


**National High Magnetic Field Laboratory Safety Program**

<b>TITLE:</b> Beryllium Window Breakage Clean-up and Disposal Procedure	<b>SUBJECT:</b> This procedure provides steps for response to, clean-up, and disposal of beryllium window if breakage occurs.
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<b>Additional Approval Signatures on Revision and Approval Page</b>	

**Overall Mission and Overview:**

The National High Magnetic Field Laboratory (NHMFL) Environmental, Health, and Safety (EHS) program's mission is to:

Provide support and guidance to all NHMFL departments with the implementation, maintenance and review of a comprehensive environmental, health, and safety program. The primary goal of the MagLabs EHS program is to control, reduce or eliminate work-related injuries, illnesses and loss of NHMFL resources.

The NHMFL is charged by the National Science Foundation (NSF) to safely:

- Promote magnet-related research to serve an interdisciplinary scientific user community.
- Provide unique high-magnetic-field facilities through a competitive and transparent proposal review process.
- Advance magnet and magnet-related technology.
- Partner with universities, other national laboratories and industry to enhance national competitiveness in magnet and related technologies.
- Serve the NSF as a prominent example of its successful stewardship of large research facilities.
- Support science and technology education in the United States.
- Increase diversity in the science, technology, engineering, and mathematics workforce
- Promote collaboration among our three partner institutions: Florida State University (FSU), the University of Florida (UF) and Los Alamos National Laboratory (LANL).



## TABLE OF CONTENTS

1.0	INTRODUCTION TO BERYLLIUM AND SAFETY HAZARDS .....	3
1.1	Goal .....	3
1.2	Scope .....	3
2.0	RESPONSE PROCEDURE IF A BERYLLIUM WINDOW BREAKS.....	4
2.1	Immediately Notify the Safety Department .....	4
2.2	Steps to Follow in Case of (Suspected) Beryllium Contamination.....	4
2.3	First Aid/Injury Response.....	5
2.4	Clean-Up Kit for Beryllium Contamination .....	5
2.5	Clean Up a Beryllium Contaminated Area .....	6
2.6	Clean Up Using a HEPA-Filtered Vacuum Cleaner.....	6
2.7	Collection of Wipe Sample for Beryllium Contamination Analysis.....	6
2.8	Disposal of Beryllium Waste .....	7
2.9	Shipment of Contaminated Equipment Back to Equipment Manufacturer .....	7
2.10	Beryllium Incident Documentation.....	7
3.0	TRAINING .....	7
4.0	REFERENCES .....	7
	APPENDIX A: WIPE SAMPLE REFERENCE DOCUMENT .....	9



## **1.0 Introduction to Beryllium and Safety Hazards**

Beryllium (elemental symbol Be) is an alkaline earth metal with the atomic number 4. Beryllium is popularly used as a window/membrane material in photon science due to its low atomic number, i.e. its low photon attenuation.

Overexposure to airborne beryllium particulate can cause lung disease such as chronic beryllium disease (CBD) or beryllium sensitization in exposed individuals. CBD is a chronic and sometimes fatal lung condition in which the lung tissues become inflamed restricting the exchange of oxygen between the lungs and the blood stream. Beryllium sensitization is a condition in which a person's immune system may become highly responsive or allergic to the presence of any beryllium within the body. Both beryllium and beryllium compounds are considered to be potential carcinogens. Routes of exposure include inhalation, ingestion and skin contact or absorption. [1,2]

Intact beryllium windows are considered “finished articles” and are not considered hazardous [1]. However, broken Beryllium windows are not considered "finished articles" and caution must be exercised in handling broken beryllium windows, during clean up and disposal.

The American Photon Source (APS) at Argonne, IL, uses beryllium windows in many experimental stations and has performed beryllium monitoring for several years. Their monitoring shows that broken beryllium windows typically result in fragments with little detectable concentration of beryllium observed from wipe sampling. Also, air monitoring following several window breakages have consistently shown no detectable airborne concentrations of beryllium [1].

At the National High Magnetic Field Laboratory (NHMFL), Beryllium windows and membranes are used in several experimental setups. Personnel are instructed to handle intact Beryllium windows with care – no personal protective equipment (PPE) is required. It is prohibited to machine, grind, polish, sand, mill, crush or otherwise abrade beryllium windows without prior authorization of the NHMFL Safety Department and appropriate precautions.

This procedure provides guidelines to be followed in case of an unexpected, accidental beryllium window breakage.

### **1.1 Goal**

The goal of this procedure is to prevent exposure to beryllium if an accidental beryllium window breakage occurs. Effective implementation of this procedure will provide the following:

- 1) Highest achievable personnel safety,
- 2) Minimum equipment damage, and
- 3) Minimum downtime of the affected experimental area.

### **1.2 Scope**





Equipment and experimental setups in several divisions of the NHMFL contain beryllium windows. The presence of beryllium windows in the laboratory can potentially lead to situations in which a beryllium window unexpectedly breaks during installation, experiment setup or (user) operation. Possible situations of fractured beryllium windows include but are not limited to:

1. *Broken Beryllium Window on an X-ray Detector or X-ray source:*  
X-ray detectors and X-ray sources are typically equipped with a thin beryllium window (tens to hundreds of microns thick), which is mounted by the equipment manufacturer.
2. *Broken Beryllium Window Under Vacuum:*  
A beryllium window can rupture under vacuum due to an unanticipated over-pressurization of the vacuum system. In such instances, fragments of the beryllium window can travel upstream and may end up in the vacuum pump.
3. *Broken Beryllium Window During Experiment Set Up:*  
A beryllium window can break when a new experimental setup is constructed, an existing experimental setup is modified or when the equipment is moved. Typical incidents are windows being dropped or being bumped into.

## **2.0 Response Procedure if a Beryllium Window Breaks**

### **2.1 Immediately Notify the Safety Department**

Designated cleanup personnel: Only trained and authorized personnel may perform the cleanup and the disposal of beryllium contamination. If a beryllium window breakage occurs immediately contact the Safety Department at SAFEMAG 855-723-3624. Safety will handle the beryllium contamination cleanup:

### **2.2 Steps to Follow in Case of (Suspected) Beryllium Contamination**

- 1) Immediately evacuate the experimental area.
- 2) Close doors to experimental area, or limit access to experimental area in case the laboratory/area does not have a door.
- 3) Notify Safety Department of (suspected) beryllium contamination (see 2.1).
- 4) Notify:
  - i) *DC Magnet Building:* Notify the Control Room personnel (580-644-4416 / 850-408-8102, room #OP152) of the (suspected) beryllium contamination.
  - ii) *General Science Building:* Notify the Principal Investigator or laboratory manager of the (suspected) beryllium contamination.
- 5) The Safety Department will respond and mark the suspect area of beryllium contamination with signage, "DANGER: Area Closed – Suspect Beryllium Contamination".
- 6) Safety Department will place tacky mat in front of door(s)/entrance(s) to affected area.
- 7) Safety Department will ensure the experimental area is secured:
  - i) *DC Magnet Building:* Control Room personnel will shut down operation in affected area; ensure that all equipment in affected area is or will be turned





*off (experimentalist/user may have to turn off equipment using appropriate PPE).*

- ii) *General Science Building: All equipment in affected area must be secured by personnel.*
- 8) Safety Team/Authorized personnel will conduct Beryllium clean-up and decontamination. This will be coordinated with the EHS Industrial Hygienist and/or Chemical Safety Officer.
- 9) After clean-up: Safety Team/Authorized personnel will take wipe samples for analysis.
- 10) Safety Department will dispose of beryllium window, contaminated cleaning equipment, and other contaminated material.
- 11) Safety Department will oversee laboratory analysis of beryllium contamination and return experimental area back to service once laboratory analysis clears area to be safe.
- 12) Safety Department will document beryllium incident in NHMFL Beryllium Incident Logbook.

