Public Health Emergency Operations Plan

Annex C: Radiation Response Annex

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1.0 INTRODUCTION

1.1 PURPOSE

The primary purpose of this Radiation Incident Specific Annex to the Tri-County Health Department (TCHD) Public Health Emergency Operations Plan (PHEOP) is to reduce morbidity and mortality, and minimize social disruption in Adams, Arapahoe, Douglas and Elbert Counties by providing a guide for the TCHD response to an accidental or intentional radiation incident. Additionally, this Annex will define the general roles and responsibilities for TCHD and overall coordination with key partners. The annex describes how TCHD will undertake planning and coordination, surveillance, investigation and protective health measures; coordinate healthcare and emergency response; and conduct communications and outreach activities. The intent of this annex is to coordinate response activities with local, state, and federal partners along with stakeholders in the community. Therefore many concepts outlined in this annex reflect those of federal agencies, including those outlined in the following documents: *US Department of Health and Human Services (HHS) Radiological Dispersal Device Playbook, the Centers for Disease Control and Prevention (CDC) and National Institute for Occupational Safety and Health (NIOSH) Guidance on Emergency Responder Personal Protective Equipment (PPE) for Response to CBRN Terrorism Incidents, the Security Staff Interagency Policy Coordination Subcommittee for Preparedness & Response to Radiological and Nuclear Threats Planning Guidance for Response to a Nuclear Detonation, the Colorado Division of Homeland Security and Emergency Management Preventative Radiological and Nuclear Detection Risk Assessment, and the Federal Register Department of Homeland Security Planning Guidance for Protection and Recovery Following Radiological Dispersal Device (RDD), Improvised Nuclear Device (IND) Incidents*. These same principles can also be used when dealing with an accidental release of radioactive material. Additionally, the goal is to provide Tri-County Health Department staff with a guide for response concepts specific to radiological nuclear incidents that are not addressed in the body of the TCHD PHEOP Basic Plan.

The main body of this annex is designed to guide TCHD in a response to an emerging radiological nuclear situation impacting our local jurisdiction or surrounding areas. TCHD would utilize the National Security Staff Interagency Policy Coordination Subcommittee for Preparedness & Response to Radiological and Nuclear Threats zone model.

Attempts have been made to develop response activities that are related to the Security Staff Interagency Policy Coordination Subcommittee for Preparedness & Response to Radiological and Nuclear Threats and Department of Homeland Security (DHS) plans. It is important to note that response activities are not fixed and can be executed at any time assuming that the parameters regulating responder health and safety, as well as the criticality of the operation, are in line with the appropriate guidelines.

1.2 Scope

The Radiation Incident Specific Annex includes actions defined in each of the TCHD annexes mentioned below, but makes them operational and specific to the radiological nuclear disaster context. Radiation and nuclear response efforts will also trigger the activation of plans external to TCHD. Due to the relatively weak nature of alpha radiation (unless inhaled, ingested, or otherwise injected into the body through cuts on the skin), response to incidents involving this agent is not detailed in this document. Response to an incident of this nature will require close coordination with subject matter experts on an incident specific basis.

Due to the nature of such an incident, local, state, and federal law enforcement will be heavily involved with the response. TCHD may serve as part of a larger command and control structure, acting as the local ESF#8 lead in support of the larger response.

This annex will be implemented in tandem with the PHEOP Basic Plan. Several annexes of the existing PHEOP are particularly relevant to radiation response. These include:

1. Annex A: TCHD Operational ESF #8 Annex
2. Annex B: Epidemiology, Surveillance and Disease Investigation Functional Annex
3. Annex D: Community Containment Annex
4. Annex E: Crisis and Risk Communications Annex
5. Annex F: Environmental Health Annex
6. Annex H: Mass Fatality Management Functional Annex
7. Annex J: Mass Prophylaxis Annex
8. Attachment VI: Vulnerable Populations Attachment

1.3 Situation Overview

Radiation is present at varying levels everywhere, irrespective of where one lives. Examples include cosmic radiation and terrestrial radiation. Naturally occurring radioactive materials (NORM) include elements such as uranium. Radon, which is found in air and water, is the main source of exposure to radiation for humans today. Procedures such as a positron emission tomography (PET) scan or X-ray imagery expose workers and patients alike to radiation on a daily basis around the globe. Along with the medical industry, veterinary industry, construction trades, the energy sector, worldwide, has adopted nuclear energy as a way of providing a low pollution energy alternative to traditional fossil fuels.

- **Radiological Dispersal Devices (RDD)** – There are two types: 1) dispersal via explosive detonation (aka "dirty bomb") or 2) dispersal via non-explosive detonation. An RDD can be contrasted with a Radiological Exposure Device (RED) which does not disperse nuclear material, but instead is meant to deliver exposure to a large population.
    - **1. RDD (explosive)** - Will be immediately recognizable as an explosive incident. Radiation will not be detected immediately. Most immediate death will be due to the actual explosion and not due to radiation. Victim decontamination is imperative.
    - **2. RDD (non-explosive)** - This type of device can be created by introducing radioactive materials into the food, soil, water or air in either an obvious or innocuous manner. A non-explosive RDD (NERDD) has the potential to pass unknown for a long period of time, and has the capability to produce mass casualties through widespread inhalation, ingestion or both. The dose of radiation may or may not produce death. This type of device may require broad investigation and intervention of food, water, and air.

- **Radiological Exposure Device (RED) (exposure)** - As with a NERDD, an RED can pass unnoticed for long periods of time. Though the risk of mass casualties may be lower in this scenario as an RED provides only a partial body dose, it will be dependent on the activity and the location of the source. Tracking who was exposed will be very difficult in a scenario such as this.

- **Improvised Nuclear Device (IND)** - This is a nuclear weapon which has four distinct energy characteristics: 1) It creates a blast wave, 2) It generates intense heat, 3) It generates intense light, and 4) It releases high levels of radiation. With any IND explosion, the most common and immediate injuries will be consequences of the blast wave, heat produced (burns), and light produced (retinal injuries).

- In addition to malicious and intentional release of radioactive material, there is also the possibility of unintentional or accidental release. This can have the same consequences as the devices described above, but lack the intent to harm.

1.4 Legal Authority

TCHD has legal authority to restrict an individual's movement in cases of radiological/nuclear incidents. Additionally, Colorado Department of Public Health and Environment (CDPHE) and Local Public Health Authorities (LPHAs) have statutory authority to establish, maintain and enforce isolation, quarantine and involuntary decontamination, as described in Colorado Revised Statute subsection 24-33.5-704 (2012).

As the Governor of Colorado has broad powers to meet the response needs of an emergency, the Governor may suspend any regulatory statute provisions, state agency orders, rules, or regulations that would prevent, hinder, or delay emergency response efforts. Based on this authority, the Governor's Expert Emergency Epidemic Response Committee (GEEERC) has created several draft executive orders that could be signed by the Governor in order to facilitate response to a public health emergency.

1.5 Assumptions

Due to the alarming or insidious nature of a radiation nuclear disaster, there are certain considerations that must be recognized:

- The device used to perpetrate such an incident will be an IND, RDD, NERDD, or a RED.
- If the device is an IND or explosive RDD, identification of a radiation component will be determined early in the response.
- Information regarding the radioactive element and its isotope may not be known for an extended period of time.
- There could be one or more devices that are used simultaneously or in succession.
- The devices will be used in a densely populated area in order to maximize casualties and the attention that is gained by such an act.
- In the case of an IND attack, there will be massive amounts of damage to critical infrastructure which will severely cripple the initial response.
- In the case of a RED the first clues will be an increase in the number of burn patients and Acute Radiation Syndrome (ARS) patients.
- In the case of an IND or explosive RDD, trauma due to the explosion will be the most immediate concern.
- There will be a large number of "worried well".
- There will be high levels of panic and paranoia.

