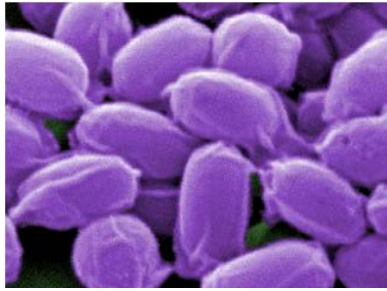


Guidelines for Responder Safety in Public Health Emergencies: A Framework for the Pennsylvania Department of Health



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Introduction

This guidance provides a framework for responder safety during public health emergencies. The framework is geared for workers who will work in public health-related field situations during disasters and emergencies. The framework adapts published guidance from the Centers for Disease Control and Prevention (CDC), the Occupational Safety and Health Administration (OSHA), and professional organizations with expertise in health care worker safety, including the Association for Professionals in Infection Control and Epidemiology (APIC), to provide public health agency staff with recommendations for their own safety during emergencies and disasters.

This guide is organized into four major sections. The first section outlines general safety practices for all individuals engaged in public health practice who may be asked to participate in response efforts during public health emergencies. These practices include receiving important immunizations, screening for infectious diseases and addressing workforce support issues like psychological health. The second section describes basic safety practices in specific public health field situations during emergencies: points of dispensing (POD) or medication centers that distribute pills or vaccines during an emergency; mass care shelters; field visits to homes and places of work for the purposes of disease investigation, control measure implementation, and related activities; and community reception centers for population monitoring after a radiation release. Many of these field settings do not offer the types of engineering controls that are often available in a health care setting to limit exposure to hazardous substances or infectious agents. However, a number of appropriate measures can make a significant difference in the protection of public health agency responders, such as the use of administrative protocols, personal protective equipment (PPE), and other workplace safety practices.

The third section describes critical components of protection against hazardous materials, including biological and chemical agents. The public health role in the field response to these events is generally limited, and the training and resource investment to ensure responder safety in the form of PPE is substantial. These sections are provided so that public health agencies can make well-informed decisions about the appropriateness of their participation and how best to ensure the safety of their staff. Finally, the fourth section addresses the need for monitoring and long-term follow-up of individuals who are involved in the response to emergencies and disasters. This section provides recommendations for pre- and post-event data collection and monitoring and identifies resources to support those efforts.

Public health agencies have expertise in population health, community health assessment and epidemiological investigation, data collection, disease control interventions, and risk communication that are critical elements of a community's capacity to respond to and recover from disasters. In some scenarios, public health agency staff may direct response efforts; in others, they will support a multi-agency public safety response. This framework is intended to guide their safe deployment in any public health emergency that requires their unique and valuable skill set.

General Preparedness for Public Health Professionals

There are several components to general, pre-event preparedness for individuals who may be asked to serve in a public health agency response to an incident or disaster. Many of these practices are adapted from occupational recommendations for health care professionals, given the similarity in potential exposures and risks of workplace hazards.

Immunizations

Because public health responders may be called upon to work in a community-wide incident related to an infectious disease outbreak, they are at risk for infectious diseases that may be transmitted via the respiratory or airborne route or via blood or body fluid secretions if they are involved in phlebotomy or in direct contact with individuals who may be contagious. Public health agency staff should consider receiving all of the vaccines that are currently recommended for health care workers. For some public health professionals, these immunizations are already required because they work in health care or in other settings with direct patient contact. Importantly, these vaccines will protect most workers from infectious diseases in the workplace during their day-to-day responsibilities. They are all also recommended for most adults, 19 years or older. The following vaccines are recommended:

- Hepatitis A vaccine: two doses, separated by at least 6 months
- Hepatitis B vaccine: three doses, at birth, 2 and 6 months
- Tetanus, diphtheria, acellular pertussis vaccine (Tdap): one booster dose as an adult
- Measles, mumps and rubella vaccine (MMR): two doses
- Varicella vaccine: if no history of immunity (prior disease)
- Influenza vaccine: annually, usually in fall season

In addition, public health response workers should be offered prophylaxis or vaccination during an incident. Some deployments of public health staff may also require very specialized vaccines depending on the response, such as pneumococcal vaccine, anthrax vaccine, and smallpox vaccine. All vaccination information should be maintained in secure employee health records along with other health information that might be relevant to an emergency response. Workers that already have immunity to hepatitis A and B, varicella, measles, mumps, and rubella, do not require additional vaccination. The immunity status of all workers should be a part of secure health records.

Workforce Support

Public health agencies should plan for two major aspects of workforce support during public health emergencies: psychological support and family support. Psychological support during times of public health crisis is an extremely important measure to protect the health of responding workers. Public health agencies should be sure that their staff has access to mental health services through employee or other occupational health services, including Critical Incident Stress Management, Employee Assistance Programs, or a similar program. Staff assigned to work in teams or partnerships may find psychological and social support in those workplace bonds that help them during the response to public health emergencies. In addition, public health agencies should consider the safety of staff deployed to field situations that involve home visitations or visits to other community settings. Staff should have access to mobile communication devices and may consider working in teams of at least two.

In addition to psychological support, public health agencies who anticipate a major role in the response to disasters should ensure that their staff have adequate plans for child care and other family support. The response to emergencies and disasters may require long working hours and time spent away from family and friends. Public health agencies should encourage staff and volunteers to develop personal preparedness plans that take into account child care and other family care needs, including pet care. In some situations, public health agencies should consider developing proactive workplace solutions to these needs if workers are unable to develop their own plans to prevent absenteeism.

General Training in Workplace Hazards and Principles of Infection Prevention

In general, public health agency staff who will be required to work in out-of-office field settings should receive basic training in elements of infection prevention, including an overview of the possible or likely hazards to which they may be exposed in a public health emergency setting. This training should review the basic types of controls or precautionary measures related to the prevention of infections in the workplace, including hand hygiene, respiratory or cough etiquette, Standard Precautions, Droplet Precautions, Contact and Airborne precautions, as well as the PPE necessary to comply with these precautions. Staff should be familiar with the general components of these precautions, including when and why they are used. Additional information about these measures is provided in the Appendices to this framework. Plans should be in place for both pre-event and 'just-in-time' training at the beginning of an incident response.

Public health agencies should make sure that sufficient supplies of equipment are on hand, including surgical and N95 masks, hand sanitizer, gloves, and, if needed, gowns and face shields. In addition, some workplace exposures to infectious disease may require a period of post-exposure monitoring and even home quarantine or exclusion (furlough) from the health care workplace. These exposures may occur despite the best efforts to control or mitigate them, and in the setting of emerging infectious diseases, may not be recognized until after an exposure has occurred. Public health agency planners should incorporate post-exposure monitoring of staff into their response plans and training for responders should address known risks. Additional information about the Agency for Toxic Substances and Diseases Registry (ATSDR) Response Registry, and the Emergency Responder Health Monitoring and Surveillance System, developed by the National Institute for Occupational Safety and Health (NIOSH), is provided in this guidance.

Responder Safety in Common Public Health Field Settings

Public health staff may be required to work in a number of different field situations during disasters, depending on the nature of the incident and the type of response or intervention that is appropriate. This section will describe the protective measures appropriate for workers in four situations that are likely to be needed in public health emergencies or disasters:

- The POD or emergency medication center
- Mass care shelters and local shelters

- The public health field visit to a residence, place of work or other community setting for the purposes of investigation, treatment, monitoring, or specimen collection
- The community reception center (CRC) for population monitoring after a radiation emergency

Public health responders and planners will have to work closely with subject matter experts during actual incidents to identify the unique risks posed by the hazard and implement appropriate controls in field situations and other worksites. Most field settings will lack engineering controls to limit employee exposures to hazards, but both administrative measures and PPE can be used for protection. In general, the principles of infection prevention and control in Standard Precautions and Transmission-Based Precautions for health care settings can be adapted for use by public health staff in field situations. These are summarized in the table below:

Type of Precaution	Protective Measures
Standard Precautions	Hand hygiene, respiratory etiquette; gloves, gowns, face shield based on anticipated exposures (used for all exposures to blood/body fluids)
Contact Precautions	Gowns, gloves for interaction with patient and their environment; patient cohorting or single room (used for protection against organisms on skin surfaces or shed in feces such as methicillin-resistant <i>Staphylococcus aureus</i> (MRSA), norovirus, <i>Clostridium difficile</i>)
Droplet Precautions	Surgical mask for public health worker and source patient, patient cohorting or single room (used for protection against infections transmitted via respiratory droplets >5 microns (μm), such as plague, seasonal influenza, mumps)
Airborne Precautions	N-95 respirator, airborne isolation room if available (used for infectious diseases transmitted via airborne droplets ≤ 5 microns (μm) in size such as tuberculosis, SARS-associated coronavirus, measles; N95 respirators or higher may be needed for exposure to individuals contaminated with radiation)

Detailed information about each type of precaution and the protective equipment needed for compliance is included in Appendix 1. Appendix 3 contains a summary table with pathogen-specific control and precaution recommendations.

In addition to the measures outlined in this document, public health field operations that use the Incident Command System to manage and organize staff should ensure that the safety officer position is filled and charged with oversight of worker safety during active operations. This individual should ensure that protective measures during public health emergency response operations are tailored to specific jobs and to specific workers, as appropriate.

The Point of Dispensing

PODs are an important component of the public health response to mass casualty events involving biological agents. They are venues to provide mass prophylaxis (vaccination or medication distribution) to an exposed, but generally asymptomatic population.