### 2.3 First Aid/Injury Response

- **Ingestion:** If beryllium metal powder or dust is ingested, have the affected person drink large quantities of water and attempt to induce vomiting. Obtain medical help.
- **Skin contact:** Skin, cuts and abrasion are to be treated by standard first aid. Skin contamination with dust or powder can be removed by washing with soap and water. If irritation persists obtain medical help. Accidental injection of the material beneath the skin requires removal.
- **Eye contact:** Flush dust or powder from eyes with water for 15 minutes (eye wash station). If irritation persists obtain medical help.

### 2.4 Clean-Up Kit for Beryllium Contamination

The Safety Department will maintain the clean-up kit.

- Tyvex suit
- Shoe covers
- Latex/nitrile gloves
- Face mask filtering for particulate (N100)
- Safety glasses
- Sticky mat for floor at door(s)/entrance(s)
- Small, clear plastic bags with ziplock (for disposing of beryllium pieces)
- Larger, clear plastic bags (for disposing of wipes, PPE etc.)
- Kim wipes
- Sticky tape
- Squeeze bottle of ethanol
- Vacuum cleaner with HEPA filter – contact Industrial Hygiene Officer
- Signage: “DANGER: Area Closed – Suspect Beryllium Contamination”
- Stickers: “DANGER: Contaminated with Beryllium”



- Stickers: “DANGER: Suspect Beryllium Contamination”

### 2.5 Clean Up a Beryllium Contaminated Area

- 1) Safety Team/Authorized and Trained personnel will don Beryllium Clean-Up PPE.
- 2) Large pieces of beryllium window are collected and placed in disposal bags.
- 3) Smaller noticeable pieces of beryllium are picked up using sticky tape and placed in disposal bags.
- 4) If broken window was part of a detector, X-ray source, or other piece of equipment, place equipment in plastic bag/tape off contaminated part of equipment. Close plastic bag/tape bag to larger equipment. Label using “DANGER: Contaminated with Beryllium” stickers.
- 5) Systematically wipe the surrounding area (any area of suspected Beryllium contamination) with Kim wipes soaked in ethanol.
- 6) Put all used wipes into a separate plastic bag and label with sticker “DANGER: Suspect Beryllium Contamination”.
- 7) Vacuum the surrounding area with HEPA filter vacuum.
- 8) When cleaning is completed, remove all PPE and place into another plastic bag. Label with sticker “DANGER: Suspect Beryllium Contamination”.
- 9) Remove tacky mat at entrance of experimental area and place into plastic bag. Label with sticker “DANGER: Suspect Beryllium Contamination”.
- 10) Place all clean up equipment into bucket, close top and label, “DANGER: Suspect Beryllium Contamination”
- 11) Contact Chemical Safety Office to pick up bucket.

### 2.6 Clean Up Using a HEPA-Filtered Vacuum Cleaner

- 1) Use dedicated HEPA-filtered vacuum cleaner.
- 2) Enter date and location of use in vacuum logbook.
- 3) If equipment has to be disassembled to gain access to beryllium contaminated area, a second person must use the HEPA-filtered vacuum along the areas where the equipment is being opened up and interior surfaces are exposed.
- 4) Once equipment is disassembled, apply general clean up procedure (refer to section 2.6).
- 5) Leave all tools and HEPA-filtered vacuum inside closed off area.
- 6) The Safety Department will perform wipe sampling of tools and HEPA-filtered vacuum decontamination.

### 2.7 Collection of Wipe Sample for Beryllium Contamination Analysis

After completing clean-up of the affected area, EHS Industrial Hygienist or designee will collect wipe samples from the previously contaminated area for laboratory analysis. See Appendix A for wipe sample reference document. Clearance for wipe samples is: 0.2 micrograms per 100 squared centimeters. Once the sample results are received from the lab and confirm required clearance levels have been achieved the area can be returned to service. If the samples do not meet clearance level requirements the cleanup and clearance process will be repeated.





### 2.8 Disposal of Beryllium Waste

All waste collected as part of the cleanup including the beryllium glass will be disposed of by the EHS Chemical Safety Office.

### 2.9 Shipment of Contaminated Equipment Back to Equipment Manufacturer

If there is equipment that cannot be decontaminated the Manufacturer will be contacted to determine appropriate measures to return the equipment to the Manufacturer. The Safety Department will coordinate equipment shipping and/or disposal with the EHS Chemical Safety Office.

### 2.10 Beryllium Incident Documentation

All beryllium incidents must be reported to the NHMFL Safety Department. The NHMFL Safety Department will document every beryllium incident in the beryllium incident logbook. If the HEPA-filtered vacuum is used, the use of the vacuum is also documented in the HEPA-filtered vacuum logbook.

The incident report document will include:

- Date, time and location of the incident
- Involved personnel (both the researcher and responding safety personnel)
- Any injury or exposure to personnel
- Equipment associated with the incident (location, model number, serial number etc.)
- Details of clean-up procedure performed including decontamination and sampling personnel
- Results of beryllium analysis.

## 3.0 Training

Personnel that use equipment containing beryllium windows must be instructed to notify SAFEMAG if a breakage occurs, to secure and leave the area, and wait for a member of the Safety Team to arrive.

## 4.0 References

- 1) "Management of Broken Beryllium Windows and Equipment Contaminated with Beryllium Oxide", APS\_11911214, Advanced Photon Source, Argonne, USA
- 2) "Interventionsprozedur beim Bersten einer Beryllium Membran" (Intervention Procedure for Broken Beryllium Membranes), Yves Loertscher, Industrial Hygiene Officer, Paul Scherrer Institute, Villigen, Switzerland
- 3) Material Safety Data Sheet, Moxtek, North Orem, USA



REVISION AND APPROVAL

**Revisions**

<b>Date</b>	<b>Revision #</b>	<b>Section</b>	<b>Description</b>
08/28/2017	000	All	Document Generation

**Approvals**

<b>Title</b>	<b>Reviewer</b>	<b>Signature</b>
<b>Industrial Hygiene &amp; Health Engineer: Environmental Health &amp; Safety</b>		





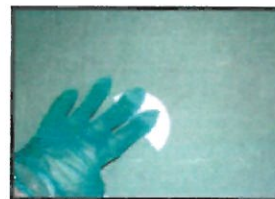
## Appendix A: Wipe Sample Reference Document

The only official copy is on-line at the SHSD website  
Before using a printed copy, verify that it is current by checking the document issue date on the website.

