Recommendations for a Tiered Approach to Respiratory Protection for Emergency Workers Responding to a Nuclear/Radiological Incident

Recommendations of the NATIONAL COUNCIL ON RADIATION PROTECTION AND MEASUREMENTS

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7910 Woodmont Avenue, Suite 400, Bethesda, MD 20814-3095
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Executive Summary

After a large-scale nuclear/radiological incident, emergency workers at public shelters, Community Reception Centers (CRCs), or other locations outside the radioactive fallout zone will be providing screening, decontamination, housing, referral, or other types of services. These emergency workers may be at risk from potential inhalation exposures to airborne radioactive materials resuspended from externally contaminated members of the population who have been displaced and evacuated from the fallout zone. Displaced individuals may have become externally contaminated through direct deposition or contact with resuspended radioactive materials during the time those individuals were in the radioactive fallout zone. For this Statement, first responders (law enforcement, firefighters, emergency medical services) and first receivers (clinical staff at hospitals) for whom adequate guidance exists, are excluded.

In the context of the hierarchy of controls, use of personal protective equipment, including respiratory protection against inhalation hazards, should be considered as the last option after every effort is made to eliminate the hazard or mitigate it through implementation of engineering and administrative controls. Many emergency workers responding to a nuclear/radiological incident will already be part of an occupational respiratory protection program because their occupation involves potential exposures to airborne radioactive materials. However, a number of emergency workers (including volunteers) will not already be part of such a program. Thus, safely conducting emergency response services will require the capacity to provide respiratory protection care to more individuals than required in non-emergency situations. In addition, depending on the severity of a nuclear/radiological incident, during the early phase of a response many organizations may lack the capacity to implement the established respiratory protection standards and guidelines for occupational exposure scenarios (referred to in this Statement as conventional respiratory protection standards of care). Nevertheless, limitations in the capacity to immediately provide conventional respiratory protection standards of care should not be allowed to cause a lack or delay in provision of emergency services because such lacks or delays may significantly increase morbidity and mortality in the affected population.

To address the health and safety needs of emergency workers in a manner that is commensurate with limitations and circumstances imposed as a result of a large public health disaster, the NCRP recommends a three-tiered approach to providing respiratory protection to
emergency workers that is similar in concept to the Crisis Standards of Care established by the Institute of Medicine for provision of medical care in response to catastrophic disasters such as that caused by natural disasters (e.g., Hurricane Katrina), terrorist incidents, or pandemics (e.g., COVID-19). As described in Section 8 and summarized in TABLE 1, the three tiers are defined as conventional, contingency, and crisis respiratory protection capacity measures. This recommended approach is practical to implement and incorporates the variability in situations that may be encountered in the early phase of a response by various organizations.
## TABLE 1 — Tiered Approach to Respiratory Protection (RP) for Emergency Workers in a Large Scale Nuclear/Radiological Incident

<table>
<thead>
<tr>
<th>Respiratory Protection Tier</th>
<th>Inhalation Exposure Mitigation Steps</th>
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</thead>
<tbody>
<tr>
<td><strong>Conventional RP Capacity</strong></td>
<td>• Make every effort to eliminate need for RP</td>
</tr>
<tr>
<td>• Workers already included in an RP program</td>
<td>• Implement the organization’s RP program</td>
</tr>
<tr>
<td>• Respirator supply is adequate</td>
<td>• Monitor and document radiological conditions at the facility</td>
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<tr>
<td></td>
<td>• Consider bioassay monitoring of workers</td>
</tr>
<tr>
<td><strong>Contingency RP Capacity</strong></td>
<td>• Make every effort to eliminate need for RP</td>
</tr>
<tr>
<td>• Workers are not part of an RP program</td>
<td>• Use available respirators even if workers are not fit tested</td>
</tr>
<tr>
<td>• Respirator supply is adequate</td>
<td>• Monitor workers</td>
</tr>
<tr>
<td></td>
<td>• Monitor and document radiological conditions at the facility</td>
</tr>
<tr>
<td></td>
<td>• Make every effort to return to conventional capacity</td>
</tr>
<tr>
<td></td>
<td>• Implement as many elements of an RP program as possible</td>
</tr>
<tr>
<td></td>
<td>• Consider bioassay monitoring of workers</td>
</tr>
<tr>
<td><strong>Crisis RP Capacity</strong></td>
<td>• Make every effort to eliminate need for RP</td>
</tr>
<tr>
<td>• Workers are not part of an RP program</td>
<td>• Consider use of face coverings if no respirators are available</td>
</tr>
<tr>
<td>• Respirator supply is inadequate or non-existent</td>
<td>• Monitor workers</td>
</tr>
<tr>
<td></td>
<td>• Monitor and document radiological conditions at the facility</td>
</tr>
<tr>
<td></td>
<td>• Make every effort to return to contingency or conventional capacity:</td>
</tr>
<tr>
<td></td>
<td>a) If face coverings are being used, replace with appropriate respirators as soon as possible</td>
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<tr>
<td></td>
<td>b) Implement an RP program</td>
</tr>
<tr>
<td></td>
<td>c) Consider bioassay monitoring of workers</td>
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</tbody>
</table>
1. Background

