal and label clothing and store outside the emergency department.
- Wash head first with patient bending forward, if possible.
- Wash face next; flush eyes, nose and ears, and rinse mouth.
- Wash wounds with saline or water.
- Carefully wash intact skin with soap and water for 3 to 5 minutes. Do not abrade skin.
- Resurvey patient and repeat washing until readings are less than two times the area's baseline and no focal contamination is found.
- Double-bag towels and store outside the emergency department.

Treatment

- Contact the hospital radiation safety officer of REAC/TS.
- Treat patient's traumatic injuries as required.
- If internal contamination of patients is suspected, collect samples of patient feces, vomitus and urine to determine the level of contamination.
- Treat GI contamination with activated charcoal (1g/kg up to 50 g PO).
- Consider treating severe cases with penicillamine, but its use will be limited by supply.

For more information, discuss the case with the Oregon Poison Center or REAC/TS.

Monitoring Patients

Monitoring is based on the patient's traumatic injuries, not on radiation.

Discharging Patients

- Admit patients with traumatic injuries that require hospitalization.
- Admit patients with significant internal contamination who may require gastrointestinal decontamination or may require an antidote.
- Discharge patients who have no internal or external contamination (either by history or survey) and do not require admission for traumatic injuries.

DHS
Oregon Department of Human Services
Public Health Division

Iodine-131 Facts for Clinicians

For more information, contact your local public health agency or the following:

Oregon Department of Human Services Radiation Protection Services:
971-673-0515

Oregon Poison Center, Toll-Free:
1-800-222-1222

Centers for Disease Control & Prevention, Toll-Free:
1-800-CDC-INFO (232-4636)
1-888-232-6348 TTY
E-mail: cdcinfo@cdc.gov

Radiation Emergency Assistance Center/Training Site (REAC/TS):
1-865-576-3131

You can also visit the following Web sites for the latest information about dirty bombs and I-131:

Centers for Disease Control and Prevention:
http://www.bt.cdc.gov/radiation/#clinicians

http://www.bt.cdc.gov/radiation/isotopes/iodine.asp

REAC/TS:
http://www.orau.gov/reacts/

If you suspect a terrorist event, immediately notify local law enforcement or the Federal Bureau of Investigation:
503-224-4181 (Portland)

or visit:
http://www.Portland.fbi.gov

Introduction

Iodine-131 (I-131) is a radioactive isotope that is used in medical radiotherapy and diagnostics. I-131 emits both beta and gamma radiation. I-131 may be a solid or gas (from sublimation of the solid) and dissolves in water or alcohol.

Although people may be exposed to the isotope by a medical source, they are most likely to be exposed due to the explosion of a bomb. A "dirty bomb" is a conventional weapon that contains the isotope. When detonated, it spreads small I-131 particles. People who are close to or down-wind from the blast will be covered with radioactive dust and debris that must be removed. They may also have inhaled or ingested particles.

Symptoms

Victims of a dirty bomb may not have radiation-related injuries upon arrival to health care. I-131 is well absorbed through the lungs and gastrointestinal tract. Once absorbed, I-131 concentrates in the thyroid gland, which may lead to an increased risk of thyroid cancer. Significant internal contamination is considered unlikely in a dirty bomb scenario.

Triage

Triage patients according to their traumatic injuries:

- **Significant trauma:** Treat patients in the emergency department after removing their clothing and placing a surgical cap on them. Stabilize patients, survey them for contamination, and then decontaminate them if necessary.
- **Stable injuries or no symptoms:** Survey patients for radiation particles and decontaminate them only if the radiation is higher than two times the area's baseline or if you find focal contamination.

Diagnosis

- Survey patient with a Geiger-Muller counter to detect radiation particles on skin and clothing; note location and level of radiation.
- Survey nasal and pharyngeal swabs with the Geiger-Muller counter to determine possible inhalation or ingestion of particles.

Personal Protective Equipment (PPE)

If you are handling contaminated patients, use Standard Precautions (e.g., cap, gown, booties, surgical mask, eye shield and gloves), with the following additions:

- Tape gloves to the gown and tape booties to the gown or pant to prevent runoff of contaminated water into gloves and boots.
- Wear a second pair of gloves and change them frequently.
- While surgical masks are adequate, N95 masks, if available, are recommended.
- Survey your own hands and clothing frequently with a Geiger-Muller counter.

Local Health Departments

Baker	541-523-8211
Benton	541-766-6835
Clackamas	503-655-8430
Clatsop	503-325-8500
Columbia	503-397-4651
Coos	541-756-2020
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Curry	541-247-3300
Deschutes	541-322-7400
Douglas	800-234-0985
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Grant	541-575-0429
Harney	541-573-2271
Hood River	541-386-1115
Jackson	541-774-8209
Jefferson	541-475-4456
Josephine	541-474-5325
Klamath	541-882-8846
Lake	541-947-6045
Lane	541-682-4041
Lincoln	541-265-4112
Linn	541-967-3888
Malheur	541-889-7279
Marion	503-588-5621
Morrow	541-676-5421
Multnomah	503-988-3674
Polk	503-623-8175
Sherman	541-506-2600
Tillamook	503-842-3900
Umatilla	541-278-5432
Union	541-962-8801
Wallowa	541-426-4848
Wasco	541-506-2600
Washington	503-846-3594
Wheeler	541-763-2725
Yamhill	503-434-7525

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(971) 673-0372 TTY

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Decontamination

- Cut off all patient clothing and carefully roll away from the face. Remove jewelry and eyeglasses. Double-bag, seal and label clothing and store outside the emergency department.
- Wash head first with patient bending forward, if possible.
- Wash face next; flush eyes, nose and ears, and rinse mouth.
- Wash wounds with saline or water.
- Carefully wash intact skin with soap and water for 3 to 5 minutes. Do not abrade skin.
- Resurvey patient with a Geiger-Muller counter and repeat washing until readings are less than two times the area baseline and no focal contamination is found.
- Double-bag towels and store outside the emergency department.

Treatment

- Treat patient's traumatic injuries as required.
- If internal contamination of patients is suspected, collect samples of patient feces, vomitus and urine to determine the level of contamination.
- Treat pulmonary contamination with bronchoalveolar lavage.
- Treat GI contamination with activated charcoal (1g/kg up to 50 g PO) or whole bowel irrigation (1 to 2 liters PEG-ES x 4 hours).
- Treat internal contamination with potassium iodide (KI):
  - Age <1 month: 16 mg (1/8th of a 130 mg tablet)
  - Age 1 month to 3 years: 32 mg (1/4th of a 130 mg tablet)
  - Age 3 years to 18 years: 65 mg (1/2 of a 130mg tablet)
  - Age 18 years to 40 years: 130 mg
  - Age > 40 years: KI is **NOT** recommended because it is less effective in this age group and there is an increased risk of allergic reactions.

Note: Patients with certain conditions should **NOT** receive KI. This includes patients with hyperthyroidism, thyroid nodules, or goiter, patients who are allergic to iodine and patients who have certain skin disorders (dermatitis herpetiformis or urticaria vasculitis).

Discuss the case with the Oregon Poison Center or REAC/TS if additional information is required.

Patient Monitoring

Monitoring is based on the patient's traumatic injuries, not on radiation.

Disposition Criteria

- Admit patients with traumatic injuries that require hospitalization.
- Admit patients with significant internal contamination who may require pulmonary or gastrointestinal decontamination or may require an antidote.
- Discharge patients who have no internal or external contamination (either by history or survey) and do not require admission for traumatic injuries.

DHS
Oregon Department of Human Services
Public Health Division

Iridium-192 Facts for Clinicians

For more information, contact your local public health agency or the following:

Oregon Department of Human Services Radiation Protection Services:
971-673-0490

Oregon Poison Center, Toll-Free:
1-800-222-1222

Centers for Disease Control & Prevention, Toll-Free:
1-800-CDC-INFO (232-4636)
1-888-232-6348 TTY
E-mail: cdcinfo@cdc.gov

Radiation Emergency Assistance Center/Training Site (REAC/TS):
1-865-576-3131

You can also visit the following Web sites for the latest information about dirty bombs:

Centers for Disease Control and Prevention:
http://www.bt.cdc.gov/radiation/#clinicians

REAC/TS:
http://www.orau.gov/reacts/

If you suspect a terrorist event, immediately notify local law enforcement or the Federal Bureau of Investigation:
503-224-4181 (Portland)

or visit:
http://www.Portland.fbi.gov

Introduction

Iridium-192 (Ir-192) is a radioactive isotope that is used in medical radiotherapy and in industrial x-ray machines. Ir-192 emits both beta and gamma radiation. It is a solid that may appear as tiny pellets or seeds (radiotherapy) or metal sticks (industrial).

Although people may be exposed to the isotope by a medical or industrial source, they are most likely to be exposed due to the explosion of a dirty bomb. A “dirty bomb” is a conventional weapon that contains the isotope. When detonated, it spreads small Ir-192 particles. People who are close to or down-wind from the blast will be covered with radioactive dust and debris that must be removed. They may also have inhaled or ingested particles.

Symptoms

Victims of a dirty bomb will not have radiation-related injuries upon arrival to health care and should be assessed for traumatic injuries first. Radiation injuries may develop if radioactive particles are inhaled, ingested, incorporated through wounds, or left on skin or mucous membranes.

Ir-192 can cause radiation burns if it remains close to the skin for a period of time. It is poorly absorbed through the lungs and GI tract, but can cause radiation injury or increase the risk of cancer within the GI tract and internal organs as it passes through the tract. Significant internal contamination is considered unlikely in a dirty bomb scenario.

Triage

Triage patients according to their traumatic injuries:

- **Significant trauma:** Treat patients in the emergency department after removing their clothing and placing a surgical cap on them. Stabilize patients, survey them for contamination, and then decontaminate them if necessary.
- **Stable injuries or no symptoms:** Survey patients for radiation particles and decontaminate them only if the radiation is higher than two times the area’s baseline or if you find focal contamination.

Diagnosis

- Survey patient with a radiation survey meter to detect radiation particles on skin and clothing; note location and level of radiation.
- Survey nasal and pharyngeal swabs with the meter to determine possible inhalation or ingestion of particles.

Local Health Departments

Baker	541-523-8211
Benton	541-766-6835
Clackamas	503-655-8430
Clatsop	503-325-8500
Columbia	503-397-4651
Coos	541-756-2020
	ext. 510
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Curry	541-247-3300
Deschutes	541-322-7400
Douglas	800-234-0985
Gilliam	541-384-2061
Grant	541-575-0429
Harney	541-573-2271
Hood River	541-386-1115
Jackson	541-774-8209
Jefferson	541-475-4456
Josephine	541-474-5325
Klamath	541-882-8846
Lake	541-947-6045
Lane	541-682-4041
Lincoln	541-265-4112
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Malheur	541-889-7279
Marion	503-588-5621
Morrow	541-676-5421
Multnomah	503-988-3674
Polk	503-623-8175
Sherman	541-506-2600
Tillamook	503-842-3900
Umatilla	541-278-5432
Union	541-962-8801
Wallowa	541-426-4848
Wasco	541-506-2600
Washington	503-846-8881
Wheeler	541-763-2725
Yamhill	503-434-7525

If you have a disability and need this document in an alternate format, call
(971) 673-1222
(971) 673-0372 TTY

8/16/2007

Personal Protective Equipment (PPE)

Health care workers are ***not*** at risk of radiation burns or sickness, as long you do not inhale or ingest particles or have prolonged contact with particles on your bare skin.

If you are handling contaminated patients, use Standard Precautions (e.g., cap, gown, booties, surgical mask, eye shield and gloves), with the following additions:

- Tape gloves to the gown and tape booties to the gown or pant to prevent runoff of contaminated water into gloves and boots.
- Wear a second pair of gloves and change them frequently.
- While surgical masks are adequate, N95 masks, if available, are recommended.
- Survey your own hands and clothing frequently with a survey meter.

Decontamination

- Cut off all patient clothing and carefully roll away from the face. Remove jewelry and eyeglasses. Double-bag, seal and label clothing and store outside the emergency department.
- Wash head first with patient bending forward, if possible.
- Wash face next; flush eyes, nose and ears, and rinse mouth.
- Wash wounds with saline or water.
- Carefully wash intact skin with soap and water for 2 to 3 minutes. Do not abrade skin.
- Resurvey patient and repeat washing until readings are less than two times the area's baseline and no focal contamination is found.
- Double-bag towels and store outside the emergency department.

Treatment

- Contact the hospital radiation safety officer or REAC/TS.
- Treat patient's traumatic injuries as required.
- If internal contamination of patients is suspected, collect samples of patient feces, vomitus and urine to determine the level of contamination.
- Treat GI contamination with activated charcoal (1g/kg up to 50 g PO).

Discuss the case with the Oregon Poison Center or REAC/TS to determine whether the patient requires antidotes.

Patient Monitoring

Monitoring is based on the patient's traumatic injuries, not on radiation.

Discharging Patients

- Admit patients with traumatic injuries that require hospitalization.
- Admit patients with significant internal contamination who may require pulmonary or gastrointestinal decontamination or may require an antidote.
- Discharge patients who have no internal or external contamination (either by history or survey) and do not require admission for traumatic injuries.

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TAB 8
RADIATION FAQS

Preparing for a Radiation Emergency

What preparations can I make for a radiation emergency?
Check with your community leaders to learn more about your community's plans and evacuation routes for a radiation emergency (they should have one). Check with your child's school, the nursing home of a family member, and your employer to see what their plans are for dealing with a radiation emergency. Also, you can develop your own family emergency plan so that every family member knows what to do in case of a radiation emergency. At home, put together an emergency kit that would be appropriate for any emergency.

Are local and state agencies in Oregon prepared for radiation emergencies?
Local and state agencies as well as emergency response personnel (emergency medical technicians, police, firefighters, and hospital staff) are in the process of being trained. Oregon trains local and state agencies, and it prepares for radiation emergencies by creating and maintaining emergency plans and practicing drills.

How do I minimize my radiation exposure?
There are three components in minimizing your radiation exposure:

- Time: Limiting the amount of time you spend near the radiation source reduces the amount of radiation exposure that you will receive.
- Distance: The greater the distance between you and the radiation source, the less radiation exposure you will receive.
- Shielding: The more heavy and denser the material between you and the source of the radiation the better. The shielding will block much of the radiation from reaching you.

What are the components of a family emergency plan?
List all telephone numbers, as well as e-mail addresses for everyone that you will need to notify in an emergency. Ask an out-of-state friend or relative to serve as the family contact. Make sure everyone in your family knows the name, address and telephone number of the contact person. Practice and quiz your family about the emergency plan at least once every six months. Also, work together with neighbors and know what specialized equipment they might have, like power generators, or expertise such as medical knowledge that might help in a crisis.

How can I get information during a radiation emergency?
Tune to the local emergency response network or news station for information and instructions during any emergency. All stations are required to carry "Emergency Alert System Messages" when government officials issue them. You may be advised to "shelter in place" (stay in your home or office) or you may be advised to evacuate.

