

Personnel Frisking and Decontamination

Nuclear Secured / Radiation Safety

NS-RS-PR-204, 0

Date Effective: 11 August 2019

Nuclear Secured / Radiation Safety		Personnel Frisking and Decontamination	
Doc. No.: NS-RS-PR-204		Revision 0	Page 2 of 17

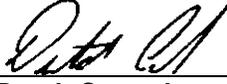
History and Approvals

History

Revision	Intent Y/N	Purpose description
0	Y	For Issue (Rebrand CS-RS-PR-002)

Approvals

Preparer:  8/5/2019
 Michael A. Carr, CHP
 Radiation Safety Officer Date

Approver:  8/14/2019
 Dutch Conrad
 Senior Vice President Field Services Date

Nuclear Secured / Radiation Safety		Personnel Frisking and Decontamination	
Doc. No.: NS-RS-PR-204		Revision 0	Page 3 of 17

Table of Contents

Chapter	Page
1. Purpose and Scope	4
1.1. Purpose	4
1.2. Scope	4
2. References	4
3. General	4
3.1. Definitions	4
3.2. Responsibilities	5
3.3. Precautions and Limitations	6
4. Pre-Requisites / Requirements	6
5. Procedure	7
5.1. Personnel Contamination Monitors	7
5.2. Personnel Frisking	7
5.3. Personnel Contamination	8
5.4. Personnel Decontamination	9
5.5. Hot Particles	11
5.6. Conditional Release of Personnel.	12
5.7. Dose Assessments	12
5.8. Follow-up	13
6. Records	13
7. Attachments and Forms	14

Nuclear Secured / Radiation Safety	Personnel Frisking and Decontamination	
Doc. No.: NS-RS-PR-204	Revision 0	Page 4 of 17

1. Purpose and Scope

1.1. Purpose

This procedure provides the specific instructions regarding personnel monitoring for skin and clothing contamination and for the decontamination of personnel.

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 monitoring personnel exposures.

2. References

- 2.1. 10CFR20, *Standards for Protection Against Radiation*
- 2.2. AE-SH-PR-002, *Incident Reporting and Notification*
- 2.3. NS-RS-PG-001, *Radiation Protection Program*
- 2.4. NS-RS-PR-102, *Project Records Management*
- 2.5. NS-RS-PR-200, *Emergency Response*
- 2.6. NS-RS-PR-502, *Bioassay Sampling*
- 2.7. NS-RS-PR-503, *External Dose Assessment*
- 2.8. NS-RS-PR-504, *Internal Dose Assessments*

3. General

3.1. Definitions

- 3.1.1. *Contamination Area (CA)* - Any area accessible to personnel with loose surface contamination greater than 1,000 dpm per 100 cm² β-γ, 20 dpm per 100 cm² α, or greater than or equal to the site's contamination limits.
- 3.1.2. *Controlled Surface Contamination Area (CSCA)* – DOE equivalent to a Contamination Area.
- 3.1.3. *Control Point (CP)* – An access point to a Restricted Area.

Nuclear Secured / Radiation Safety	Personnel Frisking and Decontamination	
Doc. No.: NS-RS-PR-204	Revision 0	Page 5 of 17

- 3.1.4. *Hot particle* - A discrete, high specific activity radioactive particle that is typically less than 0.1 cm in any dimension (and normally insoluble in water).
- 3.1.5. *High Contamination Area* – Any CA in which the removable surface contamination exceeds an administrative limit requiring increased controls; typically, 10,000 dpm/100 cm² α and 100,000 dpm/100 cm² β/γ.
- 3.1.6. *Radiation Work Permit (RWP)* – A document or series of documents prepared by the RPS to inform workers of the radiological and hazardous conditions which exist in the work area and the radiological requirements for the job.
- 3.1.7. *Restricted Area* - An area, access to which is limited by the licensee for the purpose of protecting individuals against undue risk from exposure to radiation and 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.

Nuclear Secured / Radiation Safety	Personnel Frisking and Decontamination	
Doc. No.: NS-RS-PR-204	Revision 0	Page 6 of 17

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 requirements of this procedure and the applicable radiation work permit (RWP).