The major workplace hazards for public health responders and volunteers who work in PODs reflect the specific infectious disease incident or threat for which the POD is activated. While ill individuals will likely be directed to other health care facilities outside the POD, it is possible that symptomatic persons may present to the POD and depending on the scenario, pose a threat to worker safety. In non-contagious disease scenarios (e.g., anthrax), there is unlikely to be a need for staff to don respiratory protection.

Administrative Measures

1. Screen individuals presenting to the POD for symptoms, especially in the setting of a contagious disease. These individuals should be triaged to another location or to a separate section of the POD where they can be isolated.
2. The POD should have signage that assists the public with symptom self-recognition, and public information should stress the recognition of symptoms and assist with directing individuals to health care facilities outside of PODs.
3. POD staff should work in shift rotations, with the number of hours per work shifts varying by activity. Rotations should be adjusted to provide relief to workers who may need to maintain POD operations over an extended period.

Standard and Transmission-Based Precautions, Respiratory Etiquette

1. Staff should observe Standard Precautions:
 - a. Blood and body fluids are considered to be potentially infectious; gloves should be worn by any staff that may have contact with blood or body fluids.
 - b. Respiratory etiquette should be implemented, with surgical/procedure masks provided to coughing or sneezing visitors.
 - c. Staff should don surgical/procedure masks when in proximity to coughing/sneezing visitors.
 - d. Encourage cough etiquette – use of facial tissue when coughing or sneezing into crook of elbow or sleeve if tissues not available and surgical masks in limited supply.
 - e. Have facial tissues readily available throughout POD for worker and visitor use.
 - f. Offer visitors (and staff) bandages or other supplies to cover visible wounds or lesions.
2. Hand hygiene:
 - a. Encourage hand hygiene, particularly after coughing and sneezing.
 - b. Alcohol-based hand sanitizer and hand rubs are optimal for hand hygiene in PODs when hands are not visibly soiled, given probable limited access to running water in operational areas.
 - c. When hands are visibly soiled, handwashing with soap and water is preferred.
3. Transmission-based precautions (e.g., contact, droplet, airborne precautions):
 - a. In a POD activation for contagious diseases that are spread via airborne transmission, POD staff who have contact with potentially contagious individuals (e.g., greeters, medical screening staff, etc.) may require the use of N95 respirators instead of surgical/procedure masks.

Environmental Cleaning

1. During outbreaks of diseases that are spread through direct contact and indirect contact, ‘high-touch’ surfaces or items (e.g., tables, door knobs, utensils, medical equipment) should be cleaned frequently. Ideally, these surfaces will be cleaned at least every 8 hours with an Environmental Protection Agency (EPA)-registered disinfectant or a 0.5% bleach solution.
2. Waste management (regular and medical) should conform to state regulations.

Communication and Training

1. Public information should describe symptoms of the disease, with clear instructions for directing ill persons to non-POD locations for health care.
2. The POD should have signage that reinforces this information and indicates that ill persons should not enter. Signage should be translated into the area’s top languages.
3. POD workers should receive pre-event and “just-in-time” training that provides important information about the disease or disaster, addresses the infection risks, recognition of ill individuals, specific infection prevention measures such as standard precautions, hand hygiene and respiratory etiquette, social distancing measures if appropriate (e.g., 3 feet between people if disease transmitted via respirator droplets) and use of PPE including how to don and remove respirators and face masks.

Mass Care Services and Shelters

Mass care shelters may be set up on a temporary basis during disasters and emergencies that require large-scale evacuations. The public health role in shelters varies based on jurisdictional planning, but generally entails the provision of on-site health and medical services. These clinical services may be provided by public health agency staff or volunteers from organizations like the American Red Cross or local Medical Reserve Corps. Public health agencies must also implement communicable disease surveillance to identify infectious or contagious diseases that occur among shelter residents and prevent their spread within a closed, potentially high-risk setting. In some cases, particularly when outbreaks of disease occur within shelters, large-scale vaccination or medication distribution may also be required.

In general, residents of shelters may have chronic medical conditions, but are not likely to have acute, contagious diseases. However, respiratory viruses like influenza and gastrointestinal infections like norovirus can spread rapidly and may be introduced into shelter situations by individuals with mild or subclinical symptoms. Public health responders will have an important role in the control of these and other infections when they occur.

Administrative Measures

1. Surveillance: Public health agency staff and volunteers should ensure that shelter residents and visitors are screened for symptoms of contagious disease on arrival and periodically for as long as the shelter is in operation. These symptoms include fever, acute respiratory symptoms (e.g., cough, runny nose, sore throat, eye discharge), acute gastrointestinal symptoms (e.g., nausea, vomiting, diarrhea, fever, jaundice) and an acute or new rash or wound.
2. During an outbreak of disease in a shelter, or community-wide outbreak of a disease that may affect individuals who seek shelter, signage with information regarding symptoms of concern

should be posted so that individuals can self-identify and self-refer for public health/medical attention.

3. If individuals with potentially contagious diseases are identified they should be referred to a health care facility. If they cannot leave the shelter, staff should consider creating separate living areas, with dedicated bathing and toileting facilities (isolation areas) for those individuals.
4. Assign dedicated shelter staff (both health and non-health) to care for and provide services for these ill individuals.

Hand Hygiene and Standard Precautions

1. Hand hygiene should be practiced in all shelters and alcohol-based hand rubs should be readily available to both staff and residents. Staff should wash hands with soap and water when they are visibly soiled. (Note: alcohol-based hand sanitizer may need to be monitored in public situations to prevent theft.)
2. Residents should be encouraged to practice hand hygiene before eating, after using the toilet, and as part of cough and respiratory etiquette.
3. Public health staff (and public health/health care volunteers working in health-related roles) should practice hand hygiene before and after contact with wounds, after removing gloves or eye protection, before and after donning respirators or masks, and after cleaning up spills of body fluids, vomit, or contaminated environmental surfaces.
4. Public health staff should use Standard Precautions when any contact with blood, body fluid, non-intact skin, or mucous membranes is anticipated.

Personal Protective Equipment

1. In general, public health agency staff should have little use for PPE in shelter situations, with the following exceptions:
 - a. Staff should wear gloves for any contact with blood, body fluids, non-intact skin, or mucous membranes.
 - b. Gloves should be changed to prevent cross-contamination of body sites (such as after examining a wound and before examining another body part) and between contact with each individual patient in the health care/first-aid area of shelter.
 - c. Isolation or procedure gowns (disposable if possible) should be worn if splashing or spraying clothing or body with blood or body fluids is anticipated.
 - d. Gowns should be donned and removed correctly, immediately outside the triage/clinical/isolation area (whichever is appropriate) and not worn throughout the shelter (See Appendix 2).
 - e. Public health staff who are working in isolation areas or clinical areas should wear surgical/procedure masks when they have contact with individuals who have symptoms of respiratory infections. Staff should don N95 respirators if they are providing care to individuals who may have contagious infections requiring “airborne” isolation precautions (e.g., measles, tuberculosis, varicella). Note: Individuals suspected of contagious respiratory illness should be referred to a health

care facility and/or confined to a designated 'isolation' area of the shelter, away from other residents.

- f. Staff should perform hand hygiene before and after donning and removing masks and take care to avoid contamination by not touching the surface of the mask.
- g. Shelter residents with respiratory symptoms suspected to be due to contagious respiratory infections should be asked to wear surgical masks if they remain in the shelter and need to leave a designated isolation area (assuming one has been established).

The management of an infectious disease outbreak in a temporary shelter situation will require additional measures for disease control and the protection of staff and residents that may include additional screening, cohorting of staff and residents, extensive environmental cleaning, and possibly administration of medical countermeasures such as vaccines or medications. These additional measures will be formulated as needed, in consultation with public health epidemiologists and disease control specialists.

The Public Health Field Investigation

Public health field investigations may take place in a variety of health care and non-health care settings. The purpose of the investigation can be to interview cases and collect information about disease symptoms, potential exposures, or risk factors; identify contacts to cases and other exposed persons; and collect clinical (biological) specimens such as blood, urine, or sputum. This section provides general guidance for infection control in home visit situations. They are adapted from infection control guidelines for home health care.

Personal Protective Equipment

1. Staff should be prepared to don PPE based on the transmission risks associated with the disaster or disease in question. Specifically, Standard Precautions should always be observed when any contact with blood or body fluids is anticipated (e.g., gloves, hand hygiene; disposable gown or lab coat if clothing needs to be protected; eye shield if splashes possible). Gowns may be considered in the investigation of diseases or infections requiring either contact or droplet precautions.
2. Staff should be instructed in use of surgical/procedure masks and also trained and fit-tested in the use of particulate (N95 or higher) respirators. The specifics of the disease under investigation will determine the selection of mask or respirator worn by the public health field worker.
3. Assure hand hygiene materials are accessible, including alcohol-based rubs, soap, and paper towels so that responders can wash or sanitize hands after removing equipment (including gloves, masks, and respirators).
4. Ask individuals with active respiratory symptoms who are in the home to wear a surgical mask (or particulate respirator) while staff are present.

Specimen Collection

1. If possible, ask patients to produce expectorated sputum when staff are outside the home, or ask patient to step outside to produce specimen, if the patient is known to have or suspected to have an airborne or droplet-mediated respiratory infection.
2. Specimens should be transported in containers that are labeled appropriately and have tightly fitting caps or lids to prevent spillage. They should be transported in a secure transport container.
3. Bloodborne pathogens precautions (e.g., Standard Precautions) should be observed when drawing blood and collecting/handling other clinical specimens of body fluids. In addition, sharps precautions should also be observed when handling needles or other sharps: no recapping of needles and disposal of needles and sharps in dedicated containers located convenient to point of care.