- There will be areas for the population to shelter in place.
- There will be a federal response.
- There will be a phased approach during the lifetime of the incident.
- There will be a zoned approach in regards to the actual operations portion of the response.
- Personal protective equipment (PPE) will be needed in order to ensure a safe and effective response.
- The benefits of any operation must outweigh the cumulative risks to those responders involved.
- In case of a high risk operation, all responders involved will be made aware of the risks before agreeing to carry out the mission.
- Long term surveillance will be needed to fully understand the impact of the incident.
- There will be a need to assess the larger environmental health impact and any agricultural land and/or water sources that may be associated with such an incident.

Several features set radiation nuclear disasters (RND) apart from other public health emergencies or community disasters:

RND Planning:

- The Governor of Colorado may declare a State of Emergency to provide effective command and control for response to RND. Local law enforcement agencies, along with any relevant state and federal investigative agencies will act as the lead agency for the response. CDPHE will coordinate activities with the Colorado Division of Homeland Security and Emergency Management.
- Some specific social interventions and/or containment measures, such as sheltering in place, isolation and quarantine, school cancellations, travel restrictions, and/or cancellation of public events may be required to slow the spread of radioactive contamination.
- Protective Action Guidelines (PAG's)* include either sheltering in place or evacuation or both. Determinations as to which PAGs ordered and when they will be ordered will be made public using the guidelines set forth in ***Annex E: Crisis and Risk Communications***.
- Specific polices, processes, and procedures to be used for isolation and quarantine are described in ***Annex D: Community Containment Functional Annex.*** Effective prevention and therapeutic measures, including chelation/decorporating therapy and trauma services could be delayed in distribution, be in short supply or not available.
- The TCHD will work with healthcare providers to coordinate distribution of chelation/decorporating medications/agents.
- Response to the radiological nuclear disaster will require swift and coordinated action by all levels of government and first responders.
- Hospitals and outpatient care facilities will need to expand their capacity to accommodate anticipated patient loads.
- If indicated, substantial public education regarding the need for decontamination and/or drug therapy and risk factors posed by exposure to radioactive material, along with rationing limited supplies, is paramount to controlling public panic.
- First responders and healthcare workers may be at a higher risk of exposure and illness than the general population, which may further strain the healthcare system.
- Considerations must be made for healthcare worker safety as a radiological incident may cause concern in regards to both personnel protection and the immense strain on the healthcare system as a whole.
- Widespread illness in the state of Colorado could increase the likelihood of sudden and potentially significant shortages of personnel in other sectors who provide critical public safety and necessary critical infrastructure services.

- Adequate security measures must be in place while distributing limited supplies of chelation/decorporating medication.
- Most chelating/decorporating agents that can be used in such an incident have already been FDA approved. However, for those that have not yet been approved the FDA can provide an Emergency Use Authorization if needed. Gaining the Emergency Use Authorization will be done jointly between TCHD and CDPHE with TCHD acting as the requestor and CDPHE acting as the request coordinator.
- *The Federal Emergency Management Agency's Planning Guidance for Protection and Recovery Following Radiological Dispersal Device (RDD) and Improvised Nuclear Device (IND) Incidents* along with the *National Security Staff Interagency Policy Coordination Subcommittee for Preparedness & Response to Radiological and Nuclear Threats' Planning Guidance for Response to a Nuclear Detonation 2nd Edition* help to delineate what agencies should be involved with the response and their roles and responsibilities.
- *The Environmental Protection Agency's Manual of Protective Action Guides and Protective Actions for Nuclear Incidents* outline's which PAGs are appropriate during the distinct incident phases that are used during the response effort.
- There may be a need for mass decontamination to be carried out by appropriate authorities.
- Appropriate responders such as Incident Command, ESF #8, and hospitals impacted by the incident should reach out to the Rocky Mountain Poison and Drug Center (RMPDC)/Regional Emergency Assistance Center/Training Site (REAC/TS) for health and medical guidance.
- Hospitals receiving and treating patients from a radiation incident should coordinate with those facilities participating in the Radiation Injury Treatment Network (RITN) on the treatment or movement of patients to appropriate facilities. The hospitals currently active in RITN within the Denver Metropolitan area include Presbyterian Saint Luke's and the University of Colorado Hospital.

* National Security Staff Interagency Policy Coordination Subcommittee for Preparedness & Response to Radiological and Nuclear Threats (2010). Planning Guidance for Response to a Nuclear Detonation 2nd Edition.

2.0 CONCEPT OF OPERATIONS

2.1 GENERAL

In radiological/nuclear disasters, dissemination of clear, accurate, concise, and consistent information regarding the incident and what the population can do in order to protect themselves is the most important step in gaining the public's trust. It will be vital that all agencies involved in the response communicate their needs, assets, capabilities, and jurisdiction clearly to both partners and the public, as appropriate. The response to a RND will cause a severe strain on existing healthcare infrastructure due to an influx of patients caused by the radiation device. In the case of an IND or explosive RDD, the patients will be comprised of those who have sustained injuries due to the explosion, those who have signs and symptoms of acute radiation sickness (ARS), and the worried well. In the case of a non-explosive RDD or RED, the burden imposed will initially be comprised of patients suffering from ARS or radiation induced burns. However, once information has reached the public about potential widespread radiation exposure, the burden on the healthcare system will come from an increase in the number of worried well seeking treatment.

TCHD will be involved with messaging that pertains to public health concerns, family reunification, and any other areas appropriate. This will likely involve participation in a joint information system/joint information center (JIS/JIC) in order to craft credible, salient, and current messages for the public. TCHD will do this per the guidelines set forth in ***Annex E: Crisis and Risk Communications*** and ***Annex A: ESF #8 Appendix related to the Joint Information System*** (currently under development).

PHASED RESPONSE:

A phase oriented response will enable TCHD to carry out essential functions in a timely and effective manner. This is the same guidance provided by the Federal Emergency Management Agency's Planning Guidance for Protection and Recovery Following Radiological Dispersal Device (RDD) and Improvised Nuclear Device (IND) incidents. The response phases are as follows:

- **Early Phase**: This is the emergency phase which starts at the beginning of the incident (i.e. bomb detonation, confirmation that people are being exposed to radiation, etc.). In this phase quick decisions about effective protection must be made, but data is generally not available. Considerations that are taken into account at this time are usually A) people's exposure to the radioactive plume (if present), B) people's short term exposure to deposited radioactive materials, and C) potential inhalation of radioactive material. The main objective of the early phase is effective initial emergency response actions to protect the public's health and welfare in the short-term, which can take a few hours to days. If an explosive RDD is used and there is no prior intelligence, there may be no time to take any protective measures to reduce plume or fallout exposure. In the case of IND deployment, there may only be time for early phase protective recommendations such as evacuation and shelter in place orders for areas that are miles away from the blast epicenter. IND deployment is projected to lead to a high number of casualties, large scale devastation in and around the blast epicenter, restriction of communications, long delays in

assistance, and far reaching fallout. In the case of IND deployment, self-guided protective actions such as evacuation (people should move perpendicular from the movement of the plume) or sheltering in a protective area (large building, basement) for a day or longer, is likely to be the best course of action for survivors. During this phase isotope identification is critical to understanding what decontamination and pharmaceutical interventions are available and appropriate. During the early phase, site characterization will also be critical to start to define the site and the identification of hazards going forward that may be present and impact response operations.

- **Intermediate Phase**: This phase of the response begins when the incident's radiation source has been brought under control and protective actions are being made based on measurements of the material. The activities associated with the intermediate phase usually will overlap with early phase activities and can last for days to months, until protective actions can be discontinued. Intermediate phase actions center on continuing and improving recovery actions made during the early phase, reopening critical infrastructure, and trying to return the population to a state of relative calm and normalcy. Generally, intermediate phase actions should consider the late phase actions and objectives. However, in emergency or critical situations, late phase actions do not need to be considered. The number one priority of any phase of action should be the population's health and well-being.