How do I stay calm during an emergency?
Know how to be prepared for emergencies. Develop a plan on how to respond with your family, including loved ones who will be concerned about you but who do not live with

you. Include an emergency communications plan. If a disaster happens, follow your plan. Knowing that you know what to do and doing it is the best way to remain calm.

How can I handle fears and concerns of my children during an emergency?
First it is important that parents stay calm, since children will look to your reaction for comfort. Having a family communications plan in place and talking about disasters before they occur, will give your child confidence in knowing what to do and how to contact you. Agencies like the American Red Cross have resources available that can help children deal with terrorism and tragic events. See the lessons and activities titled Facing Fear: Helping Children Deal With Terrorism and Tragic Events. These materials are available to be downloaded from *http://www.redcross.org/disaster/masters/facingfear*.

Responding to a Radiation Accident or Attack

What should I do if there is a nuclear bomb explosion?

- Cover your nose and mouth and immediately seek shelter in a stable undamaged building.
- Once inside, close windows and doors and turn off air conditioners, heaters or other ventilation systems if possible.
- Listen to local radio or television stations for national emergency-alert information.

What should I do if there is a terrorist attack on a nuclear power plant near my home?
A terrorist attack on a nuclear power plant will initiate a national emergency response that has been carefully planned and rehearsed by local, state, and federal agencies for more than 20 years. Contact the plant and ask for a copy of their emergency plan. Study these plans and be prepared to follow the instruction that local and state public health officials provide in the event of a terrorist incident involving the nuclear power plant near your home.

What should I do if there is a dirty bomb explosion in or very close to the building that I am in and there is a danger the building might collapse?
Exit the building as soon as possible. If it is not possible, take shelter against your desk or a sturdy table.

- Do not use elevators.
- Check for fire and other hazards.
- Take your emergency supply kit if time allows.
- Find a safe place to take shelter until local authorities tell you to do otherwise.

What should I do if I am in the area where a dirty bomb is exploded and there is a fire?

- Exit the building as soon as possible.
- Crawl low if there is smoke.

- Use a wet cloth to cover your nose and mouth.
- Use your hand to feel a door top to bottom.
- If the door is hot do not open it, look for another way out.
- If the door is not hot, brace yourself against it and open it slowly
- Do not use elevators.
- If you catch fire, do not run. Stop-drop-and-roll to put out the fire.
- Go to a previously designated meeting place.
- Account for your family members or coworkers and carefully supervise small children.
- Never go back into a burning building.
- Find a safe place to take shelter until local authorities tell you to do otherwise.

What do I do if I am trapped in debris?

- If possible, use a flashlight to signal your location to rescuers.
- Avoid unnecessary movement so that you do not kick up dust.
- Cover your mouth and nose with anything you have on hand (dense-weave cotton material can act as a good filter. Try to breath through the material.)
- Tap on a pipe or wall so that rescuers can hear where you are.
- Shout only as a last resort. Shouting can cause a person to inhale dangerous amounts of dust and possibly radioactive materials.

Sheltering in Place

How do I prepare a shelter in my home?

The safest place in your home during an emergency involving radioactive material is a centrally located room or basement. This area should have as few windows as possible. The further your shelter is from windows, the safer you will be. Sheltering is up to 80% effective in reducing dose depending upon length of exposure, building design and ventilation. Store emergency supplies in this area. Every 6 months check the supplies in your shelter. Replace any expired medication, food, or batteries. Also replace the water in your shelter every 6 months to keep it fresh. Make sure that all family members know where the shelter is and what it is to be used for. Caution them not to take any items from that area. If you have pets, prepare a place for them to relieve themselves in the shelter. Pets should not go outside during a radiation emergency because they may track radioactive materials into your shelter when they come back inside.

What emergency supplies should I store my shelter's supply kit?

The following is a list of things that you should consider storing in your emergency supplies kit. Most of these items should be stored in waterproof containers. You should also have small emergency disaster supply kits in each vehicle, as well as supplies at your

workplace (water, first aid kit, flares, jumper cables, flashlight and extra batteries, etc.). You should have a portable supply kit (one per family member) as well located near an exit of your house or sheltered somewhere in your backyard to take with you if you are told to evacuate.

- Food with a long shelf life – Preferably store foods that do not need cooking. Store enough food for each member of the household for at least 3 days. Make sure you also have a hand-operated can opener on hand. Include any special dietary foods that may be necessary. Examples of foods you could store:
  - Ready-to-eat canned meats, fruits, and vegetables
  - Protein or fruit bars
  - Dry cereal or granola
  - Peanut butter
  - Dried fruit
  - Nuts
  - Crackers
  - Canned juices
  - Non-perishable pasteurized milk or dry milk
  - Vitamins
- Water – Store bottled water or water from the tap in nonbreakable containers (soft drink bottles work well). Each person in the household will need about 1 gallon per day; plan on storing enough water for at least 3 days. Children, nursing mothers, and sick people may need more than 1 gallon of water per day.
- A change of clothes and shoes – Check clothing every 6 months and remove clothes that no longer fit or are unsuitable for seasonal weather. Remember to include underwear, socks, sturdy shoes or work boots, and winter or summer clothes as needed. Keep rainwear items in your supply kit as well.
- Paper plates, paper towels, and plastic utensils – Store disposable dishware and utensils because you will not have enough stored water to wash dishes.
- Plastic bags or a portable toilet – Because you may not be able to leave your shelter for several days, you will need to collect your waste. If you don't have a portable toilet, you can collect your waste in plastic bags until it can be removed.
- Bedding – Store sheets and blankets or sleeping bags and cots.
- Battery-operated radio and batteries – A battery-operated radio will allow you to listen to emergency messages. Try to get a radio that can receive the National Oceanic and Atmospheric Administration (a weather radio).
- Medicines – Have 2-3 days' dose of current prescription medications in a childproof bottle for your shelter medical kit; label it with the name and expiration date of the medicine. Be sure to check medicines in your kit every 6 months to make sure they are

not past the expiration date. Also keep prescribed medical supplies such as glucose and blood pressure monitoring equipment and supplies.

- Toiletries – Keep a supply of soap, shampoo, toothpaste, toothbrushes, washcloths, towels, feminine sanitary products, hand sanitizer, toilet paper, deodorant, disinfectants, etc.
- Flashlight and batteries.
- A telephone or cell phone – Although cell phone or ground phone service may be interrupted, there is still a chance that you will be able to use a phone to call outside for information and advice from emergency services. Make sure you have a charger or extra batteries for the cell phone.
- Extra eyeglasses or contact lenses and their cleaning supplies as well as hearing aids, dentures or canes.
- A tool kit.
- Cash – At least $50 in small bills and credit/debit cards. Be sure to include change for making phone calls at pay phones if necessary or have a prepaid phone card.
- An extra set of car keys.
- Copies of identification, valuable papers, insurance policies, medical insurance cards, Medicare/Medicaid cards, and sentimental photographs stored in a waterproof container.
- Duct tape and heavy plastic sheeting – You can use these items to seal the door to your shelter and to seal any vents that open into your shelter for a short period of time.
- Infant supplies – If you have an infant, store baby formula and diapers.
- Pet supplies – If you have pets, store pet food and supplies:
  - A 3-day supply of pet food stored in watertight, sturdy containers.
  - Kitty litter if you have a cat
  - Large capacity self-feeder and water dispenser
  - Extra medications
- Games, books, magazines, toys, and other entertainment – You may be in your shelter for several days; keep items on hand to occupy your family during that time.
- Matches and a second method to light a fire (like a lighter).
- Candles and light sticks.
- Sewing kit.
- Bottle of potassium iodide tablets.
- Whistle with neck cord (for signaling rescuers if you are trapped).
- First aid kit - You can purchase one or prepare one yourself. Be sure to include the following items:

    - A first aid reference book
    - Sterile adhesive bandages
    - Sterile gauze pads in 2 inch and 4 inch sizes
    - Adhesive tape
    - Soap or hand sanitizer
    - Latex or vinyl gloves
    - Safety pins
    - Aspirin or aspirin free pain reliever
    - Anti-diarrhea medication
    - Sterile rolled bandages
    - Scissors
    - Tweezers
    - Needle
    - Thermometer
    - Moistened towelettes
    - Eye wash solution
    - Antiseptic and antibiotic ointment
    - Tube of petroleum jelly or other lubricant
    - Laxative
    - Antacids
    - Syrup of ipecac to cause vomiting if advised by the Oregon Poison Center
    - Activated charcoal to stop vomiting if advised by the Oregon Poison Center
- Other items that would be nice to have:
    - Portable outdoor camping stove or grill with fuel supply.
    - Some form of alternative heating (kerosene heat, wood heat, heating pouches)
    - A portable generator
    - A portable air purifier with a HEPA filter

Can you give me an example of a portable emergency supply kit?

- At least a three day supply of water
- At least a three day supply of food
- Battery-powered radio and extra batteries
- Flashlight and extra batteries

- A first aid kit
- A whistle to signal for help
- A dust mask or cotton t-shirt to put over your mouth and nose to help filter the air
- Moist towelettes
- Wrench and/or pliers
- Manual can opener
- Plastic sheeting and duct tape to shelter in place
- Infant formula and diapers if you have an infant
- Garbage bags and plastic ties for personal sanitation

How do I shelter in place at home?

- If you are outside when the alert is given, try to remove clothing and shoes and place them in a plastic bag before entering the house. During severe weather, remove at least the outer layer of clothes before entering the home to avoid bringing radioactive material into your shelter. Leave clothing and shoes outside. Shower and wash your body with soap and water. Removing clothing will eliminate up to 90% of radioactive contamination.
- If possible, bring pets inside.
- Turn off fans, air conditioners, and forced-air heating units that bring air in from the outside. Close and lock all window and doors, and close fireplace dampers.
- If you are told there is a chance an explosion may occur, close the window shades, blinds, or curtains.
- Move to an inner room or basement.
- Use duct tape and plastic sheeting to seal any doors, windows, or vents for a short period of time in case a radiation plume is passing over (listen to your radio for instructions). Within a few hours, you should remove the plastic and duct tape and ventilate the room.
- Keep your radio tuned to an emergency response network or local news at all times for updates on the situation.

How long can a family stay in a sealed room?

The Federal Emergency Management Agency recommends that individuals allow ten square feet of floor space per person in order to provide sufficient air to prevent carbon dioxide build up for up to 5 hours.

Why does the government recommend duct tape and plastic sheeting?

Duct tape and plastic sheeting or even heavy-duty trash bags can be used to create an airlock in a room to reduce the amount of radioactive materials that might get into an area. These materials provide temporary shelter for you and your family for about five hours. Once the danger or plume has passed, it is easy to remove these materials and exit.

Is there a particular type (brand) of duct tape that citizens should buy?
The Federal Emergency Management Agency recommends using duct tape with a minimum thickness of 10 mils.

What is the most effective type of plastic sheeting?
The Federal Emergency Management Agency recommends using plastic sheeting with a thickness of 0.01 inch (10 millimeters). Commercially available sheeting is typically sold at 0.7, 1, 1.2, 1.5, 2, 2.5, 3, 4, 6 and 10 millimeters thickness. But, keep in mind that any type of plastic sheeting, even heavy trash bags, can be better than nothing.

Will shrink wrap plastic used for weatherproofing work?
The Federal Emergency Management Agency does not recommend using shrink-wrap plastic. Installing shrink-wrap plastic would take more time than using plastic sheeting and duct tape due to the two steps required (adhesion to the frame using double sided tape and use of hair dryer to achieve a tight fit).

Will whole house air filtration systems protect me?
These systems are designed to reduce, but not completely remove, particulate matter in the air inside a home. A house or apartment is not completely air tight or sealed, even when doors and windows are closed.

Should I buy a radiation detector?
You do not need one, but if you would like to buy a radiation detector, try to find a dose rate meter that has a scale from 1 millirem/hour up to 1 Roentgen/hr. You can use this to determine if there is radiation in an area (air, a room, a field, etc.). You might also buy a contamination meter that measures dose. You can use this to see if the surface of something is contaminated (clothing, your skin, etc.). Make sure you take the time to learn how much background radiation is in your area. Also know how and when to get the instrument calibrated. If you do not understand what these terms mean, how to take a measure of radiation dose or dose rate, or what the differences between the two types of meters are, then it might not be beneficial to you to purchase them. Improper use may cause you to panic when there is no real danger.

Should I buy some sort of protective/gas mask?
An ordinary surgical facemask provides good protection against inhaling particles. It is not recommended that you use any other type of mask. Other types of masks need to be fitted carefully for each face, and there are different kinds of masks for different types of agents. Having or using a protective mask may offer a false sense of security. They can also be unsafe for children or people with asthma. Over-the-counter N95 masks are designed to be 95% effective at blocking many particles. The N95 masks might be able to provide some protection against inhalation. But, better advice would be to stay away from the immediate area of a radiological incident, minimize the time near the area, maximize the distance between you and the source of the radiation, and place as much shielding (like a building) between yourself and the contaminated area.

How do I shelter in place at work?
Close the business. If there are customers, clients, or visitors in the building, ask them to stay, not leave. When authorities provide directions to shelter-in-place, they want everyone to take those steps immediately, where they are, and not drive or walk outdoors. Unless there is an imminent threat, ask employees, customers, clients, and visitors to call their emergency contact to let them know where they are and that they are safe.

Turn on call-forwarding or alternative telephone answering systems or services. If the business has voice mail or an automated attendant, change the recording to indicate that the business is closed, and that staff and visitors are remaining in the building until authorities advise you that it is safe to leave. Close and lock all windows, exterior doors, and any other openings to the outside. If you are told there is a danger of an explosion, close the window shades, blinds, or curtains. Have employees familiar with your building's mechanical systems turn off all fans, heating and air conditioning systems.

Gather essential disaster supplies, such as nonperishable food, bottled water, battery-powered radios, first aid supplies, flashlights, batteries, duct tape, plastic sheeting, and plastic garbage bags. Select an interior room, with the fewest windows or vents. The room should have adequate space for everyone to be able to sit in. Avoid overcrowding by selecting several rooms if necessary. Large storage closets, utility rooms, pantries, copy and conference rooms without exterior windows will work well. Avoid selecting a room with mechanical equipment like ventilation blowers or pipes, because this equipment may not be able to be sealed from the outdoors. It is ideal to have a hard-wired telephone in the room you select.

Call emergency contacts and have the phone available if you need to report a life-threatening condition. Cellular telephone equipment may be overwhelmed or damaged during an emergency, so have a land line available as well. Use duct tape and plastic sheeting to seal all cracks around the doors and any vents into the room. Bring everyone into the room. Shut and lock the doors. Write down the names of everyone in the room, and call your business' designated emergency contact to report who is in the room with you, and their affiliation with your business (employee, visitor, client, and customer.)

Keep listening to the radio or television until you are told all is safe or you are told to evacuate. Local officials may call for evacuation in specific areas at greatest risk in your community.