<b>BROOKHAVEN NATIONAL LABORATORY</b> Safety & Health Services Division - Industrial Hygiene Group Standard Operating Procedure		Number	<b>IH75190</b>
		Revision	<b>Final Rev19</b>
Subject	<b>Surface Wipe Sampling Procedure</b>	Date	<b>03/04/14</b>
		Page	<b>1 OF 17</b>

### **IH75190** **Surface Wipe Sampling Procedure**

**1.0 Purpose & Scope** This document describes a field procedure for taking wipe samples for metals on surfaces. It is based on methodology described in NIOSH 9100 "Lead in Surface Wipe Samples" of the NIOSH Manual of Analytical Methods.



The goal of the procedure is to provide a uniform methodology to collect representative samples. Using this method will ensure repeatability between various sampling personnel and between surface configurations. It is used for characterizing surface levels for the following reasons:

- Decommissioning operational areas
- Evaluating the effectiveness of clean-up of a spill
- Evaluating compliance with housekeeping levels in operational areas
- Characterizing a piece of equipment for release.

### **2.0 Responsibilities**

- 2.1 Demonstrated Competency:** This procedure is administered through the SHSD Industrial Hygiene Group. Only persons who have demonstrated competency in performing this procedure in accordance with Section 7 are qualified to use this procedure.
- 2.2 Chain of Custody procedures:** The qualified sampler is responsible for samples until they have been properly transferred to the IH Group laboratory using the *IH51300 Chain of Custody* procedures.
- 2.3 Hazard Analysis of the Sampling Task:** It is the responsibility of persons using this method and their supervisors to:
- Use appropriate personal protective equipment; see section 5.2 and Table 1.
  - Obtain required training and qualification for hazards in areas.
  - Comply with all work planning and work permit system requirements.

### **3.0 Definitions**

**Equipment Release level (recommendations for metals other than beryllium):** Internal guidelines used to determine acceptable surface levels of metals for the transfer of equipment to non-operational areas or to the public.

**Equipment Release level (mandatory for Beryllium)** 10CFR 850.31

- (a) clean beryllium-contaminated equipment and other items to the lowest contamination level practicable, but not to exceed the levels (b) and (c), and label the equipment or other items,



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		Revision	<b>Final Rev19</b>
Subject:	<b>Surface Wipe Sampling Procedure</b>	Date	<b>03/04/14</b>
		Page	<b>2 OF 17</b>

- before releasing them to the general public or a DOE facility for nonberyllium use, or to another facility for work involving beryllium.
- (b) Before releasing beryllium contaminated equipment or other items to the general public or for use in a nonberyllium area of a DOE facility, must ensure that:
    - (1) The removable contamination level of equipment or item surfaces does not exceed the higher of 0.2 ug/100 cm<sup>2</sup> or the concentration level of beryllium in soil at the point or release, whichever is greater;
    - (2) The equipment or item is labeled in accordance with 850.38(b); and
    - (3) The release is conditioned on the recipient's commitment to implement controls that will prevent foreseeable beryllium exposure, considering the nature of the equipment or item and its future use and the nature of the beryllium contamination.
  - (c) Before releasing beryllium contaminated equipment or other items to another facility performing work with beryllium, must ensure that:
    - (1) The removable contamination level of equipment or item surfaces does not exceed 3 ug/100 cm<sup>2</sup>;
    - (2) The equipment or item is labeled in accordance with 850.38(b); and
    - (3) The equipment or item is enclosed or placed in sealed, impermeable bags or containers to prevent the release of beryllium dust during handling and transportation.

**Housekeeping level (recommendation for metals other than beryllium):** An internal guideline used to answer "how clean is clean?" for surfaces that personnel access. Surface levels should be below these guideline levels during non-operational periods.

**Housekeeping level (mandatory for Beryllium)** 10CFR850.30(a): Where beryllium is present in operational areas of DOE facilities, conduct routine surface sampling to determine housekeeping conditions. Surfaces contaminated with beryllium dusts and waste must not exceed a removable contamination level of 3 ug/100 cm<sup>2</sup> during non-operational periods. This sampling would not include the interior of installed closed systems such as enclosures, glove boxes, chambers, or ventilation systems.

**Operational areas:** areas where metals are routinely used, handled or stored and personal hygiene control practices are in place (e.g. eating, drinking are prohibited; hand washing is expected on exiting the area).

**Operational periods:** times of a day when operations with metals are active.

**Non-operational areas:** areas where metals are not routinely handled and personal hygiene control practices are not in-place (e.g. eating & drinking are allowed; hand washing is not expected on exit of the area).

**Non-operational periods:** times of the day when:

- operational areas are not active (e.g. off-hours)
- anytime in a non-operational area (such as offices, lunch rooms, housing units).





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BROOKHAVEN NATIONAL LABORATORY Safety & Health Services Division - Industrial Hygiene Group Standard Operating Procedure		Number	IH75190
		Revision	Final Rev19
Subject:	Surface Wipe Sampling Procedure	Date	03/04/14
		Page	3 OF 17

#### 4.0 Prerequisites

##### Area Access:

- 4.1 Training for hazards may be needed for entry into restricted areas.
- 4.2 Contact the appropriate Facility Support Representative or Technician to obtain approval to enter radiological areas.
- 4.3 Verify if a Work Permit or Radiological Work Permit is needed or is in effect. If so, review and sign the permit.
- 4.4 Use appropriate PPE for area.

#### 5.0 Precautions

- 5.1 **Hazard assessment:** Taking surface wipe samples may cause some exposure to health risks. The surface wipe sampling technique can use hazardous solvents. Sampling may be performed in areas with metal, chemical or radiological contamination. These hazards must be assessed on a case-by-case basis by a competent individual knowledgeable of the hazards of the area.
- 5.2 **Job Risk Assessment:** Consult the *Job Risk Assessment* [SHSD-JRA-05](#) for the risk analysis of this operation based on the hazards and controls of this SOP.
- 5.3 **Personal Protective Equipment:** Use appropriate personal protective equipment when implementing this procedure.
  - 5.3.1 **Hand:** Use gloves in areas of known or suspected chemical or radiological contamination. Exam-style, splash gloves are acceptable. Acceptable polymers are: Nitrile, PVC, and Natural Rubber. The gloves must have sufficient impermeability to the surface contaminant and solvent used on the collection media to allow safe handling. See Table 1.
  - 5.3.2 **Body:** Use a disposable suit if contact of the body with contaminated surfaces is anticipated. Acceptable chemical protective equipment materials include: Tyvek®, KleenGuard®, and cotton. Contact the ECR/WMR for disposable of garments. If personal clothing items become contaminated, they must be surrender for BNL cleaning or disposal.
  - 5.3.3 **Foot:** Use disposable shoe coverings, boots or booties if contact of the feet with contaminated surfaces is anticipated. Acceptable CPC material include: Tyvek®, KleenGuard®, and rubber. If personal shoes become contaminated, they must be surrendered for BNL cleaning or disposal.
  - 5.3.4 **Respiratory:** Under normal use, respiratory protection is not required. Use a respirator in an area with the potential to exceed the OSHA, ACGIH, or DOE standards. The person collecting using respiratory protection must comply with the BNL Respiratory Protection Program.
  - 5.3.5 **Eye:** Use safety glasses with side shields in laboratories, construction, and general industry areas.



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		Revision	<b>Final Rev19</b>
Subject:	<b>Surface Wipe Sampling Procedure</b>	Date	<b>03/04/14</b>
		Page	<b>4 OF 17</b>

5.4 **Radioactive Concerns:** It is possible that some surfaces to be tested may have radioactive contamination. In these cases, personal protective equipment and administrative controls must be implemented for the radiological contaminant hazard.