3.3. Precautions and Limitations

3.3.1. Personnel recently administered medical radioisotopes may alarm personnel friskers. They should be monitored prior to entry into a Restricted Area to ensure that the residual radioactivity from the medical procedure will not interfere with contamination monitoring on exiting from the Restricted Area.

3.3.2. Prior to entering an RCA where personnel are required to frisk on exiting, ensure there are operational friskers at the control point that are within calibration and have been source checked.

3.3.3. General area background at the control point or frisking station should be less than 100 cpm; however, it shall be less than or equal to 300 cpm. If greater than 300 cpm, the frisking station shall be moved to a lower background area. Alternatively, a preliminary frisk may be performed within the higher background area followed by a secondary frisk in a low background area (i.e., <300 cpm).

4. Pre-Requisites / Requirements

4.1. Lifesaving medical procedures shall always take precedence over the decontamination of personnel. Measures to prevent or contain radioactive contamination should be taken provided it does not interfere with medical treatment.

4.2. Personnel exiting a posted contaminated area are required to perform a personnel frisk in accordance with the requirements as specified on the RWP and this procedure.

4.3. The RPS or PHP shall establish alarm limits for friskers and personnel contamination monitors (PCMs) to identify personnel contamination based on the radionuclides of concern. Generally, these are typically set as 20 cpm alpha and 100 cpm above background for beta-gamma friskers; however, this may be modified depending on the type of instrument and detector used.

4.4. Water used for the decontamination of personnel shall be treated as contaminated and disposed accordingly.

Nuclear Secured / Radiation Safety	Personnel Frisking and Decontamination	
Doc. No.: NS-RS-PR-204	Revision 0	Page 7 of 17

- 4.5. High contamination levels with dose consequences or hot particles located on the body shall require prompt decontamination.

5. Procedure

5.1. Personnel Contamination Monitors

- 5.1.1. When available, use automated whole-body monitors or PCMs for performing personnel surveys for beta-gamma and/or alpha activity.
- 5.1.2. Use the PCM in accordance with the instructions posted on the monitor.
- 5.1.3. If an alarm is experienced, exit the monitor and note the area that alarmed.
- 5.1.4. Re-enter the PCM and re-monitor the area using the same unit.
- 5.1.5. If the recount does not result in an alarm, then exit the area.
- 5.1.6. If contamination is indicated during subsequent monitoring, note the area of the body where the alarm indicated, stand fast and notify health physics personnel.
- 5.1.7. Remain in the area until health physics arrives to provide assistance.

5.2. Personnel Frisking

- 5.2.1. If an automated whole-body frisker is not available, use hand held portable field instruments as provided by health physics.
- 5.2.2. Field instruments should have both a visual and an audible response.
- 5.2.3. Ensure that the instrument is set on slow response, if available, and that the audible response is turned on.
- 5.2.4. Verify that the instrument is within the current calibration and has been source checked prior to use.
- 5.2.5. Verify that the instrument is on the lowest scale and that the background count rate as applicable is <300 counts per minute (cpm) β/γ .
- 5.2.6. If the background is too high, then contact health physics and/or the RPS for direction prior to frisking.
- 5.2.7. If practical, check hands before picking up the frisker probe.
- 5.2.8. Hold the detector with the window at approximately ½-inch for β/γ or 1/4-inch for α from the surface being monitored.

Nuclear Secured / Radiation Safety	Personnel Frisking and Decontamination	
Doc. No.: NS-RS-PR-204	Revision 0	Page 8 of 17

- 5.2.9. Typically, starting with the face and mouth, move the detector over the body surface being monitored at a rate of approximately 1 to 2 inches per second or less.
- 5.2.10. Pause for approximately 5 to 10 seconds at the nose and mouth to check for any potential indications of inhalation or ingestion of radioactive material.
- 5.2.11. Continue frisking the rest of the body.
- 5.2.12. If an increase in the audible response is noted, then cease detector movement and allow the meter to stabilize for about 5 to 10 seconds.
- 5.2.13. Pay attention to high contact areas including the hands, feet (shoes), elbows, knees, or other areas where there is a high potential for contamination.
- 5.2.14. If no contamination is detected as indicated by an alarm or visual instrument response, then exit the area.
- 5.2.15. If the frisker alarms or a visual response indicates contamination, stand fast and notify health physics.
- 5.2.16. Remain in the area until health physics arrives to provide assistance.