How will schools and daycares "shelter in place"?
You can contact the local school district or your child's daycare center and ask them for a copy of their emergency plan. Ask how they will communicate with families during a crisis. Ask if they store adequate food, water and other basic supplies. Find out where they plan to go if they must evacuate. An example emergency plan is below:

Close the school. Activate the school's emergency plan. Follow reverse evacuation procedures to bring students, faculty, and staff indoors. If there are visitors in the building, provide for their safety. Ask visitors to stay, and not leave.

Provide for answering telephone inquiries from concerned parents by having at least one telephone with the school's listed telephone number available in the room selected to provide shelter for the school secretary, or person designated to answer these calls. This

room should also be sealed. There should be a way to communicate among all rooms where people are sheltering-in-place in the school. Ideally, provide for a way to make announcements over the school-wide public address system from the room where the top school official takes shelter.

If children have cell phones, allow them to use them to call a parent or guardian to let them know that they have been asked to remain in school until further notice, and that they are safe. If the school has voice mail or an automated attendant, change the recording to indicate that the school is closed, students and staff are remaining in the building until authorities advise that it is safe to leave.

Provide directions to close and lock all windows, exterior doors, and any other openings to the outside. If you are told there is danger of explosion, direct that window shades, blinds, or curtains be closed. Have employees familiar with your building's mechanical systems turn off all fans, heating and air conditioning systems. Some systems automatically provide for exchange of inside air with outside air; these systems, in particular, need to be turned off, sealed, or disabled.

Gather essential disaster supplies, such as nonperishable food, bottled water, battery-powered radios, first aid supplies, flashlights, batteries, duct tape, plastic sheeting, and plastic garbage bags. Select interior rooms above the ground floor, with the fewest windows or vents. The rooms should have adequate space for everyone to be able to sit in. Avoid overcrowding by selecting several rooms if necessary. Classrooms may be used if there are no windows or the windows are sealed and cannot be opened. Large storage closets, utility rooms, meeting rooms, and even a gymnasium without exterior windows will also work well.

It is ideal to have a hard-wired telephone in the rooms you select. Call emergency contacts and have the phone available if you need to report a life-threatening condition. Cellular telephone equipment may be overwhelmed or damaged during an emergency. Bring everyone into the room. Shut and lock the door. Use duct tape and plastic sheeting to seal all cracks around the doors and any vents into the room. Write down the names of everyone in the room, and call your schools' designated emergency contact to report whoever is in the room with you.

Listen for an official announcement from school officials via the public address system, and stay where you are until you are told all is safe or you are told to evacuate. Local officials may call for evacuation in specific areas at greatest risk in your community.

How do I shelter in place in my vehicle?

If you are driving a vehicle and hear advice to shelter in place on the radio, go immediately to your home, office, or a public building, if nearby, and go inside. Follow the shelter-in-place recommendations for the place you pick described above.

If you are unable to get to a home or building quickly and safely, then pull over to the side of the road. Stop your vehicle in a safe place. Turn off the engine. Close windows and vents. Listen to the radio regularly for updated advice and instructions. Stay where you are until you are told it is safe to get back on the road. Be aware that some roads may be closed or traffic detoured. Follow the directions of law enforcement officials.

How do I shelter in place in a high-rise apartment building?
Know and practice your building's evacuation route and plan. Listen to the advice of local government officials. If advised to shelter in place, select an interior room on the floor that you are on and take refuge. If advised to evacuate, follow the advice of local government officials or building management.

Evacuation

What do I need to do if told to evacuate?

- Before an emergency, learn how to turn off utilities (locate the electric, gas and water shut-off valves. Keep the necessary tools near gas and water shut off valves. Teach family members how to turn off utilities. If you turn off the gas, a professional must turn it back on. Do not attempt to turn the gas back on yourself.
- Follow the directions that your local officials provide. Leave the area as quickly and orderly as possible. Listen to the radio or television for information about evacuation routes, temporary shelters, and procedures to follow.
- Before you leave, close and lock windows and doors and turn off air conditioning vents, fans, and furnace. Close fireplace dampers.
- Use your own transportation, if possible. If traveling by car, keep all windows closed and turn off the heater and ventilators. If you do not have your own transportation, the police should have you go to a designated assembly point from where a bus should pick you up and evacuate you.
- Do not attempt to pick up children from school. The school and government authorities will ensure that they are looked after.
- Take a flashlight, portable radio, batteries, first-aid kit, supply of sealed food and water, hand-operated can opener, essential medicines, and cash and credit cards.
- Take pets only if you are using your own vehicle and going to a place you know will accept animals. Emergency vehicles and shelters usually will only allow service animals inside of them. Take extra food, water, and supplies for your pet.
- Remember your neighbors and certain family members may require special assistance, especially infants, elderly people, and people with disabilities. Find out what their special needs are and plan ahead.
- If you have a car, keep a half tank of gas in it at all times.
- If time allows:
    - Call or email the "out-of-state" contact in your family communications plan.
    - Tell them where you are going
    - If there is damage to your home and you are instructed to do so, shut off water, gas and electricity before leaving
    - Leave a note telling others when you left and where you are going

How do people with disabilities prepare for radiation incidents?

- Maintain a list of the following important items and store it with the emergency supplies. Give a copy to another family member and a friend or neighbor.
  - Special equipment and supplies, like hearing aid batteries
  - Current prescriptions names and dosages
  - Names, addresses, and telephone numbers of doctors and pharmacist
  - Detailed information about your medication regime
- Create a self-help network of relatives, friends or co-workers to assist in an emergency. Tell these people where you keep your emergency supplies. Give one member of your support network a key to your house or apartment. If you think you may need assistance in a disaster, discuss your disability with relatives, friends, and co-workers and ask for their help. For example, if you need help moving or require special arrangements to receive emergency messages, make a plan with friends.
- Contact your local emergency information management office now. Many local emergency management offices maintain registers of people with disabilities so they can be located and assisted quickly in a disaster.
- Wearing medical alert tags or bracelets to identify your disability may help in case of an emergency.
- Know the location and availability of at least two medical facilities offering the care you need. For example: if you are dependent on a dialysis machine or other life-sustaining equipment or treatment.
- If you have a severe speech, language, or hearing disability:
  - You can dial 9-1-1 and tap the space bar to indicate a TDD call.
  - Store a writing pad and pencils to communicate with others.
  - Keep a flashlight handy to signal your location to other people and for illumination to aid in communication.
  - Remind friends that you cannot completely hear warnings or emergency instructions. Ask them to be your source of emergency information as it comes over their radio.
  - If you have a hearing ear dog, be aware that the dog may become confused or disoriented in an emergency. Store extra food, water and supplies for your dog.
- If you need a wheelchair, show friends how to operate your wheelchair so they can move you if necessary. Know the size and weight of your wheelchair as well as whether or not it is collapsible in case it needs to be transported.

Caring for pets

How should I prepare to care for my pets before a disaster?
Contact your local animal shelter, humane society, and veterinarian or emergency management office for information on caring for pets in an emergency. Find out if there will be any shelters set-up to take pets in an emergency. Also, see if your veterinarian will accept your pet in an emergency.

Decide on safe locations in your house where you could leave your pet in an emergency (it is not advised to leave your pet at home unless absolutely necessary).

You will need a pet carrier that allows your pet to stand up and turn around inside. Put familiar items such as the pet's normal bedding and favorite toys inside. Train your pet to become comfortable with the carrier. Use a variety of training methods such as feeding it in the carrier or placing a favorite toy or blanket inside.

If your pet is on medication or a special diet, find out from your veterinarian what you should do in case you have to leave it alone for several days. Try and get an extra supply of medications.

Make sure your pet has a properly fitted collar that includes current license and rabies tags. Including an identification tag that has your name, address, and phone number. If your dog normally wears a chain link "choker" collar, have a leather or nylon collar available if you have to leave him alone for several days.

Keep your pet's shots current and know where the records are.

Most kennels require proof of current rabies and distemper vaccinations before accepting a pet.

Contact motels and hotels in communities outside of your area and find out if they will accept pets in an emergency.

In most states, trained guide dogs for the blind, hearing impaired or handicapped will be allowed to stay in emergency shelters with their owners. Check with local emergency management officials for more information.

What should I do with my pets during an emergency?
Bring your pets inside immediately.

Even if your dogs and cats normally get along, the anxiety of an emergency situation can cause pets to act irrationally. Separate dogs and cats. Keep small pets away from cats and dogs as well.

If you evacuate your home, do not leave your pets behind! Pets most likely will not be able to survive on their own.

Make sure identification tags are up to date and securely fastened to your pet's collar. If possible, attach the address and/or phone number of your evacuation site. If your pet gets lost, his tag is his ticket home. Make sure you have a current photo of your pet for identification purposes.

Put your pet in a secure pet carrier or on a leash or harness so that if it panics, it cannot escape.

Consider making and taking a pet survival kit with you containing: pet food, bottled water, medications, veterinary records, cat litter/pan, can opener, food dishes, first aid kit and other supplies with you in case they're not available later.

If it is impossible to take your pet with you to temporary shelter, contact friends, family, veterinarians, or boarding kennels to arrange for care. Make sure medical and feeding information, food; medicine, medical records, and other supplies accompany your pet to his foster home. Some animal shelters will provide temporary foster care for owned pets in times of disaster, but this should be considered only as a last resort.

Birds must eat daily to survive. In an emergency, you may have to take your birds with you. Talk with your veterinarian or local pet store about special food dispensers that regulate the amount of food a bird is given. Make sure that the bird is caged and the cage is covered by a thin cloth or sheet to provide security and filtered light.

If you have no alternative but to leave your pet at home, there are some precautions you must take, but remember that leaving your pet at home alone can place your animal in great danger. Confine your pet to a safe area inside; do not leave your pet chained outside. Place notices outside in a visible area, advising what pets are in the house and where they are located. Provide a phone number where you or a contact can be reached as well as the name and number of your vet.

Should I do anything special with my pets after the emergency?
If after a radiation incident you have to leave town, take your pets with you. Pets are unlikely to survive on their own.

In the first few days after the radiation incident, leash your pets when they go outside. Always maintain close contact. Familiar scents and landmarks may be altered and your pet may become confused and lost.

The behavior of your pets may change after an emergency. Normally quiet and friendly pets may become aggressive or defensive. Watch animals closely. Leash dogs and place them in a fenced yard with access to shelter and water.

What can I do about wildlife in the area?
Most wildlife will evacuate an area when a loud sound, like a bomb detonation, goes off. They may panic however. If you see an injured or stranded wild animal in need of assistance, or you need help with removing a wild animal from your home, please contact your local animal control office or animal shelter.

Precautions for farmers

What disaster planning tips do you have for dealing with livestock?
Evacuate livestock whenever possible. Arrangements for evacuation, including routes and shelter sites, should be made in advance. Alternate routes should be mapped out in case the planned route is inaccessible.

The evacuation sites/shelters should have or be able to readily obtain food, water, veterinary care, handling equipment and facilities.

Trucks, trailers, and other vehicles suitable for transporting livestock (appropriate for transporting each specific type of animal) should be available along with experienced handlers and drivers to transport them. Whenever possible, the animals should be accustomed to these vehicles in advance so they're less frightened and easier to move.

If evacuation is not possible, a decision must be made whether to move large animals to available shelter or turn them outside. This decision should be determined based on the type of radiation incident and the soundness and location of the shelter's structure.

All animals should have some form of identification that will help to make their return easier.

Your disaster plan should include a list of emergency phone numbers for local agencies that can assist you if disaster strikes, including your veterinarian, state veterinarian, local animal shelter, animal care and control, county extension service, local agricultural schools and the American Red Cross. These numbers should be kept with your disaster kit in a secure, but easily accessible place

What other precautions should farmers take?
Suggested actions to protect dairy animals and livestock from radiological contamination follow. It is unlikely that animals will suffer from contamination that will cause death or permanent injury, but radioactivity ingested by dairy animals can contaminate milk and milk products. Therefore, dairy animals should be provided with shelter, stored feed and protected water supplies before precautions are taken for other farm animals. If there is sufficient shelter, feed and water available, move other livestock indoors and place them on stored feed and protected water supply. The major concern for protecting dairy animals from contamination is to protect the milk and other dairy products produced for human consumption.

Water from a covered well, tank, cistern or from a freely running spring is best. To prevent contamination from radioactive particles, do not add water to covered tanks unless the water is from a protected well or spring. Use all the water originally present in the tanks first.

Water in an exposed pond would be contaminated but, usually, the level of contamination would decrease rapidly. Such water could be used for surface irrigation. It could also be used to wash off farm buildings and unsheltered livestock. Surface water should be safe within a few days after the incident. The surface waters in ponds and rivers would tend to be safer sooner if there is no rain. Otherwise, if possible, obtain drinking water for livestock from another source.

Covered feeds are the safest feeds. Radioactive particles are like dust or dirt; a cover will prevent contamination from coming in contact or mixing with the feed.

Grain stored in a permanent bin, hay in a barn or in a covered silo can be considered safe. They can be used as feed for your dairy animals and livestock. A haystack in an open field can be protected with a tarpaulin or similar covering.

Remain alert to emergency broadcasts and other communications that will notify you of radiation levels and if animal feed growing in your area is considered harmful. As a precautionary measure, house the dairy animals and livestock and do not let them graze. In the event you have no stored feed during an emergency, you should know that animals could survive for a period of time on water alone.

State emergency personnel will be monitoring milk and milk stations, and sampling will also be done on the farms. When possible, you will be informed whether or not your milk contains radioactive materials.

Poultry is somewhat more resistant to radiation than other farm animals. Also, most poultry is raised under shelter and given feed that has been protected or stored, so they are of less concern following a radiological emergency. However, the same protective measures recommended for other livestock should be used for poultry as well.

Do not destroy any animal food products unless spoilage has made them inedible. Milk should be safe to use if it is from dairy animals that have been adequately sheltered and protected. Livestock exposed to external contamination can be used for food if the radiation level is not excessive, if they are adequately washed and if monitored by state authorities prior to slaughtering. Meat animals that have internal contamination cannot be slaughtered until the appropriate state authorities advise the owner that it is safe to do so. You will receive specific instructions from state authorities.

If milk pickups and deliveries are interrupted because of an emergency, officials concerned will be in touch with milk transport companies and will provide instructions. There may be delays in pickups, which will necessitate the holding of milk for longer than normal periods. It is possible that some milk may have to be discarded.

It is unlikely that the type and level of radioactive release would cause any animal illness. Animal’s skins containing radioactive materials can be washed off with soap and water. When washing animals, protective clothing should be worn similar to that worn when applying pesticides.

It is anticipated that most affected land could be returned to normal use in several weeks after having been contaminated. The exact length of time that the land would remain unusable would depend on the amount and type of radioactive materials deposited in a given area.

Extension agents and state agricultural officials will guide farmers in determining how to use their land following a radiological emergency.

Under the worst conditions, radioactive contamination could reduce the economic productivity of your farm. As previously mentioned, you may suffer the loss of some farm and dairy items due to spoilage during the period of time that a radiological emergency is in progress. However, following an accident, radioactive contamination might reduce the competitive economic value of your farm products. This would be due to public reluctance to purchase farm products that are suspected of having been grown in an area that has been affected by a radioactive release. State authorities will advise you on the contamination level that your farm experienced and the marketability of your farm products.