- **Late phase**: The late phase comprises of actions and steps geared towards recovery and clean up to help reduce environmental radiation to levels designated as acceptable by authorities and/or subject matter experts. The late phase of the response will end when all remediation activities are completed. During the late phase, stakeholders can be involved in providing cost effective solutions and proper cleanup recommendations to ensure the health and safety of the public.

Table 1. SUMMARY OF PHASED APPROACH:

Potential Exposure Pathway	Incident Phase: Early	Incident Phase: Intermediate	Incident Phase: Late	Protective Actions
External* radiation from facility	X			Sheltering Evacuation Control access
External radiation from plume	X			Sheltering Evacuation Control access
Inhalation from activity in plume	X			Sheltering Evacuation Control access Administration of appropriate pharmaceutical therapy
Contamination of skin and clothes	X	X		Sheltering Evacuation Decontamination of persons
External radiation from ground deposition	X	X	X	Evacuation Relocation Decontamination of land and property

Ingestion of contaminated water and food	X	X	X	Food and water controls
Inhalation of re-suspended activity		X	X	Relocation Decontamination of land and property

*Note: 'External' refers to a facility such as a nuclear depot, nuclear energy plant, etc.

2.2 Roles and Responsibilities

While responding to an incident involving radioactive materials has certain broad themes associated with it, local jurisdictions, agencies and facilities have their own written plans on their particular response roles and responsibilities. These plans were used in the development of this document and should be referenced for specific details pertaining to response partner jurisdictions, responsibilities, and response actions.

2.2.1 Federal

Deployment of any radiological/nuclear device will elicit a large federal response. Agencies such as the Department of Energy (DOE), the Federal Emergency Management Agency (FEMA), the Environmental Protection Agency (EPA), the Occupational Safety and Health Administration (OSHA), and the Federal Bureau of Investigations (FBI) will all play a significant part in such a scenario. In some cases, the federal government may take the lead and in some it will have a supporting role. In the incident of a radiological/nuclear disaster the federal government will employ two distinct types of responses: 1) military response, and 2) non-military response.

MILITARY RESPONSE:

- This will involve the Department of Defense (DoD) and can include the Defense Threat Reduction Agency (DTRA), which is the agency that coordinates DoD response personnel.
- The DTRA's Operations Center will serve as a single point of contact if the DoD is involved in the incident.
- If a federal emergency declaration is granted then the Air Force's Radiation Assessment Team (AFRAT) may provide the risk assessment in order to enhance the response in conjunction with CDPHE and other appropriate federal partners.
- Medical assistance can be provided by the Army through its Radiological Advisory Medical Team (RAMT) if it is deemed necessary.

NON-MILITARY FEDERAL RESPONSE:

- The National Nuclear Security Administration (NNSA) will be engaged.
- The Radiological Assistance Program (RAP), which is administered and overseen by the NNSA, is an organization which will not take control of any response but will help support the initial response and will report to the incident commander by providing information or deployable assets to help assess and mitigate radiological incidents.
- The National Atmospheric Release Advisory Center (NARAC), which is administered and overseen by the NNSA, can help predict the dispersion of radioactive fallout using meteorological data, land topography, computer modeling, and incident location, will become available if the nuclear material becomes airborne.
- Another NNSA asset which will be activated in case of nuclear material becoming airborne is the Aerial Measuring System (AMS), which uses fixed winged aircraft with radiological detectors to help assess the location, size, dispersion patterns, radioisotopes and radiation readings.

- The Department of Energy's (DOE), radiological triage capabilities will be activated via request which would be accessed through the RAP.
- The Radiation Emergency Assistance Center/Training Site (REAC/TS), which is also an NNSA asset, can be activated to provide medical information, personnel, and patient care.
- The DOE will help support the Department of Justice (DOJ) in cases that are suspected to be terrorism related.
- The Nuclear Regulatory Commission (NRC) will respond to coordinate if any of their licensees are involved in the incident.
- The NRC will respond as a cooperating agency in all other situations.

2.2.2 Colorado Department of Public Health and Environment (CDPHE)

CDPHE conducts the following activities in a RND response:

- Conduct research on licensure/compliance for radioactive materials involved in the incident if it is deemed to be an accident.
- Maintain situational awareness by monitoring progression of the radiation contamination and assessing the public health/medical needs in Colorado. Provide data to federal, state, bordering state and local partners regarding current status of in Colorado.
- If no federal declaration of emergency is granted then CDPHE will carry out a joint assessment with the Colorado Division of Homeland Security.
- If there is a federal emergency declaration then CDPHE will assess the situation in coordination with other federal partners.
- Activate the CDPHE DOC to coordinate Emergency Support Function (ESF) #8 – Health and Medical activities in response to progressing phases as appropriate. Coordinate with the state emergency operations center (SEOC)/Multi-agency Coordination Center (MACC).
- Develop a collaborative prioritization and utilization system of blocking agents, chelators and other therapeutic drugs. Receive, secure, manage, apportion, transport and distribute medications as designated in Colorado's SNS and Mass Prophylaxis plans.
- Coordinate with the public and private healthcare system to ensure a cohesive healthcare response network statewide to handle inpatient and outpatient care.
- Coordinate epidemiologic activities statewide including data collection, surveillance, detection and management of suspect cases and contact tracing. Provide guidance to healthcare providers, emergency medical services, health facilities, etc. regarding radiological/nuclear specific protocols such as personal protective equipment (PPE), and decontamination procedures. *Note: CDPHE will provide subject matter experts, as appropriate.*
- Work to establish proper decontamination procedures commensurate with the hazards.
- Support laboratory response testing and confirmation capacity statewide. Support mass fatalities management and response including guidance for retrieval, storage and disposition of bodies, death certificates and next of kin notification.
- Provide guidance for and coordinate implementation of Protective action guidelines (PAG's).
- Coordinate and support resource requests, as appropriate, for equipment, supplies and volunteers with the Colorado Division of Homeland Security and Emergency Management (CDHSEM).
- Provide support in coordinating and managing statewide public health and medical volunteers needed to maintain effective radiological response through the Colorado Volunteer Mobilizer.
- Coordinate timely, accurate and consistent messages to media, public and response partners about RND planning, response and recovery. Activate a joint information system or center (JIS/JIC) for public health and medical messages, as needed.
- Identify spokesperson(s) responsible for addressing RND-related public information and media requests.

- Maintain data management systems for tracking resources and information as well as surveillance activities.
- Initiate and coordinate the activation of the CO-HELP hotline to serve as a community resource for public health and medical information.
- Document and track all state public health response expenses.
- Share all pertinent information with the Colorado Information Analysis Center (CIAC).
- Coordinate plume modeling activities through the Air Pollution Control Division (APCD) and the Hazardous Materials and Waste Management Division's (HMWMD) Radiation Control Program. Provide guidance on acceptable radiation levels for a return to normal community functioning in a joint fashion with relevant federal partners.