5.3. Personnel Contamination

- 5.3.1. In the event of an emergency and it is necessary to transport a contaminated injured individual to an off-site medical facility, immediately notify the PM and/or RSO so a member of project management and health physics may accompany the individual and take appropriate precautions to minimize the spread of contamination as applicable.
- 5.3.2. Health physics shall perform a survey of the contaminated individual.
- 5.3.3. Determine whether the contamination is on the skin or clothing.
- 5.3.4. Determine if the contamination is in the form of a hot particle. A hot particle will cause the count rate to rapidly increase as the detector is moved slowly over a small area and may move as a result of its high charge and static electricity.
- 5.3.5. The RPS shall notify the PM of any individual who may be contaminated so the PM can complete an incident report and make the proper notifications in accordance with AE-SH-PR-002, *Incident Reporting and Notification*.
- 5.3.6. If the contamination is in the form of a hot particle, the RPS shall immediately notify the PM and the RSO because of the potential high dose ramifications.
 - 5.3.6.1. Quickly evaluate the hot particle.
 - 5.3.6.2. Attempt to collect and retain the particle for subsequent evaluation.

Nuclear Secured / Radiation Safety	Personnel Frisking and Decontamination	
Doc. No.: NS-RS-PR-204	Revision 0	Page 9 of 17

- 5.3.6.3. Decontaminate the individual as described in Section 5.4.
- 5.3.7. If the β/γ activity level is beyond the range of the instrumentation used immediately notify the PM and RSO because of the potential high dose ramifications and survey the contaminated area with an ion chamber dose-rate instrument.
- 5.3.7.1. Perform an "open window" scan of the affected area(s) to locate the contamination.
- 5.3.7.2. Hold the detector window within ½-inch of the surface being surveyed.
- 5.3.7.3. Obtain "open window" and "closed window" exposure rates for the contaminated area(s) as directed by the RPS or PHP.
- 5.3.7.4. Record the instrument Beta Correction Factor (BCF) as needed.
- 5.3.7.5. Estimate the size of the contaminated area using survey instrumentation for dose assessment.
- 5.3.7.6. Lightly smear any areas that may have been directly exposed to tritium contamination (e.g., face, hands, hair, knees, or soles of shoes) as directed by the RPS or PHP.
- 5.3.8. If contamination is detected on the face or airborne radioactivity was suspected immediately notify the PM and RSO and obtain nasal swabs as directed.
- 5.3.8.1. Collect nasal swabs on a clean, cotton-tipped applicator (e.g., Q-tip).
- 5.3.8.2. Gently rotate the swab over the accessible surfaces, not more than ½-inch inside the nostril.
- 5.3.8.3. Use a separate swab for each nostril.
- 5.3.8.4. Transport nasal swabs to the laboratory for analysis as soon as possible.
- 5.3.9. Record all survey information including the contamination levels, estimated size of the contaminated area, location and estimated time of contamination on a personnel contamination report, Attachment 7.1 or equivalent.
- 5.3.10. Decontaminate the individual in accordance with Sections 5.4 as applicable.

5.4. Personnel Decontamination

- 5.4.1. Except under emergency situations, only Health Physics personnel and qualified medical personnel are permitted to administer personnel decontamination procedures.

