Selection and Use of Personnel Protective Equipment

Nuclear Secured / Radiation Safety

NS-RS-PR-203, 0

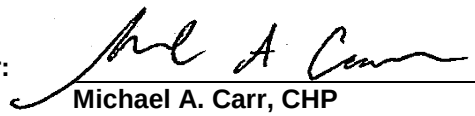
Date Effective: 11 August 2019

History and Approvals

History

Revision	Intent Y/N	Purpose description
0	Y	For Issue (Rebrand CS-RS-PR-001)

Approvals

Preparer: 

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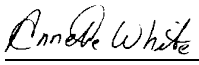
8/5/2019
Date

Reviewer: 

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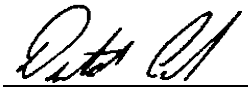
Approver: 

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8/14/2019
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1. Purpose and Scope

1.1. Purpose

This procedure provides the guidance for selecting radiological protective equipment (PPE), specifically (anti-contamination) clothing, and addresses the proper sequence for donning and removing protective clothing. This procedure does not address protective clothing for non-radiological hazards such as chemical exposure.

1.2. Scope

This procedure applies to all Nuclear Secured (NS) personnel and subcontractors where the NS Radiation Protection Plan (RPP) has been implemented for the management of the project site Restricted Areas and only addresses PPE for radiological protection.

2. References

2.1. 10CFR20, *Standards for Protection Against Radiation*

2.2. 29CFR1910 and 1926, *Occupational Health and Safety Regulations*

2.3. NS-RS-PG-001, *Radiation Protection Program*

2.4. NS-RS-PR-204, *Personnel Frisking and Decontamination*

2.5. NS-RS-PR-601, *Selection and Use of Respiratory Protection Equipment*

3. General

3.1. Definitions

3.1.1. *Airborne Radioactivity Area (ARA)* – A room, enclosure or area in which airborne radioactive materials composed wholly or partially of licensed material exist in concentrations in excess of the Derived Airborne Concentration as specified in 10CFR20 Appendix B Table 1 OR such that an individual present in the area without respiratory protection equipment, during the hours an individual is present in a week, could exceed an intake of 0.6 percent of the Annual Limit on Intake or 12 DAC-hours.

3.1.2. *Contamination Area (CA)* - Any area accessible to personnel with loose surface contamination greater than 1,000 dpm per 100 cm^2 β-γ, 20 dpm per 100 cm^2 α, or greater than or equal to the site's contamination limits.

3.1.3. *Controlled Surface Contamination Area (CSCA)* – DOE equivalent to a Contamination Area.

3.1.4. *Control Point (CP)* – An access point to a Restricted Area.

3.1.5. *Hazard Assessment* - The determination of the degree of risk based on all aspects of an exposure situation; including the characteristics of the chemical(s) or radiation to which individuals will be exposed and the conditions that determine the degree of exposure.

3.1.6. *High Contamination Area* – Any CA in which the removable surface contamination exceeds an administrative limit requiring increased controls; typically, 10,000 dpm/100 cm^2 α and 100,000 dpm/100 cm^2 β/γ.

3.1.7. *Protective Clothing* - Any material or combination of materials used to isolate parts of the body from direct contact with a potentially hazardous chemical or radiological contaminant.

3.1.8. *Radiation Work Permit (RWP)* – An administrative mechanism used to establish radiological controls for intended work activities with radioactive materials..

3.2. Responsibilities

Depending on personnel qualifications and the size of the project, project personnel may be assigned multiple roles and/or responsibilities.

3.2.1. NS Radiation Safety Officer

The NS Radiation Safety Officer (RSO) maintains and oversees the implementation of the NS RPP. The RSO shall ensure that radiation safety, radioactive materials management, and radiological operations procedures and programs are kept up to date such that they comply with current regulations and incorporate current and relevant industry practices and regulatory guidance.

3.2.2. Project Manager

The Project Manager (PM) is responsible for ensuring that the proper program procedures and programs are implemented on the project site as required by customer agreements and contracts. The PM is responsible for ensuring that these programs and procedures are properly incorporated into project specific plans and procedures. The PM is responsible for ensuring that the NS RPP and client programs and procedures, as applicable, are available for use by project personnel.