Growing fruit and vegetables can become externally contaminated. Leaves, pods and fruits that are contaminated with radioactive particles can be cleaned before being eaten. Green

vegetables that are contaminated should have outer layers removed. Washing is probably the most effective measure.

Roots and tubers absorb little contamination. The normal cleaning or peeling of underground vegetables such as potatoes and carrots would be adequate for removing contamination.

Fruits that are ripe at the time of a radiological accident may be lost due to a possible personal hazard to the worker. Fruits that do not have to be picked immediately can be saved and picked after the contamination has decayed.

Radiation Incidents Abroad

What should I do if a radiation incident occurs where I am while abroad?
In general, you should do the same things to prepare and to help yourself, as you would do at home. You probably will not have a disaster supply kit with you, however, you can still try to find shelter, stay as far away from the site of the incident as possible and minimize your time near any areas that might be radioactive.

In addition you should contact the U.S. Embassy or Consulate if you need help. Be sure to register with the U.S. Embassy or Consulate by phone, fax, or in person if possible. Monitor the U.S. Embassy and State Department's home pages. Monitor Voice of America and BBC broadcasts announcements.

When a crisis occurs abroad the State Department sets up a task force to bring together all of the people necessary to work on the incident. Usually this task force will be in touch by telephone 24 hours a day with our Ambassador and Foreign Service Officers at the embassy in the country affected.

What happens if a family member is involved in a radiation incident abroad?
Relatives will want information on the welfare of their family members and on the disaster. Despite the possibility of lack of electricity, phone lines, gasoline, etc. that could occur in a disaster, foreign service officers work hard to get information back to the State Department as quickly as possible.

As concerned relatives call in, officers of the Bureau of Consular Affairs collect the names of the Americans possibly involved in the disaster and pass them to the embassy and consulates. Officers at these posts attempt to locate these Americans in order to report on their welfare. The officers work with local authorities and may personally search hotels, airports, hospitals, or even prisons.

When an American dies abroad, the Bureau of Consular Affairs must locate and inform the next-of-kin. Sometimes discovering the next-of-kin is difficult. If the American's name is known, the Bureau's Office of Passport Services will search for his or her passport application. However, the information there may not be current.

The Bureau of Consular Affairs provides guidance to grieving family members on how to make arrangements for local burial or return of the remains to the U.S. The disposition of remains is affected by local laws, customs, and facilities, which are often vastly different from those in the U.S. The Bureau of Consular Affairs relays the family's instructions and

necessary private funds to cover the costs involved to the embassy or consulate. The Department of State has no funds to assist in the return of remains or ashes of American citizens who die abroad. Upon completion of all formalities, the consular officer abroad prepares an official Foreign Service Report of Death, based upon the local death certificate, and sends it to the next-of-kin or legal representative for use in U.S. courts to settle estate matters.

A U.S. consular officer overseas has statutory responsibility for the personal estate of an American who dies abroad if the deceased has no legal representative in the country where the death occurred. The consular officer takes possession of personal effects, such as apparel, jewelry, personal documents and papers. The officer prepares an inventory and then carries out instructions from members of the deceased's family concerning the effects. A final statement of the account is then sent to the next-of-kin. In Washington, the Bureau of Consular Affairs gives next-of-kin guidance on procedures to follow in preparing Letters Testamentary, Letters of Administration, and Affidavits of Next-of-Kin as acceptable evidence of legal claim of an estate.

In the case of an injured American, the embassy or consulate abroad notifies the task force, which notifies family members in the U.S. The Bureau of Consular Affairs can assist in sending private funds to the injured American; frequently it collects information on the individual's prior medical history and forwards it to the embassy or consulate. When necessary, the State Department assists in arranging the return of the injured American to the U.S. commercially, with appropriate medical escort, via commercial air ambulance or, occasionally, by U.S. Air Force medical evacuation aircraft. The use of Air Force facilities for a medical evacuation is authorized only under certain stringent conditions, and only when commercial evacuation is not possible. The full expense must be borne by the injured American or his family.

As for evacuation, sometimes commercial transportation entering and leaving a country is disrupted during a disaster. If this happens, and if it appears unsafe for Americans to remain, the embassy and consulates will work with the task force in Washington to charter special air flights and ground transportation to help Americans to depart. The U.S. Government cannot order Americans to leave a foreign country. It can only advise and try to assist those who wish to leave.

Antidotes/Supplements

Other than Potassium Iodide, are there any other supplements or over-the-counter products, which might be helpful in a radiation incident?
The simple answer is no. Some people have asked in the past if they should take something like large doses of calcium to protect against strontium-90 (which can accumulate in bone). Since strontium-90 is not a gas, but a particle, it would enter the body through contaminated food and drink. It is therefore easy to prevent exposure to strontium-90 by not eating or drinking anything that might be contaminated.

Potassium Iodide

What is Potassium Iodide (KI)?
KI is a salt of iodine. KI has been approved by the FDA as a nonprescription drug for use as a "blocking agent" to prevent the human thyroid gland from absorbing radioactive iodine. However, KI may not provide people with 100% protection against all radioactive iodine.

Should I take Potassium Iodide during a radiation emergency?
Potassium iodide (KI) should only be taken in a radiation emergency that involves the release of radioactive iodine, such as an accident at a nuclear power plant or explosion of a nuclear bomb. A person who is internally exposed to radioactive iodine may experience thyroid disease or thyroid cancer later in life. Potassium iodide will saturate the thyroid with iodine, decreasing the amount of harmful radioactive iodine that can be absorbed. Potassium iodide will only protect the thyroid and does not protect from any other radiation exposure. It must be taken prior to exposure or immediately after exposure to be effective. Potassium iodide can be dangerous to some people, so it is not recommended that it be taken unless there is a definite risk of exposure to radioactive iodine.

When should I take Potassium Iodide (KI)?
Local emergency management officials will tell people when to take KI. If radioactive iodine is not present, then taking KI will not protect people. Taking KI will not protect people from radioactive substances that may be present other than radioactive iodine.

What forms does Potassium Iodide (KI) come in and how much should be taken?
- KI comes in tablets of 130mg. A one-time dose at the levels recommended below is usually all that is required. Below are the usual recommended doses.
- Adults should take one 130mg tablet.
- Children between 3 and 18 years of age should take one-half of a 130mg tablet (65mg total).
- Infants from birth to 1 month of age should be given one-eight of a 130mg tablet (16mg).
- Women who are breastfeeding should take the adult dose, and their infants should take the recommended dose above.
- Children approaching adult size (greater than or equal to 150 pounds) should take the adult dose regardless of their age.

How long can KI tablets be stored?
KI tablets can be shored for at least 5 years without losing their potency.

Where can I obtain KI?
People should talk to their pharmacists to obtain KI and instruction on taking it.

Can't I just take table salt (since it is iodized) instead of Potassium Iodide (KI)?
Iodized table salt will not provide enough iodine to protect the thyroid and should not be used as a substitute.

Who should or should not take KI when the public is told to do so?
Children are the most susceptible to the dangerous effects of radioactive iodine. The FDA and the World Health Organization (WHO) recommend that children from newborn to 18 years of age all take KI unless they have a known allergy to iodine. Women who are breastfeeding should also take KI to protect both themselves and their breast milk. Breastfeeding infants should still be given the recommended dosage of KI to protect them from any radioactive iodine that they may breathe in or drink in breast milk. Young adults between the ages of 18 and 40 have a smaller chance of developing thyroid cancer or disease from exposure to radioactive iodine than do children. However, the FDA and WHO still recommend that people ages 18 to 40 take the recommended dose of KI.

Adults over the age of 40 have the smallest chance of developing thyroid cancer or disease after an exposure to radioactive iodine. Adults over age 40 also have a greater chance of having an allergic reaction to the high dose of iodine in KI. Because of this, they *are not recommended* to take KI unless a very large dose of radioactive iodine is expected.

What medical conditions make it dangerous to take KI?

- The high concentration of iodine in KI can be harmful to some people. People should not take KI if they:
- Have ever had thyroid disease (such as hyperthyroidism, thyroid nodules, or goiter).
- Know they are allergic to iodine (If you are allergic to shellfish, ask your doctor or pharmacist about taking KI).
- Have certain skin disorders (such as dermatitis herpetiformis or urticaria vasculitis).

Prussian Blue

What is Prussian blue?
Prussian blue is a blue dye used by artists and manufacturers. It is also called Radiogardase. It got its name from its use as a dye for Prussian military uniforms. Prussian blue dye and paint are still available today from art supply stores.

How is Prussian blue used to treat radioactive contamination?
Prussian blue is used to treat people who have been internally contaminated with radioactive cesium or thallium. Prussian blue can be given at any point after doctors have determined that a person is internally contaminated. Prussian blue will help speed up the removal of cesium and thallium from the body. Prussian Blue is available only by prescription and should be given only under the supervision of a physician after assesssing a person's medical condition. It is not to be confused with the artist's pigment color "prussian blue".

How does Prussian blue work?
Radioactive cesium and thallium, whether ingested or inhaled, will end up in the intestines. Prussian blue traps these materials in the intestines and keeps them from being absorbed by the body. The radioactive materials then move through the intestines and are excreted in bowel movements. Prussian blue reduces the time that radioactive cesium and thallium stay in the body; it helps limit the amount of time the body is exposed to radiation.

Who can take Prussian blue?
The drug is safe for all adults, children, and infants, including pregnant women and women who are breast-feeding their babies. Prussian blue may not be recommended for people who have had constipation or blockages in the intestines.

What are the side effects of taking Prussian blue?
The most common side effects of Prussian blue are upset stomach and constipation. These side effects can easily be treated with other medications. People will have blue feces during the time that they are taking Prussian blue

How soon after exposure to radioactive cesium or to thallium does somebody have to receive Prussian blue to avoid illness and death?
Prussian blue should be taken as soon as possible after exposure. However, even when treatment cannot be started right away, patients should be given Prussian blue as soon as it becomes available because it is still effective even after time has elapsed since exposure.

Where can I get Prussian blue?
Prussian blue is not routinely available. It is supplied in 500-milligram capsules that can be swallowed whole or mixed in liquid for children to drink. The amount to be taken depends on how badly a person is contaminated. Prussian blue must be taken 3-4 times a day for up to 150 days, depending on the extent of the contamination, under the supervision of a doctor.

People should not take Prussian blue artist's dye in an attempt to treat themselves. This type of Prussian blue is not designed to treat radioactive contamination and is not manufactured in a germ-free area. People who are concerned about the possibility of being contaminated with radioactive cesium or thallium should go to their doctors for advice and treatment.

Can my doctor write a prescription for Prussian blue for me to keep on hand?
Prussian blue should be given only under the supervision of a physician after assessing your medical condition. It is only effective to treat contamination with radioactive cesium or thallium. The dose and duration of treatment depends on the amount of contamination a person is exposed to. Therefore, this drug should be given only when the physician has determined your need for it.

How do I know that Prussian blue will be available in case of an emergency?
The U.S. government makes sure that needed medications, especially medicines that may be needed to treat a terrorist threat, are stored in sufficient quantity to provide treatment if there is an emergency.

Will Prussian blue be added to the National Stockpile?
It is already part of the National Stockpile of drugs that can be used in an emergency situation.

Radiation Basics

What is radiation?
Radiation is a form of energy. It is all around us. It is a type of energy in the form of particles or electromagnetic rays that are given off by atoms. The type of radiation we are concerned with, during radiation incidents, is “ionizing radiation”. Radiation is colorless, odorless, tasteless, and invisible.

What is radioactivity?
It is the process of emission of radiation from a material.

What is ionizing radiation?
It is a type of radiation that has enough energy to break chemical bonds (knocking out electrons).

What is non-ionizing radiation?
Non-ionizing radiation is a type of radiation that has a long wavelength. Long wavelength radiations do not have enough energy to "ionize" materials (knock out electrons). Some types of non-ionizing radiation sources include radio waves, microwaves produced by cellular phones, microwaves from microwave ovens and radiation given off by television sets.

What types of ionizing radiation are there?
Three different kinds of ionizing radiation are emitted from radioactive materials: alpha (helium nuclei); beta (usually electrons); x-rays; and gamma (high energy, short wave length light).

Alpha particles stop in a few inches of air, or a thin sheet of cloth or even paper. Alpha emitting materials pose serious health dangers primarily if they are inhaled.

Beta particles are easily stopped by aluminum foil or human skin. Unless Beta particles are ingested or inhaled they usually pose little danger to people.

Gamma photons/rays and x-rays are very penetrating. They pose a large danger to people because of they are able to penetrate, or even pass completely through, the human body. Gamma rays and x-rays can go through many feet of air or many inches of lead shielding.

Can radioactivity be neutralized?
Currently there is no way in which we can neutralize radioactivity. The best we can do is transfer radioactive material to some place safe and then wait for it to decay.

What is radioactive decay?
It is the process where radioactive materials disintegrate as they release radiation.

What is half-life?
Half-Life is the amount of time it takes for half of the atoms in a sample of radioactive material to decay. For example, a sample of 1000 atoms of a radioactive material with a half-life of one year will have only 500 atoms of the material left after one year and by the end of the second year there will only be 250 atoms of the material left.

Radiation Exposure

What is radiation exposure?
When a person is exposed to some types of ionizing radiation the energy can penetrate the body. For example, when a person has an x-ray, they are exposed to radiation.

How can an exposure occur?
People are exposed to small amounts of radiation every day. This radiation comes from both naturally occurring sources and man-made sources.

What types of exposure occur?
Exposures can be either internal or external. Internal exposures are when radioactive material is taken into the body through breathing, eating, drinking, absorption through the skin, or through cuts in the skin. External exposure refers to radioactive material that is deposited anywhere (except internally) that it is not supposed to be, such as on an object or on a person's skin.

What happens when people are exposed to radiation?
Radiation can affect the body in many ways, and the health effects may not be apparent for many years. These effects include mild symptoms, such as skin reddening, to serious effects such as cancer and death. These effects are dependant upon the amount of radiation absorbed by the body (the dose), the type of radiation, whether or not the exposure was internal or external, and the length of time the person was exposed. Any living tissue in the human body can be damaged by ionizing radiation. The body attempts to repair the damage, but sometimes the damage is too severe or widespread. Mistakes can also be made in the body's natural repair process as it tries to repair the damage caused by the radiation (mutations).

What is prenatal radiation exposure?
It is the exposure of an unborn baby to radiation. This can occur when the mother's abdomen is exposed to radiation, either externally or internally. Also, radioactive materials may enter the mother's bloodstream if a pregnant woman accidentally swallows or breathes in radioactive materials. From the mother's blood, radioactive materials may pass through the umbilical cord to the baby.

Unborn babies are less sensitive during some stages of pregnancy than others. However, unborn babies are particularly sensitive to radiation during their early development, between weeks 2 and 15 of pregnancy. The health consequences can be severe, even if radiation doses are too low to make the mother sick. Such consequences can include stunted growth, deformities, abnormal brain function, or cancer that may develop

sometime later in life. The radiation dose to the unborn baby is usually lower than the dose to the mother for most radiation exposure events.