Nuclear Secured / Radiation Safety	Personnel Frisking and Decontamination	
Doc. No.: NS-RS-PR-204	Revision 0	Page 10 of 17

- 5.4.2. Cleaning of open wounds shall only be done under the direction of qualified medical personnel.
- 5.4.3. Take appropriate precautions to minimize the spread of contamination when proceeding from the control point or step-off-pad (SOP) to the decontamination facility.
- 5.4.4. Perform personnel decontamination in such a manner as to prevent the spread of contamination to other body parts, breaking the skin, or the ingestion of radioactive material.
- 5.4.5. If the contamination is on an article of clothing, health physics personnel shall perform the following:
- 5.4.5.1. Attempt to decontaminate the article using a tape press.
 - 5.4.5.2. Carefully remove the article of clothing.
 - 5.4.5.3. Survey the inside surface(s) that were against the skin.
 - 5.4.5.4. Verify that no contamination was transferred to the skin.
 - 5.4.5.5. Remove label, and bag the clothing if decontamination was not successful. Store the item pending further evaluations and/or dose calculations.
 - 5.4.5.6. Provide modesty clothing as necessary and determine a replacement cost of the item.
- 5.4.6. If the individual is physically contaminated, health physics personnel shall perform the following:
- Determine the size area of contamination in cm².
 - Decontaminate personnel in accordance with the methods as described in Attachment 7.2.
 - Decontamination of nasal passages shall be limited to repeated nose blowing by the individual.
 - Decontamination of eyes shall be limited to repeated eye flush using saline.
 - Decontamination methods other than those listed in Attachment 7.2 shall be performed under the direction of qualified medical personnel.
- 5.4.7. For contamination distributed over an area greater than or equal to the area of the probe, the measured activity may be assumed to be distributed over the probe area (i.e., the area of a typical pancake probe is 15.5 cm²).
- 5.4.8. If the area of contamination is less than the area of the probe but greater than 1 cm², the actual area of the activity must be determined if possible.

Nuclear Secured / Radiation Safety	Personnel Frisking and Decontamination	
Doc. No.: NS-RS-PR-204	Revision 0	Page 11 of 17

- 5.4.9. If the contamination area is less than or equal to 1 cm², assume an area of 1 cm². An area <1cm² should never be assumed.
- 5.4.10. Re-survey the individual following each decontamination attempt and record all survey information on the personnel contamination report, Attachment 7.1 or equivalent.
- 5.4.11. The RPS or PHP may allow a contaminated employee to go when, in their judgment; further decontamination effort would not be beneficial or would harm the contaminated individual in accordance with Section 5.6.

5.5. Hot Particles

- 5.5.1. Attempt to remove the hot particle by pressing a piece of masking tape onto the clothing or skin and lifting the particle with the tape.
- 5.5.2. Repeat the tape removal technique up to three times.
- 5.5.3. Record any survey results and the time of hot particle removal on the personnel contamination survey form, Attachment 7.1 or equivalent.
- 5.5.4. Recover and retain the hot particle for further analysis.
- 5.5.5. If the tape removal technique is not successful, remove the hot particle by gently washing with soap and lukewarm water.
- 5.5.6. Attempt to recover the particle for further analysis.
- 5.5.7. After each washing, pat dry the area and resurvey the location where the particle was found.
- 5.5.8. If the particle has moved, but it is still on the skin, indicate the new location and time on the personnel contamination survey form, Attachment 7.1 or equivalent and repeat the process.
- 5.5.9. If there is no indication of the hot particle, check the surrounding areas and any locations where the hot particle may have been transported.
- 5.5.10. If the particle is still on the skin after the three wash cycles, immediately contact the RSO or designee.
- 5.5.11. Complete the personnel survey contamination form, Attachment 7.1 or equivalent, following hot particle removal and obtain the individual's signature.
- 5.5.12. Submit the particle for isotopic analysis noting the known or potential radionuclide of concern, the count rate or dose rate on the particle and the date and time of removal.

Nuclear Secured / Radiation Safety	Personnel Frisking and Decontamination	
Doc. No.: NS-RS-PR-204	Revision 0	Page 12 of 17

5.6. Conditional Release of Personnel.

- 5.6.1. Do not release personnel if detectable skin contamination is present unless authorized by the RPS or PHP.
- 5.6.2. The contaminated individual shall be informed by the RPS and suitable contamination control measures discussed.
- 5.6.3. Follow-up monitoring shall continue until all detectable contamination has been removed.
- 5.6.4. Document any instructions given to the individual and the follow-up actions on Attachment 7.1, or equivalent.

