Contents: Beryllium

Effective Date: **August 2004**
Point of Contact: Beryllium Subject Matter Expert

Section	Overview of Content (see section for full process)
Introduction	
1. Planning to Use Beryllium	• Verify that using beryllium will not produce airborne beryllium dust. • Ensure training was completed. • Prepare or verify that a Beryllium Use Review Form (BURF) or departmental written documentation on beryllium use is in effect. • Review and approve BURF or documentation.
2. Using and Disposing of Beryllium	• Verify that using beryllium will not produce airborne beryllium dust. • Complete training. • Ensure that appropriate beryllium materials are in CMS. • Label containers. • Verify that documentation on beryllium use is in effect. • Review actions to take in case of spill, breakage, or release. • Use PPE. • Conduct operations following precautions and controls. • Dispose of beryllium through WMD.
Definitions	

Exhibits
Beryllium Use & Spill Clean-up

Forms
Beryllium Use Review Form (BURF)

Training Requirements and Reporting Obligations

This subject area contains training requirements. See the Training and Qualifications Web Site.

This subject area contains reporting obligations. See the section Using and Disposing of Beryllium.

References

Additional Medical Surveillance Form (AMS), Occupational Medicine Clinic Web Site

Beryllium Addendum Form, Occupational Medicine Clinic Web Site

Chemical Management System (CMS)

Facility Use Agreements home page (*Limited Access)

Training and Qualifications Web Site

Work Planning and Control for Experiments and Operations Subject Area

*Access Limited to BNL Staff and Authorized Non-BNL Staff

Standards of Performance

All staff and guests shall comply with applicable Laboratory policies, standards, and procedures, unless a formal variance is obtained.

Managers shall analyze work for hazards, authorize work to proceed, and ensure that work is performed within established controls.

All staff and users shall identify, evaluate, and control hazards in order to ensure that work is conducted safely and in a manner that protects the environment and the public.

All staff and users shall ensure that they are trained and qualified to carry out their assigned responsibilities, and shall inform their supervisor if they are assigned to perform work for which they are not properly trained or qualified.

Management System

This subject area belongs to the **Worker Safety and Health** management system.

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Introduction: Beryllium

Effective Date: **August 2004**
Point of Contact: Beryllium Subject Matter Expert

Beryllium is valued for its strength, formability, thermal and electrical conductivity, magnetic transparency, and corrosion resistance. Its low-neutron absorption, high-neutron scattering characteristics, and ability to multiply neutrons has led to its use in experimental nuclear reactors and accelerators. The alloying property of beryllium confers improved resistance to corrosion, vibration, and shock, and improves alloy hardness and ductility.

The inhalation of beryllium dust or particles can cause chronic beryllium disease (CBD) and beryllium sensitization. The Department of Energy (DOE) has established regulations to require a Chronic Beryllium Disease Prevention Program (CBDPP) for certain work conditions. The goal of the CBDPP is to reduce the number of workers currently exposed to beryllium, minimize the levels of exposure to beryllium, and establish medical surveillance requirements to ensure early detection and treatment of disease. In 1997 and 1999 BNL conducted reviews of the use of beryllium on-site. These evaluations determined the applicability of BNL current operations to DOE regulations and led to the establishment of BNL policy on the use and handling of beryllium. This subject area serves as the BNL Chronic Beryllium Disease Prevention Program.

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Subject Area: ***Beryllium***

1. Planning to Use Beryllium

Effective Date: **August 2004**
Point of Contact: Beryllium Subject Matter Expert

Applicability

This information applies to BNL staff and non-BNL staff who plan the use of beryllium at Brookhaven National Laboratory. Equipment and operations that are covered by these procedures are as follows: handling articles, laboratory use of beryllium powders and beryllium compounds, and operations covered by department-approved equipment-handling procedures.

Required Procedure

Step 1	Supervisors and Workers verify that the use of beryllium will not produce airborne beryllium dust. Dust-producing activities are prohibited at BNL without written permission from the Laboratory Director, the Environment, Safety and Health (ES&H) Directorate, and the Beryllium Subject Matter Expert. Prohibited activities include machining, grinding, turning, cutting, sanding, buffing, polishing with abrasives, filing, welding, drilling, tapping, brazing, burning, or any other modification of the physical shape of an article. If you wish to conduct an activity at BNL that produces airborne dust, your operations will need to comply with the DOE Chronic Beryllium Disease Prevention Program requirements and New York State air permits. **Note:** Machining or modification of beryllium articles (including operations that are dust-generating) can be arranged at outside sources via the Central Fabrication Services Division. **Note:** Permitted activities at BNL include the handling of beryllium articles and the use of beryllium on a laboratory scale with approved precautions.
Step 2	Before working with beryllium or cleaning up beryllium spills or releases, Supervisors ensure all workers who will contact beryllium have completed TQ-Beryllium: Beryllium Use at BNL and the appropriate HazCom, Lab Standard