In addition, the collected sample must be analyzed for the radiological hazard before it can be submitted to the IH Group for analysis. The radiological contamination must be below the permissible release limits to the general public.

5.5 **Work Planning:** All requirements of work permits and work planning system reviews must be met in performing this procedure.

5.6 **Environmental Impact and Waste Disposal:** This technique does not have adverse impact on the environment. Based on WMD testing of similar material, templates and gloves can be disposed as normal trash. See Attachment 9.5.

## 6.0 Procedure

### 6.1 Equipment

<b>Sample container</b> (either):	Bag, plastic, sealable with "zip" type seal.
	Vial, glass or plastic. (Glass is needed for hexane solvents based samples).
<b>Sample media</b> (any of these):	Gauze: 2" x 2" or 4" x 4" cotton gauze
	Paper: Ashless quantitative filter paper (typical diameter is 1.5 to 4 inches) Pre-moistened wipe: manufacturer foil wrapped, solvent soaked disposable cloths (An acceptable brand is the GhostWipes™, via Environmental Express.)
<b>Gloves</b>	Appropriate for contaminant and solvent (see Table 1) and site hazards.
<b>Solvent</b>	Distilled water, Isopropanol, ethanol, methanol, n-hexane, or pre-moistened. See Table 1 for recommended solvent for each contaminant.
<b>Template</b>	Plastic sheet or cardboard: See Table 1 for size needed <ul style="list-style-type: none"> <li>• 100cm<sup>2</sup>: 10 cm x 10 cm square –or- circle of 11.24 cm diameter.</li> <li>• 1ft<sup>2</sup>: 1foot x 1 foot, or other shape totaling 144 in<sup>2</sup>.</li> </ul>

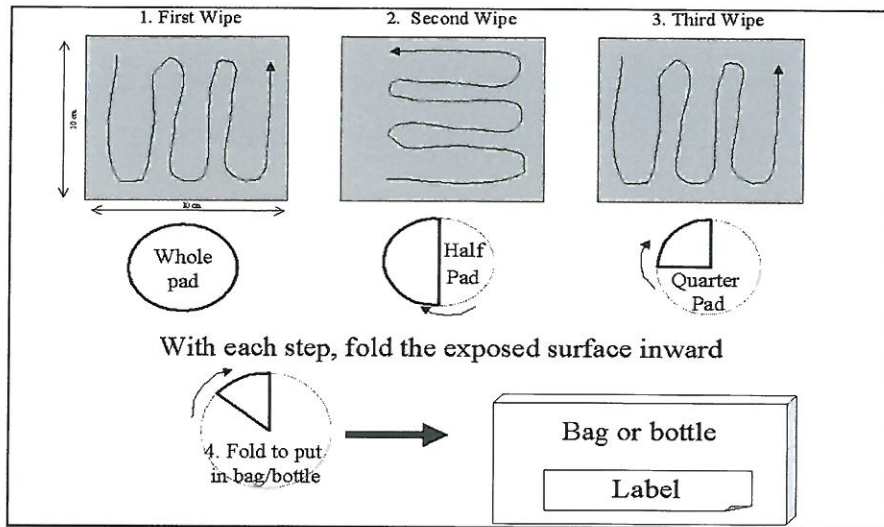
6.2. **Wipe Technique:** BNL SHSD IH Group has selected the NIOSH method of collecting wipe samples. For uniformity, this method should be used for all sampling surface to be sampled (Visually depicted in Figure A)

**Figure A: NIOSH Surface Wipe Method**



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		Revision	<b>Final Rev19</b>
Subject	<b>Surface Wipe Sampling Procedure</b>	Date	<b>03/04/14</b>
		Page	<b>5 OF 17</b>



6.2.1 Use a pre-moistened wipe (e.g. GhostWipe™) or moisten the sample media with 1 to 2 ml of the appropriate solvent (see **Table 1**). Apply only enough solvent to moisten approximately 80% of the area of the media. Avoid excess solvent on the filter or pad as it may cause drips and running on the surface thus diluting the sample.

Contaminant	Media	Solvent <sup>(1)</sup>	PPE Glove <sup>(2)</sup> Disposable Style	Sample Size
<b>Lead</b>	Gauze or Filter	Distilled Water	Natural Latex Rubber, Nitrile, PVC, or Polyethylene	1 square foot, 100 cm <sup>2</sup> requires advanced approval by IH professional verifying that sensitivity is adequate
	GhostWipe™ (should be cut in half) <sup>(3)</sup>	Wipe is premoisten (Water & Benzalkonium Chloride)		
<b>Beryllium</b>	Gauze or Filter	Distilled Water Isopropanol, Methanol, Ethanol	Natural Latex Rubber, Nitrile, PVC, or Polyethylene	1 square foot minimum needed always
	GhostWipe™ (should be cut in half) <sup>(3)</sup>	Wipe is premoisten (Water & Benzalkonium Chloride)		
<b>Arsenic, Cadmium, Chromium, or Nickel</b>	Gauze or Filter	Distilled Water	Natural Latex Rubber, Nitrile, PVC, or Polyethylene	100 cm <sup>2</sup> typically acceptable
	GhostWipe™ (should be cut in half) <sup>(3)</sup>	Wipe is premoisten (Water & Benzalkonium Chloride)		
<b>Hexavalent</b>	DO NOT USE GHOST	None: For chrome	Powderless:	100 cm <sup>2</sup> typically





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		Revision	<b>Final Rev19</b>
Subject:	<b>Surface Wipe Sampling Procedure</b>	Date	<b>03/04/14</b>
		Page	<b>6 OF 17</b>

<b>Chromium</b>	WIPES OR MCE FILTER <u>Preferred Medias:</u> (a) 0.45 mm 37 or 47 mm binderless quartz fiber filter (rough or smooth surfaces) (b) 5 um, 37-mm PVC filter (smooth surfaced) (c) Chrome plating: PVC or binderless quartz: immediately place in glass vial containing 10% Na <sub>2</sub> CO <sub>3</sub> with 2% NaHCO <sub>3</sub> .	plating operations, see stabilizing solution in Attachment 9.4	Natural Latex Rubber, Nitrile, PVC, or Polyethylene	acceptable
<b>PNAH</b>	Filter	Hexane	Nitrile, Neoprene	100 cm <sup>2</sup> typically acceptable

Media and solvents described in Reference 9.2.

**Notes for Table 1:**

- (1) Solvent: The solvent is not critical for lead, beryllium, and most heavy metals such as cadmium, nickel, and chromium. In doing wipes for these compounds, it is allowable to choose the solvent that will have the least impact (residues) on the owner of the equipment being sampled (i.e. some equipment is sensitive to water residues and an alcohol or other solvent may be preferred by the equipment owner.)
- (2) Selection criteria: Breakthrough time greater than 1 hour of continuous contact. Source of data is *DOE Guidelines for the Selection of Chemical Protective Clothing, 1991*.
- (3) The use of full size GhostWipes™ may cause the sample not to meet the minimum level of detection. To increase sensitivity, cut GhostWipes™ in half to reduce the size of the wipe.