After a large-scale nuclear/radiological incident (e.g., detonation of a nuclear weapon or improvised nuclear device) a large population may be displaced, and many may be contaminated with radioactive materials. Once the shelter-in-place period is past, this population will be received at locations and facilities that are set up outside the damage zones and dangerous fallout zones\(^1\) to provide shelter for the displaced evacuees, screen them for radioactive contamination, help with decontamination, and provide them referrals for medical, relocation, or other services. The population arriving at these facilities may be contaminated by direct deposition of fallout or through resuspension of fallout during transit through contaminated areas. Emergency workers\(^2\) will be involved in transporting evacuees, providing logistics, or other emergency support activities. The magnitude and relative significance of the potential inhalation hazard to which this group of workers may be exposed, as well as the health risks resulting from that exposure, are dependent on many factors including the type of radiation incident, time after the incident, distance from the incident, and any decontamination (including self-decontamination or change of clothes) which may have taken place prior to people reaching these emergency workers.

After a nuclear detonation, the primary hazard within the dangerous fallout zone\(^3\) is dominated by external radiation. The early fallout reaching the ground surface within the first few hours and in the vicinity of the detonation site is dominated by large-sized, non-respirable particles, particularly in the case of ground or near surface detonations (Glasstone and Dolan, 1977; Klement, 1965). Exposure of the population or emergency workers to airborne radioactive materials during the passage of this fallout plume poses negligible health risks


\(^2\) NCRP Report 179 (2017) defined emergency worker as: “those workers who would be called to assist with the response to a radiological or nuclear incident, acknowledging that most emergency workers have jobs that do not routinely expose them to radiation significantly greater than background levels. Such workers would include law enforcement, firefighters, emergency medical services, and members of the public thrust into a response effort as volunteers.” These workers also include public health and mass care workers responding to the emergency.

\(^3\) The dangerous fallout zone is defined in Planning Guidance for Response to a Nuclear Detonation as “The area covered by fallout that impacts responder life-saving operations and/or has acute radiation injury potential to the population.”
compared to the health risks posed by external radiation exposures to radioactive fallout. However, neither the potential inhalation exposures from passage of the fallout plume or potential external radiation exposures to the fallout are the focus of this Statement. This Statement focuses on health risks posed to emergency workers away from the detonation site who come in contact with members of the displaced population.

At increasing distances from the detonation site, nuclear fallout contains smaller-sized respirable particles at much lower concentrations which take longer to deposit on the ground (DTRA, 2009; Ng et al., 1990; Cerderwell et al., 1990; Hicks, 1982; US AEC, 1966; Klement, 1965). Evacuated and displaced people who arrive at mass care facilities, CRCs, or other locations outside the damage zones and dangerous fallout areas to receive assistance could be contaminated by direct deposition or resuspension of this fallout. This contamination, if not removed, can present an inhalation hazard from resuspension to emergency workers staffing those facilities. Non-respirable size particles (larger than 10 µm), while unlikely to deposit in the respiratory tract of emergency workers, may be trapped in the nose, swallowed, and result in ingestion dose to those workers (Ibrahim et al., 2010; Ng et al. 1990; LeRoy et al., 1966). Airborne radioactivity poses a greater potential hazard to emergency workers staffing mass care facilities or CRCs as these workers are present for longer time periods, while members of the public pass through.

The availability of personal protective equipment (PPE) guidance for each type of emergency worker varies widely:

- For first responders, there is extensive authoritative guidance from the Occupational Safety and Health Administration (OSHA) (OSHA, 2005; OSHA, 2011).
- For first receivers, though guidance is available (OSHA, 2005), the issues are generally those of training and understanding applications of existing guidance. There is adequate guidance addressing the health and safety needs of emergency workers entering the hot zone and for healthcare workers receiving patients with or without injuries (DRG, 2016; OSHA, 2009).