5.7. Dose Assessments

- 5.7.1. Perform bioassay sampling as directed by the PHP or RSO in accordance with NS-RS-PR-502, *Bioassay Sampling*.
- 5.7.2. Perform an external dose assessment as necessary for skin / clothing contamination in accordance with NS-RS-PR-503, *External Dose Assessment* for the following:
 - Hot particle contamination, or
 - General skin or clothing contamination exceeding 10,000 dpm/100 cm² β/γ.
- 5.7.3. Perform an internal dose assessment as necessary for a potential internal uptake in accordance with NS-RS-PR-504, *Internal Dose Assessments* for the following:
 - Any detectable nasal or mouth contamination exceeding background,
 - Any detectable facial contamination in the event that respiratory protection is not worn,
 - When an airborne event is suspected to which the individual may have been exposed without respiratory protection, or
 - As directed by a Certified Health Physicist (CHP) based upon an evaluation of the circumstances.
- 5.7.4. When in-vivo examinations are required as a result of an incident, the involved personnel shall be transported directly to the whole-body counter facility/counter as soon as practicable.
- 5.7.5. When in-vitro examinations are required as a result of an incident, the involved personnel shall continue supplying the required samples until directed to stop by the PHP or RSO.

Nuclear Secured / Radiation Safety	Personnel Frisking and Decontamination	
Doc. No.: NS-RS-PR-204	Revision 0	Page 13 of 17

5.7.6. If Tritium exposure is suspected, tritium bioassays should not be collected any sooner than 2 hours after the contamination event.

5.7.7. Restrict personnel activities pending bioassay results as directed by the RSO or PHP pending the completion of any dose assessments.

5.8. Follow-up

5.8.1. Determine if any notifications are required in accordance with NS-RS-PR-200, *Emergency Response*.

5.8.2. Perform a root-cause analysis of the event as part of the personnel contamination report, Attachment 7.1, with participation from the PM, RPS, PHP, RSO and those individuals involved in the event.

5.8.3. Identify the location where the event occurred, sequence of events leading up to the event and any contributing conditions including:

- Are proper radiological controls being implemented,
- Did the event occur during doffing of PCs,
- General rad practices of the individual and is re-training required.
- Are there changing conditions within the area.
- Are areas properly posted and controlled.
- Personnel restrictions pending bioassay results and the completion of any dose assessments.

5.8.4. Perform any follow-up actions as a result of the investigation and root-cause analysis.

- Bioassay sampling
- Follow-up surveys

5.8.5. Complete and/or update the personnel condemnation survey form, Attachment 7.1.

6. Records

6.1. Personnel Contamination Report

6.2. Incident Reports

Nuclear Secured / Radiation Safety		Personnel Frisking and Decontamination	
Doc. No.: NS-RS-PR-204		Revision 0	Page 14 of 17

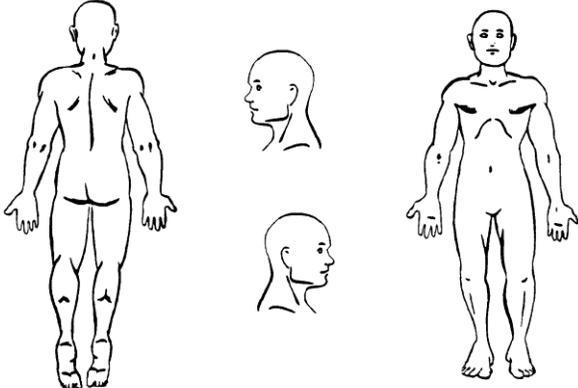
7. Attachments and Forms

- 7.1. Personnel Contamination Report
- 7.2. Decontamination Guidance

Nuclear Secured / Radiation Safety		Personnel Frisking and Decontamination	
Doc. No.: NS-RS-PR-204		Revision 0	Page 15 of 17

Attachment 7.1

Personnel Contamination Report

General Information				
Name:		ID:	Event Date:	
RWP:		Work Activity:		
Initial Survey Summary				
Instrument Model:		SN:	Cal Date:	
Detector Model:		SN:	Cal Date:	
Beta Correction Factor:		Radionuclide(s):		
				