2.2.3 TRI-COUNTY HEALTH DEPARTMENT (TCHD)

Local public health agencies are responsible for coordination of the public health response to RND incidents within local and regional jurisdictions. Specifically, TCHD will conduct the following activities:

- Activate public health DOCs and PHIMT and/or participate in local county EOCs to coordinate ESF #8 – Health and Medical activities in response to progressing phases of the response, as appropriate. Coordinate with the CDPHE DOC and local/regional EOC's within the jurisdiction.
- Initiate contact with CDPHE regarding the potential receipt and distribution of Strategic National Stockpile (SNS) medical countermeasures and supplies, as appropriate.
- Receive, secure, manage, transport and dispense medications, supplies, and equipment in the local jurisdiction as outlined in PHEOP ***Annex J: Mass Prophylaxis Annex*** if necessary.
- Utilize communication system resources including WebEOC, EMResource, and news media initiatives to communicate with response partners and the public during response and recovery.
- Initiate, coordinate and support mass fatality response in the jurisdiction as outlined in ***Annex H: Mass Fatality Management Functional Annex***. Coordinate with coroners' offices (if applicable).
- Provide data to partners regarding current status of situation in the TCHD jurisdiction via situation reports, including resource and volunteer requests.
- Provide situation updates to local ESF #8 and Emergency Management partners regarding current status of situation in the jurisdiction via situation reports and coordinate conference calls, as appropriate.
- Coordinate timely, accurate and consistent messages to media, public and response partners about radiological/nuclear planning, and response and recovery activities in the TCHD jurisdiction.
- Engage in crisis and emergency risk communication activities regarding public health related information as outlined in ***Annex E: Crisis and Emergency Risk Communication***.
- Use the *FEMA: Improvised Nuclear Device Response and Recovery Communicating in the Immediate Aftermath* (see Appendix B for hyperlink) document to help guide public messaging in regards to public health matters.
- Maintain situation awareness and ensure communication between hospitals and response agencies as appropriate.
- Participate in a public health or jurisdictional JIS/JIC, as appropriate.
- Identify spokesperson(s) responsible for addressing public health-related public information and media requests.
- Manage all resources and document/track all expenses in real time.
- Conduct epidemiologic activities within the jurisdiction in coordination with CDPHE. This may include data collection, surveillance, detection and management.

- Utilize syndromic surveillance to monitor victim and responder health status along with use of other surveillance systems, including CEDRS (see ***Annex B: Epidemiology Surveillance***).
- Provide hospitals and other healthcare facilities with support in procuring additional pharmaceutical support. This may include assets from the Strategic National Stockpile (SNS).
- Provide agencies with access to the Radiation Response Volunteer MRC (RRVC), through coordination with the TCHD Medical Reserve Corps (MRC). MRC Unit Coordinator and the Volunteer Coordinator at CDPHE to request this support.
- Help healthcare providers deal with patient surge by finding staff if available.
- Provide state or federally developed incident specific guidance, as appropriate, to all responding agencies regarding responder personal protective equipment (PPE) (see Appendix C).
- Utilize subject matter experts in Environmental Health regarding short, intermediate, and long term policies for cleanup and recovery issues generated by the radiological/nuclear disaster incident.
- Ensure access to TCHD subject matter experts and provide information for all public health and responder health inquiries as appropriate.
- Ensure timely and proper coordination and provision of guidance on health and safety related to radiation exposure to all those involved in the response and/or those persons who could be affected by radiation exposure.

3.0 Actions and Activities

This section details TCHD actions in response to triggers within the RND phases. The response actions will reflect planning efforts within the United States and more importantly within the state of Colorado and the local TCHD jurisdiction.

3.1 Early Phase

I. This is the emergency phase which starts at the beginning of the incident (i.e. bomb detonation, confirmation that people are being exposed to radiation, etc.).

3.1.1 Planning and Coordination

TCHD Objectives

a. To ensure that mechanisms exist so that imminent potential human health threats or lack thereof can be recognized and dealt with.
b. To coordinate timely interventions that will reduce the impact of a RND.
c. To establish or participate in a JIC/JIS with the appropriate entities.
d. To consider implementing protective action guidelines (PAG's) such as a sheltering in place order or evacuation orders.

Internal Actions

- The Department Commander of the Public Health Incident Management Team (PHIMT) will provide regular status updates to the Policy Group (TCHD's Executive Management Team (EMT)).
- Review TCHD Crisis and Risk Communication Annex.
- Disseminate guidance to TCHD staff on dealing with calls and questions from the public.
- Activate TCHD Call Center, if appropriate, and request activation of CO-HELP.
- The PHIMT will prepare routine messaging for the Executive Director, or designee, to update staff on the ongoing situation and activities at TCHD.
- EMT will implement the TCHD Continuity of Operations Plan as appropriate, including use of Mission Essential Functions.

- Assist in ongoing evaluation of messaging. Finalize adjustment of official guidelines and recommendations. Assess and publicize the current local impact.
- Use emergency powers as appropriate regarding disaster declarations or Governors Expert Emergency Epidemic Response Committee (GEEERC) draft executive orders.

External Actions

- Engage response partners in surveillance, review pharmaceutical options, restriction of movement considerations, and communication strategies.
- Implement public education and information programs.
- Provide regular situation updates to stakeholders.
- Provide guidance and training to partners, volunteers and stakeholders on checklists, planning and response concepts.
- Assess the availability to provide or request mutual aid.
- Provide PPE guidance and health guidance to responders and responding agencies as needed.
- Continue to provide guidance and situation updates to all stakeholders on radiation response activities.
- Meet with external partners and response agencies to determine the need for implementing PAGs.

3.1.2 Medications

Internal Actions

- Utilize existing legal avenues to waive liability and other legal issues associated with mass dispensing of chelators, blocking agents, and decorporating agents during an emergency or declared disaster.
- Provide healthcare centers such as hospitals or other healthcare facilities with pharmaceutical support, along with internal coordination regarding the use of Points of Dispensing (PODs), if appropriate.

3.1.3 Healthcare and Emergency Response

TCHD Objectives

a. To raise awareness among healthcare providers of a potential patient surge.
b. To educate hospital staff on appropriate public health response using established protocols.
c. To coordinate behavioral health support as appropriate.
d. To work with coroners in order to assure proper body handling and storage.
e. To coordinate ESF #8 efforts for situational awareness and resource management as outlined in ***Annex A: ESF #8***.
f. To ensure that community inclusion is achieved, TCHD will coordinate with key partners to disseminate clear information and instructions as dictated by the Communication, Maintaining health, Independence, Safety support services and Self-determination, and Transportation (C-MIST) Framework.

Internal Actions

- As designated in the PHEOP Basic Plan, the Emergency Preparedness and Response (EPR) Director or Executive Director will activate the DOC at the appropriate level and the EPR Director will serve as the initial Department Commander (DC) of the PHIMT. The DOC Deployment Manual will be utilized to complete DOC activation.
- Implement plans to obtain additional resources including supplies and volunteers through the TCHD DOC Logistics and Admin/Finance Sections.
- Based on the activation level of the DOC, the Operations Section may activate the Epidemiology and Surveillance Branch and recommend long term syndromic surveillance.
- Depending on hospital and healthcare provider needs, TCHD will be advised to begin chelator agent and decorporating agent distribution (not dispensing) to healthcare providers.

- The TCHD Logistics Section will notify key officials and emergency management of need for additional resources, if necessary.
- The Department Commander (DC) will evaluate the effectiveness of current operations and consider going to 24/7 operations as appropriate.
- In coordination with EPR, the TCHD Continuity of Operations Plan will be implemented by the Policy Group (EMT).
- The DOC would be activated to the level deemed most appropriate by the EPR Director/Department Commander and Policy Group designee at TCHD.
- All public health/medical agencies will monitor staffing needs and report routinely to their local EOC (if activated) and the DOC.
- All divisions will coordinate response related activities within TCHD through the PHIMT with approval from the Policy Group. The TCHD PHIMT will coordinate response with partner agencies and other public health agencies within the North Central Region (NCR).
- All divisions will document expenses of RND response and report/code as directed by the PHIMT Finance Section.
- The TCHD Finance Section will track the cost of all RND related response efforts within TCHD.
- The DOC Liaison Officer will initiate internal and external contacts to ensure that the human resources and logistics are in place to begin any distribution and administration of supplies and equipment if available, taking into account the need for added staff due to illness. The Liaison Officer will keep emergency coordination arrangements and chain of command for health systems fully functional.
- Maintain surge-capacity arrangements; prepare for imminent switch to mass surge working arrangements.
- Activate and continue to operate the DOC as appropriate, review the PHIMT Incident Action Plan (IAP) on an ongoing basis and revise objectives as appropriate.
- Implement mass messaging, information, and counter-information campaign according to priority status, according to plans and availability.