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4 See also https://www.osha.gov/respiratory-protection.
For the large network of responders, public health workers and volunteers who would be assisting the displaced population outside the hot zone, however, there is far less applicable literature on PPE and respiratory protection. The majority of these workers are not occupationally exposed to radiation as part of their regular duties, and they are not part of a respiratory protection program or an occupational bioassay monitoring program.

Respiratory protection standards and guidelines that are suitable for occupational exposure scenarios will be difficult to implement for all emergency workers who will be called upon to interact with and provide services to potentially contaminated people. Unlike the medical response to mass casualties or crises, there is currently no equivalent provision for “crisis standards of care” when it comes to addressing the health and safety needs of this group of emergency workers in a manner that is commensurate with limitations and circumstances imposed as a result of a large public health disaster. Lack of guidance and potential confusion about acceptable approaches to protect the health and safety of these individuals can impede emergency response operations at CRCs, public shelters, and other facilities where potentially contaminated people may need to receive services. Lack or delay in provision of these services may significantly increase morbidity and mortality in the affected population. Thus, it is important to establish guidance before disaster strikes so public health and emergency planners can be prepared to protect their workers in the most efficient and effective manner possible under such emergency conditions.

NCRP Report No. 179 (2017) and its companion Commentary No. 28 (2018) addressed the radiation dosimetry needs of emergency workers. Similarly, the NCRP has issued this Statement to address the respiratory protection for workers who are not occupationally exposed to radiation as part of their regular duties, and they are not part of a respiratory protection program or an occupational bioassay monitoring program.
2. **Scope**

This Statement is limited to respiratory protection issues related only to the emergency workers responding to a nuclear/radiological incident. Respiratory protection issues for first responders to nuclear/radiological incidents (e.g., firefighters, law enforcement, paramedics, and EMTs) and first receivers (clinical staff at hospitals and other medical facilities) are outside the scope of this Statement. Furthermore, this Statement addresses situations where it has been determined that the presence of radioactive contamination is the sole respiratory hazard. Considerations for appropriate respiratory protection actions in the situations involving mixed hazards such as biological or chemical or other hazards to health are outside the scope of this Statement. To the extent possible, guidance from OSHA Best Practices Guidance (OSHA, 2005), EPA Protective Action Guides and Planning Guidance for Radiological Incidents (EPA, 2017), and the Health and Safety Planning Guide for Protecting Responders Following a Nuclear Detonation (DRG, 2016) were used in developing this Statement. While the primary focus of this Statement is response to a nuclear detonation or radiological dispersion, the recommendations can be applied to a range of radiological disasters when significant resource limitations may be experienced.

3. **Factors Influencing Inhalation Hazards**

Many factors influence the potential health risks from exposures to inhalation hazards, and thus, the potential health risks to emergency workers from exposure to airborne radioactive materials. The influencing factors include the type of contamination (type of radionuclide and physical characteristics), environmental conditions, variables influencing resuspension from contaminated surfaces, and spatial and temporal circumstances in the exposure setting. Most of these can be combined into two broader categories: airborne radioactivity concentration in the breathing zone and inhalation exposure factors. Assessing the exposure concentration and inhalation exposure factors will help inform the need to consider respiratory protection for responding personnel.

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5 See also [https://www.osha.gov/emergency-preparedness](https://www.osha.gov/emergency-preparedness).
To characterize contamination, the radionuclide mixture, physical form (particulate or aerosol), chemical form (soluble or insoluble), particle size distribution, radioactive decay type (alpha, beta, gamma), decay rate (radiological and biological), suspension/resuspension rate should be considered. Other factors that influence breathing zone radioactivity concentrations include working indoors versus outdoors, the volume of the work area, air exchanges (wind or indoor air circulation), weather (precipitation, humidity, temperature, wind speed) and arrival rate and degree of contamination on evacuees being provided service. The most reliable method to ascertain the presence of an inhalation hazard is by direct measurements of the airborne radioactivity concentration. A hazard assessment will take these factors into consideration to either eliminate the need for respiratory protection or to require respiratory protection.

While there are many factors that affect the potential health risks to emergency workers exposed to airborne inhalation hazards, actions to reduce the airborne radioactivity concentration could have a significant impact on the actual respiratory risk posed, and the potential need for respiratory protection.