The Community Reception Center – Population Monitoring After a Radiation Emergency

The CRC is an emergency response operation that may be activated during a radiation incident. Its role is to provide mass population screening, monitoring, decontamination, information dissemination, mental health support, as well as referral if needed. Individuals exposed to radiation may also be enrolled in long-term health surveillance. In Pennsylvania, CRCs are a component of the response plan for nuclear power plant accidents. These sites are usually away from the scene, in an area that is minimally or not impacted by radiation. They may be co-located or near community emergency shelters or located in other publicly accessible locations such as PODs. The primary concern for CRC staff is exposure to individuals with external radiation contamination on their skin and clothing, which can spread to workers or be released into the air and inhaled or ingested.

During an incident involving the release of radiation such as a radiation dispersal device (“dirty bomb”) or nuclear accident, there will be an emergency response at the primary scene to respond to immediate casualties and begin to screen and decontaminate individuals who were in the closest vicinity to the device or release. The first responders to the scene of a radiation incident are hazardous materials (hazmat)-trained fire professionals, Emergency Medical Services (EMS), and law enforcement personnel. These personnel wear PPE with respiratory protection, as determined by hazmat protocols. Victims with acute, life-threatening injuries will be managed by EMS personnel and transported to hospitals, as needed. Public health staff generally do not have an on-scene response role at this point.

After a radiation incident, there may also be a large number of exposed individuals who survive the initial blast or release without injuries, but who require radiation screening and possibly even decontamination. Some of these individuals will self-evacuate to their homes or other locations and follow instructions for self-decontamination. Others may stay on the scene if portable decontamination is available. In both scenarios, there will be a need for large-scale population radiation monitoring of exposed persons – some who have showered, changed clothes, and need screening; and others who may need both decontamination and screening.

Many communities have plans to operate CRCs in the wake of a radiation release to assist these individuals who may have been exposed to radiation following an incident, but who do not need acute, emergent medical attention for wounds or other injuries. Specific plans for these centers vary from region to region across Pennsylvania, but their mission and overall operations are similar. Public health agencies may have a major role in the operation of these reception centers. This section outlines the important safety considerations for the workers who staff them.

Threats to Worker Safety in a CRC for Radiation Monitoring

Public health staff and volunteers that conduct population monitoring in a CRC after a radiation incident will primarily be concerned about exposure to individuals with external radiation contamination on their skin and clothing. These materials can irradiate the body when beta and gamma-emitting radionuclides are present. Radioactive materials on the skin or clothing can be released into the air and inhaled or accidentally ingested, resulting in internal contamination. External contamination on individuals can also be spread, resulting in cross-contamination to workers and surfaces in the center.

Workers in CRCs are neither first receivers in hospitals nor first responders to scenes with heavily contaminated individuals. First receivers are a subset of first responders. Unlike most first responders (e.g., firefighters, law enforcement, hazmat teams, ambulance personnel), first receivers do not work at the primary site of the incident or release, but they have considerable exposure risks when providing medical care to individuals who may be contaminated with chemical, biological, or radioactive agents. These guidelines assume that the risks of exposure to radiation in CRCs are considerably lower and more controlled than those settings.

Administrative Measures and Environmental Monitoring

1. The command structure of the CRC (based on the Incident Command System) should include a safety officer or other position (i.e., health physicist) with responsibility for environmental monitoring of the facility and a hazard assessment. Hazard assessment should be an ongoing function and may include sampling of surfaces and specific areas of the center, air monitoring, and monitoring personnel contamination throughout the operation of the center.
2. The safety officer should make safety recommendations for personal protective actions and other measures that are customized to the incident and the operation of the center. Recommendations may include the use of personal dosimeters (a device worn to estimate the amount of radiation to which the wearer is exposed) or PPE and should be based on job specifications.
3. The CRC should be set up with two zones: (1) Contamination Control Zone and (2) Clean Zone.
4. Activities in the Contamination Control Zone include greeting and initial sorting of victims, provision of medical treatment or transport to alternate care, contamination screening, and decontamination at a wash station. Workers who staff this zone may be exposed to individuals who have radioactive materials on their clothes or bodies, resulting in cross-contamination or inhalation hazards to staff. Staff that work in this zone will need to don PPE.

5. The safety officer will evaluate the need for, and issue as appropriate, personal dosimetry devices and other PPE to the staff. Staff should try to minimize physical contact with people, and gloves should be changed or checked frequently for contamination.
6. Workers who staff the Clean Zone are unlikely to be exposed to any external radioactive contaminants and therefore require only minimal PPE. This zone includes the registration and collection of demographic and event-specific information needed for follow-up and monitoring of victims who have been screened for radioactive contamination and cleared to enter the clean zone. In this zone, staff may also screen for internal contamination, arrange follow-up or treatment, and refer individuals to counseling services or public shelters as necessary.
7. Efforts should be made to identify contaminated individuals as they present to the center, including partial-body contamination screening which can quickly identify contamination, allow for immediate referral to wash stations for decontamination, and protect others waiting in line and staff. Separate lines can also be established for individuals who have showered and changed clothes before coming to the CRC to expedite their movement through the center.
8. Signage, barrier equipment (e.g., stanchions and rope), step off pads, floor coverings (i.e., plastic sheeting), and plastic bags should be available in the center to limit cross-contamination.

Personal Protective Equipment

1. Workers in the Contamination Control Zone will interact with victims more likely to be contaminated and should wear PPE as determined by the safety officer, appropriate for the exposure risks related to specific activities or stations within this zone. Universal medical precautions, including gown, gloves, face mask, safety glasses, and appropriate respiratory protection (as determined by the safety officer) should afford protection for workers in this zone.
2. The safety officer will make specific recommendations for respiratory protection in all zones of the CRC. Workers who may be exposed to radioactive aerosols may need N95 masks (or higher levels of protection, if deemed necessary by the safety officer), in addition to hooded coveralls, plastic examination gloves (either vinyl or nitrile), disposable shoe covers, and face shields. Surgical masks, duct tape, and masking tape should also be available.
3. Staff that wear gloves should change them frequently. Double-gloving may be required for optimal protection; taping the inner glove to the sleeve facilitates an easier removal of the outer glove.
4. Workers who staff wash stations in the Contamination Control Zone should wear PPE that provides splash protection when working near showers or decontamination units.
5. Workers in the Clean Zone are less likely to interact with externally contaminated victims, and may need little, if any PPE beyond Standard Precautions.
6. The safety officer and CRC leadership should work with subject matter experts to clarify the level of PPE and other protective measures required for all center staff and volunteers. Staff should have access to radiation monitoring, either through the use of personal dosimeters or access to the monitoring equipment used for the public, so that they can assess their own contamination risk and be assured of their personal safety and effectiveness of their protective measures.

7. The center should also be equipped with personal decontamination equipment, including disposable wipes, paper towels, zip-top bags for small personal items, soap, shampoo, plastic sponges, nail brushes, towels, and shoe-coverings. While these are mainly to be used by exposure victims, center staff may also need these items.

Communication and Training

1. CRC staff and volunteers should receive both pre-event and just-in-time training regarding the hazards of radiation, mechanisms of exposure and personal protective measures, and practices to minimize internal and external contamination.
2. CRC workers should receive just-in-time training for the use of all PPE that is available at the center. Training should be specific to the role or position that an individual will assume in the center operations, as different positions entail more risk for cross-contamination than others.
3. Public information for incident victims should provide clear recommendations for self-decontamination (e.g., clothing removal, containment and disposal, showering) for individuals who self-evacuate to home or other locations, to minimize the radiation exposures for individual victims and for CRC staff. Information regarding the services available at CRCs and what is recommended for individuals who plan to use them should be clear and widely available using linguistic and culturally appropriate messages for the community.

Protection from Chemical, Biological, and Radiation Exposures

Choosing the appropriate level of PPE is critical to ensuring the safety and health of first responders who have the potential to be exposed to chemical, biological, and radiation agents. This section describes the levels of PPE that exist for those types of exposures. The levels of PPE and criteria for use are based on the recommendations set forth by the NIOSH and the Occupational Safety and Health Administration (OSHA).

After a catastrophic chemical, biological, or radiation incident that involves large numbers of victims, hospital emergency departments will likely be the initial sites for the treatment of injured and contaminated individuals. Staff that work in these settings are considered first receivers.

In most cases, it is unlikely that public health professionals will have any field role in these types of incidents, although that may vary from jurisdiction to jurisdiction. Public health agencies should engage in collaborative planning with the agencies that traditionally provide the first response to these incidents, so that the public health role and agency expectations are clearly defined. The decision to train and equip public health staff with PPE appropriate for these hazards should be made on the basis of those expectations. The training and resource investments necessary to maintain proficiency in their use are considerable.

The US Environmental Protection Agency (EPA) and OSHA define four levels of protection from vapors, gases, and particulates from hazardous substances. Response personnel working in sites where they may be exposed to these hazards must be protected, and the more that is known about the hazards at a release site, the easier it is to select PPE that will provide a barrier to the likely routes of exposure - inhalation, skin absorption, ingestion, and eye or skin contact. In general, the safety officer at the scene (within the Incident Command System structure) will designate the level of protection that is needed.

The four levels of PPE for first responders are level A, B, C, and D, with Level A providing the most protection and Level D providing minimal protection. See Appendix 4 for a detailed description of the components of these levels. Level A PPE provides the greatest level of skin, respiratory, and eye protection and includes full-faced self-contained breathing apparatus (SCBA) and a totally-encapsulating chemical-protective suit. Level B affords the highest level of respiratory protection (full-faced SCBA) but lesser protection for skin (e.g., hooded chemical-resistant clothing, face shield). Level C PPE is used when air-purifying respirators (either full-or half-face) are sufficient respiratory protection; skin and eye protection are similar to level B PPE. Level D PPE affords minimal protection from hazards and generally includes coveralls, face shield, and gloves; there is no respirator for respiratory protection.