External Actions

- The PHIMT will initiate and maintain communication with local and state partners and stakeholders as directed by the IC.
- The IC will convene the PHIMT and meet with partners and stakeholders to review key components of the TCHD plans for response, as appropriate.
- The Policy Group (EMT) will notify key county government officials and the Board of Health of the need for additional monetary resources (if not already available).
- The TCHD Logistics Section will arrange for appropriate facilities use and additional staffing should any be required as part of the health and medical response.
- Key TCHD staff will coordinate with hospitals and healthcare facilities (ESF #8 and Liaison) to coordinate information sharing and data collection/surveillance (Operations Section).
- The TCHD PHIMT will interface with appropriate counterparts at the state and local level through existing communications channels and the TCHD DOC Liaison Officer.
- Provide support for decontamination centers in coordination with emergency management, as appropriate.
- The TCHD PHIMT will arrange for additional human and material resources and support requests for alternative means of healthcare delivery based on forecasted needs and plans.
- The TCHD PHIMT will coordinate with county coroners on corpse/fatality management procedures.
- The TCHD PHIMT will implement in full contingency plans for health systems and essential services at local levels where affected; monitor health system status; adjust triage system if necessary; deploy additional workforce and volunteers; ensure staff support; provide medical and non-medical support for ill people in

alternative (non-healthcare) facilities if needed; provide social/psychological support for health-care workers, victims and communities.

3.1.4 Communications and Outreach

TCHD Objectives

a. To communicate with the public regarding RND response progression.
b. To control inaccurate information provided by media sources by using counter-messaging.
c. To develop a system to rapidly share information among public health and stakeholders/partners.

Internal Actions

- The TCHD Public Information Officer (PIO) in coordination with the Crisis and Emergency Risk Communications (CERC) Team will identify target groups for delivery of key messages; develop appropriate materials, formats, and language options.
- The TCHD PHIMT will continue to monitor and ensure appropriate communication to all communities in the TCHD jurisdiction by incorporating best practices as outlined in existing TCHD plans and annexes, including detail found in the TCHD PHEOP Attachment VI: Vulnerable Populations.
- The TCHD Information Technology (IT) staff will review TCHD communications systems and facilities to make sure they are up to date and functioning optimally.
- The TCHD Operations and Planning Sections will coordinate closely with the CDPHE regarding health information and data sharing.
- The PHIMT Liaison Section will manage the activated TCHD Call Center.
- The TCHD PIO in coordination with CERC Team will redefine key message, set reasonable public expectations, emphasize need to comply with public health measures despite their limitations.
- The TCHD Planning Section will meet expected State information demands.
- TCHD EPR staff will audit outcomes of activities to refine current response and inform future RND planning.

External Actions

- The TCHD Liaison Officer will work with partners to ensure that consistent messages are being delivered.
- The TCHD Liaison Officer will continue to work with external stakeholders by receiving and relaying the most current information through their Liaison Officers and assistance with the CERC team.
- The TCHD DOC Liaison Officer in coordination with the Public Information Officer and subject matter experts will provide specific guidance to critical infrastructure personnel (i.e. energy providers, water treatment facilities, etc.) on how to protect staff.
- A TCHD representative will be stationed at or coordinate closely with the CDPHE Joint Information Center (JIC) to coordinate messages/communications if appropriate.
- TCHD will utilize the Vulnerable Populations Appendix to the TCHD Public Health Emergency Operations Plan (PHEOP) for outreach to special needs populations.
- The TCHD Public Information Officer will disseminate key information to public, partners, and the media on an ongoing basis in accordance with the TCHD Incident Action Plan (IAP) using traditional communications, social media and/or the health alert network.
- The PIO will continue to coordinate public information with the CDPHE JIC and other local health departments within the NCR and statewide.
- The TCHD CERC Team will continue to monitor media coverage and provide information to address misinformation.
- TCHD will acknowledge public anxiety, grief and distress associated with the incident.

3.2 Intermediate Phase

This phase of the response is assumed to have begun when the incident's radiation source has been brought under control and protective actions are being made based on measurements of the material.

TCHD Objectives

a. To assess damage to and repair critical TCHD infrastructure and determine the best way to reopen essential services.
b. To continue effective messaging and communication with the public regarding health, safety, and information that could reduce panic and anxiety.
c. To continue counter-messaging against false and erroneous information.
d. To support healthcare activity.
e. To provide pharmaceutical support if needed.
f. To provide responders with pertinent information in regards to radiation exposure, dose, and personal protective equipment (PPE).

Actions

- The TCHD PIO and CERC will continue providing joint messaging with state and federal entities to ensure relevant information regarding the incident is being disseminated.
- The TCHD PHIMT will conduct internal assessments with other response agencies to identify response gaps and strategies to bridge the identified gaps.
- The TCHD Logistics Section will respond to any request for pharmaceutical support to healthcare providers.
- The TCHD Logistics Section will respond to any request for staffing support.
- The TCHD Logistics Section will respond to any request from ESF #8 partners and TCHD staff for ordering and supplying personal protective equipment and dosimeters.
- The TCHD Liaison Officer, in coordination with Incident Command, will continue dialogue with key stakeholders to develop additional response and recovery plans.

3.2.1 Protective Health Measures

TCHD Objectives

a. To assess the need for additional staffing.
b. To assess the need for additional pharmaceutical supplies.
c. To assess the need for additional PPE.
d. To continue to provide guidance based on radiation measurements.

Actions

- The TCHD PHIMT will evaluate healthcare providers' needs for additional staffing.
- The TCHD PHIMT will evaluate pharmacy and SNS levels of chelating/blocking agents and decorporating agents.
- In coordination with CDPHE and key clinical subject matter experts, determine method to track patients in order to evaluate therapy efficacy and outcomes in patients suffering from acute radiation sickness (ARS).
- TCHD will consider asking FDA to provide temporary authorization of experimental drugs if current therapy is ineffective.
- The TCHD Safety Officer will evaluate the need for more PPE for ESF #8 partners and TCHD staff and coordinate type, amount, and drop off locations if necessary.
- The TCHD Operations and Planning Sections will monitor and update all information regarding radiation levels, isotope readings, changes in response zones, and relay information to appropriate audience.

3.2.2 Healthcare and Emergency Response

TCHD Objectives

a. To ensure that healthcare and public health capacity are used effectively and optimally.
b. To ensure integrated ESF #8 response in the TCHD jurisdiction.

Actions

- The TCHD Safety Officer will ensure that overworked staff has opportunities for rest and recuperation.
- The TCHD Logistics Section will restock medications and supplies; service and renew essential equipment as required and requested for the incident.
- TCHD EPR staff will review/revise plans as needed.
- The TCHD PHIMT support rebuilding of essential services.
  The TCHD Operations Section, Disease Control Branch, under the direction of the TCHD Department Commander, will coordinate with CDPHE, hospitals, response entities, and incident command on the exposure monitoring to include guidance and process development for direct and indirect, cumulative monitoring for those responding to the incident.

3.2.3 Communications and Outreach

TCHD Objectives

a. To rapidly share appropriate information among health authorities and other stakeholders.

Actions

- The PIO and the CERC Manager will evaluate communications response during previous phases; review lessons learned.
- The TCHD PIO will coordinate with appropriate partners to ensure appropriate communication is provided to the public after the RND incident to promote resiliency. This may include information regarding uncertainties associated with the incident.

3.3 Late Phase and Recovery

The late phase comprises of actions and steps that are geared towards recovery and cleaning up to help reduce environmental radiation levels to levels that are acceptable.

Planning and Coordination

- Provide accurate public messaging about the incident.
- Engage stakeholders in regards to remediation, mitigation, and community resiliency.
- Convene technical working groups to gain access to expert advice and assess alternative measures, costs, and community impacts.