Inhalation factors help to assess how much material is inhaled, how much is deposited in the respiratory tract, and how that deposited material will result in a radiation dose to the emergency worker. Inhalation factors include breathing rates, the amount of time spent in areas of elevated radioactivity concentration, particle size distribution of the aerosol, dose conversion factors for each radionuclide present, and any protection factors that may be attributed to the use of PPE. Airborne radioactivity concentration provides a measure of how much radioactive material might be available to be inhaled. Reducing the time spent in the area, use of engineering controls, and making proper use of respiratory protection will reduce the inhalation dose.

4. Hierarchy of Controls

The concept of hierarchy of controls (NIOSH, 2015) is foundational to occupational health and safety for purposes of protecting workers from the risks posed by exposure to hazards such
as biological, chemical, or radiological agents. These controls, ordered from most effective to least effective are:

1. Elimination of the hazard: physically remove the contaminant (not practical in the emergency response phase of a nuclear/radiological incident).

2. Substitution: replace the contaminant with a less-hazardous agent (not applicable to a nuclear/radiological incident.)

3. Engineering controls: isolate the contaminant from contact with individuals, verified by monitoring, and surveillance of radiological conditions.

4. Administrative controls: change the way people work to minimize exposure or minimize contact with contamination that could result in subsequent uptake.

5. Personal Protective Equipment (PPE): protect the worker from exposure to the hazard through the use of PPE, which may include protective clothing (e.g., Tyvek coveralls), gloves, foot coverings, and/or respiratory protection.

Radiation safety principles for radiation workers include managing time, distance, and shielding to reduce external radiation exposure and eliminate or reduce internal exposure from ingestion or inhalation of radioactive materials. Examples of some administrative controls or precautions that should be considered for protection of personnel in a receiving facility include, but are not limited to:

- Setting up and managing a screening area to reduce or eliminate the amount of radioactive contamination brought into the facility by screening property and individuals for radioactive contamination prior to their entry into the receiving facility. Contaminated property and individuals can then be redirected to decontamination as appropriate.

- Maintaining appropriate distance with contaminated evacuees, limiting time in screening areas, providing change of clothing and footwear to arrivals, using dosimeters for screeners, and using area air monitoring devices to alert workers if there should be a sudden increase in radiation levels.

- Establishing awareness, understanding, and the ability to apply effective strategies regarding where to locate ingress/egress points at the facility relative to
environmental conditions (e.g., wind, rain) to minimize potential routes of radioactive contamination transport into the facility.

- Establishing awareness, understanding, and the ability to apply effective strategies regarding the use of general Heating, Ventilation, and Air Conditioning (HVAC) ventilation (e.g., positioning of ventilation inlets and outlets, air velocities, and ventilation system air changes per unit time) to isolate people from airborne radioactive contamination and thereby reduce radiation exposure.
- Establishing and following procedures for proper disposal/storage of radioactively contaminated waste.
- Establishing and following procedures for donning/doffing, disposal, decontamination, and storage of PPE.

The use of respiratory protection (i.e., the least effective control) should be considered as the last option in the hierarchy of controls. In any potential inhalation exposure situation, every attempt should be made to eliminate the need for respiratory protection through application of the hierarchy of controls. However, in the early phases of a response to a public health emergency, sufficient resources may not be available when requested to manage the radiological contaminants either prior to entry or within the facility itself. As a result, during such time there may be potential for levels of radioactive contamination within the facility that necessitate respiratory protection.

If there is potential for inhalation exposure, it would be prudent to apply some type of strategically placed environmental surveillance and monitoring of the facility to assess and record the levels of airborne and surface contamination. This can be accomplished by use of portable continuous air monitors or lapel air samplers for facility personnel. If resources for monitoring airborne contamination are not immediately available, an assessment of the presence of airborne contamination can be made by directly measuring deposited radioactivity on surfaces or indirectly by using swipes. Decisions regarding the need and the methods for active surveillance of air contamination levels at the facility will be made by the appropriate
health and safety authority\textsuperscript{6}. In either case, when measurements are made it is important to
document the measurement results, and when measurements are not made it is important to
document the reasons justifying a determination that such environmental surveillance at the
facility is not warranted.