6.2.2 Place the template over the area to be sampled or measure out 1 ft<sup>2</sup> or 100-cm<sup>2</sup> surface area, as per Table 1. If the object has a total surface area of less than 1 ft<sup>2</sup> or 100 cm<sup>2</sup>, sample the whole surface area, if possible, and record the surface area. If the surface does not allow the use of a template, carefully determine the dimensions that will equal 1 ft<sup>2</sup> or 100 cm<sup>2</sup>.

6.2.3 Wipe the surface with firm pressure, using “S” strokes, covering the entire surface (edge to edge). If the surface is very rough (such as concrete), a dabbing action may be substituted for the full contact pressure rubbing of the media across the surface. When dabbing, make sure to completely cover the same area as in the S-stroke wipe. Indicate dabbing done on **Attachment 9.3**.

Fold the exposed side of the pad or filter inward (i.e. fold in half).

6.2.4 Using the once-folded media, wipe the same area S-strokes (see Figure A), starting at right angles to the first wipe. Fold the exposed side of the pad or filter inward.

6.2.5 Using the twice-folded media, wipe with S-strokes (see Figure A) starting at the original point and wipe in the same direction. Fold the exposed side of the pad or filter in.



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<b>BROOKHAVEN NATIONAL LABORATORY</b> Safety & Health Services Division - Industrial Hygiene Group Standard Operating Procedure		Number	<b>IH75190</b>
		Revision	<b>Final Rev19</b>
Subject:	<b>Surface Wipe Sampling Procedure</b>	Date	<b>03/04/14</b>
		Page	<b>7 OF 17</b>

- 6.2.6 Place the media in a plastic bag or vial. Seal the zip lock or vial. Record the sample identification on the bag or vial.
- 6.2.7 Thoroughly clean reusable templates or discard paper templates in preparation of the next sample. Based on WMD testing of similar material, templates can be disposed as normal trash.
- 6.2.8 Remove gloves by pulling them off inside-out and discard appropriately before handling the next filter or pad.
- 6.2.9 Record the sample identification, surface area sampled, and description of the sample and surface on the sample form in **Attachment 9.3**.
- 6.2.10 Include 1 blank filter or pad (moisten and placed in bags or vials) with each set of samples (provide 1 blank per 6 samples).
- 6.3 Surface Wipe Technique for Hexavalent Chromium: see Attachment 9.2.
- 6.4 **Sampling Protocol :**
  - 6.4.1 Determine HOW MANY samples to take. It is not possible to provide definitive guidance on the number of samples to be taken in every case. **Table 2** provides general guidance on which to base professional judgment determining the number of samples. Factors that should be considered in selecting the number of samples include: the size of the area to be tested, the predicted uniformity of contamination over the surface area, and the eventual fate of the surface area (disposal, remediation, background measurement, etc.)

If more than six (6) samples are to be taken, it is suggested that at least one (1) duplicate sample be taken in close proximity to one other to verify the precision (repeatability) of the sampling.

Surface Configuration	Minimum Number of Samples	Qualifier
Entire Surface is less than 100 cm <sup>2</sup> (example: a small article)	1	If possible, sample the whole item, one sample is usually sufficient.
Surface Area of object or area is greater than 100 cm <sup>2</sup> but only a few square feet (example: table top on which a process is done)	1	If only one sample is taken, select the area with highest potential contamination
Surface Area of object or area is greater than a few square feet (example: floor or wall of a room)	1 - 3	Ideally three samples are taken, but fewer samples may be taken depending on the purpose for sampling



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<b>BROOKHAVEN NATIONAL LABORATORY</b> Safety & Health Services Division - Industrial Hygiene Group Standard Operating Procedure		Number	<b>IH75190</b>
		Revision	<b>Final Rev19</b>
Subject:	<b>Surface Wipe Sampling Procedure</b>	Date	<b>03/04/14</b>
		Page	<b>8 OF 17</b>

Surface Configuration	Minimum Number of Samples	Qualifier
Multiple surfaces in a large area with the same exposure potential to source (example, many rooms in a building with a common source such as the HVAC system)	1 – 3 for each surface, 6 or more for the whole area	Assumes all the surfaces have similar exposure potential, else treat each area separately.

6.4.2 Determine WHAT KIND of samples (LOCATION). Consider these locations when characterizing levels of surface metals:

- surfaces that are frequently accessed,
- surfaces that hazardous metal object rest on,
- surfaces that are infrequently cleaned or disturbed (such as top of cabinets or high shelves)
- sources of the contamination (such as process equipment, lab apparatus, site of known spills),
- areas where contamination is not expected (these serve as a control), and
- areas where contamination would not be permissible (such as lunch rooms).

6.5 **Results interpretation:** Normalize the units of sampling results from the laboratory to the base units of the Acceptable Surface Levels listed in **Table 3**.

**Conversion of data between various laboratory reporting units of measures:** Data can be converted from the various regulatory reporting and laboratory reporting units of measure based on the following values: 1 sq.ft. = 929 cm<sup>2</sup> 1 mg = 1000 ug

Convert from:	Multiply by
ug/100 cm <sup>2</sup> to ug/sq. ft	<b>9.29</b>
ug/sq. ft to ug/100 cm <sup>2</sup>	<b>0.1076</b>

6.6 **Reporting results:** Convey the assessment of results to the requestor of the sampling, ESH Coordinator and the IFM management in the form of a written analysis documenting: sampling and analysis methods, contamination levels measured, compliance with regulatory and recommended levels, and recommended corrective actions (if necessary).

Compound	Acceptable Surface Level		Criteria type	M/R	Basis for Calculation (shaded and in bold)		
	ug/100cm <sup>2</sup>	ug/sq ft				TLV 2011 ug/m <sup>3</sup>	PEL ug/m <sup>3</sup>
<b>Arsenic (As)</b>	15	139	Housekeeping- all	R2	DOE Be correlation	10	500
	1	9.3	Equipment Release- all	R2			
<b>Beryllium (Be)</b>	3	28	Housekeeping - all	M	DOE 10CFR850.30 [3 ug/100cm <sup>2</sup> ]	0.05 [I] [skin]	2
	3	28	Equipment Release- Be operational areas	M	DOE 10CFR850.31 [3 ug/100cm <sup>2</sup> ]	0.05 [I] [skin]	2
	0.2	1.9	Equipment Release- public & non-Be operational areas	M	DOE 10CFR850.31 [0.2 ug/100cm <sup>2</sup> ]	0.05 [I] [skin]	2





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<b>BROOKHAVEN NATIONAL LABORATORY</b> Safety & Health Services Division - Industrial Hygiene Group Standard Operating Procedure		Number	<b>IH75190</b>
		Revision	<b>Final Rev19</b>
Subject:	<b>Surface Wipe Sampling Procedure</b>	Date	<b>03/04/14</b>
		Page	<b>9 OF 17</b>