Responders need to consider several factors when selecting the appropriate level of PPE during an incident:

- Identification of the hazards or suspected hazards;
- Potential routes of hazard exposure
- Ability of PPE materials to provide a barrier against hazards.

PPE is material-hazard specific, meaning that certain PPE protects well against certain hazards and poorly against others. There are also instances in which PPE materials cannot provide continuous, long-term protection against hazards; therefore, PPE must be changed before the protection expires. Work duties must not exceed the time that the PPE provides protection against the hazard(s). Additionally, the appropriate level of PPE is dependent upon the responders' work duties and working conditions on-scene. Factors such as the durability of PPE materials to withstand tearing and the physical stress of long-term use of PPE should be considered when deciding on the level to use.

Protective Measures for Chemical, Biological, and Radiation Scenarios

Emergency response operations following the release of chemical, biological, or radiological agents are conducted within three zones, hot, warm, and cold (may also be described as red, yellow, and green -- see www.osha.gov/SLTC/emergencypreparedness/cbrnmatrix) based on the level of contamination from the release.

The red zone, also referred to as the hot zone by emergency responders, consists of the area where there is either confirmed or suspected significant contamination from the agent. In the red zone, the area is considered to be life threatening from the possibility of agent inhalation or skin contact. The following are guidelines for PPE levels in the red zone.

- Level A PPE should be worn:
 - While a release is still occurring.
 - Until the agent has been identified and the atmospheric concentrations of the agent have been measured.
 - When the agent has been identified and is known to present a skin exposure hazard.
- Level B PPE should be worn:
 - When the agent does not present a skin exposure hazard.
 - When the agent is partially identified but is suspected to present a low to moderate hazard.
- Level C or Level D PPE may be worn at the discretion of the on-scene Incident Commander when the substance has been fully identified and is known to produce a low to moderate hazard.

The yellow zone, also referred to as the warm zone by emergency responders, consists of the area where there is possible contamination from a chemical, biological, or radiological agent. In the yellow zone, the active release of the agent has finished and environmental monitoring has been established. The following are guidelines for PPE levels in the yellow zone.

- Level A PPE should be worn:
 - When an agent is unidentified but is suspected to pose a serious hazard.
 - When the agent is identified and is known to present a skin exposure hazard.
- Level B PPE should be worn:
 - When the agent does not present a skin exposure hazard.
- Level C or Level D PPE may be worn at the discretion of the on-scene Incident Commander when the substance is known or suspected to produce a low to moderate hazard.

The green zone, also referred to as the cold zone by emergency responders, consists of the area that is unlikely to be contaminated by the CBRN agent. PPE should be worn on an as-needed basis to prevent infection or nuisance contamination for responders.

Selecting Personal Protective Equipment

In most scenarios, the on-scene operations will be led by fire, hazmat, and EMS professionals, who will assume Incident Command. In these cases, a safety officer will convey the minimum acceptable level of PPE for all response personnel. In general, if only one type of PPE is available or selected, it should be sufficient to cover the worst-case scenario. See below for PPE recommendations for Selected CBRN Agents (adapted from

<https://www.osha.gov/SLTC/emergencypreparedness/cbrnmatrix/radiological.html>):

Chemical: Nerve Agents

Initial recommendations for responders are to wear Level A protective suit and positive pressure self-contained breathing apparatus. Subsequent monitoring results and identification of agent characteristics may allow for other decisions by the Incident Commander and safety officer. Some agents may degrade or damage respirators. When conditions have been determined to be appropriate for the use of air purifying respirators, a NIOSH-approved CBRN (chemical/biological/radiation/nuclear) APR full face-piece Air Purifying Respirator (APR) with a CBRN canister, or a Chemical Warfare Agents (CWA) tested full face-piece APR with a combination organic vapor/acid gas/particulate canister may be used. A list of approved Self-Contained Breathing Apparatus (SCBA) and APR may be obtained from the NIOSH website.

Chemical: Blister Agents

Initial recommendations for responders are to wear Level A protective suit and positive pressure self-contained breathing apparatus. Subsequent monitoring results and identification of agent characteristics may allow for other decisions by the Incident Commander and safety officer. Some agents may degrade or damage respirators. When conditions have been determined to be appropriate for the use of air purifying respirators, a NIOSH-approved CBRN APR Full Face-piece with a CBRN Canister, or a CWA tested full face-piece APR with a combination organic vapor/acid gas/particulate canister may be used. A list of CBRN approved SCBA and APR may be obtained from the NIOSH website.

Radiation Dispersal Devices

The actual radiation risk depends on the source material used in the device. Emergency responders to an explosion or the resulting fires will generally not know they are being exposed to radiation unless they utilize a radiation detecting device. There is no practical PPE to protect first responders against externally penetrating gamma radiation. Monitoring devices are the only means to ensure that responders do not enter an area where exposures to external gamma radiation is excessive.

PPE to prevent skin contamination of particulates is very effective against particulate-borne radiation hazards (i.e., alpha and beta particles). Typical firefighter "turn-out" gear, including a SCBA, is generally adequate for this purpose. The use of turn-out gear or any disposable protective clothing suitable for

particulate exposure should be followed by appropriate decontamination of personnel and equipment.

Protection of internal organs from inhalation of radioactive particulates can be provided by wearing an appropriate particulate respirator. The SCBAs will provide the highest level of protection. Responders should utilize at least a full-APR with a P-100 or high efficiency particulate air (HEPA) filter, as appropriate. Respiratory protection specifically approved by NIOSH for CBRN exposures is desirable. However, where specific CBRN-approved respirators are not available, the incident commander may allow alternative NIOSH-approved respirators, such as SCBAs, or full-face powered or non-powered air-purifying respirators with P-100 or HEPA filters, as appropriate. It should be noted that these recommendations for respiratory protection are designed ONLY for protection against inhalation of radioactive particulates, and do not consider protection that may be necessary for other contaminants, such as chemical or biological agents.

Particulate sampling can be performed to measure the radioactivity of dust in the air and to further characterize exposures. Based on the sampling data, the respirator protection factor needed to meet the relevant exposure limits can be determined, and the specific type of respirator needed can be identified. According to the data, it may be possible to downgrade or remove requirements for respiratory protection. However, until exposures have been characterized, responders and support personnel should continue to utilize full-face air-purifying P100 respirators, or higher respiratory protection (e.g., SCBAs, Powered Air-Purifying Respirator (PAPRs)).

Biological Agents

(These recommendations apply to environmental exposures and not exposures to patients infected with these agents. They are adapted from <https://www.osha.gov/SLTC/bioterrorism/anthrax/> and <http://www.bt.cdc.gov/DocumentsApp/Anthrax/Protective/10242001Protect.asp>.)

Biological agents (e.g., bacteria, viruses, toxins) may be inhaled, ingested, or result in exposures from contact with skin or mucous membranes. They are considered particles and will not penetrate properly assembled respirators or protective clothing. Existing recommendations for protecting workers from biological hazards require the use of half-mask or full face-piece APRs with particulate filter efficiencies ranging from N95 (for hazards such as pulmonary tuberculosis) to P100 (for hazards such as hantavirus) as a minimum level of protection.

Devices used for intentional biological terrorism may disseminate large quantities of biological materials in aerosols. During an initial emergency response, when the characteristics of the agent and aerosols are not known, emergency first responders typically use SCBA respirators with a full face-piece operated in the most protective, positive pressure (pressure demand) mode during emergency responses. This type of SCBA provides the highest level of protection against airborne hazards when properly fitted to the user's face and properly used. NIOSH respirator policies state that, under those conditions, SCBA reduces the user's exposure to the hazard by a factor of at least 10,000. This reduction is true whether the hazard is from airborne particles, a chemical vapor, or a gas. SCBA respirators are used when hazards and airborne concentrations are either unknown or expected to be high. Respirators providing lower levels of protection are generally allowed once conditions are understood and exposures are

determined to be at lower levels. Protective clothing, including gloves and booties, also may be required for the response to a suspected act of biological terrorism. Protective clothing may be needed to prevent skin exposures and/or contamination of other clothing. The type of protective clothing needed will depend upon the type of agent, concentration, and route of exposure. When information is unknown or the event is uncontrolled, level A protective suits should be worn.

Responders may use a Level B protective suit with an exposed or enclosed NIOSH-approved pressure-demand SCBA if the situation can be defined in which:

- The suspected biological aerosol is no longer being generated;
- Other conditions may present a splash hazard.

Responders may use a full face-piece respirator with a P100 filter or PAPR with HEPA filters when it can be determined that:

- An aerosol-generating device was not used to create high airborne concentration;
- Dissemination was by a letter or package that can be easily bagged.

These types of respirators reduce the user's exposure by a factor of 50 if the user has been properly fit tested.

The table from OSHA on the following page summarizes protective measures, including PPE, that are recommended for Emergency Medical Services (EMS) responders in a range of hazardous substance release situations. These principles are relevant for other health-focused response personnel.