3.2.3. Project Health Physicist

The Project Health Physicist (PHP) is responsible for assisting the RSO in providing health physics support to the PM and Radiation Protection Supervisor (RPS). This includes technical support to ensure procedural and regulatory compliance and to ensure that the project-specific Data Quality Objectives (DQOs) are met.

3.2.4. Radiation Protection Supervisor

The Radiation Protection Supervisor (RPS) is responsible for implementing the NS RPP at the project location. The RPS manages and oversees the project personnel in regards to radiation safety and is specifically responsible for establishing the Restricted Areas on-site and establishing the entry requirements including PPE to ensure the health and safety of project personnel.

3.2.5. Project personnel

Project personnel that enter posted Restricted Areas are responsible for following the entry requirements and the proper use of PPE. This includes the proper inspection of PPE and the appropriate donning and doffing sequence to minimize the potential of personnel contamination.

3.3. Precautions and Limitations

3.3.1. This procedure does not address protective clothing for non-radiological hazards such as exposures to chemicals.

3.3.2. PPE for non-radiological hazards shall be specified by Health and Safety personnel including hard hats, steel toed shoes and boots, safety glasses, respiratory protection for chemical hazards and vapors, etc.

3.3.3. The use of protective clothing can contribute to physical and heat stress concerns.

3.3.4. The selection of respiratory protection as part of the PPE is addressed in NS-RS-PR-601, *Selection and Use of Respiratory Protection Equipment*.

3.3.5. PPE should be donned such that it has overlapping or layered surfaces to ensure clean surfaces are available during the doffing sequence.

3.3.6. Place used PPE in the proper radioactive waste or laundry receptacles.

3.3.7. Pushing clothing or trash into radioactive waste receptacles to compress the contents may cause airborne radioactivity.

4. Pre-Requisites / Requirements

4.1. Engineering and administrative controls shall be considered and implemented, to the extent practical, to minimize PPE requirements.

4.2. Ensure consideration for the type of protective clothing and ensure it does not increase the risk of personnel exposure or jeopardize personnel safety.

4.3. Protective clothing requirements shall be based on known and expected contamination levels, hazard assessments, exposure pathways, and expected working conditions.

4.4. Proper quantities and sizes of PPE shall be available.

4.5. PPE shall be stored in a dry and controlled area to prevent damage and degradation.

5. Procedure

5.1. Selection of PPE

5.1.1. PPE should only be used when engineering and administrative controls are not sufficient to eliminate the hazard.

5.1.2. The following factors should be considered when specifying the PPE requirements:

- The levels and types of radiological contamination present or expected in the work area
- The physical properties and matrix of the contamination (i.e., dry, wet, oily, etc.)
- The type of work to be performed
- The location of contamination (e.g. floor, walls, overhead, in systems)
- The physical configuration of the work area (close or congested areas may require more protective clothing than open areas)
- Environmental conditions such as heat and humidity
- Exposure pathways (vapor, pressured splash, liquid splash, intermittent liquid contact, or continuous liquid contact)
- Toxicity of the radioactive materials and/or chemical(s) (i.e., ability to permeate the skin and systemic toxicity)
- Functional requirements of the task (e.g., dexterity, thermal protection, fire protection, and mechanical durability requirements)
- Properties of the PPE that are relevant to the hazards present such as the permeation, degradation and penetration resistance of the PPE.

5.1.3. Types of PPE that may be considered include but are not limited to the following:

- Cotton Liners and rubber or nitrile gloves
- Leather or Kevlar gloves (sharp resistant)
- Booties and shoe covers
- Rubber boots
- Coveralls (cloth, Tyvek®, Saranex®)
- Aprons
- Lab coat

- Surgeons caps and/or hoods
- Face shields

5.1.4. General guidance for the selection of radiological PPE is provided in Attachment 7.1 based on the type of work, radiological hazards, and levels of potential contamination present or suspected.