5. Types of Respiratory Protection

The National Institute for Occupational Safety and Health (NIOSH)\textsuperscript{7} and the Occupational
Safety and Health Administration (OSHA)\textsuperscript{8} provide a wealth of information about different
types of respirators\textsuperscript{9} and their properties, including assigned protection factors, as well as the
requirements for using them. Examples of respiratory protection include filtering facepiece
respirators, elastomeric respirators with various types of filter cartridges, and powered air
purifying respirators. If respiratory protection is required for some response workers, the safety
officer or the appropriate health and safety authority decides which type of respiratory
protection is most appropriate.

In contrast to filtering facepiece respirators and other types of respirators designed to
protect the wearer, face coverings such as surgical masks are intended to function as source
control devices. In healthcare settings, for example, surgical masks are intended primarily to
protect the patient from respiratory secretions of the healthcare worker while they also protect
the clinician from large droplet splashes and sprays of bodily fluids from patients (NIOSH, 2016). Face coverings such as surgical masks are typically loose fitting and they do not provide
the same level of protection for the wearer as respirators. ASTM International has issued
standard specifications for barrier face coverings (ASTM, 2021)\textsuperscript{10}. Face coverings are not

\textsuperscript{6} The term “appropriate health and safety authority” in this statement is used to denote a person assigned duties as a science officer, safety officer within incident command structure, qualified respiratory protection program manager, or other qualified individual responsible for performing hazard assessment to evaluate the need for use of respiratory protection within the scope of this statement. The term does not refer to a governmental body or agency.

\textsuperscript{7} https://www.cdc.gov/niosh/topics/respirators/

\textsuperscript{8} https://www.osha.gov/respiratory-protection

\textsuperscript{9} The term respirator explicitly refers to a device that has been tested and approved by NIOSH.

\textsuperscript{10} NIOSH has issued interim guidance on masks and face coverings that incorporate the ASTM F3502-21 standard. This guidance can be found here: www.cdc.gov/niosh/topics/emres/pandemic/ and an updated list of products that have declared conformance to this standard can be found here: https://wwwn.cdc.gov/PPEInfo/RG/FaceCoverings.
Face coverings are not respirators and should not be used in situations where respiratory protection is needed and available.

Investigations of filtration efficiencies for various types of face coverings have, however, demonstrated that face coverings may offer some degree of protection (Long et al., 2020; Clase et al., 2020; Ueki et al., 2020; Whiley et al., 2020; Shakya et al., 2017; van der Sande, 2008; Dato et al., 2006). Unfortunately, published information about degrees of protection vary and are not directly comparable or easily quantifiable. The differences among the reported results stem in large part from varying details of experimental design, including differences in air flow rates, use of human subjects vs. mannequins, use of actual masks vs. pieces of cloth, and differences in the types of fabric used, among other factors.

While no definitive statement can be made for any specific type of face covering, it can be said that a properly fitting face covering (i.e., a face covering that leaves no noticeable gap) may offer some degree of protection against liquid aerosols or dry particulates. However, if face coverings are used during a radiological emergency, the response organization should always assume that these devices offer no protection from the respiratory hazard. The response organization should alleviate any false sense of security that may arise about the respiratory protection provided by face coverings by informing workers who choose to wear face coverings that these devices cannot be relied upon as a form of respiratory protection equipment.

6. Requirements for a Respiratory Protection Program

Implementation of the organization’s respiratory protection program, described as conventional respiratory protection capacity in Section 7, should be the first option considered in an emergency. Such programs should cover procedures for use of respirators, are required
to be developed in written form, and have a qualified individual designated to direct the program (OSHA, 2011). The following summarizes the required respiratory protection program elements, when applicable.

- **Procedures for selecting respirators.** The appropriate health and safety authority must evaluate the work area for respiratory hazards and identify relevant workplace and user factors. The selection of appropriate respirators must be made based on the factors identified from this evaluation.

- **Medical evaluations.** For each worker required to use a respirator, the appropriate health and safety authority must have a physician or other licensed health care professional perform a medical evaluation using either a medical questionnaire or a medical examination which obtains the same information as the questionnaire. The mandatory medical questionnaire is provided in 29 CFR 1910.134 Appendix C, OSHA Respirator Medical Evaluation Questionnaire\(^{11}\).

- **Fit testing.** Before workers may be required to use negative or positive pressure tight-fitting respirators, which includes filtering facepiece respirators, the appropriate health and safety authority must ensure that the workers using these respirators pass an appropriate qualitative or quantitative fit test.