Table 2. Training, Respiratory Protection, and PPE for EMS Responders

ZONE► (EMS Responder Assigned Role) ► ▼ Scenario	HOT ZONE (Rescue/Life support) ^{(A) (G)}	WARM ZONE (Decontamination/ treatment in warm zone)	COLD ZONE (Treat uncontaminated/ decontaminated patients in clean area)	EMERGENCY TRANS- PORT FOR 911 CALLS (Transport nominally clean or cleaned patients) ^(K)	INTER-FACILITY TRANSPORT ONLY (Never respond to 911 calls. No mutual aid agreements for emer- gency response)
CBRNE agent or substance generat- ing IDLH environ- ment at the site ^(B)	When a skin hazard is present... Training: Operations level ^(C) Respirator: SCBA ^(E) PPE: Level A ^(D)	When a skin hazard is present... Training: Operations level ^(C) Respirator: SCBA ^(E) PPE: Level A ^(D)	Training: Awareness level strongly recom- mended ^(K) (Operations level recommended). ^(L) Respirator & PPE: Only as needed for preventing infection.	Training: Awareness level strongly recom- mended ^(K) (Operations level recommended). ^(L) Respirator & PPE: Only as needed for preventing infection.	Not applicable
	No skin hazard... Training: Operations level ^(C) Respirator: SCBA ^(E) PPE: Level B ^(D)	No skin hazard... Training: Operations level ^(C) Respirator: SCBA ^(E) PPE: Level B ^(D)			
Unknown substance - could be a serious hazard ^(H)	Training: Operations level ^(C) Respirator: SCBA ^(E) PPE: Level A ^(D,F)	Training: Operations level ^(C) Respirator: SCBA ^(E) PPE: Level A ^(D)	Training: Awareness level strongly recom- mended ^(K) (Operations level recommended). ^(L) Respirator & PPE: Only as needed to prevent infection.	Training: Awareness level strongly recom- mended ^(K) (Operations level recommended). ^(L) Respirator & PPE: Only as needed to prevent infection.	Not applicable
Partially character- ized hazard, avail- able information suggests low or moderate hazard	Training: Operations level ^(C) Respirator: SCBA, or as indicated by IC based on site charac- terization. ^(E) PPE: Level B, or as indicated by Incident Commander ^(F) based on site characteriza- tion. ^(I)	Training: Operations level ^(C) Respirator & PPE: As per Incident Commander ^(E, F, L, J)	Training: Awareness level strongly recom- mended ^(K) (Operations level recommended). ^(L) Respirator & PPE: Only as needed to prevent infection.	Training: HazCom ^(M) (Operations level rec- ommended). ^(L) Respirator & PPE: Only as needed to prevent infection.	Not applicable
Known substance, low or moderate hazard	Training: Operations level ^(C) Respirator & PPE: As per Incident Commander (IC) ^{(E) (F, J)}	Training: Operations level ^(C) Respirator & PPE: As per Incident Commander (IC) ^{(E) (F, L, J)}	Training: Awareness level strongly recom- mended ^(K) (Operations level recommended). ^(L) Respirator & PPE: Only as needed to prevent infection.	Training: HazCom ^(M) (Operations level rec- ommended). ^(L) Respirator & PPE: Only as needed to prevent infection.	Not applicable
No emergency response	Not applicable	Not applicable	Not applicable	Not applicable	Routine HazCom train- ing. ^(M) PPE only as needed to prevent infection.

Source: OSHA. Best Practices for Protecting EMS Responders During Treatment and Transport of Victims of Hazardous Substance Release. 2009. Available at <https://www.osha.gov/Publications/OSHA3370-protecting-EMS-respondersSM.pdf>

Exposure Monitoring and Follow-Up

The response to an emergency or disaster may result in significant health consequences from exposures to infectious agents, chemicals, radiation, or other toxins. These health consequences may occur in the short-term or over a period of months to years. In either case, it may be necessary to monitor individual responders or workers to identify the health impacts early and ensure that they are managed appropriately.

At the time this framework was completed in June 2014, the Pennsylvania Department of Health (PADOH) was developing a Worker Safety Plan that included directives to address this need. The PADOH has pre- and post-deployment screening forms and tools that can be used when public health agency staff must be deployed to respond to emergencies and disasters. Prior to deployment, employees will be asked to complete a pre-screening tool. Medical clearance may be required prior to deployment, based on information provided in the forms, and the nature of the incident. During field deployments, on-site safety monitoring personnel and employees themselves will be responsible for assuring that personnel work in a safe manner, and the PADOH will monitor overall work conditions. Following deployment, employees should complete post-deployment forms. If the incident itself, or the information provided in these forms suggest that there will be a need for longer-term follow-up, the PADOH will enroll employees in a long-term monitoring program and arrange for medical referral, including psychological assistance or other supports, as needed.

A number of additional resources exist to assist public health agencies in the collection of worker/responder health information pre- and post-response activities. ATSDR has developed a Rapid Response Registry that is designed to give public health response agencies easy-to-use tools that can be adapted to collect critical information from public health and emergency responders. ATSDR has developed a toolkit (available at <http://www.atsdr.cdc.gov/rapidresponse/>) that includes two documents that guide responders preparing for deployments (“What to Bring to Deployment” and “How to Prepare for Deployment”). The toolkit also contains a two-page survey instrument that can be completed on a real-time basis during the response to a disaster. This registry and survey tool can be used for both responder and non-responder monitoring following an incident. Its use will require staff and resource dedication; although, the survey form can be self-completed by responders.

In addition, NIOSH, in partnership with other federal agencies, state health departments, labor unions, and volunteer emergency responder groups, has developed the Emergency Responder Health Monitoring and Surveillance (ERHMS) system. The system includes specific recommendations and tools for pre-deployment health screening, training, data management and information security, on-site responder processing, guidance for integrating exposure assessments with responder activity documentation and controls, and post-event tracking of responder health and function. Additional information and instructions for system implementation is available at <http://www.cdc.gov/niosh/topics/erhms>.

Resources

These resources provide additional information regarding workplace and field hazards during the response to disasters that threaten the health of the responding workforce.

1. Agency for Toxic Substances and Disease Registry, available at <http://www.atsdr.cdc.gov/>. Program within U.S. Department of Health and Human Services that provides health information to prevent exposures and diseases related to toxic substances.
2. Chemical Hazards Emergency Medical Management (CHEMM) is a website and application that can be downloaded to computers or mobile devices; provides information about chemical hazards for first responders, first receivers, and public health and emergency management planners. Available at <http://chemm.nlm.nih.gov/>
3. ChemTrec is a web-based resource for obtaining immediate response information about incidents involving hazardous materials. Available at <http://www.chemtrec.com/>.
4. Medline Plus is a website operated by the National Institutes of Health and the National Library of Medicine that has links to general health topics as well as disasters, disaster preparation, and recovery. Available at <http://www.nlm.nih.gov/medlineplus/>
5. National Library of Medicine Disaster Information Management Resource Center, available at <http://disaster.nlm.nih.gov/>
6. Radiation Emergency Medical Management (REMM) is a guide for health care providers on the medical management of radiation exposure and illness. Available at <http://www.remm.nlm.gov/>
7. Toxnet is a web-based guide developed by the National Library of Medicine (NLM) for searching resources related to toxicology, hazardous chemicals, environmental health, and toxic releases. Available at <http://toxnet.nlm.nih.gov/>. TOXMAP® (<http://toxmap.nlm.nih.gov>) is a Geographic Information System (GIS) of the NLM that uses maps of the United States to help users visually explore data from the U.S. Environmental Protection Agency (EPA)'s Toxics Release Inventory and Superfund Program as well as other non-EPA datasets.
8. WISER - Wireless Information System for Emergency Responders, available at <http://wiser.nlm.nih.gov/>. This web-based or wireless system operated by the National Library of Medicine provides immediate access to information related to chemical and other hazards and their health impacts.

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Appendix 1 – Overview of Personal Protective Equipment and Standard and Transmission-Based Precautions for Public Health and Health Care Personnel

Personal Protective Equipment for Public Health and Health Care Personnel

PPE in public health and health care is equipment such as gowns, gloves, face shields, eye wear, respirators, and surgical masks that protects mucous membranes, airways, skin, and clothing from hazards. The selection of PPE during a public health emergency response operation will be based on the nature of the threat, the specifics of the response, as well as the type of work or position and the likelihood of exposure to that threat. This section outlines the components of PPE that may be needed in common or likely public health emergency response activities that require protection from infectious disease threats using either Standard or Transmission-Based Precautions (see below). These PPE components are also appropriate for dealing with contaminated disaster victims in a community reception center for population monitoring during a radiation incident.

Gloves

Gloves are used to prevent contamination of hands when: 1) anticipating direct contact with blood or body fluids, mucous membranes, non-intact skin, and other potentially infectious material; 2) having direct contact with patients colonized or infected with pathogens transmitted by direct contact (e.g., MRSA) or with disaster victims with external radiation contamination; and 3) handling or touching visibly or potentially contaminated patient care equipment and/or environmental surfaces. Non-sterile disposable medical gloves are made from a variety of materials (e.g., latex, vinyl, nitrile). Latex or nitrile gloves are preferred for use when manual dexterity is needed or for prolonged patient contact. Gloves should not be washed for subsequent reuse. They are put on last when worn in combination with other PPE and removed first.

Gowns

Gowns are worn to protect arms, exposed body areas, and prevent contamination of clothing with blood, body fluids, and potentially hazardous material. The type of gown selected is generally based on the nature of the interaction with a potentially infectious/contaminated patient, and the potential for penetration of the barrier. The wearing of isolation gowns is mandated by the OSHA Bloodborne Pathogens Standard. Clinical and laboratory coats or jackets worn over personal clothing for comfort or purposes of identity are not considered PPE. Gowns are worn in combination with gloves and with other PPE when indicated, and they are usually the first piece of PPE to be donned. In most health care settings, disposable gowns are used for Standard and Transmission-Based Precautions.