**Table 3 (BNL Surface Wipe Criteria for metals)**

Compound	Acceptable Surface Level		Criteria type	M/R	Basis for Calculation (shaded and in bold)		
	ug/100cm <sup>2</sup>	ug/sq ft				TLV 2011 ug/m <sup>3</sup>	PEL ug/m <sup>3</sup>
<b>Cadmium (Cd)</b>	3	27.9	Housekeeping- all	R2			
	0.2	1.9	Equipment Release- all	R2	DOE Be correlation	10 2 [R]	5 Z.1 200 Z.2
<b>Chromium III (Cr<sup>3+</sup>)</b>	750	6968	Housekeeping- all	R2			
	50	464	Equipment Release- all	R2	DOE Be correlation	500	500
<b>Chromium VI (Cr<sup>6+</sup>)</b>	7.5	69.7	Housekeeping- all	R2			
	0.5	4.6	Equipment Release- all	R1	DOE Be correlation	10	5
<b>Cobalt (Co)</b>	30	278.7	Housekeeping- all	R2			
	2	18.6	Equipment Release- all	R2	DOE Be correlation	20	100
<b>Lead (Pb)</b>	26.9	250	Housekeeping- Pb operational areas	R1	EPA TSCA (40CFR745) & HUD Sills		
	4.3	40	Housekeeping- non-Pb operational areas	R1	<b>250 ug/ft<sup>2</sup></b>	EPA/ HUD	EPA/ HUD
	26.9	250	Equipment Release- Pb operational areas	R1	EPA TSCA (40CFR745) & HUD Floors	[50]	[50]
	4.3	40	Equipment Release- public & non-operational areas	R1	<b>40 ug/ft<sup>2</sup></b>		
<b>Manganese (Mn)</b>	300	2786	Housekeeping- all	R2			
	20	184	Equipment Release- all	R2	DOE Be correlation	200 [R]	5000
<b>Nickel (Ni)</b>	1500	13935	Housekeeping- all	R2			
	100	929	Equipment Release- all	R2	DOE Be correlation	1500 [I]	1000
<b>Silver (Ag)</b>	15	139	Housekeeping- all	R2			
	1	9.3	Equipment Release- all	R2	DOE Be correlation	100	10

M = Mandatory based on regulation applicable to BNL  
 R1= Recommended based on regulation not applicable to BNL  
 R2= Recommended based on ratio of TLV/PEL airborne to DOE Beryllium housekeeping or release criteria

Basis for the R2 recommendations	
DOE Beryllium Housekeeping criteria (3 ug/100cm <sup>2</sup> ) DOE/OSHA airborne PEL for beryllium (2 ug/m <sup>3</sup> )	= BNL Housekeeping recommendation for toxic metal (in ug/100cm <sup>2</sup> ) ACGIH 2011 Airborne TLV or OSHA Airborne PEL (in ug/m <sup>3</sup> )
DOE Beryllium Release criteria (0.2 ug/100cm <sup>2</sup> ) DOE/OSHA airborne PEL for beryllium (2 ug/m <sup>3</sup> )	= BNL Release recommendation for toxic metal (in ug/100cm <sup>2</sup> ) ACGIH 2011 Airborne TLV or OSHA Airborne PEL (in ug/m <sup>3</sup> )

## 7.0 Implementation and Training

7.1 **Qualification Criteria:** Use of this SOP shall be limited to persons who have demonstrated the competency to satisfactorily use the procedure, as evidenced by experience and training. All persons must have demonstrated competency in the qualification criteria set in the Job Performance Measure (Attachment 9.4.).

7.2 Qualification on this JPM is required on a 3 year basis.

## 8.0 References



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BROOKHAVEN NATIONAL LABORATORY Safety & Health Services Division - Industrial Hygiene Group Standard Operating Procedure		Number	IH75190
		Revision	Final Rev19
Subject:	Surface Wipe Sampling Procedure	Date	03/04/14
		Page	10 OF 17

- 8.1 ACGIH Threshold Limit Values 2011
- 8.2 NIOSH Manual of Analytical Method, Fourth Edition, Method 9100: *Lead in Surface Wipe Samples*, 8/15/94.
- 8.3 OSHA Instruction CPL 2-2.20B: *Sampling for Surface Contamination*, 2/5/90.
- 8.4 OSHA 29CFR1910.1000 Table Z1, Z2.
- 8.5 EPA: Toxic Substance Control Act (TSCA) 40CFR761.130.
- 8.6 Ness, S.A.; *Surface and Dermal Monitoring for Toxic Exposures*, Van Nostrand Reinhold, 1994.

**9.0 Attachments**

- 9.1 Sample of Signs for Areas and Material
- 9.2 Liberty Mutual Wipe Sampling Technique for Hexavalent Chromium
- 9.3 Surface Contamination Sampling Form
- 9.4 SHSD Job Performance Measure (JPM) Completion Certificate
- 9.5 SHSD Environmental Evaluation of Surface Wipe Sampling

**10.0 Procedure Documentation**

ISM Review - Hazard Categorization:	<input type="checkbox"/> High;	<input checked="" type="checkbox"/> Moderate;	<input type="checkbox"/> Low/Skill of the craft
Validation:	<input type="checkbox"/> Formal Walkthrough	<input type="checkbox"/> Desk Top Review	<input checked="" type="checkbox"/> SME Review

Rev	Revision Log
0	New document. Prepared By R. Selvey, CIH 02/25/2000; Technical Reviewed By: N. Bernholz, CIH 02/27/00; RCD Facility Support Approved By: 04/22/01 N. Foster Procedure Committee Review; QA Review : E. Tucker; SHSD Approved By: R. Selvey 03/02/2000
1	Revised for minor correction noted in training classes. Reviewed By: R. Selvey 10/6/00
2	Added new format, SBMS header and reviewed sections on Hazard assessment, PPE. Added Waste Disposal and Environmental Impact text. Reviewed By: R. Selvey 02/05/01
3	Minor format change. Converted SOP number from IH-FP-3.2 to new system IH75190. Reviewed By: R. Selvey 03/09/01
4	Revised to include RCD Facility Support Procedure Committee Review comments. Reviewed By: R. Selvey 04/22/01
5	Updated Table 1 adding Arsenic and Cadmium Media. Update Table 3 with Arsenic and Cadmium Release Criteria and update EPA Lead Criteria. Reviewed By: R. Selvey 04/10/02
6	Updated Table 1 to correct error in lead criteria. Insert Section 7 and transfer information from section 4. Renumbered attachments. Reviewed By: R. Selvey 4/17/02
7	Added Best Management Practice release criteria for Arsenic and Cadmium to Table 3. Reviewed By R. Selvey 08/16/02:
8	Added Best Management Practice release criteria for Nickel to Table 3. Reviewed By: R. Selvey 10/17/02
9	Full review of SOP. Significant text changes. Deleted OSHA Method for procedure & PCB criteria. Updated Attachments 9.1 and 9.2. Added Attachment 9.3. Reviewed By: R. Selvey 05/21/04
10	Added reference and link to JRA-05 in 5.1. Added text to 6.2.2 to clarify using Table 1 to determine 100cm2 versus 1 sq ft. Changed "S-stroke" wording in 6.2.3.through 6.2.5 to avoid confusion with the S-stroke used the Health Physics terminology. The two patterns are different. Changed the qualification criteria in Section 7 to reflect the unified qualification policy. Updated the Sample form (Attachment 9.1) to reflect the <i>Compliance Suite</i> order of sample numbering. Reviewed By: R. Selvey 02/21/06
11	Reworded the "S-stroke" wording in 6.2.3.through 6.2.5 to avoid confusion with the S-stroke used the Health Physics terminology. Passage on "dabbing" was modified to indicate that the dabbing action replacing pulling the media, but does not replace the S-pattern. Minor typo corrections in Section 5 and 6. Reviewed By: R. Selvey 02/21/06