- **Procedures for proper use of respirators.** The appropriate health and safety authority must develop and implement procedures for the proper use of respirators which include prohibiting conditions that may cause air leakage at the facepiece seal, preventing emergency workers from removing the respirator in hazardous environments, developing actions needed to ensure effective respirator operation throughout the shift, and if applicable, establishing procedures for use of respirators in atmospheres that are immediately dangerous to life or health (IDLH).

- **Procedures for cleaning, storage, and maintenance.** The appropriate health and safety authority must develop and implement procedures for cleaning and disinfecting, storing, inspecting, and repairing the respirators.

- **Procedures to ensure adequate air quality, quantity, and flow of breathing air if atmosphere-supplying respirators are used.** If applicable, the appropriate health and safety

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authority must provide response workers using atmosphere-supplying respirators (e.g., SCBA) with high purity breathing gases.

- **Training of response workers.** The appropriate health and safety authority must provide effective, comprehensive, and understandable training to response workers who are required to use respiratory protection. The training must be provided at least annually or more often if necessary. The appropriate health and safety authority is also required to provide the basic information on respirators provided in 29 CFR 1910.134 Appendix D\(^{12}\) to response workers who chose to wear respirators voluntarily.

- **Procedures for regular evaluation of the program.** The appropriate health and safety authority must conduct evaluations of the workplace as necessary to ensure the provision of the respiratory protection program are being effectively implemented.

For the specific requirements for each of these respiratory protection program elements response organizations should refer to 29 CFR 1910.134\(^{13}\), Respiratory Protection, and the OSHA Small Entity Compliance Guide for the Respiratory Protection Standard (OSHA, 2011). Additional information is available from the DHHS/NIOSH CBRN Respiratory Protection Handbook (NIOSH 2018).

### 7. A Tiered Approach to Respiratory Protection

As illustrated below, the safety authority may determine the need for respiratory protection when the inhalation hazard is known and well characterized or when an inhalation hazard is suspected.

**Situation 1: Known presence of a potential inhalation hazard**

A hazard assessment indicates that the potential for an inhalation hazard exists. Efforts to reduce or eliminate the source of exposures are implemented. Measurements of contamination in the air or on surfaces inside the facility confirm that levels of contamination would require the use of respiratory protection.

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Situation 2: Suspected presence of a potential inhalation hazard of unknown magnitude

There is insufficient information to inform a hazard assessment. The safety authority, based on site-specific circumstances, makes a prudent assumption that inhalation hazard exists. Efforts to reduce or eliminate the presumed source of inhalation exposures are implemented. There are no resources to assess contamination levels in the air or on surfaces inside the facility, and the safety authority determines respiratory protection is needed until measurements can be made to indicate otherwise.

In a wide-scale radiation incident, environmental conditions, potential hazards, availability of resources (radiation detection instruments, PPE, staffing, etc.), and degree of preparedness will vary from location to location. Thus, one specific set of recommendations for respiratory protection will not be suitable or applicable to every location at any given time. In this Statement, a tiered approach is recommended that is practical to implement and considers this variability.

This tiered approach is similar in concept to the Crisis Standards of Care (Institute of Medicine, 2013; 2012; 2010; 2009) for provision of medical care in response to catastrophic disasters such as that caused by natural disasters (e.g., Hurricane Katrina), terrorist incidents, or pandemics (e.g., COVID-19). The three general tiers used to describe surge capacity in the healthcare setting (CDC, 2020; Hick et al., 2020; Hick et al., 2009) may be adapted and applied as a tiered approach to meeting the potentially wide range of surge-capacity needs for respiratory protection of emergency workers in a large-scale radiation incident:

- **Conventional respiratory protection capacity measures**: operational conditions (spaces, staffing, equipment, procedures) are consistent with daily practices within the organization. A major disaster triggers the activation of the organization’s emergency response plan consisting of the implementation of engineering, administrative, and personal protective equipment controls that should already be part of their training and experience practices.

- **Contingency respiratory protection capacity measures**: operational conditions are not consistent with daily practices or recommended conventional respiratory protection approaches, but they are functionally similar. Contingency respiratory protection capacity
measures are implemented if conventional respiratory protection capacity measures are either non-existent or cannot be implemented due to shortage of resources or exigencies demanded by the emergency.