Actions

- The TCHD PIO and CERC team will continue JIS/JIC messaging operations until the incident has formally come to a close.
- TCHD will reach out to all relevant and key stakeholders in order to build consensus and agreement on what steps should be taken in order to mitigate any future incidents and promote community resiliency.
- TCHD will participate in the recovery and mitigation planning and implementation efforts following an incident of this nature.

- TCHD's Environmental Health Division will work with key partners in order to make sure remediation is done correctly.
- The TCHD Policy Group and ICs will evaluate alternative remediation proposals, methods, costs, and other burdens to the community.
- The TCHD PIO and CERC team will communicate to the public safe levels of radiation and health risks posed even at acceptable doses.

APPENDIX A: RADIATION RESPONSE PHASES AND ZONES

RESPONSE PHASES:

It has been well established that the response to a RDD, NERDD, RED, and IND follow a very similar pattern and that the response can generically be broken down into 3 phases. These phases may be distinct or overlap.

Early Phase

This is the emergency phase which starts at the beginning of the incident (i.e. bomb detonation, confirmation that people are being exposed to radiation, etc.). In this phase quick decisions about effective protection must be made, but data may not be available. Considerations taken into account at this time may include: A) people's exposure to the radioactive plume (if present), B) people's short term exposure to deposited radioactive materials, and C) potential inhalation of radioactive material. The main objective of the early phase is effective initial emergency response actions to protect the public's health and welfare in the short-term. This can take a few hours to days. If an explosive RDD is used and there is no prior intelligence there may be no time to take any protective measures to reduce plume or fallout exposure. In the case of IND deployment there may only be time for early phase protective recommendations such as evacuation and shelter in place orders for areas that are miles from the blast epicenter. IND deployment is projected to lead to a high number of casualties, large scale devastation in and around the blast epicenter, restriction of communications, long delays in assistance, and far reaching fallout. In the case of IND deployment, self-guided protective actions such as evacuation (perpendicular from the plume movement) or sheltering in a protective area (large building, basement) for a day or longer is likely to be the best course of action for survivors.

Intermediate Phase

This phase of the response is assumed to have begun when the incident's radiation source has been brought under control and protective actions are being made based on measurements of the material. The activities associated with the intermediate phase may overlap with early phase activities and can last for days to months, or until protective actions are discontinued. Intermediate phase actions center on continuing and improving recovery actions made during the early phase, reopening critical infrastructure, and trying to return the population to a state of relative calm and normalcy. Generally, intermediate phase actions should consider the late phase actions and objectives. However, in emergency or critical situations, late phase actions do not need to be considered. The priorities of any phase of action should be to keep the population's health and well-being as the number one priority.

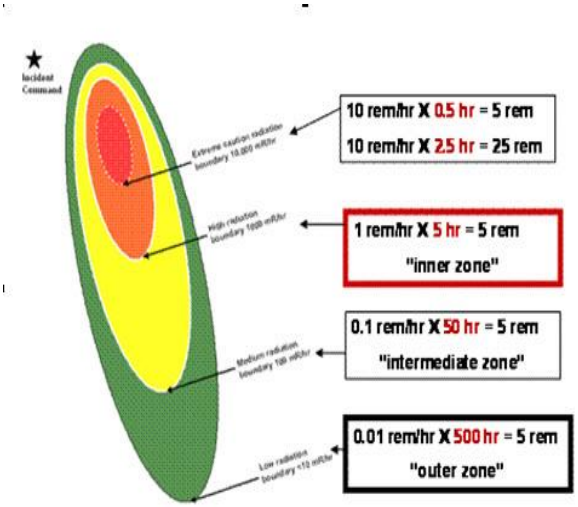
Late phase

The late phase comprises of actions and steps that are geared towards recovery and cleanup to help reduce environmental radiation levels to a level that is acceptable. The late phase of the response may end when all remediation activities have ceased and been completed. It is at this stage that stakeholders may be involved in providing cost effective and proper cleanup recommendations that keep the public safe as the priority.

RESPONSE ZONES:

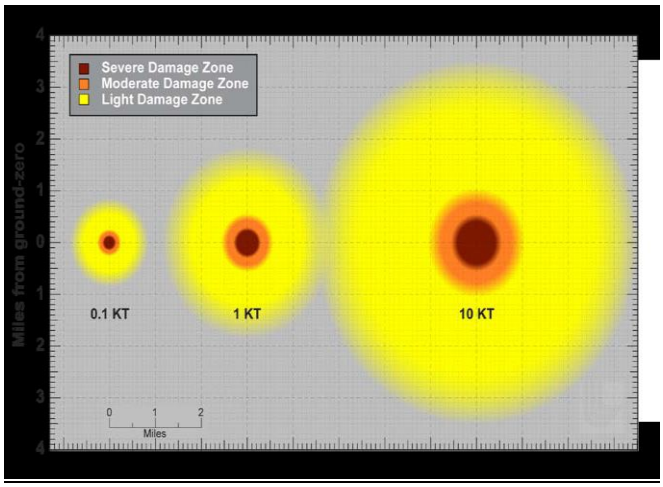
While response phases (Appendix A) are time dependent, response zones are distance dependent. Generically zones can be divided into three distinct areas: 1) inner zone or severe damage zone (both can also be referred to as the "hot zone"), 2) intermediate zone or moderate damage zone, and 3) outer zone or light damage zone.

RDD ZONES*:



*Represents a zone approach based on radiation readings.

IND ZONES:



Represents 0.1 KT, 1 KT, and 10 kiloton (KT) explosions estimates.

The main goal of using a zoned approach to a radiological nuclear disaster (RND) is to save lives and to minimize the amount of radiation that first responders and rescue teams are exposed to. Due to IND's and RDD's being very different; there are some operational differences that will arise when using the zone approach for response to either.

RDD Zone Approach:

The zone approach in an RDD situation is dependent on radiation measurements. This means that the zones will be set up to reflect how much radiation is present in a certain area (refer to RDD Zones picture provided above for an example). An example of determining radiation zones could be similar to the following.

The inner zone extends from the epicenter of the RDD blast to the inner boundary of the intermediate zone. In the inner zone the radiation levels will be 1000 mrem/hr or more (see Appendix E for unit information and conversion chart).

The intermediate zone extends from the outer boundary of the inner zone to the inner boundary of the outer zone. In the intermediate zone radiation levels will be from 100 – 999 mR/hr.

The outer zone extends from the outer boundary of the intermediate zone to the outer boundary of the outer zone. The outer zone radiation dose rates will range from 10 – 99 mrem/hr.

This represents just an example of how the zones can be set up and any guidance as to which radiation levels should be used in order to determine zones should be obtained from OSHA, NIOSH, EPA, and DOE protocols taking into account the type of PPE response units have access to. While most responders should be kept out of the inner zone, there will be an exception made for life saving activity of short duration. In cases like this, the responders must be made aware of ALL consequences they face by voluntarily entering a high radiation zone and no one can be forced to enter without prior written consent.

IND Zone Approach:

The IND zone approach is based on a combination of radiation measurements, physical damage, and projected plume/fallout direction.

The severe damage zone (SDZ) is represented by massive widespread destruction such as completely destroyed buildings, high piles of indistinguishable rubble, and extreme radiation levels. Unlike the RDD response, initially in the response to an IND attack NO ONE IS ALLOWED TO ENTER THE SD ZONE FOR ANY REASON. The chance of finding survivors in the SDZ is minimal and the danger to response personnel should be considered prohibitive for at least 48 hours (depending on device size, radioactive material isotope, and weather conditions). Only after the radiation levels have fallen to acceptable levels may search and rescue operations commence.