Pregnant women should consult with their doctors if they have any concern about radiation exposure to their unborn baby.

How are radiation exposure victims medically treated?
Treatment of a victim within the first six weeks to two months after exposure is vital. Treatment is determined by what types of radioactive materials to which the victim was exposed.

Medical personnel will treat victims for hemorrhage and shock. Open wounds are usually cleaned to remove any bits of radioactive materials that may be in them. Amputation of limbs may occur if a wound is highly contaminated and recovery of its function is not likely.

If radioactive material is ingested, treatment is given to reduce absorption into the body and enhance body's natural elimination processes (excretion and elimination). It can include stomach pumping or giving the victim laxatives or aluminum antacids.

If radioactive material has gotten into internal organs and/or tissues, treatment includes giving the patient blocking and diluting agents, such as potassium iodide, to decrease absorption into the body. Other chemicals such as ammonium chloride, diuretics, expectorants and inhalants are given to a patient to force the body to release the harmful radioactive materials. Other treatments involve chelating agents, which, when ingested, bind with some radioactive metals to form a stable material that is more easily removed from the body through the kidneys.

Is any amount of radiation safe?
Some scientists believe that low levels of radiation are beneficial to health (known as hormesis). However, there do appear to be thresholds of exposures for various health effects, for example: at 50 rem nausea occurs, at 70 rem vomiting occurs, at 400 rem death occurs. These numbers are subjective. People may not show any symptoms at 50 rem. With medical support a person may survive after receiving 400 rem.

Sources of Radiation

What are naturally occurring sources of ionizing radiation?
They include elements in the soil, naturally occurring radon, uranium mill tailings, and cosmic rays from the sun.

Where do man-made sources of ionizing radiation come from?
The sources include medical sources (x-rays, treatments), and from nuclear weapons testing. Some consumer products that contain radioactive materials include: smoke detectors, some watches and clocks (especially older radium dial type), some ceramics (such as old orange-red glazed Fiesta ware), some glass (especially antique glassware with a yellow or greenish color), fertilizer, food, gas lantern mantles, and antique 'quack' radioactive medical curative devices.

What is the most commonly occurring radionuclide in the human body?
Potassium-40 is the most common. It is found in potassium-rich foods such as bananas.

Radiation's Health Effects

What is radiation sickness?
Radiation sickness, known as acute radiation syndrome (ARS), is a serious illness that occurs when the entire body (or most of it) receives a high dose of radiation, usually over a short period of time.

People exposed to radiation will get ARS only if:

- The radiation dose was high
- The radiation was able to reach internal organs
- The person's entire body (or most of it) received the dose
- The radiation was received in a short time, usually within minutes

The first symptoms of ARS typically are nausea, vomiting, and diarrhea. These symptoms will start within minutes to days after the exposure. These symptoms will last for minutes to several days, and may come and go. Then the person usually looks and feels healthy for a short time, after which he or she will become sick again with loss of appetite, fatigue, fever, nausea, vomiting, diarrhea, and possibly even seizures and coma. This stage may last from a few hours up to several months.

People with ARS usually have some skin damage that can start to show within a few hours after exposure. This damage can include swelling, itching, and redness of the skin (like a bad sunburn). There can also be hair loss, nausea, and diarrhea. As with the other symptoms, the skin may heal for a short time, followed by the return of swelling, itching, and redness days or weeks later. Complete healing of the skin may take from several weeks or up to a few years depending on the radiation dose to the skin.

The chance of survival for people with ARS decreases with increasing radiation doses. Most people who do not recover from ARS will die within several months of exposure. The cause of death in most cases is the destruction of the person's bone marrow, which results in infections and internal bleeding. For the survivors of higher doses, the recovery process may last from several weeks up to 2 years.

If a radiation emergency occurs that exposes people to high doses of radiation in a short period of time, they should immediately seek medical care from their doctor or local hospital.

How do we know radiation causes cancer?
Basically, we have learned through observation. Scientists didn't understand that there were any health effects associated with radioactive materials when people first began working with them. As the use of radioactive materials and reports of illnesses became more frequent, scientists noticed a pattern to the illnesses. People working with radioactive materials and x-rays developed particular types of uncommon medical conditions. Among the best-known long-term studies, about the effects of radiation, are

those of Japanese atomic bomb blast survivors, other populations exposed to nuclear testing fallout (natives of the Marshall islands for example), and uranium miners.

Aren't children more sensitive to radiation than adults?
Yes, because children are growing more rapidly, there are more cells dividing and a greater opportunity for radiation to disrupt the process. Fetuses, depending on their stage of development, can also highly sensitive to radiation.

What are the possible health effects that an unborn baby could experience when exposed to ionizing radiation?
During the first 2 weeks of pregnancy, the radiation-related health effect of greatest concern is the death of the baby. Of the babies that survive, few will have birth defects related to the exposure, regardless of how much radiation they were exposed to.

Large radiation doses to the unborn baby during the stages of development (between weeks 2 and 15 of pregnancy) can cause birth defects, especially to the brain. Babies exposed to the atomic bombs dropped on Hiroshima and Nagasaki during the 8 to15 week stage of pregnancy were found to have a high rate of brain damage that resulted in lower IQ and even severe mental retardation. They also suffered stunted growth (up to 4% shorter than average people) and an increased risk of other birth defects.

Between the 16th week of pregnancy and birth, health effects due to radiation exposure are unlikely unless the unborn baby receives an extremely large dose of radiation. In the 16 to 25 week stage of pregnancy, health consequences similar to those seen in the 8 to 15 week stage could occur, but only when the doses are extremely large (more than the equivalent of about 5,000 chest x-rays received at one time). At this dose level, the mother could be showing signs of acute radiation syndrome.

After the 26th week of pregnancy, the radiation sensitivity of the unborn baby is similar to that of a newborn. Unborn babies exposed to radiation during this stage of pregnancy are no more sensitive to the effects of radiation than are newborns. This means that birth defects are not likely to occur, and only a slight increase in the risk of having cancer later in life is expected.

Do chemical properties of radioactive materials contribute to radiation health effects?
The chemical properties of a radionuclide can determine where health effects occur. To function properly many organs require certain elements. They cannot distinguish between radioactive and non-radioactive forms of the element and will accumulate one as quickly as the other. For example:

Radioactive iodine concentrates in the thyroid. The thyroid needs iodine to function normally. As a result, radioactive iodine contributes to thyroid cancer more than any other types of cancer.

Calcium, strontium-90, and radium-226 have similar chemical properties. The result is that strontium and radium tend to collect in calcium rich areas of the body, such as the bones and teeth. The strontium-90 and radium-226 can contribute to bone cancer.

What is the cancer risk from radiation? How does it compare to the risk from other sources?

Currently estimates are that overall, if each person in a group of 10,000 people exposed to 1 rem of ionizing radiation, in small doses over a life time, we would expect 5 or 6 more people to die of cancer than would otherwise. In this group of 10,000 people, we can expect about 2,000 to die of cancer from all non-radiation causes.

What are the risks of other long-term health effects?
There is the possibility of mutations in fetuses and genetic effects in children and adults.

What are the possible genetic effects due to radiation exposure?
Genetic effects are mutations that can be passed from parent to child or mutations that occur in the person exposed.

Radioactive Contamination

What is radioactive contamination?
Radioactive contamination occurs when radioactive material is deposited in an unexpected or unwanted place. A person or object can be contaminated either externally or internally. Radioactive materials released into the environment can cause air, water, surfaces, soil, plants, buildings, people or animals to become contaminated.

What is external contamination?
External contamination on humans occurs when radioactive material, in the form of dust, powder, or liquid, comes into contact with a person's skin, hair, or clothing. Many radionuclides are poisonous in addition to being radioactive. It is important to consult a physician if internal contamination is expected.

What is internal contamination?
Internal contamination occurs when people swallow or breathe in radioactive materials or when these materials enter the body through an open wound or are absorbed through the skin. Some types of radioactive materials stay in the body and are deposited in different body organs. Other types are eliminated from the body in blood, sweat, urine, and feces.

How does contamination differ from exposure?
A person can be exposed to radiation and not become contaminated. Radioactive contamination emits radiation. If a person is contaminated, they will continue to be exposed to radiation until the contamination is removed.

How can exposure or contamination happen?
Radioactive materials could be released into the environment in the following ways:

- A nuclear power plant accident
- An atomic bomb explosion
- An accidental release from a medical or industrial device

- Nuclear weapons testing
- An intentional release of radioactive material as an act or terrorism

How is radioactive contamination spread?
People who are externally contaminated with radioactive material can contaminate other people or surfaces that they touch. People who are internally contaminated can expose people near them to radiation from the radioactive material inside their bodies. The body fluids (blood, sweat, urine) of an internally contaminated person can contain radioactive materials. Coming in contact with these body fluids can result in contamination and/or exposure.

How could your home become contaminated?
People who are externally contaminated can spread the contamination by touching surfaces, sitting in a chair, or even walking through a house. Homes can also become contaminated with radioactive materials in body fluids from internally contaminated people.

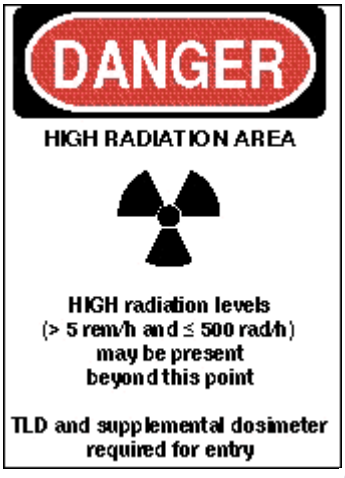
How is radioactive material contamination cleaned up?
Techniques include sandblasting buildings to remove the layers of contamination and removing the layers of contaminated soil and trucking it away to a radioactive waste disposal site. We cannot eliminate radioactivity. We can only transfer radioactivity from one place to another. Then we must wait until the radioactive materials decay.

How can I limit the chances of becoming contaminated?
- Get out of the immediate area of the radiation incident quickly. Go inside the nearest safe building or to an area to which law enforcement or health officials direct you.
- Remove the outer layer of your clothing. If radioactive material is on your clothes, getting it away from you will reduce the external contamination and decrease the risk of internal contamination. It will also reduce the length of time that you are exposed to radiation.
- Place the clothing in a plastic bag or leave it in an out-of-the-way area. Keep people away from it to reduce their exposure to radiation. Keep cuts and abrasions covered when handling contaminated items to avoid getting radioactive material in them.
- Wash all of the exposed parts of your body using lots of soap and water to remove contamination.
- If medical authorities determine that internal contamination may have occurred, you may be able to take medication to reduce the radioactive material in your body.
- Be on the lookout for information. Once emergency personnel can assess the scene and the damage, they will be able to tell people whether or not radiation was involved in the incident.

Radiation Signs and Symbols

The symbol above is called a tri-foil and it is the international symbol for radiation. The symbol can be magenta or black, on a yellow background. This sign is posted where radioactive materials are handled, where radiation-producing equipment is used, or where a radiation exposure is possible. This sign is used as a warning to protect people from being exposed to radioactivity or contaminated by radioactive material.

Some examples of signs using this tri-foil symbol are shown below. You might see the radiation symbol in a hospital where radioactive medicine is used, or in a university, or research facility. In a radiation incident, the signs would be posted where radioactive materials have been found and a site clean up is taking place.



Where to find more information

Where can I go to find more information about radiation health effects and emergency response? The following are sources of information used in this text. They are also good places to find more information on radiation incidents.

- The Nuclear Regulatory Commission (NRC) can be reached at (301) 415-8200 or at *http://www.nrc.gov*
- The Federal Emergency Management Agency (FEMA) can be reached at (202) 646-4600 or at *http://www.fema.gov/*
- The Radiation Emergency Assistance Center/Training Site (REAC/TS) can be reached at (865) 576-3131 or at *http://www.orau.gov/reacts/*
- The U.S. Department of Energy (DOE) can be reached at 1-800-dial-DOE or at *http://www.doe.gov/*
- The CDC Public Response Source can be reached at 1-888-246-2675 or at *http://www.cdc.gov/*
- The Conference of Radiation Control Program Directors can be reached at (502) 227-4543 or at *http://www.crcpd.org/*

- World Health Organization, Radiation and Environmental Health Unit at (international call) +41 22 791-3427 and +41 22 791-4312 or at *http://www.who.int/ionizing_radiation/en/*
- The Humane Society of the United States, Disaster Services Program can be reached at (202) 452-1100 or at *http://www.hsus.org/ace/352*
- The International Atomic Energy Agency (IAEA) at *www.iaea.org*
- The Center for Technology and National Security Policy, National Defense University at *http://www.ndu.edu/ctnsp/home.html*
- The Health Physics Society at *http://www.hps.org/*
- National Terror Alert Resource Center at *http://www.nationalterroralert.com/*
- Ready.gov from the U.S. Department of Homeland Security at *http://www.ready.gov/*
- U.S. Department of State, The Bureau of Consular Affairs at *http://travel.state.gov*
- The U.S. Environmental Protection Agency at *www.epa.gov*
- The Department of Homeland Security at *www.dhs.gov*
- The U.S. Food and Drug Administration *www.fda.gov* or at 1-888-INFO-FDA
- Nuclear War Survival Skills Book online at *www.ki4u.com/free_book/s73p904.htm*

TAB 9
LHD PLANNING FOR RADIOLOGICAL INCIDENTS

LHD PLANNING FOR RADIOLOGICAL INCIDENTS

Every local health department (LHD) is required to have a plan for responding to a radiological incident. The Oregon Public Health Division (OPHD) developed this tool to help design these plans. Feedback from LHDs is always useful for improving this tool.

The first step in creating a radiological plan is to perform a hazard analysis for radiological incidents. The first part of this tab contains guidelines for performing an analysis for your jurisdiction. You can then refine your analysis by completed the hazard analysis worksheet provided by the Office of Emergency Management, which is available at: *http://www.oregon.gov/OOHS/OEM/docs/library/oem_haz_analy_methodology_8_05.pdf*

After you have completed your analysis, you can use the sample plan format in this tab to create your plan.

Hazard Analysis

This worksheet has three categories: vulnerability, threat, and probability. In the OEM methodology there is usually a fourth category, history. In this worksheet, history has been combined with probability. When gathering information to complete this analysis, carefully consider which severity level your jurisdiction fits into. Support this decision with a brief written narrative.

For each category, apply a severity rating of Low, Medium or High.

Vulnerability

Vulnerability is the percentage of population and property likely to be affected under an "average" occurrence of the hazard. To calculate vulnerability, consider your jurisdiction's population, transportation routes, industry, and number of personnel trained to deal with radiological emergencies.

Population: Each jurisdiction should take into account its population, the location of potential radiological hazards, and the percentage of the population near a high-threat area.

- High–Dense population, especially around high probability or high threat areas.
- Medium–Dense population, but not around high probability or high threat areas, or medium populations around high probability or high threat areas.
- Low–Sparse population, especially near high threat or high probability areas.

