

<b>BROOKHAVEN NATIONAL LABORATORY</b> Safety & Health Services Division <b>INDUSTRIAL HYGIENE GROUP</b> Standard Operating Procedure: Program Procedure	NUMBER <b>IH71200</b>
	REVISION <b>FINAL Rev1</b>
Subject: <b>Personal Protective Equipment (PPE)</b> <b>Selection for Non-Radiological Chemical Hazards</b>	DATE <b>11/02/10</b>
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### **1.0 PURPOSE & SCOPE**

**Purpose:** This document sets the policy of the Safety & Health Services Division (SHSD) Industrial Hygiene (IH) group for selecting Personal Protective Equipment (PPE) for chemical hazards. This SOP is to be used in conjunction with the BNL Subject Areas: *Personal Protective Equipment & Respirators* and *Chemical Safety*.

This program assists BNL in complying with OSHA 29CFR1910.132 (*PPE General requirements*) and 29CFR1910.138 (*Hand Protection*). It uses *ANSI ISEA 105-2005* as a reference.

This document describes a procedure for selecting Chemical Protective Clothing (CPC) by considering available equipment options and the hazard and severity of surface and airborne non-radiological contaminants present in the workplace. The goal of the procedure is to provide a uniform methodology in selecting CPC.

**Scope:** The scope of this SOP is for chemical hazards (such as dusts, fumes, mists, and vapors, lead, toxic metals, and asbestos). It is limited to glove and chemical impervious suit selection. It is not intended or approved for use in selecting radiological hazards CPC. When exposure is to both radiological and non-radiological hazards, the IH must work together with the Radiological Control Division Facility Support Representative to determine the combined CPC.

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## **2.0 RESPONSIBILITIES**

- 2.1 It is the responsibility of persons selecting CPC to comply with all provisions in the BNL *PPE* and *Chemicals, Working with Subject Areas* and this SOP.
- 2.2 It is the responsibility of persons selecting CPC to:
  - 2.2.1 Use the appropriate personal protective equipment while performing field evaluations of the work process, when needed.
  - 2.2.2 Obtain all required training and qualification for hazards present in areas where field evaluations will be done (such as lead, asbestos, chemicals, or radioactive contamination).
  - 2.2.3 Comply with all work planning and work permit system requirements when entering areas to obtain information to select the correct CPC.
- 2.3 The person using this procedure is responsible to ensure that information they provide on CPC selection is integrated into the work planning documentation for the work being done.

## **3.0 DEFINITIONS**

**Break through Time:** the time, after the onset of challenge of a chemical to a glove/suit, when the chemical permeates through the inner layer of the glove/suit.

**Degradation:** A deleterious change in one or more properties of a glove due to contact with a chemical. Rubber gloves may swell, soften and weaken; plastic gloves may shrink, stiffen, and crack when flexed.

**Dexterity:** the ability of the wearer to manipulate objects and control his or her hands in the desired manner.

### ***Chemical Hazard Types***

**Dust:** An aerosol consisting of mechanically produced solid particles derived from the breaking up of larger particles. Dusts generally have a larger particle size when compared to fumes.

**Fumes:** Solid aerosols formed by condensation of a gas or vapor. Fumes generally have a smaller particle size than dusts.

**Gas:** The gaseous phase of matter that normally exists in a gaseous state at room temperature

**Mist:** An aerosol composed of liquid particles.

**Vapor:** The gaseous phase of matter that normally exists in a liquid or solid state at room temperature.

**Grip:** the ability of the glove wearer to exert pressure on an object when holding it.

**Occupational Exposure Limit (OEL):** The lower of ACGIH TLV®, Ceiling, STEL® or OSHA PEL.

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**Penetration:** *The flow of a chemical through zippers, stitched seams, pinholes, or other imperfections in chemical protective clothing on a non-molecular level.*

**Permeation:** The flow of a chemical through the barrier layer of a glove/suit on a molecular level. This process involves: absorption of the chemical onto and into the outside of the glove/suit; diffusion of the chemical through the glove/suit (as individual molecules pass between molecules of the glove film); and desorption of the chemical inside the glove/suit.

**Qualified Selector:** A person who has demonstrated competency, in accordance with Section 7, to perform this procedure.