5.2. PPE Inspection

5.2.1. Determine the PPE requirements as specified by the applicable RWP.

5.2.2. Select the appropriate sized and type of PPE.

5.2.3. Inspect the PPE for holes, tears, or other damage while paying close attention to seams and fasteners.

5.2.4. Test gloves as applicable for pin holes by folding/holding the cuff closed while gently squeezing the glove. (Do not blow into the glove(s) to fill with air)

5.2.5. Do not wear damaged PPE.

5.2.6. Damaged PPE may be disposed as clean waste provided it may not be mistaken as radiological waste based on color and it should be rendered unrecognizable and clearly marked as clean waste; otherwise, dispose as radiological waste.

5.3. Donning PPE

5.3.1. If required by the RWP, remove all personal clothing except shoes, socks and modesty clothing (i.e., scrubs, gym shorts, t-shirts, or bathing suit).

5.3.2. If the work area temperature is such that extra warmth is needed, additional personal clothing may be allowed at the discretion of the RPS or Health and Safety personnel.

5.3.3. Don any required special dosimetry (e.g., finger rings) prior to donning protective clothing unless otherwise specified by the RWP.

5.3.4. Wear primary dosimetry outside of the wearer's modesty clothing under their PPE on the front of the body facing outward between the neck and waist unless otherwise specified by the RWP (e.g., if beta exposure is of concern).

5.3.5. The donning sequence does not have to be followed in the given order provided the clothing is properly worn. Clothing shall be layered and/or overlapped to provide clean surfaces during the doffing sequence.

5.3.6. Don the first pair of booties and glove liners.

5.3.7. Don coveralls and secure any closures (e.g., zipper, drawstring, snaps, or buttons). The coveralls should fit loosely to allow the necessary movement while working and so that they can be easily removed without cross contaminating the skin.

5.3.8. Coverall closures may be taped such as the crotch or zippers.

5.3.9. Tape the bottom of the coverall legs to the booties; allowing enough slack in the coverall legs to facilitate stooping and bending.

5.3.10. Don rubber shoe covers.

5.3.11. Place any self-reading dosimeter as specified in the RWP on the coveralls in the upper breast tab or pocket of the outer PPE for ease of access. If the PPE does not have an upper breast tab or pocked the SRD shall be worn as directed by health physics personnel.

5.3.12. If required, don a surgeon's cap.

5.3.13. If a respirator is specified ensure that the surgeons cap is situated such that it will not intrude into the respirator seal area.

5.3.14. Don the respirator in accordance with NS-RS-PR-601, *Selection and Use of Respiratory Protection Equipment*.

5.3.15. Don the hood, allowing it to overlap the rubber around the lens of the face piece if a respirator is work and fall over the shoulder.

5.3.16. Tape the hood to the respirator and to the coveralls if required.

5.3.17. Ensure that the hood is slack enough around shoulders to allow for full head movement.

5.3.18. Don rubber gloves.

5.3.19. Don second set of coveralls if required for high contamination areas or if fire retardant PPE is required.

5.3.20. Don outer rubber gloves.

5.3.21. Tape innermost rubber gloves to coverall sleeves prior to donning additional sets of rubber gloves and/or second set of coveralls as required.

5.3.22. Leather work gloves may be substituted for outer rubber gloves for some jobs as specified on the RWP.

5.4. Doffing PPE, Double Step-off Pad

5.4.1. Health physics support personnel shall be provided when doffing outer PPE from high contamination areas and when requested.

5.4.2. Remove any outer dosimetry (SRD) and provide to Health Physics support personnel for frisking and release.

5.4.3. Remove any tape securing outer gloves (i.e., second set) and/or booties and dispose as radioactive waste.

5.4.4. Remove outer PPE in the following order starting with items that are the most contaminated or as directed by health physics support personnel.

- Rubber shoe covers
- Outer gloves
- Hood
- Outer set of coveralls
- Respirator
- Outer booties

5.4.5. While doffing PPE, use/grasp newly exposed surfaces to help minimize any spread of contamination.

5.4.6. Coveralls should be rolled outward and/or turned inside out during removal to help prevent the spread of contamination.