Face Protection: Masks, goggles, face shields

Masks – Masks are used for three primary purposes in health care settings: 1) placed on health care/public health workers to protect them from contact with infectious materials from patients (e.g., respiratory secretions or sprays of blood and body fluids); 2) placed on health care workers engaged in a procedure requiring sterile technique to protect patients from exposure to infectious agents carried in a

worker's mouth or nose; and 3) placed on coughing patients to limit potential dissemination of respiratory secretions from the patient to others, as part of respiratory hygiene and cough etiquette. They are an important component of Standard and Droplet Precautions. Masks used for face protection are either surgical masks that are cleared by the Food and Drug Administration (FDA) to have fluid-resistant properties, or procedure or isolation masks. Masks may be molded or non-molded, and come in various shapes, sizes, filtration efficiency, and method of attachment (e.g., ties, elastic, ear loops). These masks are not considered (and should not be confused with) particulate respirators that are used to prevent inhalation of small particles that may contain infectious agents via airborne droplets (see below).

Example of surgical or procedure mask



(image source:

http://www.cdc.gov/niosh/npptl/topics/respirators/disp_part/RespSource3healthcare.html)

Goggles, face shields – Goggles and face shields afford eye protection from exposures to infectious agents in body fluids and respiratory droplets. Personal eyeglasses and contact lenses are NOT considered adequate eye protection. Many goggles will fit over prescription glasses with minimal gaps. The choice of eye protection should be tailored for specific work situations based on the exposure circumstances, other PPE used, and personal vision needs. Face shields are an alternative to goggles and afford protection to facial areas in addition to the eyes. Face shields that extend from chin to crown protect the face and eyes from splashes and sprays; face shields that wrap around the sides of the face may reduce exposure to splashes around the edge of the shield.

Respiratory Protection

Respirators differ from loose-fitting surgical or procedure masks. They fit tightly against the face so that most of the air inhaled goes through the filtering material, protecting the wearer from exposure to infectious agents in small airborne droplets and small particles. Respiratory protection requires the use of a respirator with an N95 or higher filtration such as a P100. (N refers to “non-oil filtering” and the 95 designation signifies that the respirator filters 95% of particles. P100 respirators are oil-proof – the respirator will be effective if contaminated with oil – and filter 100% of particles.) Respiratory protection is regulated by OSHA and currently requires that users undergo medical clearance to wear a respirator, receive education and training regarding their use and safety, and receive fit-testing for wearers of N95 respirators. These respirators are generally disposable, half-faced devices that are intended to be discarded after use. In some emergency scenarios, respirators with higher-level filtration such as an APR or PAPR with a HEPA filter may be required. These can be either half-faced or full-faced, tight-fitting or

loose-fitting. Loose-fitting respirators may be used by wearers with facial hair and do not require fit-testing. APRs and PAPRs are not disposable and they may be re-used. None of these respirators are appropriate for use in an oxygen-deficient atmosphere.

Example of N95 and N100 respirators



Example of APR



Example of PAPR



(Images courtesy of Public Health Images Library, Centers for Disease Control and Prevention)

Overview of Standard and Transmission-Based Precautions

Hand Hygiene

Hand hygiene is a general term that applies to any one of the following: 1) handwashing with plain (non-antimicrobial) soap and water); 2) antiseptic handwash (soap containing antiseptic agents and water); 3) antiseptic handrub (waterless antiseptic product, most often alcohol-based, rubbed on all surfaces of hands); or 4) surgical hand antisepsis (antiseptic handwash or antiseptic handrub performed preoperatively by surgical personnel to eliminate transient hand flora and reduce resident hand flora).

Standard Precautions

Standard Precautions refers to group of infection prevention practices that apply to all patients, regardless of suspected or confirmed diagnosis or presumed infection status. Standard Precautions is a combination and expansion of Universal Precautions and Body Substance Isolation. Standard Precautions is based on the principle that all blood, body fluids, secretions, excretions except sweat, non-intact skin and mucous membranes may contain transmissible infectious agents. Standard Precautions includes hand hygiene and depending on the anticipated exposure, use of gloves, gown, mask, eye protection, or face shield. Also, equipment or items in the patient environment likely to have been contaminated with infectious fluids must be handled in a manner to prevent transmission of infectious agents (e.g. wear gloves for handling, contain heavily soiled equipment, properly clean and disinfect or sterilize reusable equipment before use on another patient).

Respiratory Hygiene/Cough Etiquette

Respiratory hygiene and cough etiquette are a combination of measures designed to minimize the transmission of respiratory pathogens via droplet or airborne routes in health care settings. The components of Respiratory Hygiene/Cough Etiquette are: 1) covering the mouth and nose during coughing and sneezing; 2) using tissues to contain respiratory secretions with prompt disposal into a no-touch receptacle; 3) offering a surgical mask to persons who are coughing to decrease contamination of the surrounding environment; and 4) turning the head away from others and maintaining spatial separation, ideally >3 feet, when coughing. These measures are targeted to all patients with symptoms of respiratory infection and their accompanying family members or friends beginning at the point of initial encounter with a health care setting (e.g., reception/triage in emergency departments, ambulatory clinics, health care provider offices).

Droplet Precautions

Droplet precautions apply to patients known or suspected to be infected with a pathogen that can be transmitted by droplet route; these include, but are not limited to:

- Respiratory viruses (e.g., influenza, parainfluenza virus, adenovirus, respiratory syncytial virus, human metapneumovirus)
- Bordetella pertussis
- For first 24 hours of therapy: *Neisseria meningitidis*, group A streptococcus

In a health care setting, place the patient in an exam room with a closed door as soon as possible (prioritize patients who have excessive cough and sputum production). If an exam room is not available,

the patient is provided a facemask and placed in a separate area as far from other patients as possible while awaiting care.

PPE use:

- Wear a facemask, such as a procedure or surgical mask, for close contact with the patient. The facemask should be donned upon entering the exam room.
- If substantial spraying of respiratory fluids is anticipated, gloves and gown as well as goggles (or face shield in place of goggles) should be worn.
- Perform hand hygiene before and after touching the patient and after contact with respiratory secretions and contaminated objects/materials; use soap and water when hands are visibly soiled (e.g., blood, body fluids).
- Instruct patient to wear a facemask when exiting the exam room, avoid coming into close contact with other patients and practice respiratory hygiene and cough etiquette.

Contact Precautions

Contact precautions apply to patients with any of the following conditions and/or disease:

- Presence of stool incontinence (may include patients with norovirus, rotavirus, or *Clostridium difficile*), draining wounds, uncontrolled secretions, pressure ulcers, or presence of ostomy tubes and/or bags draining body fluids.
- Presence of generalized rash or exanthems (including infections with methicillin-resistant *S. aureus* (MRSA)).

The components of contact precautions are:

- Hand hygiene before touching patient and prior to wearing gloves.
- PPE use: wear gloves when touching the patient and the patient's immediate environment or belongings. Wear a gown if substantial contact with the patient or their environment is anticipated.
- Perform hand hygiene after removal of PPE; use soap and water when hands are visibly soiled (e.g., blood, body fluids) or after caring for patients with known or suspected infectious diarrhea (e.g., *Clostridium difficile*, norovirus).
- Clean/disinfect the exam room or patient care area accordingly.
- Instruct patients with known or suspected infectious diarrhea to use a separate bathroom, if available. Clean/disinfect the bathroom before it can be used again.

Airborne Precautions

Airborne precautions apply to patients known or suspected to be infected with a pathogen that can be transmitted by airborne route; these include, but are not limited to: Tuberculosis, Measles, Varicella (Chickenpox) until lesions are crusted over, localized (in an immune compromised patient) or disseminated varicella (Herpes Zoster or shingles) until lesions are crusted over.

- Have patient enter through a separate entrance to the facility (e.g., dedicated isolation entrance), if available, to avoid the reception and registration area.
- Place the patient immediately in an airborne infection isolation room (AIIR).

- If an AIIR is not available:
 - Provide a facemask (e.g., procedure or surgical mask) to the patient and place the patient immediately in an exam room with a closed door.
 - Instruct the patient to keep the facemask on while in the exam room, if possible, and to change the mask if it becomes wet.
 - Initiate protocol to transfer patient to a health care facility that has the recommended infection-control capacity to properly manage the patient.

PPE use:

- Wear a fit-tested N-95 or higher level disposable respirator, if available, when caring for the patient; the respirator should be donned prior to room entry and removed after exiting room.
- If substantial spraying of respiratory fluids is anticipated, gloves and gown as well as goggles or face shield should be worn.
- Perform hand hygiene before and after touching the patient and after contact with respiratory secretions and/or body fluids and contaminated objects/materials; use soap and water when hands are visibly soiled (e.g., blood, body fluids).
- Instruct patient to wear a facemask when exiting the exam room, and avoid coming into close contact with other patients and practice respiratory hygiene and cough etiquette.
- Once the patient leaves, the exam room should remain vacant for generally one hour before anyone enters. However, adequate wait time may vary depending on the ventilation rate of the room and should be determined accordingly.
- If staff must enter the room during the wait time, they are required to use respiratory protection.

Source: <http://www.cdc.gov/HAI/settings/outpatient/basic-infection-control-prevention-plan-2011/transmission-based-precautions.html#b>

Appendix 2 –Using Personal Protective Equipment in Health Care Settings

The following guidelines for donning, using, and removing PPE from the Centers for Disease Control and Prevention and the Health Care Infection Control Practices Advisory Committee (see http://www.cdc.gov/hicpac/2007IP/2007ip_fig.html) are relevant for use in public health field settings.

Recommendations for Donning and Removing PPE

General points about using PPE

- Don PPE before contact with patients, generally before entering clinical settings.
- Use PPE carefully – don't spread contamination.
- Remove and discard carefully, either at the doorway or immediately outside a patient care area. Remove respirator outside room.
- Immediately perform hand hygiene after PPE removal (includes gloves).