**Tactility:** the ability of the glove wearer to sense objects by touch.

#### **4.0 PREREQUISITES**

none

#### **5.0 PRECAUTIONS**

- 5.1 **Chemical Protective Clothing (CPC):** The CPC selection process does not in itself expose the selector to any hazard. Personal protective equipment is not required when using this procedure unless needed to enter hazardous areas to observe workplace conditions.
- 5.2 **Hazard Determination:** The CPC selection process may be done in areas where hazards (such as lead, asbestos, chemicals, or radioactive contamination) may be present. Use appropriate PPE.
- 5.3 **Work Planning:** All requirements of the work planning system reviews must be met in performing this procedure.
- 5.4 **Job Risk Assessment:** Consult the *Job Risk Assessment* for the risk analysis of this operation based on the hazards and controls:
  - [SHSD-JRA-05](#) for the field review portions of this SOP.
- 5.5 **Environmental Impact and Waste Disposal:** This procedure does not have adverse impact on the environment. No waste or environmental contamination is generated in this process.

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## **6.0 PROCEDURE**

- 6.1 **Determine the airborne and surface level concentration:** Measure or calculate the maximum expected workplace concentration of contaminants by measurement by:
- 6.1.1 NIOSH, OSHA, or EPA approved integrated sampling methodology, or
  - 6.1.2 Calculation of maximum concentration based on use rate and atmospheric conditions.

Follow accepted methodology described in SHSD IH Group SOPs for surface wipe sampling and integrated sampling collection and exposure analysis. Because activities in the work area may vary during the shift and hazard concentrations could change, the monitoring should include the period of highest probable exposure conditions possible throughout a full work shift.

- 6.2 Consider the physical, chemical, and toxicological properties of the contaminant(s) including: physical state (gas, vapor, particulate/dust, fume, and mist), health & physical hazards; odor threshold and warning properties.
- 6.3 **Selection of CPC elastomer:** Select the acceptable CPC material(s) based on the capabilities, limitations, and ability of the CPC to protect against:
- Permeation,
  - Penetration, and
  - Degradation.
- Use the information sources listed in the reference section to determine acceptable CPC materials.

- 6.4 Consider the physical, environmental, and chemical use conditions at the work area when specifying CPC. Select the best choice from the available CPC elastomers and PPE styles considering the following:
- Duration of contact with the chemical,
  - Worker activity: Continuous or intermittent work; light, medium, or heavy work,
  - Frequency of use: Routine, non-routine, emergency or rescue use,
  - The ability to move in the CPC, especially impact on the escape of workers if an emergency occurs and access of rescue operations,
  - The person's ability to wear or use the equipment and negative impact of the equipment on the operation,
  - Ensure all hazards are covered such as physical hazards including sharp edges. It may be necessary to require both chemical protective and physical hazards together (eg. nitrile disposable under leather gloves),

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- Consider the length of time between uses for disposal purposes. (e.g., Will the CPC be stored without full decontamination awaiting the next use? The chemicals already present will continue to permeate the glove material.)
- 6.5 When multiple contaminants are present, unless information on the mixture is available, select the equipment based on protection for the most hazardous contaminant. However, protection must be provided for exposure to all anticipated hazardous contaminants. (Choose the best glove material for the most hazardous, but it must provide adequate protection for all components in the mix).
- 6.6 Document the equipment selection on the *PPE Selection Form* located in the BNL SBMS Subject Area: Personal Protective Equipment: [\*Protective Clothing Selection Form\*](#).

## **7.0 IMPLEMENTATION AND TRAINING**

- 7.1 CPC selection shall be performed by persons who have demonstrated the competence to satisfactorily perform the tests as evidenced by experience and training. Ensure personnel meet the qualification criteria set in Attachment 9.3 (Job Performance Measure). The re-qualification period is three years.
- 7.2 The qualification criteria for a use of this SOP are:
- 7.2.1 An overall knowledge of CPC principles and completion of the BNL web course (or equivalent) in CPC – Chemical Protective Clothing User Training HP-OSH-157.
  - 7.2.2 Specific knowledge of this procedure and OSHA 29CFR1910.132 & 138.

## **8.0 REFERENCES**

- 8.1 BNL SBMS Subject Area Personal Protective Equipment Exhibit: [\*Personal Protective Equipment \(PPE\) Requirements for Specific Work\*](#).
- 8.2 BNL SBMS Subject Area Personal Protective Equipment Exhibit: [\*PPE Descriptions and Design Requirements Standards\*](#)
- 8.3 Occupational Safety and Health Administration, OSHA 29CFR1910.132 *PPE General Requirements*.
- 8.4 Occupational Safety and Health Administration, OSHA 29CFR1910.138 *Hand Protection*.
- 8.5 Occupational Safety and Health Administration, OSHA 29CFR1910.120 Hazardous Operations and Emergency Response.