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<b>BROOKHAVEN NATIONAL LABORATORY</b> Safety & Health Services Division - Industrial Hygiene Group Standard Operating Procedure		Number	<b>IH75190</b>
		Revision	<b>Final Rev19</b>
Subject:	<b>Surface Wipe Sampling Procedure</b>	Date	<b>03/04/14</b>
		Page	<b>11 OF 17</b>

12	Section 6.3 was added with a reference to new Attachment 9.4; Table 1: was updated to include hexavalent chromium. Attachment 9.4 was added to include Liberty Mutual Wipe Sample Method. Liberty Mutual method was added. Section 8 References and Attachment 9.4 was added and included in Section 9.0 Attachments. Reviewed By: J. Peters 11/28/06; Reviewed By: R. Selvey 12/05/06
13	Added Section 4.1, 4.2 and 5.6. Revised 5.2. Added document control to attachment 9.3 and 9.4. Reviewed By: R. Selvey 05/23/07
14	Table 3: Updated to include Cobalt and description of calculation. Changed IH training link in Step 7.1. Reviewed By: M.Chuc 09/22/08 Reviewed By: R. Selvey 10/13/08
15	Added Attachment 9.5. Reviewed By: R. Selvey 02/09/09
16	Edited section 4.0 and 5.2 for brevity. Added definition for Release and Housekeeping Criteria. Changed Cr6 release level based on OSHA recommendation. Added ANSI Caution to Attachment 9.1 sign. Revised directions in Attachment 9.2. Reviewed By: R. Selvey 03/21/11
17	Full review of steps 1 to 7. Expanded and revised Release and Housekeeping Criteria definitions in Section 3 and in Table3. Reviewed By: R. Selvey 04/27/11
18	Corrected error in units in section 3: mg/100cm <sup>2</sup> to ug/100 cm <sup>2</sup> . Reviewed By: R. Selvey 05/10/11
19	Edited Section s 2 and 7 to remove reference to rescinded HP65100. Changed format of Section 9. Reviewer: R. Selvey 03/04/14





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<b>BROOKHAVEN NATIONAL LABORATORY</b> Safety & Health Services Division - Industrial Hygiene Group Standard Operating Procedure		Number	<b>IH75190</b>
		Revision	<b>Final Rev19</b>
Subject:	<b>Surface Wipe Sampling Procedure</b>	Date	<b>03/04/14</b>
		Page	<b>12 OF 17</b>

**Attachment 9.1**  
**Samples of Signs for Areas and Material**

**CAUTION**

**Cadmium Surface Contamination**

Some surfaces in this area have Cadmium levels above BNL Guidelines

- Do NOT perform operations that causes the dust to become airborne (such as using an air hose to clean surfaces or dry sweeping)
- Contact SHSD IH Group x-7475 prior to Building Renovations or Demolition
- Wash hands prior to eating, drinking, chewing gum, or smoking
- Do not eat or drink in this area.

**CLEAN**

The material on this pallet is below (i.e. cleaner than) the SHSD Best Management Practice Surface Release Guidelines for Lead and Cadmium

It is appropriate to be released and used anywhere at BNL without any specific precautions.

**Exceeds Guidelines  
for Lead or Cadmium**

The material on this pallet is above (i.e. not cleaner than) the SHSD Best Management Practice Surface Release Guidelines for Lead and/or Cadmium

Specific precautions are needed in areas where this material is used or stored.

- No operations that cause airborne dust (such as air hoses, blowers, or dry sweeping)
- Wash hands prior to eating, drinking, chewing gums, or smoking.
- Do not eat or drink in this area.
- Notify occupants of the area of the presence of Lead/Cadmium on these surfaces.



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BROOKHAVEN NATIONAL LABORATORY Safety & Health Services Division - Industrial Hygiene Group Standard Operating Procedure		Number	IH75190
		Revision	Final Rev19
Subject:	Surface Wipe Sampling Procedure	Date	03/04/14
		Page	13 OF 17

## Attachment 9.2

### WIPE SAMPLING TECHNIQUE FOR HEXAVALENT CHROMIUM

#### Materials supplied by the lab:

##### Sampling media

For chrome plating: PVC or binderless quartz filter. Immediately after sampling, place the filter sample in a vial containing 10% Na<sub>2</sub>CO<sub>3</sub> with 2% NaHCO<sub>3</sub> to stabilize the Cr<sup>+6</sup>.

All other operations:

- 5 um, 37-mm PVC filter for smooth surfaces
- 0.45 mm thick 37-or 47-mm binderless quartz fiber filter for rough surfaces (**preferred media for both smooth and rough surfaces**)

**Do not use Ghost wipe®, Whatman, mixed cellulose ester (MCE) or glass fiber filter as they convert Cr<sup>+6</sup> to Cr<sup>+3</sup>.**

Template (10 cm x 10 cm)

Teflon coated or plastic tweezers

Empty glass vials

Glass vials containing 5 ml aqueous solution of 10% Na<sub>2</sub>CO<sub>3</sub> with 2% NaHCO<sub>3</sub> for chrome plating samples

Powderless gloves

#### Sampling Technique:

1. Prepare a sufficient number of vials, each labeled with a unique number.
2. Sketch a diagram of the room or area to be sampled.
3. Wear a new pair of clean gloves for each sample. **DO NOT** use powdered gloves.
4. Record the sample vial number and location where the sample is taken.
5. Remove the filter from the carrying container with a clean PTFE-coated tweezers or plastic tweezers. **DO NOT** use metal tweezers to handle the filters, as they could deposit Cr<sup>+6</sup> onto the filters.  
*Note: Surfaces should not be wetted with water as the water will allow any metal interference to interact with Cr<sup>+6</sup> thereby affecting the results.*
6. Use firm pressure when wiping the surface. Start at the one corner moving to the opposite side then upward one wipe width and wipe back to the starting side. Repeat to cover the whole surface area. Fold inward and repeat wiping the entire surface again. Fold in and repeat a third time.
7. After wiping, fold the filter with the contaminant side inward. Place the filter immediately in the sample vial and cap.  
*Filter samples taken in chrome plating operation must be placed in a vial containing 10% Na<sub>2</sub>CO<sub>3</sub> with 2% NaHCO<sub>3</sub> to stabilize the Cr<sup>+6</sup>.*
8. Submit at least one blank wipe filter, treated in the same fashion, but without wiping.
9. Sample results will be reported as ug/100cm<sup>2</sup>. OSHA's target concentration is 0.050ug/100 cm<sup>2</sup>.
10. Ship samples immediately. If unable to ship immediately, keep cold then ship next day air to:  
Liberty Mutual IH Lab, Bldg C; 71 Frankland Road; Hopkinton, MA 01748



**Surface Contamination Sampling Form**

BNL-IH75190 Attachment 9.3 Form Rev: 05/23/2007

**Brookhaven National Laboratory  
Safety & Health Service Division  
Industrial Hygiene Group**

Analyte: **LEAD**  
**BERYLLIUM**  
**CADMIUM**  
 Other: \_\_\_\_\_

**DEPT:** \_\_\_\_\_  
**BUILDING:** \_\_\_\_\_

**LOCATION NAME, ROOM NUMBER & DESCRIPTION:** \_\_\_\_\_

**Sample Media:**  
 Ghost Wipe™  
 Cotton Gauze  
 Size: \_\_\_\_\_  
 Filter Paper  
 Type & Size: \_\_\_\_\_  
 Other: \_\_\_\_\_