The moderate damage zone (MDZ) can be recognized and distinguished from the SDZ via damage assessments on the ground. Unlike the SDZ, the MDZ is characterized by significant (not total) destruction of infrastructure, overturned vehicles, and fires. In the MDZ, the bigger and sturdier buildings may be intact whereas the smaller and less reinforced buildings will be unstable or already collapsed. Within the MDZ, responders should expect to find rubble that will make search and rescue very difficult or impossible in some instances. When in the MDZ, the greatest risk to survivors and responders will be fires and water pressure will be of concern if the infrastructure is

damaged. The MDZ is also characterized by having the highest number of survivable victims. While responders will concentrate most of their operations in the MDZ, there are certain considerations that need to be taken. Responders will be exposed to a myriad of hazards that include: 1) elevated radiation levels, 2) unstable infrastructure, 3) downed power lines, 4) ruptured gas lines, 5) hazardous chemicals and particulate matter (PM) released by violent destruction of buildings, and 6) sharp metallic objects and glass. Responders entering the MDZ must have either a person with radiation monitoring equipment with them or personal dosimeters, but a combination of both would be most effective. ANY MISSION INTO A RADIOACTIVE ZONE MUST HAVE A BENEFIT THAT OUTWIEGHS THE TOTAL COMBINED RISKS TO THE RESPONDERS.

The light damage zone (LDZ) will have damage that is associated with that of a large shockwave, not unlike a sonic boom, only much more magnified. Most injuries and damage will be the result of blown out windows and flying glass. Most of the LDZ will be non-radioactive; however, responders should be alert to radiation levels as they may rise due to fallout.

FALLOUT:

Fallout is when radioactive particles that have been dispersed via explosion come back down to the ground surfaces. Most of the time fallout looks like sand or powder coming down from the sky. Fallout is usually composed of debris, fission products, and radiated soil (if the explosion took place at ground level). Larger pieces of debris will fall near the epicenter of the blast, but as the particles of debris become smaller, they will deposit further from the blast site. Fallout can be subcategorized as early fallout (deposits within 24 hours) and delayed fallout (deposits from days to years later).

Fallout will be best gauged by weather patterns (proceeding, during, and after the blast) and the size of the blast. Most RDD's are projected to create very little, if any, fallout due to the relative weak explosions created by such weapons. They probably will not have the capacity to thrust radioactive material high enough into the atmosphere or far enough in a linear fashion to cause widespread radioactive contamination. An IND is on the opposite side of the spectrum in regards to fallout. There will most definitely be widespread fallout that will deposit miles from the blast site. While weather patterns do help with predicting the area most at risk for being contaminated with fallout, radiation levels and the amount that is actually deposited is comprised of a number of variables and harder to predict. Wind speed, the type of nuclear device used, the height of the blast, and the ground conditions at the blast site are all considerations that need to be taken into account when trying to predict where the fallout might travel.

In the case of an IND there will be a dangerous fallout zone (DF zone). In this zone, the level of radiation due to fallout will be enough to cause acute radiation syndrome (ARS) and MUST BE AVOIDED AT ALL TIMES. The DF zone will travel longitudinally along the path of any prevailing wind patterns and can extend far beyond the MDZ and LDZ. The best action in regards to people who will be in the path of the DF zone is to communicate the relevant protective actions.

The fallout produced by an IND contains 60% of the nuclear radiation produced by the weapon.

APPENDIX B: SUPPLEMENTAL DOCUMENTATION

1. *FEMA: Improvised Nuclear Device Response and Recovery Communicating in the Immediate Aftermath*
2. *OSHA: Best Practices for Protecting EMS Responders*
3. *IAEA: Manual for First Responders to a Radiological Emergency*
4. *National Security Staff Interagency Policy Coordination Subcommittee for Preparedness & Response to Radiological and Nuclear Threats: Planning Guidance for Response to a Nuclear Detonation*
5. *NIOSH: Guidance on Emergency Responder Personal Protective Equipment (PPE) for Response to CBRN Terrorism Incidents*
6. *The Medical Aspects of Radiation Incidents (pdf available from the Radiation Emergency Assistance Center/Training Site at Oak Ridge Institute for Science and Education*

APPENDIX C: PERSONAL PROTECTIVE EQUIPMENT (PPE) GUIDANCE

There are four levels of PPE protection as classified by OSHA and the EPA. The classifications are broken down into levels A-D with A being the most protective and D being the least protective.

IMPORTANT: In all cases where radioactive contamination is suspected, first receivers (those receiving the patients from first responders) should also wear personal radiation dosimeter to monitor their radiation absorbed dose.

Table 1. General PPE Overview*

Classification	Level A	Level B	Level C	Level D
Protection Provided	Highest level of skin, eye, and respiratory protection	Highest level of respiratory protection maintained, but lower level of skin protection.	Lower level of both skin and respiratory protection. It is adequate for radiation event response where other hazards have been determined not to be present.	Lowest level of skin and respiratory protection.
Use Indications	Identified or suspected hazards requiring maximal skin, eye, and respiratory protection. Working in confined spaces where hazards have not yet been identified fully.	Identified or suspected hazards requiring maximal respiratory protection. Working in atmospheric conditions containing less than 19.5% oxygen. When a lower level of skin hazard is present.	Hazards clearly identified. Hazards will not be absorbed by or adversely react with exposed skin. All criteria for using an air purifying respirator are met (concentrations of all airborne contaminants are known, appropriate filters are available, oxygen levels are sufficient).	Atmosphere contains no contamination. No or very low potential for unexpected respiratory or skin contact with environmental hazards.
Who will wear this	First responders. When there is	First responders. When entering the	First responders and first receivers.	First receivers. When working in

	definite or suspected risk of biological, liquid or vapor chemical hazard exposure.	most heavily contaminated radiation zones to rescue victims or protect valuable property necessary for public welfare.	When caring for patients/victims likely to be contaminated with radiological material.	post-decontamination areas should wear standard PPE for infection control purposes.

*This table is a reproduction of the Radiation Emergency Medical Management. *http://www.remm.nlm.gov/radiation_ppe.htm*.

Standard precaution PPE and procedures used to prevent transmission of infections within healthcare settings will provide adequate protection against low levels of radiological contamination that may be found in post-decontamination areas of the hospital such as the emergency room or operating room.

The National Fire Protection Association (NFPA) PPE classification system is also used widely in the United States and follows the same four level approach of the OSHA/EPA system. It is labeled from level 1-4 with level 1 being the most protective and level 4 being the least.

The following table (Table 3) outlines the Department of Health and Human Services' Radiation Emergency Medical Management protocol for appropriate PPE practices for first responders.

Table 2. PPE for FIRST RESPONDERS*:

Emergency Type	**Recommended PPE**
Radiation plus chemical and/or biological hazard: "combined hazard" event	**BEFORE** combined hazard(s) are well characterized: First responders should be instructed to wear PPE ensembles that protect against *ANTICIPATED* (anticipation should be made for multiple) hazards. **AFTER** combined hazards are confirmed: First responders should be instructed to wear PPE in accordance to what will protect them from *IDENTIFIED* hazards.
Radiation only event with high risk of contamination (and non-radiation hazards have been excluded): RDD, NERDD	Level C PPE will provide sufficient respiratory and dermal protection.
Radiation only event with high risk of exposure (and non-radiation have been excluded): RED	**PPE confers no protection against ionizing radiation.** Factors that will help decrease radiation dose from exposure:

	1-minimizing time near radiation source. 2-maximizing distance from radiation source. 3-increase the physical shielding between a person and radiation source.

*This table is a reproduction of the Radiation Emergency Medical Management. *http://www.remm.nlm.gov/radiation_ppe.htm*.

The following table presents the Department of Health and Human Services' Radiation Emergency Medical Management protocol as appropriate PPE practices for first receivers.