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- 8.6 American National Standard Institute (ANSI) ISEA 105-2005: *American National Standard for Hand Protection Selection Criteria.*
- 8.7 National Institute for Occupational Safety and Health, NIOSH PPE Decision Logic DHHS/NIOSH Publication No. 97-108.
- 8.8 K. Forsberg, S. Mansdorf; *Quick Selection Guide to Chemical Protective Clothing*, 4<sup>th</sup> Edition, 2007, Van Nostrand Reinhold.

## 9.0 ATTACHMENTS

- 9.1 Sample of *Online NIOSH Pocket Guide to Chemical Hazards*
- 9.2 *SHSD Non-Radiological PPE Qualification record*

## 10.0 DOCUMENTATION

Document Development		
Prepared By: <i>(signature/date on file)</i> R. Selvey 03/14/07 Certified Industrial Hygienist	Reviewed By / Date: <i>(signature/date on file)</i> John Peters 09/05/07 Certified Industrial Hygienist	Approved By / Date: <i>(signature/date on file)</i> R. Selvey 09/05/07 Industrial Hygienist Group Leader
ESH Coordinator/ Date:  <i>none</i>	Work Coordinator/ Date:  <i>none</i>	SHSD Manager / Date  <i>none</i>
QA Representative / Date:  <i>none</i>	Training Coordinator / Date:  <i>none</i>	Filing Code:  <b>IH52</b>
Facility Support Rep. / Date:  <i>None</i>	Environ. Compliance Rep. / Date:  <i>none</i>	Effective Date:  <b>09/05/07</b>
ISM Review - Hazard Categorization <input type="checkbox"/> High <input type="checkbox"/> Moderate <input checked="" type="checkbox"/> Low/Skill of the craft	Validation: <input type="checkbox"/> Formal Walkthrough <input checked="" type="checkbox"/> Desk Top Review <input type="checkbox"/> SME Review Name / Date:	Implementation: Training Completed: Tracked in BTMS Procedure posted on Web: 09/06/07 Document Control: 09/065/07

Revision Log
Purpose: <input type="checkbox"/> Temporary Change <input type="checkbox"/> Change in Scope <input type="checkbox"/> Periodic review <input type="checkbox"/> Clarify/enhance procedural controls Changed resulting from: <input type="checkbox"/> Environmental impacts <input type="checkbox"/> Federal, State and/or Local requirements <input type="checkbox"/> Corrective/preventive actions to non-conformances <input type="checkbox"/> none of the above Section/page and Description of change: Rev1- Minor text changes in Sections 1,2,6, and 7. Updated Section 8 references. Removed Attachment 9.1. Updated JPM form. SME Reviewer/Date: R. Selvey (signature/date on file) 11/02/10

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## Attachment 9.1

### Sample of Online NIOSH Pocket Guide to Chemical Hazards

<b>Acetic acid</b>		CAS 64-19-7	
CH <sub>3</sub> COOH		RTECS <a href="#">AF1225000</a>	
<b>Synonyms &amp; Trade Names</b> Acetic acid (aqueous), Ethanoic acid, Glacial acetic acid (pure compound), Methanecarboxylic acid [Note: Can be found in concentrations of 5-8% in vinegar.]		<b>DOT ID &amp; Guide</b> 2790 <a href="#">153</a> (10-80% acid) 2789 <a href="#">132</a> (>80% acid)	
<b>Exposure Limits</b>	NIOSH REL: TWA 10 ppm (25 mg/m <sup>3</sup> ) ST 15 ppm (37 mg/m <sup>3</sup> )		
	OSHA PEL: TWA 10 ppm (25 mg/m <sup>3</sup> )		
IDLH 50 ppm See: <a href="#">64197</a>		Conversion 1 ppm = 2.46 mg/m <sup>3</sup>	
<b>Physical Description</b> Colorless liquid or crystals with a sour, vinegar-like odor. [Note: Pure compound is a solid below 62°F. Often used in an aqueous solution.]			
MW: 60.1	BP: 244°F	FRZ: 62°F	Sol: Miscible
VP: 11 mmHg	IP: 10.66 eV		Sp.Gr: 1.05
FLP: 103°F	UFL (200°F): 10.0%	LEL (5.0%): 5.0%	
Class II Combustible Liquid: F+		<b>SAMPLE</b>	
<b>Incompatibilities &amp; Reactivity</b> Strong oxidizers (especially chromates, permanganates, and peroxides.) Corrosive to			
<b>Measurement Methods</b> NIOSH <a href="#">1603</a> ; OSHA <a href="#">ID186SG</a> See: <a href="#">NMAM</a> or <a href="#">OSHA Methods</a>			
<b>Personal Protection &amp; Sanitation</b> Skin: Prevent skin contact (>10%) Eyes: Prevent eye contact Wash skin: When contaminated (>10%) Remove: When wet or contaminated (>10%) Change: No recommendation Provide: Eyewash (>5%), Quick drench (>50%)		<b>First Aid (See procedures)</b> Eye: Irrigate immediately Skin: Water flush immediately Breathing: Respiratory support Swallow: Medical attention immediately	
<b>PPE Recommendations NIOSH/OSHA</b> Up to 50 ppm: (APF = 25) Any supplied-air PPE operated in a continuous-flow mode <sup>†</sup> /(APF = 25) Any powered, air-purifying PPE with organic vapor cartridge(s) <sup>‡</sup> /(APF = 50) Any chemical cartridge PPE with a full facepiece and			