Location	Clothing or Skin	Area (cm ²) or Hot Particle	Survey Results (A _o)	~ Event Time (T _o)
1.				
2.				
3.				
Decontamination				
Location	Method & Attempt	Survey Results		Time (T _i)
		Pre	Post (A _i)	
Notes:				

Nuclear Secured / Radiation Safety		Personnel Frisking and Decontamination	
Doc. No.: NS-RS-PR-204		Revision 0	Page 16 of 17

Attachment 7.1 (Continued)

Personnel Contamination Report

Event Summary	
Description of Events:	
Root Cause Analysis	
<u>Source:</u> <input type="checkbox"/> Physical compromise of PC (tear, penetration) <input type="checkbox"/> Contaminated skin by touching contaminated item <input type="checkbox"/> Contaminated by contaminated liquid <input type="checkbox"/> Contaminate from airborne radioactivity <input type="checkbox"/> Contaminated from laundered PCs <input type="checkbox"/> Contaminated during removal of hood <input type="checkbox"/> Contaminated during removal of Resp. Protection <input type="checkbox"/> Contaminated during removal of outer PC <input type="checkbox"/> Contaminated during removal of inner PC <input type="checkbox"/> Contaminated during removal of plastics <input type="checkbox"/> Contamination spread to area and not identified <input type="checkbox"/> Improper control of airborne radioactive material <input type="checkbox"/> Work area not deconned to extent practicable <input type="checkbox"/> Changed work conditions <input type="checkbox"/> Work activity not covered by RWP <input type="checkbox"/> Other: _____	<u>Worker</u> <input type="checkbox"/> Worker knowledge/experience <input type="checkbox"/> Improper donning of PCs <input type="checkbox"/> Improper doffing of PCs <input type="checkbox"/> Improper doffing of respirator <input type="checkbox"/> Worker careless removing PC <input type="checkbox"/> Improper actions in work area (sitting, lying) <input type="checkbox"/> Worker actions while removing PC – accident <input type="checkbox"/> Noncompliance with postings/rad controls <input type="checkbox"/> Accidental contact beyond worker control <u>HP Support:</u> <input type="checkbox"/> RP technician actions - unavoidable/accident <input type="checkbox"/> RP technician actions - avoidable <input type="checkbox"/> Improper PC requirements on RWP <input type="checkbox"/> Improper RP coverage of worker activity <input type="checkbox"/> Improper monitoring of laundered PCs <input type="checkbox"/> Improper control of rad material <input type="checkbox"/> Surveys not current
Follow-Up Actions	
Review	
Individual:	Date:
RPS / PHP or RSO:	Date:

Nuclear Secured / Radiation Safety		Personnel Frisking and Decontamination	
Doc. No.: NS-RS-PR-204		Revision 0	Page 17 of 17

Attachment 7.2

Decontamination Guidance

Method	Effective For	Instructions
Tape Press	Dry contamination, Hot particles	Apply tape to skin by lightly patting. Remove carefully.
Waterless Hand Cleaner	All skin contamination	Apply to affected area and allow it to melt onto the skin. Remove with cotton or soft disposable towel.
Soap and Tepid Water	All skin contamination	Wash area with soap and lukewarm water. Repeat until further attempts do not reduce the level. A cloth or surgical hand brush may be used with moderate pressure.
Carbonated Water	All skin contamination	Apply to affected area with cotton or soft disposable towel and wipe with dry towel.
Cornmeal Detergent Paste	All skin contamination	Mix cornmeal and powder detergent in equal parts with enough water to form a paste. Rub onto affected area for 5 minutes. Remove with cotton or disposable towel. Rinse skin.
Shampoo	Hair contamination	Wash hair and rinse. Repeat as necessary.
Sweating	All skin contaminations	Cover affected area with impermeable cover (plastic, glove, para film) to cause sweating. Remove after sweating has occurred and wipe area.
Saline / Water Flush	Eyes, Nose, Ears, Mouth	Perform only under medical supervision.