How to use PPE safely

- Keep gloved hands away from face.
- Avoid touching or adjusting other PPE.
- Remove gloves if they become torn; perform hand hygiene before donning new gloves.
- Limit surfaces and items touched.

Sequence for donning PPE

- Gown first
- Mask or respirator
- Goggles or face shield
- Gloves

Sequence for removing PPE

- Gloves (they are considered the most contaminated pieces of PPE so are removed first)
- Face shield or goggles (they might interfere with removal of other PPE)
- Gown
- Mask or respirator

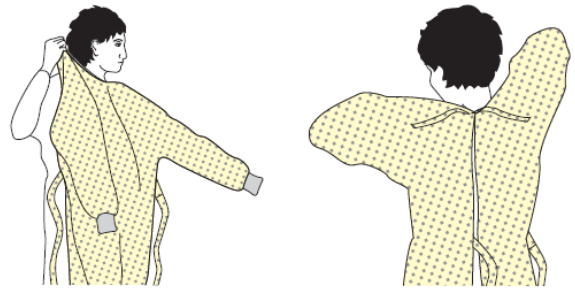
These recommendations for donning and removing PPE are summarized in the graphics on the following pages.

Putting on Personal Protective Equipment

Type of PPE used will vary based on the level of precautions required, e.g., Standard and Contact, Droplet or Airborne Isolation Precautions. Put on PPE in the sequence depicted below.

1. Gown

- Fully cover torso from neck to knees, arms to end of wrist, and wrap around the back.
- Fasten in back at neck and waist.
- If too small, use two gowns: Gown #1 ties in front, Gown #2 ties in back.



2. Mask or Respirator

Mask:

- Secure ties or elastic band at middle of head and neck.
- Fit flexible band to nose bridge.
- Fit snug to face and below chin.
- Fit-check respirator.

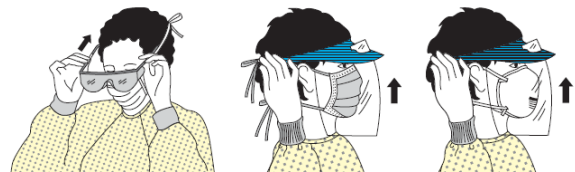
Particulate respirator (e.g., N95, N99, N100):

- Select a fit tested respirator.
- Place over nose, mouth and chin.
- Fit flexible nose piece over nose bridge.
- Secure on head with elastic.
- Adjust to fit and perform a fit check:
 - Inhale – respirator should collapse.
 - Exhale – check for leakage around face.



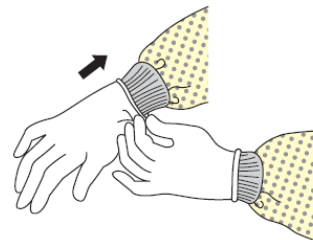
3. Goggles/Face Shield

- Put over face and eyes and adjust to fit.



4. Gloves

- Extend to cover wrist of isolation gown.



Use safe work practices to protect yourself and limit the spread of contamination.

- Keep hands away from face.
- Limit surfaces touched.
- Change gloves when torn or heavily contaminated.
- Perform hand hygiene.

Source: Centers for Disease Control and Prevention, accessed June 22, 2014 at <http://www.cdc.gov/HAI/pdfs/ppe/ppeposter1322.pdf>

Removing Personal Protective Equipment

Except for respirator, remove PPE at doorway or in anteroom in the sequence depicted below. Remove respirator after leaving patient room and closing door.

- The outside front and sleeves of the gown, the outside front of goggles, mask, respirator, face shield, and gloves are considered contaminated, regardless of whether there is visible soil.
- The inside of gloves, inside and back of gown (including the ties), and the ties, elastic, or ear pieces of the mask, goggles, and face shield are considered clean.

1. Gloves

- Outside of gloves is contaminated!
- Grasp outside of glove with opposite gloved hand; peel off.
- Hold removed glove in gloved hand.
- Slide fingers of ungloved hand under remaining glove at wrist.
- Peel glove off over first glove.
- Discard gloves in waste container.



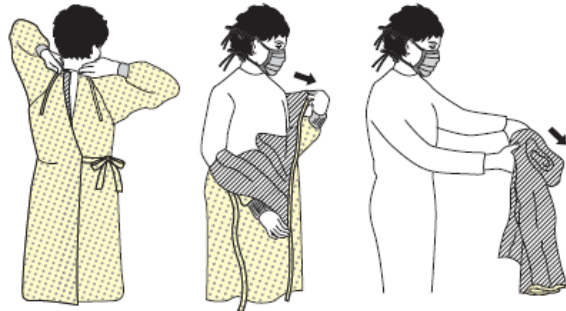
2. Goggles or Face Shield

- Outside of goggles or face shield is contaminated!
- To remove, handle by head band or ear pieces.
- Place in designated receptacle for reprocessing or in waste container.



3. Gown

- Gown front and sleeves are contaminated!
- Unfasten ties.
- Pull away from neck and shoulders, touching inside of gown only.
- Turn gown inside out.
- Fold or roll into a bundle and discard.



4. Mask or Respirator

- Front of mask/respirator is contaminated—DO NOT TOUCH!
- Grasp bottom, then top ties or elastics and remove.
- Discard in waste container.



Perform hand hygiene immediately after removing all PPE.

- If hands become visibly contaminated during PPE removal, wash hands before continuing to remove PPE. Wash hands thoroughly with soap and warm water or, if hands are not visibly contaminated, use an alcohol-based hand rub.

Source: Centers for Disease Control and Prevention, accessed June 22, 2014 at <http://www.cdc.gov/HAI/pdfs/ppe/ppeposter1322.pdf>

Personal Protective Equipment Use During a Shortage of Respirators or Masks

During infectious disease disasters, there may be shortages of N95 respirators as well as surgical masks. CDC and APIC have outlined a number of suggestions for conserving respirators and for extending the use and/or reusing respirators. Some of these suggestions are summarized here, although in a disaster in which respiratory protection equipment is in short supply, public health professionals should consult with experts at CDC and APIC regarding the most appropriate way to allocate and use PPE, based on the specific hazard and situation. Readers are encouraged to refer to the primary documents that are listed in the reference section of this framework. This is an area of ongoing research and there are little data regarding safe or best practices in this situation. When respirators or masks are used during direct care for patients with respiratory pathogens that are spread via direct and indirect contact with respiratory droplets, their exterior can become contaminated and serve as a reservoir for infectious agents. Special precautions must be taken when extending the use or reusing disposable respiratory protection to prevent worker exposure.

Recommendations for conserving respirators

- Implement engineering or administrative controls (e.g., triage protocols) to decrease the number of staff who need respiratory protection.
- First priority is for protection of workers who perform or are exposed to aerosol generating procedures such as administration of nebulized medications, intubation, suctioning for people with chronic respiratory conditions, or sputum induction.
- Second priority is for workers who are providing direct care involving close contact (within three feet) of coughing individuals or cohorted areas (e.g., in shelters).
- When N95 supplies are limited, identify alternatives and use whenever feasible:
 - Alternatives include other NIOSH certified N-, R-, or P-class respirators.
 - Reusable elastomeric respirators.
 - Powered air purifying respirators.
- Extend the use of respirators (wear a disposable respirator during serial patient encounters without removing or re-donning the device). This is preferred over reuse (removing and re-donning between encounters), although depending on the scenario either or both may be recommended.
 - Avoid contamination by not touching the outside of the respirator.
 - The respirator should not be removed, adjusted or touched outside of care activities.
- Use or reuse the respirator as long as possible.
- Discard if it becomes soiled or damaged or if used during an aerosol-generating procedure.
- The respirator must be discarded if the wearer has difficulty breathing.
- Workers in isolation or cohorting areas should keep the respirator on while in those high-risk areas.
- Consider use of a surgical or procedure mask or face shield over the respirator to reduce contamination of the device.
- If supplies of N95 or higher respirators become unavailable and respiratory protection is needed, consider use of tight-fitting surgical or procedure masks.

- Select masks that can be tied tightly or have elastic straps.
- Ear loop masks are less preferred than tight-fitting masks because they do not form a seal.
- Surgical masks do not protect against small droplet aerosols so they should only be used if N95 masks are not available in the setting of an infectious disease hazard that is transmitted by small aerosols.