- **Crisis respiratory protection capacity measures**: operational conditions are not consistent with usual standards of worker safety and health protection, but it is necessary to provide the best possible worker safety and health protection given disaster circumstances and resources available. *Crisis respiratory protection capacity measures should only be implemented if conventional and contingency respiratory protection capacity measures are nonexistent or have been overwhelmed, and cessation of emergency response services is likely to impart greater harm to the public.* Crisis respiratory protection capacity measures are only to be used for a short term and efforts should be made to implement conventional respiratory protection capacity measures for emergency response workers as soon as possible.

While it is reasonable to assume (because of implied emergency response responsibilities) that conventional respiratory protection capacity strategies could be applied for first responders/receivers, such strategies may be more difficult to implement for the increased number and type of workers considered in this Statement. This will be due to lack of resources and lack of inclusion of these workers in established respiratory protection programs. This tiered approach can be implemented in the early phases of the response to address these issues as described below and summarized in TABLE 1.

8. **Implementation of the Three Tiers of Respiratory Protection Capacity**

8.1 **Plan A – Conventional Respiratory Protection Capacity Measures**

The value of preparedness for any type of public health emergency cannot be overstated. If a response organization determines in advance of the incident that respiratory protection may
be needed during an emergency, then 29 CFR 1910.134 requires the response organization to develop and implement a written respiratory protection program. Additionally, the respiratory protection standard requires that emergency managers designate a qualified and appropriately trained or experienced program administrator to oversee the respiratory protection program. A written respiratory protection program may be required if respirators are only used voluntarily, depending on the type of respirator used. Section 6 provides a summary of the respiratory protection program elements that are required.

8.2 Plan B – Contingency Respiratory Protection Capacity Measures

It is recognized that the majority of emergency workers from the many organizations that may be called upon to assist with the response, are not part of an occupational respiratory protection program. Consequently, implementation of the conventional approach to respiratory protection, as specified by regulatory requirements for occupational exposures, may not be possible in the initial phases of the response to the emergency. It is possible, however, that respirators designed to protect against particulates such as N-95 filtering facepiece respirators or elastomeric respirators could be available or could be supplied in short order.\(^{14}\)

Under these conditions, workers in need of respiratory protection should wear these respirators even if they have not been previously fit tested. If the workers exhibit any sign of breathing difficulty, they should stop wearing those respirators and be assigned to other duties. Elastomeric respirators have the advantage of reusability as long as proper cleaning/decontamination procedures are followed. If the supply of disposable respirators is limited or is in question, use of elastomeric respirators may provide an effective alternative. The safety authority should provide just-in-time training for proper use of these respirators and proper cleaning of them after use.

\(^{14}\) During the COVID-19 pandemic, the FDA issued emergency use authorization (EUA) for FFRs designed using foreign standards. Some OSHA requirements for FFRs were also waived to facilitate widespread use of respiratory protection. As access to NIOSH-approved FFRs increased nationwide, the FDA revoked EUAs for non-NIOSH-approved disposable respirators. [www.dhs.gov/sites/default/files/saver PARTICULATE-RESPIRATORY-PROTECTION_TECHNOTE_06AUGUST2021.PDF](http://www.dhs.gov/sites/default/files/saver PARTICULATE-RESPIRATORY-PROTECTION_TECHNOTE_06AUGUST2021.PDF).
As discussed earlier, it is essential to monitor and document the radiological conditions at the facility and implement measures to reduce or eliminate the need for respiratory protection. If a hazard assessment by the appropriate health and safety authority determines a low probability of inhalation hazard, the need for respiratory protection should be re-evaluated. If continued use of respiratory protection is needed for some emergency workers, every effort should be made, as resources and priorities allow, to implement procedures consistent with conventional capacity (i.e., implement a respiratory protection program). While the resources necessary to implement every element of a respiratory protection program may not be immediately available to a response organization, those elements that can be implemented immediately should be.

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Organizations should document the reasons why certain elements of a respiratory protection program cannot be immediately implemented, document the steps that have been taken to meet the requirement of the standard, and work to implement those missing elements as soon as practicable. Depending on the level of potential exposure, implementing a worker bioassay monitoring program should be considered.

8.3 Plan C – Crisis Respiratory Protection Capacity Measures

In the early phases of a response, it is possible that emergency workers who are providing public health and mass care services to the displaced, evacuated, or otherwise potentially contaminated individuals do not have access to adequate respiratory protection such as N95 or other respirators designed and certified to protect against particulates. Delay in provision of critical public health and mass care services until such resources arrive could have a detrimental effect on the safety and well-being of large populations in need of such services.