Transportation: Consider the number of transport routes (for example, water, highway, or rail) that have radioactive material shipped through your jurisdiction. Do any of the routes cross? What is the volume of shipments?

- High–Multiple routes, several cross, and a large volume of shipments.
- Medium–Multiple routes, some cross, medium-to-low volume of shipments.
- Low–One or two routes that don't cross, medium-to-low volume of shipments.

Industry: Consider the number of industries that use radioactive material in your jurisdiction, as well as the amount of radioactive material used.

- High–Two or three facilities with high-level sources, multiple low-level sources.
- Medium–Six or more facilities with medium or low-level sources.
- Low–Two to five facilities with low-level sources.

Trained Personnel: Consider the number of personnel trained to handle radiological incidents. This is a subjective measurement that will require input from all concerned.

- High–Inadequate personnel to handle medium-to large incidents; remote, vulnerable areas that are hard for trained teams to reach quickly.
- Medium–Inadequate personnel to handle small-to-medium incidents.

- Low–Adequate personnel to handle all sizes of incidents; rapid response teams that can reach all areas of the jurisdiction.

Threat

Threat is the highest percentage of population and property that could be impacted under a worst-case scenario. To calculate threat, determine potential sites or targets of radiological emergencies and determine the population around these sites.

Terrorism: Are there primary or secondary terrorist targets in your jurisdiction? What is the population density around these targets?

- High–One primary or two or more secondary targets with dense population in the vicinity.
- Medium–One or more secondary targets with medium-to-high population density.
- Low–No targets identified.

Transportation: Does the jurisdiction have major transportation routes that become treacherous during bad weather?

- High–Multiple routes, major intersections, all treacherous during bad weather.
- Medium–Several routes, some intersecting, all or some treacherous during bad weather.
- Low–One or two routes without treacherous conditions.

Fixed facilities: How many fixed facilities in your jurisdiction use radioactive material? Do they have good emergency plans? Are first responders aware of and trained in those plans?

- High–Multiple facilities with good to poor planning and good to poor awareness.
- Medium–Some facilities with good to poor planning and good to poor awareness.
- Low–Few or no facilities.

Probability

Probability is the likelihood of future occurrence.

Terrorism: Based on the number of primary or secondary targets and past history of terrorist incidents, assign a probability of Low, Medium or High.

Transportation: Based on the number of transportation routes, the maintenance of these routes, the affect of bad weather on the routes, and a history of transportation accidents, assign a probability of Low, Medium or High.

Fixed facilities: Based on the number of fixed facilities, the quality of emergency plans at these facilities, mitigation efforts on identified weaknesses at the facilities, and past history of incidents, assign a probability of Low, Medium or High.

SAMPLE RADIOLOGICAL HAZARD ANALYSIS

The following information is a sample only and is not meant to represent any specific jurisdiction in Oregon.

Vulnerability

Category	Risk Level	Explanation
Population	Medium	The high threat areas in this city/county have a lower population density.
Transportation	High	Multiple routes exist in the county, several of which cross. A high volume of traffic exists on all routes (interstate, secondary highways and railroads).
Industry	Medium	There are ____ facilities that use radioactive material in this city/county.
Personnel	Low	A high percentage (65%) of first responders in this city/county have received radiological Hazmat training in the past three years. (Note: the more trained personnel, the lower the vulnerability.)

Threat

Category	Risk Level	Explanation
Terrorism	Medium	There is one primary and one secondary target in this jurisdiction, with a low population around the primary target.
Transportation	High	During adverse weather, three intersections and two portions of interstates become treacherous.
Fixed facilities	Low	Although there are ____ facilities using radioactive material in this jurisdiction, they all have emergency plans, and local first responders have copies of those plans.

Probability

Category	Risk Level	Explanation
Terrorism	Medium	Although one primary and one secondary target have been identified, the primary target is in an isolated portion of this jurisdiction. Due to the preparedness level of the county for disasters or hazards, it is believed the political impact would not be as severe if an incident occurred.
Transportation	High	There have been four radiological transportation incidents in the past 10 years, which is a high level for Oregon. This has been mainly due to movement of radioactive material during bad weather.
Fixed facilities	Low	Even though this jurisdiction has ____ facilities using radioactive material, the amounts used and the way they are used preclude the chance of an incident.

LHD Radiological Plan Format

Note: This plan should only include information that is specific to radiological incidents. Refer to your "base plan" for general emergency response information.

Section 1: Introduction

- Provide a context for radiological hazards and emergencies
- Refer to your base plan and other relevant plans

Section 2: Purpose and Authority

2.1 Purpose

2.2 Authorities—statues, rules or policies that authorize the actions described in this plan

Section 3: Situation and Assumptions

3.1 Situation

3.2 Assumptions

Section 4: Concept of Operations

4.1 Notification

4.2 Operational Priorities

4.3 Phases of Management for LHDs

Section 5: Roles and Responsibilities

5.1 Preparedness

5.2 Response

5.3 Recovery—for a large radiological incident, the recovery section may be a separate plan

Section 6: Training and Exercises

Section 7: Vulnerable Populations

Section 8: Plan Maintenance

Section 9: Glossary

Section 10: Terms, Acronyms, Abbreviations

Section 11: References and Resources

Section 12: Attachments, SOPs, Checklists, and ICS Position Descriptions, as appropriate

LHD Sample SOP: Responding to a Radiological Incident

Note: The following basic information is a suggested sample of a standard operating procedure (SOP) and should not to be taken as anything other than guidance. In addition, this represents only a partial SOP.

Depending on the severity of the incident:

1. Verify the emergency: call local first response/emergency management.
   Phone #_____.
2. Notify neighboring jurisdictions (health departments) that may become involved in the incident.
   Phone #'s: _____, and _____.
3. Notify OPHD, to ensure they have been apprised of the situation.
   Phone #_____.
4. Contact the local emergency management office to ensure they know the LHD is available for any liaison work needed for health-related issues. This will include liaising between emergency management/first responders and any community partners that work with the local health department.
5. Verify radiological equipment and trained user lists are up-to-date by contacting local fire departments, regional Hazmat teams in your area of concern, and Radiation Protection Services (971-673-0515).
6. In a smaller incident not requiring multiple-agency response, monitor the situation in case health-related issues arise.

The following questions may be helpful in the development of this and other SOPs.

- Do you have a list of medical clinics/hospitals/etc. in your jurisdiction? Have you included point-of-contact names and phone numbers?
- Does your county/jurisdiction have an emergency planning committee (or its equivalent)? Are you a member?
- Do you have alternate means to communicate with needed personnel during an emergency?
- Who is your point of contact at local health departments in adjoining jurisdictions? Do you have memoranda of understanding with them, in the event of an emergency?
- Do you have alternate means of dealing with customers in your various programs during a radiological emergency/disaster? (For example: large numbers of the public have been displaced and some not getting their WIC checks.)
- Who do you contact at the state level for assistance when your resources are gone?

Explanatory Notes

A brief description of each portion of a LHD radiation plan follows:

Section 1: Introduction

This portion gives an overview of how a local health department will respond to a release of radioactive material, whether deliberate or accidental. A release could have a devastating impact on human health, as well as the environment.

What is the likelihood of occurrence of a large radiation incident in your jurisdiction? A small incident? Has your county emergency manager developed an assessment? Is it up to date? Include information about it here.

Radiological hazards range from small, localized incidents involving small amounts of radioactive material in shipments, storage, or use, to large-scale catastrophic incidents involving several jurisdictions.

Approximately three million shipments of radioactive material are made annually in the U.S. by road, rail, water and air. No deaths or serious injuries have been attributed to the radioactive nature of the materials involved in a transportation accident.

Radioactive material is composed of unstable atoms, which give off excess energy until they become stable. The energy emitted is ionizing radiation. The longer a person is exposed to higher levels of radiation, the greater the risk. Radiation cannot be detected by sight, smell, or any other sense. There are three types of radiation of primary concern: Alpha, beta and gamma. If a nuclear explosion were to occur, another type of radiation would have a major impact close to the blast area. It is called neutron radiation.

For more information about this subject, contact Radiation Protection Services (971-673-0490).

Finally, you may wish to state this is an annex/appendix to the base LHD or county plan.

Section 2: Purpose and Authority

2.1 Purpose

Summary of what the LHD will do in radiological incident.

2.2 Authority

Legal authorities for emergency response are usually covered in your LHD or county base plan. This section should only include radiation-specific authorities not covered in the base plan.

Section 3: Situation and Assumptions

3.1: Situation

Public health response to a radiological incident will focus on protecting human health. The incident may threaten not only the public, but the health and safety of first responders, emergency hospital personnel, and other workers in occupational settings. Besides the direct threat to personnel, the environment may become contaminated, resulting in ongoing human exposures and long-term health consequences. The incident may also have a psychological impact on people who are not actually exposed to hazardous materials, but who are still concerned about their health.

Local health authorities may be asked to conduct a radiological health assessment following an accident or disaster with suspected radioactive material, including acts of terrorism. A timely response is critical in limiting the health impact of public exposure to ionizing radiation. It is also important to put out timely, accurate information about the incident to help quell the public's fears.

3.2: Assumptions

Note: The assumptions listed below are only samples.

- A large radiological incident will pose significant treats to the infrastructure that provides services in health.
- Accidents involving radioactive material will be handled in accordance with the National Incident Management System.
- The level of response will be determined by the scale of the incident, as well as the type of incident (accidental vs. terrorist).
- LHDs will require the assistance of OPHD for receiving and moving medical supplies, equipment and personnel.
- Monitoring of the public will be necessary in a large incident, due to the "worried well" who will want to ensure they aren't contaminated with radioactive material.

Note: There may be additional assumptions each jurisdiction wishes to include here. The above list is only to be used as a guide.

Section 4: Concept of Operations

Notification and operational priorities may be included in the base plan, which means they shouldn't be here. Phases of management will probably be somewhat different; the differences should be listed here.

Section 5: Roles and Responsibilities

This section should address only responsibilities that are not in the base plan.

When you develop your local health plan, the following radiological planning issues should be addressed:

Preparedness Phase

- Write an emergency response plan that includes a radiological annex.
- Develop a hazard vulnerability assessment for known radioactivity sources for the jurisdiction (see Hazard Analysis on page 2 of this tab).
- Develop and maintain standard operating procedures for the public health response to a radiological incident. (See the sample SOP on page 7 of this tab.)
- Include local stakeholders and volunteer groups in planning and training for a radiological emergency.
- Ensure telephone numbers and points of contact are current, including:
  - Local emergency management
  - Hazmat
  - Fire/police
  - Public utilities
  - Local hospitals, nursing homes, clinics, and other health care facilities
- Provide training to appropriate LHD personnel regarding radiation response.
- Participate in training, exercising and coordinating with the county emergency manager and state agencies to ensure everyone's plans interrelate appropriately.

Response Phase

General Emergency Response

- Follow your SOPs for radiation emergencies.
- Provide public health updates to key agencies as requested.
- Coordinate all activities with the local Emergency Operations Center (EOC).
- Ensure that public health messages are routed through the Joint Information Center.
- If the LHD building is considered contaminated, evacuate the building and leave all supplies in the building to prevent the spread of radioactive materials.
- Instruct public health employees who might be contaminated with radioactive material to seek decontamination at the hospital or other designated location and to not report to work.
- If requested, assist with monitoring potentially contaminated people. Ensure that staff members wear appropriate personal protective equipment.
- Work with the Oregon Public Health Laboratory to collect, package and ship clinical samples to the CDC (and other state chemical terrorism laboratories at the direction of CDC or OSPHL).

Epidemiology

- Collect exposure data on those impacted.
- Receive and manage the data from the clinical samples and advise medical facilities accordingly.
- Work with OPHD to conduct syndromic surveillance as required by the incident.

Environmental Services

- Provide guidance on the monitoring of public and private water sources.
- Inspect food services, including those provided at mass care centers.
- Issue advisories on food preservation, disposal and consumption.

Communications

- Send a Public Information Officer to the county EOC to help provide public health updates and gather information for the public and for medical providers and hospitals in the county.
- At the direction of the Incident Commander, provide a 24/7 public information hot line that will allow 1% of the county population to receive information in a 48-hour period.

Strategic National Stockpile (SNS)—Activation and Point of Dispensing

- If necessary, request activation of the Strategic National Stockpile to obtain drugs and supplies to treat radiation exposure. Requests will come from the Incident Commander through the Public Health Administrator and the local emergency manager.
- Administer prophylaxis to all people determined to need it.

Vulnerable Populations

- Identify vulnerable populations in the county and develop methods for locating and communicating with each group.

Recovery Phase

- Assess local capacity to resume normal public health functions.
- Assess local capacity to resume normal health care delivery.
- Report results of assessments to local governments and OPHD.
- Identify potential/continuing hazards affecting public health.
- If a Recovery Committee is convened, become involved in its activities.
- Conduct syndromic surveillance in collaboration with OPHD.

- Evaluate the LHD's response in the after-action report and incorporate needed changes into plans.
- Review and update response plans.

Section 6: Training and Exercises

Radiological training and exercise assistance can be obtained from Radiation Protection Services.

Section 7: Vulnerable Populations

Address only issues that are not already in the base plan.

Section 8: Appendices

These should be addressed in the county emergency plan. Anything related to radiological incidents you need in this appendix should be put here.

Section 9: References and Resources

Almost all of this section should be either in the base health or county plan.

Section 10: Terms, Acronyms, Abbreviations

This section should include terms that are radiation-specific.

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TAB 10
SUGGESTED RADIATION INCIDENT PROTOCOLS FOR MEDICAL SERVICES

SUGGESTED RADIATION INCIDENT PROTOCOLS
Medical Services

Sample Format

PURPOSE:

To provide instruction and guidance for the safe treatment of a radiologically contaminated victim and to reduce the risk of contamination of staff, equipment, and the environment.

GENERAL INFORMATION:

Normally, a radiologically contaminated victim will be one who has received serious injury as the result of an industrial-type incident and the situation is complicated because of the presence of radioactive contamination. In most instances, the contaminated persons would be decontaminated at the scene or prior to admittance at this facility. For the rare instance when the medical condition is unstable, they may have to be admitted prior to decontamination being performed.

Except in extreme cases, this contamination presents no direct external radiation exposure hazard to either the victim or to attendant personnel.

The primary concern with radioactive contamination is controlling the spread of radioactive materials (RAM) and preventing internal contamination of the victim or attendant medical personnel. In general the following techniques are used for contamination control:

1. Set up a controlled area large enough to hold the anticipated number of victims.
2. Prevent tracking of contaminants by covering floor areas and monitoring at exits of the controlled area.
3. Restrict access to the controlled area.
4. Monitor anyone or anything leaving the controlled area.
5. Use strict isolation precautions including protective clothing and double bagging.
6. Use a buffer zone or secondary control line for added security.
7. Control waste by using large, plastic-lined containers for clothing, linens, dressings, etc.
8. Change instruments, outer gloves, drapes, etc., when they become contaminated.
9. Use waterproof materials to limit the spread of contaminated liquids.