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organic vapor cartridge(s)/(APF = 50) Any air-purifying, full-facepiece PPE (gas mask) with a chin-style, front- or back-mounted organic vapor canister/(APF = 50) Any self-contained breathing apparatus with a full facepiece/(APF = 50) Any supplied-air PPE with a full facepiece

**Emergency or planned entry into unknown concentrations or IDLH conditions:** (APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode/(APF = 10,000) Any supplied-air PPE that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

**Escape:** (APF = 50) Any air-purifying, full-facepiece PPE (gas mask) with a chin-style, front- or back-mounted organic vapor canister/Any appropriate escape-type, self-contained breathing apparatus

**Exposure Routes** inhalation, skin and/or eye contact

**Symptoms** Irritation eyes, skin, nose, throat; eye, skin burns; skin sensitization; dental erosion; black skin, hyperkeratosis; conjunctivitis, lacrimation (discharge of tears); pharyngeal edema, chronic bronchitis

**Target Organs** Eyes, skin, Respiratory system, teeth

See also: [INTRODUCTION](#) See ICSC CARD: [0363](#)

## Non-Radiological CPE Selector

### Job Performance Measure (JPM) Completion Certificate

Candidate's Name	Life Number:
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**Practical Skill Evaluation: Demonstration of Evaluation Methodology**

Criteria	Qualifying Performance Standard	Unsat.	Recov.	Satisf.
1.	<b>Conducts appropriate interviews</b> Demonstrates knowledge in conducting interviews with supervision and workers to determine exposure characteristics, patterns, and duration. I			
2.	<b>Hazard Identification</b> Demonstrates knowledge to correctly determine and document the type of hazards, including: - Health hazards from chemicals - Physical hazards - Mixtures: Synergistic and Additive Effects			
3.	<b>Equipment Selection</b> Knows the theory, advantages, disadvantages, and limitations to consider in selecting the PPE, including: - Dexterity           - Permeation - Tactility            - Penetration - Grip                 - Degradation			
4.	<b>Equipment Selection</b> Knows sources of vendor and generic recommendations for PPE selection.			
5.	<b>Operating Parameters</b> Knows the theory to establish operating parameters (safety envelope) for the PPE selected: - End of Service Life   - Break-through time - Warming Properties			
6.	<b>Decontamination/ Storage</b> Has knowledge to recommend the proper post exposure handling of the PPE selected: - Disposal           - Decontamination - Disinfection      - Storage			
7.	<b>Documentation</b> Demonstrates how to correctly obtain and fill out SBMS <i>Chemical Protective Clothing Selection Form</i> .			

**Practical Skill Evaluation: Demonstration of Knowledge by Evaluation of a Case Study**

8.	<b>Evaluation of a Hypothetical Exposure Scenario</b> First Score: _____ Retest Score (if needed): _____
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I accept the responsibility for performing this task as demonstrated within this JPM and the corresponding SOP.

Candidate Signature:	Date:
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I certify the candidate has satisfactorily performed each of the above listed steps and is capable of performing the task unsupervised.

Evaluator Signature:	Date:
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