Appendix 3 – Summary of Safety Measures and Precautions for Selected Infectious Diseases

	Transmission	Standard Precautions	Transmission Precautions	Pre-Exposure Prophylaxis	Post-exposure prophylaxis
Anthrax	Animal exposure or weaponized	Yes	Contact if skin lesions	Vaccine	Antibiotics, vaccine, immune globulin
Brucellosis	Animal exposure or weaponized	Yes	None	None	Antibiotics
Influenza-seasonal	Respiratory	Yes	Standard, Droplet	Vaccine	Antivirals
Influenza-novel strain	Respiratory Animal source possible	Yes	Contact, Droplet, Airborne (N95 mask)	Vaccine (if available)	Antivirals
Hemorrhagic Fever Viruses	Respiratory and bloodborne	Yes	Droplet, Contact (N95 masks for aerosol-generating procedures)	None available	None available
Hepatitis A	Fecal-oral, food/water contamination	Yes	Contact	Vaccine (Immune globulin)	Vaccine, immune globulin
Hepatitis B	Bloodborne	Yes	Standard	Vaccine	Vaccine, immune globulin
Hepatitis C	Bloodborne	Yes	Standard	None	None
HIV	Bloodborne	Yes	Bloodborne	Antiivirals (not for HCWs)	Antivirals
Legionella	Environmental (Inhaled)	Yes	None	None	None
Measles	Respiratory	Yes	Airborne	Vaccine	Vaccine, immune globulin
MERS CO-V	Respiratory	Yes	Standard, Contact, Airborne	None	None
Mumps	Respiratory	Yes	Droplet	Vaccine	Vaccine
Neisseria meningitidis	Respiratory	Yes	Droplet	Vaccine	Antibiotics
Norovirus	Fecal-oral; food and water contamination	Yes	Contact (consider droplet if vomit exposure)	None	None
Pertussis	Respiratory	Yes	Droplet	Vaccine	Antibiotics
Plague bubonic and pneumonic	Vector, Respiratory	Yes	Droplet if pneumonic plague	None	Antibiotics
Poliomyelitis	Fecal-oral	Yes	Contact	Vaccine	Vaccine
Rabies	Animal exposure	Yes	None	Vaccine	Vaccine, immune globulin
SARS	Respiratory	Yes	Airborne, droplet, contact	None	None
Smallpox	Respiratory, skin contact Weaponized	Yes	Contact, airborne	Vaccinia virus vaccine	Vaccinia virus vaccine, immune globulin
Ricin Toxin	Weaponized; ingestion	Yes	None	None	None
Tuberculosis	Respiratory	Yes	Airborne	None	Antibiotics
Tularemia	Vector, aerosols Weaponized	Yes	Standard for both skin and pulmonary	None	Antibiotics
Varicella	Respiratory, skin contact	Yes	Contact and airborne	Vaccine	Vaccine, immune globulin

Standard Precautions: Hand hygiene, respiratory etiquette; gloves, gowns, face shield based on anticipated exposures

Contact Precautions: Gowns, gloves for interaction with patient and their environment; patient cohorting or single room

Droplet Precautions: Surgical mask (public health worker and source patient), patient cohorting or single room

Airborne Precautions: N-95 respirator, airborne isolation room if available.

Adapted from Siegel et al., 2007 Guideline for Isolation Precautions: Preventing Transmission of Infectious Agents in Health Care Settings.

Appendix 4 – Overview of Level A, B, C, and D Protective Equipment (PPE)

Level A Personal Protective Equipment

Level A is considered to be the highest level of protection available for first responders. This level of protection provides a vapor-tight atmosphere for the responder, meaning that, when used correctly, Level A PPE provides complete respiratory, skin, and eye protection against environmental hazards. The following are the components of Level A PPE:

Respirator	<ul style="list-style-type: none"> • Positive pressure, full face self-contained breathing apparatus (SCBA) • Positive pressure air respirator with escape SCBA
Clothing	<ul style="list-style-type: none"> • Fully-encapsulating chemical protective suit • Coveralls, as needed • Long underwear, as needed
Accessories	<ul style="list-style-type: none"> • Chemical-resistant inner and outer gloves • Hard hat worn under suit, as needed
Footwear	<ul style="list-style-type: none"> • Chemical-resistant boots with steel toe and shank
Other	<ul style="list-style-type: none"> • Disposable protective suit, gloves and boots, worn over fully encapsulating suit

The equipment comprising Level A PPE is physically taxing for the wearer and should be worn continuously for no longer than thirty minutes. This level of protection presents safety hazards from restricted movement, vision, and communication abilities. Additionally, the equipment triggers physical and psychological concerns, including exhaustion, claustrophobia, excessive heating, and dehydration. Because of the stressors the equipment places on the body, training, respirator fit testing and medical clearance are required prior to use. Cardiac, pulmonary, vision, and hearing screenings, as well as exercise tolerance tests are required prior to use to ensure the safety of the wearer. For more information about Level A PPE, visit http://www.remm.nlm.gov/osha_epa_ppe.htm#levelA

Level A PPE should be used when:

- Hazardous substances have been identified.
 - Hazardous substances require the highest level of skin, eye, and respiratory protection, based on the following:
 - Actual or potential high measured concentrations of vapors, gases, or particulates in the environment.
 - Potential for splashing, immersion, or unexpected exposure to vapors, gases, or particulates that are harmful to exposed skin during site operations.
- Hazardous substances to skin have been identified or are suspected to be present.
- Operations will be conducted in a poorly-ventilated area.
- The absence of conditions requiring Level A protection has not yet been confirmed.

Example of Level A PPE

(Source: http://www.remm.nlm.gov/percutaneous_ppe.htm)

Level B Personal Protective Equipment

Level B is considered the next highest level of protection, following Level A. This level of equipment provides complete respiratory protection but less skin and eye protection for responders. Level B PPE is the minimum recommended level of equipment that should be used when entering an incident scene until all sampling has been completed and the hazard has been defined. The following are the components of Level B PPE:

Respirator	<ul style="list-style-type: none"> • Positive pressure, full face SCBA • Positive pressure air respirator with escape SCBA
Clothing	<ul style="list-style-type: none"> • Hooded, chemical-resistant clothing <ul style="list-style-type: none"> ○ Overalls and jacket ○ Coveralls ○ Chemical splash suit ○ Disposable chemical-resistant overalls • Coveralls, as needed
Accessories	<ul style="list-style-type: none"> • Chemical-resistant inner and outer gloves • Hard hat, as needed • Face shield, as needed
Footwear	<ul style="list-style-type: none"> • Chemical-resistant boots with steel toe and shank • Chemical-resistant boot covers, as needed

As with Level A equipment, Level B PPE is also physically taxing for the wearer, although it is less restrictive than Level A PPE. Training, respirator fit testing and medical clearance are also required for this level of protection. For more information on Level B PPE, visit

http://www.remm.nlm.gov/osha_epa_ppe.htm#levelB

Level B PPE should be used when:

- The type of hazards and their atmospheric concentrations have been identified.
 - Hazards require a high level of respiratory protection but less skin protection.
- The atmosphere contains less than 19.5% oxygen.
- A direct-reading organic vapor detection instrument has incompletely identified vapors or gases in the atmosphere.
 - Vapors or gases are not suspected to contain high levels of chemicals harmful to skin.

Example of Level B PPE



(Source: http://www.remm.nlm.gov/percutaneous_ppe.htm)

Level C Personal Protective Equipment

Level C equipment follows Level B PPE as the next level of protection for responders. Level C PPE provides less respiratory protection and is used when the airborne substances and their concentrations are known and the criteria are met for using an air-purifying respirator. This level of PPE provides limited skin protection against hazards. The components of Level C PPE include:

Respirator	<ul style="list-style-type: none"> • Full or half-face mask • APR
Clothing	<ul style="list-style-type: none"> • Hooded, chemical-resistant clothing <ul style="list-style-type: none"> ○ Overalls ○ Two-piece chemical splash suit ○ Disposable chemical-resistant overalls • Coveralls
Accessories	<ul style="list-style-type: none"> • Chemical-resistant inner and outer gloves • Hard hat, as needed • Face shield, as needed • Escape mask, as needed
Footwear	<ul style="list-style-type: none"> • Chemical-resistant boots with steel toe and shank • Chemical-resistant boot covers, as needed

Level C equipment is less physically and psychologically stressful for the wearer as compared to Levels A and B, as responders have greater mobility and are able to wear the equipment for longer operational periods. Medical monitoring and equipment training are required for Level C PPE. However, respiratory fit testing is not always required if the responder is using a hooded respirator, such as a powered air-purifying respirator (PAPR). For more information about Level C PPE, visit:

http://www.remm.nlm.gov/osha_epa_ppe.htm#levelC

Level C PPE should be used when:

- Atmospheric contaminants, liquid splashes, or direct contact with substances will not adversely affect skin.
 - Substances will not be absorbed through the skin.
- Air contaminants have been identified and measured in concentration.
 - Air-purifying respirators are available that can remove contaminants.
- All criteria for the use of air-purifying respirators are met.
- The atmosphere contains at least 19.5% oxygen.

It should be noted that respirators typically used for Level C PPE, including APRs and PAPRs are not approved for use with CBRN agents and may allow agent penetration. The exception to this includes APRs and PAPRs that have been specially modified during the manufacturing and testing process and have been specifically approved for CBRN use by NIOSH. These respirators are modified to include eyepiece and mask protective coverings. Only respirators labeled by NIOSH as being approved for CBRN use should be worn for CBRN events.

Examples of Level C PPE



(Source: http://www.remm.nlm.gov/percutaneous_ppe.htm)

Level D Personal Protective Equipment

Level D PPE provides the minimum level of protection against environmental contaminants for response personnel and often consists of an everyday work uniform. This level of PPE does not provide any respiratory protection and offers minimal skin protection. The components of Level D PPE include:

Respirator	<ul style="list-style-type: none"> • None
Clothing	<ul style="list-style-type: none"> • Regular work uniform • Coveralls
Accessories	<ul style="list-style-type: none"> • Gloves, as needed • Safety or chemical splash goggles, as needed • Hard hat, as needed • Escape mask, as needed • Face shield, as needed
Footwear	<ul style="list-style-type: none"> • Chemical-resistant boots with steel toe and shank • Chemical-resistant boot covers, as needed

Level D PPE consists primarily of a normal working uniform with disposable protective gown and a surgical/procedure mask. There is little equipment training or respiratory fit testing, thus no medical clearance is necessary for the responder. For more information about Level D PPE, visit http://www.remm.nlm.gov/osha_epa_ppe.htm#levelD

Level D PPE should be used when:

- The atmosphere contains no known hazard.
- The atmosphere contains at least 19.5% oxygen.
- Work duties preclude splashes, immersion, potential unexpected inhalation or contact with hazardous levels of any chemicals.

Example of Level D PPE (Source: http://www.remm.nlm.gov/percutaneous_ppe.htm)