Types of Radiation Victims:

External irradiation occurs when all or part of the body is exposed to penetrating radiation from an external source as in the case of a chest x-ray. A person who has been exposed to radiation from an external source, but has not been contaminated by the RAM, is **NOT** radioactive and presents no danger to caregivers.

External contamination means that RAM in the form of gases, liquids or solids are released into the environment and contaminate people externally, such as on skin or clothing. This may present some degree of hazard to attending personnel or facilities if not properly handled. This type of contamination is the easiest to remove.

Internal contamination refers to RAM being taken into the body. Radioactive materials enter through body orifices, eyes, wounds or other skin breaks. Intact skin forms a good barrier to most forms of RAM.

Incorporation refers to the uptake of RAM by body cells, tissues or target organs such as bone, liver, thyroid or kidney. Radioactive materials are distributed throughout the body based on their chemical properties. Incorporation cannot occur unless contamination has occurred. Incorporation can occur rapidly, within as little as an hour or less. This is the most difficult type of contamination to remove.

EQUIPMENT:

Floor covering - Plastic/paper sheeting for covering the floor of the contamination control area.

Equipment Covering - Plastic sheeting and tape for covering all equipment not removed from the control area.

Ventilation Cover - Plastic sheeting/filter to cover the **supply** air ducts to the control area. Exhaust vents are left open. (Can also shut down ventilation to contamination control area, if possible)

Waste Receptacles - Place four standard waste receptacles (trash cans without lids) at the edge of the draped control area. Line them with plastic bags. Using a black marker pen, label one container as “disposable waste”, and one as “non-disposable material”. Label other containers as “protective clothing”.

Survey instruments - (what type, if any, do you have? List here)

Dosimetry - (list type and amount)

Protective clothing - (Surgical scrubs, shoe covers, mask, face shield, surgical gloves {2 pair per person})

Other - (black marking pens, masking tape, etc...)

ESD PROCEDURES:

Steps:

PRIOR TO ARRIVAL OF PATIENT:

1. If exposure occurs in E.D.:
   - Isolate area.
   - Remove patients and staff.
   - Shower as necessary.

2. If not in E.D., all personnel are to continue normal operations until directed otherwise by their supervisor.

3. Inventory crash/radiation cart, medications, IVs and dressings/linen.

4. Call Facilities to set up radiation decontamination area.
   - Refer to "Preparation of Treatment Area for Radiation Contamination Control" on page 6.

5. Prepare to move triage to the outside area.

6. Obtain additional staff as needed (where from? Who?)

7. Remove all equipment from ambulance entrance or from entrance to be used.

8. Bring cart into hallway. (NOTE: Do you have a crash/radiation cart?)

9. Tech and nurse dress down.
   - Refer to "Dressing to Prevent the Spread of Radioactive Contamination" on page 8.

10. Physician stands by to give medical orders.

11. Nurse Director/Lead nurse maintain ED flow.

ARRIVAL OF PATIENT:

1. Isolate ambulance. Place barrier (rope/etc.) around the ambulance from one side of the emergency entrance to the other.

2. Begin initial assessment (actions by doctor and nurses).
   - Upon arrival of the ambulance, the emergency room doctor and one nurse may elect to enter the ambulance and check the medical condition of the patient. If their condition permits, initial decontamination can be performed inside the ambulance. A second nurse should remain outside the ambulance and be prepared to help if requested. If patient can't be decontaminated in the ambulance a radiation

contamination control room should be established (refer to "Preparation of Treatment Area for Radiation Contamination Control" on page 6).

3. Obtain blood work of choice. Suggested baseline studies include: CBAC, Basic Metabolic Profile, UA, Pulse oximetry.

4. Ambulance driver and attendant should be directed to remain in the controlled area until surveyed for possible contamination.

TREATMENT AND DECONTAMINATION:

1. Coordinate medical treatment with radiological assessment. Serious medical conditions always take precedence over decontamination. Treat and decontaminate patient as injury requires. Refer to Procedure for "Decontamination of Patient with Radiological Contamination" on page 11.

2. When decontamination and treatment are complete, the patient should be transferred out of the controlled area in the same manner isolation patients are transferred. A complete radiological survey of the patient should again be conducted.

POST TREATMENT:

1. All original charts, recordings, and information taken while in the controlled area should be monitored prior to leaving the area. If records are contaminated, information should be dictated to someone in the clean area. The contaminated original charts should then be discarded as contaminated.

2. Exit the controlled area as outlined in "Dressing to Prevent the Spread of Radioactive Contamination" on page 8.

3. Personnel Survey:

   A. Each person leaving the controlled area should be completely surveyed using the survey instrument.

   B. The ambulance driver and attendant should be completely surveyed using the survey instrument and be decontaminated as necessary. Coveralls need not be removed unless contaminated. Refer to "Ambulance Driver/Attendant Decontamination" on page 10.

4. Clean up: All paper and plastic sheeting should be rolled up, taking care not to disturb any loose contamination, and deposited in labeled and doubled plastic bags. The area should be surveyed for contamination and cleaned as necessary.

5. Final survey: The affected area and all equipment therein, including the transport vehicle, must be surveyed and decontaminated as necessary.

6. Contaminated or potentially contaminated waste materials should be packaged in labeled plastic bags (double bagged) and stored in the Hazardous Waste Store Room (where is this?)

Preparation of Treatment Area for Radiation Contamination Control

PURPOSE:

The goals of contamination control are to prevent the spread of radioactive materials from the patient, rescue personnel, gurney and equipment, and ambulance to personnel and equipment at the hospital, as well as surrounding areas.

GENERAL INFORMATION:

See page 1 for techniques to be used for contamination control.

EQUIPMENT:

- ❒ Plastic sheeting
- ❒ Large plastic garbage containers
- ❒ Waterproof disposable sheeting
- ❒ Brown wrapping paper (3-4 feet wide)
- ❒ Wide masking tape

PATIENT CARE SERVICES PROCEDURES:

1. Designate the treatment room. Choose one near an outside entrance if possible.

2. Remove or cover equipment that will not be needed during emergency care of the radiation accident victim.

3. Cover treatment table with several layers of waterproof, disposable sheeting.

4. Stock the room with several plastic bags of a variety of sizes.

5. Establish a control line at the entrance to the decontamination room by placing a wide strip of tape at that location.

6. Establish a buffer zone by taping off a square space outside the entrance to the treatment room. A 5' by 5' areas is sufficient. This area is used to facilitate removal of contaminated protective clothing following treatment and as a radiation survey area.

7. Cover floor of treatment room with plastic/paper.

8. Make a path from the ambulance entrance to the decontamination room by rolling out brown wrapping paper and taping it to the floor. Ordinary bed sheets or absorbent pads can be used as an alternative.

9. Either turn off ventilation to the room being used, or cover the supply duct with either a plastic sheet or a filter. No other special precautions are strictly required, as there is very little likelihood that contaminants will become suspended in air and enter the ventilation system.

Dressing to Prevent the Spread of Radioactive Contamination

PURPOSE:

The purpose of protective clothing is to keep bare skin and personal clothing free of contaminants.

EQUIPMENT:

- ❒ Surgical scrubs
- ❒ Shoe covers
- ❒ Hat
- ❒ Mask
- ❒ Face shield
- ❒ Dosimeter
- ❒ Masking tape
- ❒ Black tip marking pen
- ❒ Waste receptacle
- ❒ Plastic bags

PATIENT CARE PROCEDURES:

1. Team members should remove outer clothing and dress in scrubs.

2. Cover shoes with proper shoe covers.

3. Tape pants hem to shoe cover, tape strip on bottom to prevent slipping.

4. Don surgical gown as outer cover.

5. Double glove. Under glove taped to gown with folded tab.

6. Don hat, mask and face shield for splash protection.

7. Wear a dosimeter.

8. ID team member with name and job title on front of uniform (tape and black marker)

Disrobing:

1. Place garbage receptacle inside control line. Use a plastic garbage can lined with plastic bags (double bag).

2. Remove outer gloves first.

3. Place dosimeter in small plastic bag (Ziploc) and give to safety officer.

4. Undo all taped seams using tabs created earlier.

5. Remove outer surgical gown. Turn inside out, and drop into receptacle (avoid shaking).

6. Inside control area, roll pants down and remove. Sit in a chair covered with a plastic garbage bag.

7. Remove head cover and mask while leaning forward over receptacle (avoid shaking head cover and mask).

8. Sitting in the chair, remove foot cover. DO NOT put your foot down. While foot is raised the safety officer will monitor to determine if shoe is clean. If clean, place foot down outside the control line.

9. Remove second shoe cover and, again, safety officer will monitor to determine if shoe is clean. If clean, stand up and step over line to step off area.

10. Remove inner gloves over receptacle and drop WITHOUT stepping back over the control line.

11. While you are standing on the step off pad, the safety officer will radiologically monitor your entire body. If clean, leave area.

Ambulance Driver/Attendant Decontamination

PURPOSE:

To ensure the decontamination of ambulance personnel involved in transport of a radiologically contaminated victim.

GENERAL INFORMATION:

The following procedure should be used in the event that the regional HAZMAT team is not available to provide this decontamination function.

EQUIPMENT:

- ❒ Plastic garbage bags
- ❒ Paper coveralls
- ❒ Plastic or paper sheeting approximately 5' by 5' square
- ❒ Cloth towels
- ❒ Soap
- ❒ Gloves

PATIENT CARE PROCEDURES:

1. Have individual remove all valuables and place them in small plastic bag and tie the top.

2. Remove all clothing, and place in plastic bag and tie top.

3. Proceed to nearest shower and wash completely. The radiological assistant will then conduct a complete body survey. NOTE: The plastic or paper cover should be placed on the floor outside the shower or adjacent to the area used for cleansing.

4. If a shower facility is not available, using wet towels and soap, wash body, starting with the face. Change towels frequently, then dry off. The radiological assistant will then conduct a complete body survey. Repeat cleansing until decontaminated.

5. Discard towels into a plastic bag (don't tie the top yet).

6. Step over to the clean piece of paper/plastic, wiping the bottom of the feet as you step over.

7. Discard towel into the plastic bag with the other towels and tie top.

8. Put on the paper overalls, booties, and gloves, and remain in the service entrance area, until the radiological assistance representative is available to conduct a complete body survey.

Decontamination of Patient with Radiological Contamination

PURPOSE:

The purpose of decontamination is to prevent or reduce incorporation of the material (internal contamination); to reduce the radiation dose from the contaminated site to the rest of the body; to contain the contamination; and to prevent its spread.

GENERAL INFORMATION:

Good judgment is essential in determining decontamination priorities. Since some radiological materials are corrosive or toxic because of their chemical properties, medical attention might have to be directed first to a non-radiological problem if radioactive materials are components of acids, fluorides (uranium hexafluoride), mercury, lead, or other compounds.

In general, contaminated wounds and body orifices are decontaminated first, followed by areas of highest contamination levels on the intact skin.

EQUIPMENT:

- ❒ Gloves
- ❒ Gauze swabs
- ❒ Mild soap
- ❒ Bulb syringe
- ❒ Beta/gamma instrument
- ❒ Specimen bags (plastic)
- ❒ Hand brush
- ❒ Towels
- ❒ Plastic bags
- ❒ Phisohex/equivalent
- ❒ Lava soap

PATIENT CARE PROCEDURES:

Body Surface Contamination:

1. Remove contaminated clothing carefully (if not already done) to minimize spread of contamination.

2. Place all clothing in a large plastic bag. Label with individual's name.

3. Save all metal objects, rings, coins, dosimeter badges, etc., and place in labeled plastic bags.

Monitoring Body Surfaces:

1. Obtain radiological contamination monitor and proceed to an area of the room away from the patient. Place plastic bag or latex glove over the probe/instrument. Perform an operational check on the instrument; observe and record the background count.

2. Using the contamination monitor, return to the patient and move the probe approximately 1-2 inches per second over the contaminated individual, maintaining a 2 to one inch distance from the skin. Watch for an increase in count rate.

3. Record the count rate for the contaminated areas on the human body outline sketch.

4. Using swabs, obtain smears of the nose, ears, and mouth. Check the swabs for contamination with the survey instrument. Place smears in labeled bags.

Decontamination of Body Surfaces:

Level one:

1. Starting with the body area with the highest count rates, wash the skin thoroughly for two to three minutes using Phisohex or equivalent and tepid water.

2. Cover the contaminated surface with a good lather, and rinse off completely. Pat dry with a towel; avoid spreading contamination to adjacent body areas.

3. Avoid contact with radioactively contaminated spillage during decontamination.

4. Have body area surveyed to determine effectiveness of washing.

5. Survey adjacent body areas to ensure no spreading of the contaminants has occurred.

6. Repeat process up to three times, as necessary.

7. If contamination remains, proceed to next level of decontamination efforts.

Level two:

1. Repeat Step one (above), using a mild soap (such as Ivory) and the hand brush. Avoid scrubbing hard to prevent skin irritation.

2. If contamination remains, proceed to next level of decontamination efforts.

Level three:

1. Repeat Step one (above), using Lava soap. Do not use the hand brush.

2. Clip hair if necessary.

3. Survey area. If contamination remains, repeat procedure until contamination is removed.

Eyes, Ears, Nose and Mouth Contamination:

Eye Contamination:

1. Position a towel around the eye. Roll the eyelid back as far as possible.

2. Flush with large amounts of saline solution, using the bulb syringe. Rinse thoroughly with tepid water, and dry the eye area with a clean towel.

3. Save the flushings, if possible. Label the container.

Ear Contamination:

1. Position a towel around the ear. Flush with large amounts of saline solution using a bulb syringe.

2. Rinse thoroughly with tepid water. Dry the ear with a clean towel; use a swab to clean the ear.

3. Save the swab and flushings, if possible. Label the container.

Nose and Mouth Contamination:

1. If patient is able, advise nose blowing, coughing, spitting, brushing the teeth and mouth with toothpaste, frequent rinsing of the mouth, etc. for nose and mouth clearance.

2. Position a towel around the face. Use swabs to clean the nose.

3. Use saline solution to rinse patient's mouth. Rinse with tepid water. Swabs can be used to clean the mouth.

4. Dry nose and mouth area with a clean towel. Save swabs and rinsings, if possible. Label the containers.

Wound Contamination:

The decontamination of open wounds should be directed by the physician. The following is a suggested procedure:

Cleaning of Wound:

1. Isolate the wound area.

2. Promote bleeding, if not profuse. If profuse, stop bleeding first, then clean the wound.

3. Flush wound with large amounts of tepid water. Spread edges so as to flush the wound well. A light tourniquet may be applied, if necessary, to restrict venous return without restricting arterial flow.

4. Scrub wound with Phisohex, Ivory, or equivalent, using the hand brush. Wash frequently.

5. Cleaning may be continued for up to 30 minutes. Antiseptics should not be used.

6. Save all rinsings, if possible.

Excising the Wound:

1. In some situations, shaving may be necessary for rapid removal of the bulk of contamination.

2. Save all material removed from the wound. Thoroughly irrigate the wound with saline solution to remove foreign substances.