**Solvent:**  
 Pre-Moistened  
 Distilled Water  
 Hexane  
 Isopropanol  
 Other: \_\_\_\_\_

**Surface Area Measurement:**  
 Template  
 Measured Area  
 Estimated Area  
 Other: \_\_\_\_\_

**REASON FOR SAMPLING:**  
 Area Characterization  
 Pre-Remediation  
 Post Remediation  
 Other: \_\_\_\_\_

Sample Identification

Blkg#	MMDDYY	Analyte Symbol	Sample #	Sample Location	Surface Type	Surface Area
					Metal / Plastic / Glass / Painted Wood / Wood / Painted Concrete / Concrete	1 ft <sup>2</sup> 100 cm <sup>2</sup> other _____
						1 ft <sup>2</sup> 100 cm <sup>2</sup> other _____
						1 ft <sup>2</sup> 100 cm <sup>2</sup> other _____
						1 ft <sup>2</sup> 100 cm <sup>2</sup> other _____

Additional Samples next page \_\_\_\_\_ Total Number of Samples: \_\_\_\_\_

**SAMPLE DATE:** \_\_\_\_\_

**SAMPLES TAKEN BY: (Print Name and Signature)** \_\_\_\_\_

**RELINQUISHED TO SHSD TH LAB BY: (SIGNATURE):** \_\_\_\_\_ **DATE/TIME:** \_\_\_\_/\_\_\_\_/\_\_\_\_

**RECEIVED BY SHSD TH LAB EMPLOYEE (SIGNATURE):** \_\_\_\_\_ **DATE/TIME:** \_\_\_\_/\_\_\_\_/\_\_\_\_





IH75190 Attachment 9.4

**HP-IHP-75190**

Environmental, Safety, Health & Quality Directorate  
SHSD Industrial Hygiene

**Chemical Surface Wipe Sampling  
Job Performance Measure (JPM) Completion Certificate**

Candidate's Name	Life Number:	Qualification Number: <b>HP-IHP- 75190</b>
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**Knowledge of the Principles of Surface Wipe Sampling Demonstrated by Written Exam**

Criteria	Qualifying Standard
<b>Hazard Analysis</b>	Understands the need to perform a hazard analysis of the sampling area and potential exposure to the sampler.
<b>Personal Protective Equipment</b>	Understands the need to be aware of the potential surface contamination and airborne levels of contaminants and knows how to determine the need for PPE.
<b>Sampling Protocol</b>	Understands the exposure monitoring logic necessary to appropriately select sampling locations to accurately measure worker, public and environmental exposure potential.
<b>Analysis of data</b>	Understands the need to perform analysis on the sampling data to assess potential exposure to the sampler, worker, public and environment, and to recommend corrective actions as necessary.

**Practical Skill Evaluation: Demonstration of Surface Wipe Methodology**

Criteria	Qualifying Performance Standard	Unsat	Recov	Satisf
<b>Sampling Equipment</b>	Knows where equipment needed for the procedure is located and how to properly sign it out.			
<b>Moistening Media</b>	a. Filter/gauze: Moistens media with the appropriate solvent. Applies solvent to moisten approximately 80% of the area of the media. Does not over moisten. b. For pre-moistened media, shows reduction in size of wipe.			
<b>Size of Area &amp; Use of Template</b>	Understands the importance of quantifying the area sampled. Demonstrates placing template on surface or measuring the surface area.			
<b>Folding Media at each wipe step</b>	Demonstrates the inward folding of media after each wipe and placement of media into container so that surfaces loaded in the wiping are not exposed.			
<b>NIOSH Method wipe pattern</b>	Demonstrates the technique of three passes of wiping in "S" pattern, changing the direction on second pass, original direction on third pass.			
<b>Choose correct solvent</b>	Knows how to select correct solvent from Table 1.			
<b>Select the correct number of samples</b>	Knows how to choose the appropriate numbers of samples based on Table 2.			
<b>Record forms</b>	Shows how to correctly and completely fill all forms associated with this SOP.			

I accept the responsibility for performing this task as demonstrated within this JPM and the corresponding SOP.

Candidate Signature:	Date:
----------------------	-------


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

Evaluator Signature:	Date:
----------------------	-------

SOP-IH75190 JPM Form (Revision Date: 05/23/07)



### **SHSD Environmental Evaluation of Surface Wipe Sampling for Chemicals/Metals**

<p><b>Operation Description:</b> Field samples for potential metals or chemicals are collected on pre-moistened pads. This process concentrates toxic substances on the media. The wipes are either sent off-site for analysis or in some instances are analyzed at BNL by the IH Group using direct reading meters.</p>	
<p><b>Frequency of Operation:</b> 10 to 20 times per year.</p>	
<p><b>Environmental impact:</b></p> <ul style="list-style-type: none"><li>▪ The wipes sampled at BNL are consumed in the analysis at the end of test by the off-site lab. Conformance with proper wipe disposal by the off-site vendor laboratory is validated to BNL IH Group's satisfaction in the AHIA Accreditation process.</li><li>▪ PPE used during sampling and the paper templates are disposed of at the direction of the EPD ECR. The current policy is for disposal as non-hazardous waste. This is justified because the concentration is too low to be of concern (a few micrograms per wipe surface).</li></ul>	
<p><b>Waste Disposal:</b></p> <ul style="list-style-type: none"><li>▪ PPE and paper templates are disposed of as non-hazardous waste, unless otherwise directed by EPD.</li></ul>	

IH75190 Attachment 9.5 Rev 06/05/09



Surface Contamination Sampling Form BNL-IH75190 Attachment 9.1				Page	of
Blg#	Sample Number		Sample Location	Surface Type Metal / Plastic / Glass / Painted Wood / Wood / Painted Concrete / Concrete	Surface Area
	MMDDYY	Analyte Symbol Sample #			
					1 ft <sup>2</sup> _____ 100 cm <sup>2</sup> _____ other _____
					1 ft <sup>2</sup> _____ 100 cm <sup>2</sup> _____ other _____
					1 ft <sup>2</sup> _____ 100 cm <sup>2</sup> _____ other _____
					1 ft <sup>2</sup> _____ 100 cm <sup>2</sup> _____ other _____
					1 ft <sup>2</sup> _____ 100 cm <sup>2</sup> _____ other _____
					1 ft <sup>2</sup> _____ 100 cm <sup>2</sup> _____ other _____
					1 ft <sup>2</sup> _____ 100 cm <sup>2</sup> _____ other _____
					1 ft <sup>2</sup> _____ 100 cm <sup>2</sup> _____ other _____

SAMPLE DATE	RELINQUISHED TO SHSD IH LAB BY: (SIGNATURE)	DATE / TIME: /
SAMPLES TAKEN BY: (Print Name and Signature)	RECEIVED BY SHSD IH LAB EMPLOYEE (SIGNATURE):	DATE / TIME: /

BNL-IH75190 Attachment 9.3 Form Rev: 05/23/2007