5.4.7. When removing respirators, lean forward and grasp the respirator snout and pull straight down to clear the chin and away from the body

5.4.8. Place PPE in the appropriate receptacles. Gloves and booties will be disposed as radioactive waste while hoods, coveralls and shoe covers will either be laundered or disposed as radioactive waste. Respirators will have the filters removed and disposed as radioactive waste and the respirator staged for laundering or decontamination and re-use.

5.4.9. While removing the outer booties, step onto the step of pad.

5.4.10. Move to the outer step of pad and continue with the with procedure for a single step of pad.

5.5. Doffing PPE, Single Step-off Pad

5.5.1. Remove any outer dosimetry (SRD) and provide to health physics support personnel for frisking and release.

5.5.2. Remove any tape securing gloves and/or booties and dispose as radioactive waste.

5.5.3. Remove PPE in the following order starting with items that are the most contaminated or as directed by health physics support personnel.

- Shoe covers
- Gloves
- Hood
- Respirator
- Coveralls
- Booties
- Cotton liners

5.5.4. While doffing PPE, use/grasp newly exposed surfaces to help minimize any spread of contamination.

5.5.5. Coveralls should be rolled outward and/or turned inside out during removal to help prevent the spread of contamination.

5.5.6. When removing respirators, lean forward and grasp the respirator snout and pull straight down to clear the chin and away from the body

5.5.7. Place PPE in the appropriate receptacles. Gloves and booties will be disposed as radioactive waste while hoods, coveralls and shoe covers will either be laundered or disposed as radioactive waste. Respirators will have the filters removed and disposed as radioactive waste and the respirator staged for laundering or decontamination and re-use.

5.5.8. While removing the outer booties, step onto the step of pad.

5.5.9. Proceed to the nearest frisking station and perform a whole-body frisk or as specified on the RWP in accordance with NS-RS-PR-204, *Personnel Frisking and Decontamination*.

6. Records

6.1. Radiological Surveys

7. Appendices and Forms

7.1. PPE Guidance Levels

Attachment 7.1 **PPE Guidance Levels**

Removable Contamination dpm/100 cm^2	Recommended Minimum Protective Clothing
BETA/GAMMA EMITTERS	
1,000 - 5,000 (inspection only)	Booties, rubber shoe covers, gloves/liners, lab coat
5,000 - 100,000 (inspection only)	Booties, rubber shoe covers, gloves/liners, coveralls, hood
1,000 - 100,000 (hands on work)	
> 100,000 (all entries)	Double PPE: booties, gloves/liners, coveralls, hood, booties (outer), coveralls (outer), rubber shoe covers, gloves (outer), hood (outer), respirator
< 100,000 with spraying or standing water	Booties, rubber shoe covers or boots, gloves/liners, coveralls, hood. PPE should be water resistant or utilize wetsuit. Face shield.
> 100,000 with spraying or standing water	Double PPE: booties, gloves/liners, coveralls, hood, booties (outer), coveralls (outer), rubber shoe covers, gloves (outer), hood (outer). Outer PPE should be water resistant (e.g. wetsuit). Face shield.
ALPHA EMITTERS	
20 – 1.000 (inspection only)	Booties, rubber shoe covers, gloves/liners. Lab coat
1.000 - 10,000 (inspection only)	Booties, rubber shoe covers, gloves/liners, coveralls, hood
20 - 10,000 (hands on work)	
> 10,000 (all entries)	Double PPE: booties, gloves/liners, coveralls, hood, booties (outer), coveralls (outer), rubber shoe covers, gloves (outer), hood (outer), respirator
< 10,000 with spraying or standing water	Booties, rubber shoe covers or boots, gloves/liners, coveralls, hood. PPE should be water resistant or utilize wetsuit. Face shield.
> 10,000 with spraying or standing water	Double PPE: booties, gloves/liners, coveralls, hood, booties (outer), coveralls (outer), rubber shoe covers, gloves (outer), hood (outer). Outer PPE should be water resistant (e.g. wetsuit). Face shield.

Depending on the type of work such as grinding and or more aggressive work, the removable contamination limits used for PPE guidance should be reduced by at least 50% as directed by the RSO and/or PHP.