Crisis capacity strategies should only be implemented if conventional and contingency capacity are nonexistent, and cessation of services can impart greater harm to the public.
Evidence has demonstrated that face coverings (such as those advised for the public during the COVID-19 pandemic) may offer some protection from particulates for the wearer (CDC, Long et al., 2020; Clase et al., 2020; Ueki et al., 2020; Whiley et al., 2020; Shakya et al., 2017; van der Sande, 2008; Dato et al., 2006). The evidence further suggests that how well a face covering fits the face of the individual is as important, if not more important, than the particular fabric used (Brooks et al., 2021; Hill et al., 2020).

Crisis capacity strategies should only be implemented after considering implementation of conventional and contingency capacity strategies. Facilities may consider crisis capacity strategies when the respirator supply is not able to meet an organization’s current or anticipated use rates.

Use of face coverings should be considered only as a temporary crisis measure until proper respiratory protection can be obtained. While a face covering may offer some unquantifiable degree of protection against liquid aerosols or dry particulates in the air, the use of the face coverings as a crisis capacity strategy is based on the premise that any protection, however imperfect, may help reduce exposure to the emergency workers. Face coverings are not a substitute for respiratory protection. Workers should be informed that these devices cannot be relied upon as a form of respiratory protection.

Use of face coverings should be considered only as a temporary crisis measure until proper respiratory protection can be obtained. While face coverings may offer some unquantifiable degree of protection against liquid aerosols or dry particulates in the air, the use of the face coverings as a crisis capacity strategy is based on the premise that any protection, however imperfect, may help reduce exposure to the emergency workers.

Under these conditions, it is essential to monitor and document the radiological conditions by any means possible. If a hazard assessment by the appropriate health and safety authority determines a low probability of inhalation hazard, need for respiratory protection should be re-

Face coverings are not a substitute for respiratory protection.
evaluated. If continued use of respiratory protection is needed for some of the emergency workers, every effort should be made, as resources and priorities allow, to implement procedures consistent with contingency capacity with the goal to returning to conventional respiratory protection capacity. Depending on the levels of potential exposure, implementing a worker bioassay monitoring program should be considered.

8.4 Communicating with Emergency Workers

Regardless of which capacity tier is applied for respiratory protection, it is essential to ensure that all emergency workers (especially those who are volunteers) are briefed about potential risks they may encounter and the health and safety practices they should follow. Many workers in a disaster response situation have not had prior training in health and safety operations for such an emergency setting, and it is important to provide them with ample opportunity to ask questions from the appropriate health and safety authority and to provide them with just-in-time training as needed. Just-in-time training must include information on the inhalation hazards to which workers may be exposed, the nature of the health risks (e.g., stochastic effects), and on the proper use of the respiratory protection, including donning and doffing, limitations of their use, and their maintenance, storage, or disposal.

References


Acknowledgements

This Statement was prepared by NCRP Scientific Committee (SC) 3-3. The members are:

Committee Members

Armin Ansari, Ph.D., CHP, Co-Chair  
Centers for Disease Control and Prevention  
Atlanta, Georgia

K. Frieda Fisher-Tyler, MHS, CIH  
Delaware Division of Public Health (retired)  
Magnolia, Delaware

Adela Salame-Alfie, Ph.D., FHPS, Co-Chair  
Centers for Disease Control and Prevention  
Atlanta, Georgia

Ken Yale  
Environmental Protection Agency  
Washington DC

Jeff Chapman, PhD, CHP  
National Nuclear Security Administration  
Washington DC

Technical Advisors

Sean M. Crawford  
Federal Emergency Management Agency  
Washington DC

Ryan Schwartz  
Georgia Army National Guard  
Marietta, Georgia

Luis Garcia, Ph.D.  
Federal Emergency Management Agency  
Washington DC

Jonathan Szalajda  
National Institute for Occupational Safety and Health  
Pittsburgh, Pennsylvania

Jeffrey Lodwick, Ph.D., CHP  
Occupational Safety and Health Administration  
Salt Lake City, UT

Trae Windham  
Texas Department of State Health Services  
Austin, Texas

NCRP Secretariat

Kathryn D. Held, Ph.D., President (2019-present)  
Jerrold T. Bushberg, Ph.D., Senior Vice President (2011-present)  
Emily A. Caffrey, Ph.D., CHP, Staff Consultant  
Cindy L. O’Brien, Managing Editor  
Laura J. Atwell, Director of Operations

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