Table 3. PPE for FIRST RECEIVERS*:

Emergency Type	Response Role	Recommended PPE	Notes, Caveats, Concerns
Radiation plus chemical and/or biological hazard: "combined hazard" event.	First receivers delivering care to contaminated victims.	**Before incident hazard(s) are identified:** first receivers should be instructed to wear PPE ensembles that protect against **anticipated** hazards. First receivers may need to wear a higher level of PPE than usual until hazard identification is complete. **After combined hazards are confirmed:** first receivers should be instructed to wear PPE ensembles that protect against **identified** hazards.	Higher level PPE ensembles are generally not available in most hospitals.
Radiation only event with high risk of contamination (and non-radiation hazards have been excluded): RDD, NERDD	First receivers delivering care to victims **more likely** to be externally contaminated: i.e. healthcare providers working in **pre-decontamination (triage) and decontamination**	Level C PPE usually provides sufficient level of respiratory and skin protection. Level C PPE should be worn until risk identification determines	Recommended respiratory PPE includes a full face piece air purifying respirator with a P-100 or High Efficiency Particulate Air (HEPA) filter. Other respiratory

	areas.	that Level D PPE provides sufficient protection.	protective equipment (i.e. N-95, simple facemask), non-fit tested respirators or ad hoc respiratory protection do not deliver appropriate or sufficient respiratory protection; environmental testing and hazard assessment by a safety professional can help identify hazards and risk levels and direct choices of permissible PPE. Lead aprons do not protect against exposure from high energy ionizing radiation.
Radiation only event with high risk of contamination (and non-radiation hazards have been excluded): RDD, NERDD	First receivers delivering care to victims **less likely to be externally contaminated:** i.e. health care providers working in **post-decontamination areas of the hospital.**	Level D PPE provides sufficient respiratory and skin protection for first receivers working in post decontamination areas of the hospital; this includes those delivering care to persons who may not yet be decontaminated (i.e. patients who self-refer or who arrive by transport with life- and limb-threating injuries). Level D PPE also protects skin and personal clothing against possible splashes of contaminated blood and body fluids (urine, feces, wound drainage, etc.). Level D PPE is equivalent to Standard Precautions	Do not delay stabilization of any patient to first perform decontamination. Perform life- and limb-saving tasks before managing radiation problems.

		PPE worn in medical facilities as protection against transmission of biohazards from patients to providers.	
Radiation only event with high risk of contamination (and non-radiation hazards have been excluded): RDD, NERDD	First receivers delivering care to victims with **suspected or confirmed internal contamination:** i.e. healthcare providers working in **post-decontamination areas of the hospital.**	Level D PPE also protects skin and personal clothing against possible contamination from blood and body fluids (urine, feces, wound drainage, etc.). Level D PPE is equivalent to Standard Precautions PPE worn in medical facilities as protection against transmission of biohazards from patients to providers.	Hospital radiation safety officer or health physicist will routinely monitor work areas and patient blood and body fluids for radioactive contamination or elevated radiation levels.
Radiation only event with high risk of exposure (and non-radiation hazards have been excluded): RED	First receivers delivering care to victims in all areas of the hospital.	Level D (Standard Precautions) PPE should be used by healthcare workers when caring for victims of radiation exposure.	Patients exposed to radiation but not contaminated with radioactive material pose no threat of exposure to healthcare providers.

*This table is a reproduction of the Radiation Emergency Medical Management. *http://www.remm.nlm.gov/radiation_ppe.htm*.

APPENDIX D: MEASUREMENTS, ABBREVIATIONS, AND CONVERSIONS

The most useful prefixes include:

Prefix	As an exponent	As a decimal	Abbreviation	Example
nano	10^{-9}	0.000000001	n	nm = nanometer
micro	10^{-6}	0.000001	µ	µCi = microcurie
milli	10^{-3}	0.001	m	mrem = millirem
centi	10^{-2}	0.01	c	cm = centimeter
kilo	10^{3}	1000	k	kg = kilogram
mega	10^{6}	1,000,000	M	MBq = megaBequerel
giga	10^{9}	1,000,000,000	G	GHz = Gigahertz

Units of Radioactive Materials Quantities

1 Curie (Ci) = 3.7×10^{10} disintegrations per second = 3.7×10^{10} Bq

1 Becquerel (Bq) = 1 disintegration per second = 2.7×10^{-10} Ci

For example, a typical patient receiving a nuclear medicine scan is administered approximately 20 mCi (740 MBq) and an industrial radiography source may contain 200 Ci (7400 GBq).

Units of Radiation Dose

Radiation dose is defined in terms of energy deposited. For the purposes of this document, we will assume that doses are due to external sources of beta or gamma radiation.

1 rad = 1 erg/g = 1 rem = 0.01 Gray (Gy) = 1 cGy

1 Gray (Gy) = 1 Sievert (Sv) = 100 rad = 100 rem

For example, the average annual radiation dose due to natural background radiation in Colorado is approximately 450 mrem (4.5 mSv).

Many instruments measure in terms of exposure in Roentgens (R). 1 Roentgen (R) is approximately equal to 1 rad.

1 Roentgen = 0.000258 Coulomb per kilogram (C/kg).

APPENDIX E: COMMUNITY INCLUSION PLANNING CMIST MATRIX

Functions	Considerations
Communication	

Use Social Media	• Post pertinent information on:
	  ○ Facebook
	  ○ Twitter
	  ○ Other appropriate platforms
	• Post in languages other than English
	• Post using easy to understand graphics
	• Consider low vision web applications

Use Other Media/Outlets	Message appropriately using: • T.V. • Radio • Flyers • Newspapers • Web based media • Consider specific population media sources • Community navigator
Signs	• Large print signs • Languages other than English • Easy to understand graphics • Braille signs • Sign language
Alerts	• Voice messaging • Visual alerts • Sound alerts • Graphic alerts • Alerts in other languages
Directions	Give directions using: • Writing • Spoken instructions • Graphics • Interpreter services and Language lines

	Screening forms: • All forms at POD in language other than English available
Maintaining Health **Independence** **Safety and Self Determination** **Transportation**	N/A

APPENDIX F: ACRONYMS

AFRAT – Air Force Radiation Assessment Team

AMS – Aerial Measuring System

ARS – Acute Radiation Syndrome

CBRN – Chemical, Biological, Radiation, Nuclear

CEDRS – Colorado Electronic Disease Reporting System

CERC – Crisis and Emergency Risk Communications

CDHSEM – Colorado Division of Homeland Security and Emergency Management

CDPHE – Colorado Department of Public Health and Environment

C-MIST – Communication, Maintaining health, Independence, Safety support services and self-determination, Transportation

DC – Department Commander

DOC – Department Operations Center

DoD – Department of Defense

DOE – Department of Energy

DOJ – Department of Justice

EMT – Executive Management Team

EOC – Emergency Operations Center

EPA – Environmental Protection Agency

ERDD – Explosive RDD

ESF – Emergency Support Function

FBI – Federal Bureau of Investigations

FDA – Food and Drug Administration

FEMA – Federal Emergency Management Agency

GEEERC – Governor's Expert Emergency Epidemic Response Committee

HHS – Health and Human Services

IAP – Incident Action Plan

IND – Improvised Nuclear Device

JIS/JIC – Joint Information System/Joint Information Center

MACC – Multi-agency Coordination Center

MRC – Medical Reserve Corps

NARAC – National Atmospheric Release Advisory Center

NERDD – Non-explosive RDD

NIOSH – National Institute for Occupational Safety and Health

NORM – Naturally Occurring Radioactive Materials

NNSA – National Nuclear Security Administration

NRC – Nuclear Regulatory Commission

OSHA – Occupational Safety and Health Administration

PAG – Protective Action Guideline

PHEOP – Public Health Emergency Operations Plan

PHIMT – Public Health Incident Management Team

PIO – Public Information Officer

POD – Points of Dispensing

PPE – Personal Protective Equipment

TCHD – Tri-County Health Department

RAMT – Radiological Advisory Medical Team

RAP – Radiological Assistance Program

REAC/TS - Radiation Emergency Assistance Center/Training Site

RED – Radiological Exposure Device

RDD – Radiological Dispersal Device

RND – Radiation Nuclear Disaster

RRVC – Response Volunteer MRC

SEOC – State Emergency Operations Center

SNS – Strategic National Stockpile