3. Obvious necrotic and devitalized tissue must be removed surgically.

4. As uncontaminated tissue is encountered during debridement, contaminated instruments, linen, and drapes should be discarded.

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ATTACHMENT A: RADIOLOGICAL DISPERSAL DEVICE

This attachment provides additional decision-making guidance for use by OPHD if an RDD is used.

An RDD is a much more likely terrorist device than an IND because of the relative ease of securing the relevant material. A terrorist incident involving radiological material would be declared a federal disaster area very quickly. Federal assets would begin arriving within 24 hours. It would be the responsibility of the public health AOC and the state ECC to coordinate these resources to ensure their best use.

The scenario for an RDD follows:

Phase I (Early Response)

An explosion or other incident has occurred. Damage will be limited to the immediate area of an explosion. If there is no explosion, there will be no physical damage, and signs of an RDD may only be detectable with radiation survey monitors. Once the site has been secured, life saving and first-aid becomes a top priority. Identifying dose levels and the type of radioactivity is vital to establishing protective action recommendations (PARs).

Phase II (Intermediate Response)

The incident is over in terms of the explosion or initial distribution of the radioactive material. The radiation hazard has been identified. This is the beginning of the recovery process.

Phase III (Recovery)

Cleanup and full recovery take place. If necessary, food control restrictions will be implemented using the following food advisories.

- Dairy cows, goats and other valuable livestock inside barns or enclosed and covered sheds.
- Restrict dairy cows, goats, and other valuable livestock to feed that has been enclosed or in covered storage.
- Restrict livestock to water sources that are covered or are from enclosed underground storage.
- Do not drink fresh milk produced since the following: (date and time).
- Do not drink water from streams, lakes, or ponds.
- Do not let drink let animals drink from streams, lakes, or ponds.
- Do not pick or harvest fruits, vegetables, or grain.
- Do not transport uncovered agricultural products through the advisory area.

Assumptions

- The FBI will be the lead coordinating agency for the criminal investigation, and OPHD will work closely with the CDC. At the state level, OPHD would be a member of a Unified Command.
- The dose and activity trigger levels (PARs) developed for emergency response at nuclear power plants and used for relocation and food control can be applied to these incidents.
- Radioactive material and medium-to-low radiation levels will be involved. Contamination will be the most serious issue.

Objectives

- Evacuate and decontaminate as many affected people as possible.
- Make decisions about radiation exposure outside of the immediate blast area.
- Help determine whether food and water were contaminated.

TAB A-1
PROTECTIVE ACTION RECOMMENDATIONS (PARS) FOR A RDD

Protective action recommendations for a RDD should be applied to locations and individuals within one mile of the incident until further information is gathered concerning the threat of another explosive device present at the scene. Once security elements have ensured that no other explosive device is present, first responders can proceed to set up a perimeter between 500 and 600 meters from the incident or where 2 millirem per hour is measured, whichever is furthest from the scene.

Note: 550 meters is the recommendation from a study conducted by Sandia Laboratory (Musolino 2006), which noted this was an optimal distance for a dirty bomb scenario.

Phase I

Public PARs

- Shelter in place. This means to stay inside a building, close the windows, and turn off ventilation or turn it on re-circulation if possible. Duct tape and plastic are not necessary unless windows are broken.

  Sheltering in place is a temporary measure and normally will last less than 24 hours. During that time safe paths of egress will be determined so people can then leave the area in as safe a manner as possible.
- Contamination is not a medical emergency and does not require a visit to the hospital or emergency room. Seek medical attention only if you have an injury or medical emergency. Contaminated individuals can go to Public Assistance Centers for aid. These will be set up as per local emergency plans.
- Move away from the explosion; for example, move to the opposite side of the building and stay away from windows in case of broken glass.
- Listen to the news, via TV or radio—tune in to your local emergency broadcasting station (Emergency Alert System) for further instructions.

First Responder PARs

- Recognize other threats, such as fire or explosion that immediately impact life. These take priority over radiation hazards.
- Don’t deny or delay needed medical attention.
- Take samples (soil, vegetation, etc.) as soon as possible and send them in to the Oregon State Public Health Laboratory. A multi-channel analyzer will be brought to the scene as soon as possible to assist in identifying the radionuclide.

Phase II

The incident has happened and the radiation hazard has been identified.

Public PARs

- If you think you have been contaminated, remove outer layer of clothes, bag them, and then take a shower using lukewarm water and plenty of soap. Do not scrub skin excessively.
- Public Assistance Centers will be set up as needed and you will be informed by radio/TV of their locations.
- Do not retrieve vehicles or personal effects that are near the blast scene, especially if they are coated with visible dust from the blast.
- Do not eat or drink anything that was near the scene, especially items that are not packaged (e.g., fresh fruit or water from open containers) or food from a home garden.
- When you reenter your home or workplace after evacuation and if there may be contamination, wear gloves and booties. Remove them when you are back in the clean zone.
- Those who live within the contamination area (the area in which the level of radiation is high enough to harm people) should leave their homes until cleanup can be done. If you live outside the contamination area, or if there is no contamination area, you need not leave. However, there may still be some contamination in the area and there are several simple things you can do to protect yourself and your family. These include:
  - Hosing off car, roof of house, driveway and sidewalks.
  - Washing homegrown vegetables to remove all dirt. Any contamination will be removed as well.
  - Removing shoes when entering the house.

First Responder and Local Government PARs

- Keep fighting fires. Be aware that radiation is involved—use your radiation monitoring equipment.
- Prepare an assistance center for eventual possible evacuation, decontamination, and for people going into the Hot Zone and coming back out. See Tab 2, “Perimeter Control,” for a definition of the zones.
- Discontinuance of sheltering requires determining a safe pathway out. This is done by making measurements of contamination and radiation levels and determining the areas that are outside of the plume and not impacted. Egress points need to be selected and staffed by people who understand how to use a radiation detector to survey people. If all areas have been equally impacted, wash down a pathway out before establishing egress stations.

- Discourage unnecessary entry into the area. For those who do enter or exit the area, direct them to the assistance center for radiological monitoring and assessment on their way out. Do not prohibit necessary movement into the zone.
- After the initial incident, there will be many reasons for people to reenter the incident site, either for retrieving necessary items, or for longer periods such as work, keeping essential services operating, and security patrols. To reenter, the following steps should be taken:
  - Establish access/egress points with radiation monitors. Decontaminate the pathway if possible.
  - Give people training so they can be treated as occupational radiation workers. After training, the occupational dose limit of 5 rem can be applied to them. If they receive no training, the limit will be 0.1 rem.
  - Measure the dose rate and establish a stay-time for people reentering. Consider issuing dosimetry if practical or mount dosimetry in the facility to be used for future dose assessments and to verify that stay-times are correct.

One of the recommendations found in section 7.6.3 of EPA 400-R-92-001 states that when cleaning surface contamination during emergency situations "Do not waste effort trying to contain contaminated wash water." This recommendation was made because, in most cases, the levels of contamination would not exceed standards for public health and safety. With that in mind, the following PARs are suggested:

- Sewage treatment plant operators may consider bypassing wash water into large bodies of water such as the Willamette or Columbia Rivers to reduce exposure to workers and limit contamination of the plant and biosolids. From a radiological standpoint, it is considered safe to do this for wash water used during cleanup of a large area after a radiological incident.
- Major thoroughfares such as freeways into and out of a city could be used shortly after an incident with the following stipulations:
  - Assess dose rate and contamination levels on the roadway.
  - Wash down the roadway if contamination is found.
  - Block off exits so that no traffic can enter the Hot Zone or other areas where there may be contamination.

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ATTACHMENT B: IMPROVISED NUCLEAR DEVICE

This attachment provides additional decision-making guidance for use by OPHD in the event of an IND explosion.

The scenario of a nuclear bomb follows:

Phase I (Early Phase)

A nuclear explosion occurs. Massive damage is sustained within Zone A (see Tab B-1) and prompt fallout in Zone B. Both zones have high, life-threatening levels of radiation, in addition to the death and injury caused by the blast and thermal effects. Any rescue efforts into Zone A must be done with the awareness that due to the high dose levels, people in this zone may not survive, even if rescued. Distance from the blast and shielding (e.g., in a basement) will be factors that help survival.

Victims in Zone B should be advised to immediately evacuate this zone, as prolonged stay could result in acute radiation exposure effects including death.

Phase II (Intermediate Phase)

The explosion is over, and the plume has dissipated. There is widespread contamination - high, life-threatening levels of radiation are present in Zones A and B. The boundaries of Zone C are identified. Zone C is a temporary evacuation area for Zones A and B, and then all people in Zone C are eventually evacuated. This phase is the beginning of the recovery process.

Phase II (Recovery Phase)

Cleanup and recovery begins. Food control restrictions will apply for this phase. An incident of this magnitude would be declared a federal disaster area very quickly. Federal assets would begin arriving within 24 hours, and it would be the responsibility of the state ECC to coordinate these resources.

Assumptions

- The FBI would be the lead coordinating agency, and OPHD would be working closely with CDC. At the state level, OPHD would be a member of the Unified Command.
- Immediate dose levels are likely to be life threatening in the blast area and perhaps for several miles beyond.
- The dose and activity trigger levels (PARs) developed for emergency response at nuclear power plants and used for relocation and food control can be applied for these events.
- Radioactive material and high radiation levels will be involved.

Objectives

- Evacuate and decontaminate as many affected people as possible.
- Make decisions about in shelter in place options.
- Help decide on access to food and water.

TAB B-1
NUCLEAR EXPLOSION EMERGENCY PLANNING ZONES

The size and extent of each zone will vary depending on the event (e.g., its size, the weather, wind direction, etc.). The zones are a conceptual idea based on the range of effects possible at varying distances from ground zero. In the early part of the emergency, the rescue and evacuation actions will be based on the extent of damage and the dose rates measured. The demarcation between zones will not be absolutely defined for an extended period.

Zone A Immediate Evacuation Area

Area is massively impacted. Depending on the nuclear yield, Zone A may extend ½ to 2 miles from ground zero. Lethal radiation doses are possible either from immediate radiation exposure during the explosion or from fallout. This zone can be readily determined as the rate where fires and/or severe structural damage occur. In this zone, survivors must try to leave. Responders will probably not be able to enter this area due to high radiation levels. In a very short time, any survivors within the area will have received lethal exposures and will not survive even if rescued.

Zone B Fallout Evacuation Area

This is the area beyond Zone A, extending out to approximately 10 miles. It is the area where visible fallout has occurred. Very high life-threatening radiation levels are likely. In this area, sheltering is unlikely to be effective, and evacuation is necessary to save lives (sheltering for a brief time until the plume has passed may be a good idea to reduce inhalation of dust). The shape of this zone will depend on the pattern of fallout, which is dictated by meteorological conditions. For planning purposes, Zone B extends 10 miles from the explosion. Evacuation of this area will be the priority during the first 24 hours.

Zone C 24-Hour Shelter Fallout Area

This area is beyond Zone B and extends out to approximately 100 miles in the direction that fallout has occurred. High life-threatening radiation levels are possible. In this area, sheltering is likely to be more effective than evacuation in limiting radiation exposure. The shape of this zone will depend on the pattern of fallout dictated by meteorological conditions. For planning purposes, Zone C extends 100 miles from the explosion. Determining if relocation from this area is necessary will be a priority after the first 24 hours.

Zone D No Short Term Actions Area

This is the area beyond Zone C where no short-term actions are necessary during the first 24-48 hours, and relocation is unlikely to be needed. Some fallout is possible, and further actions may be necessary as per ingestion planning as done for CGS and Hanford responses.

TAB B-2
PROTECTIVE ACTION RECOMMENDATIONS

This tab provides protective action recommendations (PARs) for INDs. (See Tab B-3 for the technical background supporting these PARs). In the case of an IND, very large consequences are expected that require immediate and specific actions requiring additional priorities to be established beyond those identified for an RDD (see Attachment A, Tab A-1). Life-saving efforts are the first priority, and these efforts should be directed to areas where fallout is seen.

The PARs identified in this tab are focused on protecting the public from the immediate threats of radioactive fallout from a nuclear explosion and should take precedence over other PARs during the first 24-48 hours following a nuclear explosion. Once the radiation levels have decreased, follow the RDD PARs (Tab A-1) outside the low radiation boundary (10 mR/hr).

Public PARs

- Move away from the blast zone and out of the path of the radioactive fallout cloud as quickly as possible (Zones A and B; see Tab B-1). The shortest distance to safety is at right angles to the prevailing wind direction and cloud movement. Walk if you have to.
- If it is not possible to move out of the path of the radioactive fallout cloud, take shelter as far underground as possible, or if underground shelter is not available, seek shelter in the upper floors of a multistory (5 or more stories) building. If there are no multistory buildings, shelter in the very center of a building.
- Find ways to cover skin, nose and mouth, but do not let such precautions impede your actions to evacuate or seek shelter. Note that three thicknesses of toilet paper, held over the nose and mouth, will keep out 91% of the dust particles. A crumpled man's handkerchief will keep out 88% of dust particles.
- Once protected from fallout, decontaminate by removing outer clothing and washing skin.
- If outside the evacuation area, seek shelter to avoid any residual radiation.

First Responder PARs

- Evacuations may be necessary immediately after the explosion in areas where radioactive fallout is occurring. Responders performing evacuations should be aware that radiation levels in Zones A and B may present imminent threats to the safety of responders. If responders have the capability to monitor radiation levels, they should limit their exposure accordingly. In general, however, avoid areas where fallout has occurred. Expect radiation levels to decrease significantly after the first day due to natural decay.

- If your instrument goes off scale on all scales, leave the area.
- Observe the dose limits (see Tab 2).

TAB B-3
TECHNICAL BACKGROUND FOR DEVELOPMENT OF IND PROTECTIVE ACTION RECOMMENDATIONS

Government estimates of the radiological consequences of an improvised nuclear device (IND) were based on a worst-case scenario for people and property using a surface detonation of a 10 kiloton (kT) bomb and mild weather conditions. The dose estimates at different distances from ground zero were calculated using the HOTSPOT software (Lawrence Livermore National Laboratory 2.05) and Glasstone (1977).

Under these conditions, the accumulated dose during the first 24 hours was calculated as 540 rad at 10 miles. Smaller yields will result in lower radiation levels, but the exact magnitude of the nuclear yield would be unlikely to be determined in the hours immediately following the explosion. A shielding factor for sheltering of 0.1 was assumed, consistent with factors for basements, concrete and masonry structures, and upper floors of multi-story buildings (Glasstone 1977). Shielding provided by small aboveground frame structures (e.g. single family homes) is probably less (0.3 to 0.6). Those sheltering in frame structures may need additional recommendations (e.g., stay in center of the structure on the ground floor) in order to minimize dose accumulated while in shelter.

First-year doses at 100 miles were extrapolated from HOTSPOT tabulated dose results for distances ranging from 5 to 80 miles (the HOTSPOT limit for such calculations under a 10 kT scenario). Based on these extrapolations, and on HOTSPOT dose contours, first year doses decrease to 2 rem approximately 100 miles from the explosion.