	training, or NSLS User Orientation Training. See the Training and Qualifications Web Site.
Step 3	Supervisors or Principal Investigators prepare or verify that a Beryllium Use Review Form (BURF) or departmental written documentation on beryllium use is in effect for each operation that involves beryllium by contacting your ES&H Coordinator. • Plan for actions to be done in case of a spill, breakage, or release. • Determine the appropriate personal protective equipment (PPE), such as gloves, lab coats, or impervious suits to prevent contact with beryllium powder or beryllium oxide residues. • Determine precautions and controls to minimize exposure and prevent airborne dust levels. If a BURF or departmental written documentation on beryllium use is not in effect, complete the documentation with your Supervisor and/or ES&H Coordinator and submit it to your ES&H Coordinator.
Step 4	The ES&H Coordinator reviews and approves the BURF or the departmental written documentation on beryllium use.
Step 5	The Beryllium SME reviews each BURF or departmental written documentation on beryllium use annually. The SME prepares a summary report of any needed corrective actions for operations that are not in compliance with this Subject Area.

References

Training and Qualifications Web Site

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Subject Area: ***Beryllium***

2. Using and Disposing of Beryllium

Effective Date: **August 2004**
Point of Contact: Beryllium Subject Matter Expert

Applicability

This information applies to BNL staff and non-BNL staff who handle or use beryllium at Brookhaven National Laboratory. Equipment and operations that are covered by these procedures are as follows: handling articles, laboratory use of beryllium powders and beryllium compounds, and operations covered by department-approved equipment-handling procedures.

Required Procedure

Step 1	Do not perform any operation with beryllium that will produce airborne beryllium dust. Dust-producing activities are prohibited at BNL without written permission from the Laboratory Director, the Environment, Safety and Health (ES&H) Directorate, and the Beryllium Subject Matter Expert. Prohibited activities include machining, grinding, turning, cutting, sanding, buffing, polishing with abrasives, filing, welding, drilling, tapping, brazing, burning, or any other modification of the physical shape of an article.
Step 2	Before you work with beryllium or clean up beryllium spills or releases, complete TQ-Beryllium: Beryllium Use at BNL and the appropriate HazCom, Lab Standard, or NSLS User Orientation Training. See the Training and Qualifications Web Site.
Step 3	Ensure that all beryllium stock materials and original manufacturers' containers of beryllium powders and compounds are included in the Chemical Management System (CMS) inventory. Beryllium articles do not need to be included in the CMS inventory.
Step 4	Label containers of beryllium dust or powder with the following wording: "**Danger, Beryllium, Cancer and Lung Disease Hazard**."

Step 5	Verify that a Beryllium Use Review Form (BURF) or departmental written documentation on beryllium use is in effect for each operation that involves beryllium by contacting your ES&H Coordinator. If a BURF or departmental written documentation on beryllium use is not in effect, complete the documentation with your Supervisor and/or ES&H Coordinator and submit it to your ES&H Coordinator.
Step 6	Review actions to take in case of a spill, breakage, or release. Refer to the BURF or departmental written documentation on beryllium use. See the exhibit Beryllium Use & Spill Clean-up.
Step 7	Use personal protective equipment (PPE), such as gloves, lab coats, or impervious suits to prevent contact with beryllium powder or beryllium oxide residues, as per BURF or departmental written documentation on beryllium use. Wear gloves when handling beryllium articles. Dispose of contaminated PPE as beryllium waste.
Step 8	Conduct beryllium operations following the precautions and controls stated in the BURF or departmental written documentation on beryllium use.
Step 9	Characterize employee exposure for any unplanned scenario that has the potential to result in airborne exposure or surface contamination. Contact your ES&H Coordinator to initiate the appropriate sampling and monitoring.
Step 10	Dispose of beryllium metal, powders, stock material, and articles of pure beryllium through the Waste Management Division (WMD). Contact WMD before use to determine the appropriate waste stream from the type of beryllium waste generated. Beryllium waste must be disposed of in sealed, impermeable bags or containers and labeled with the following wording: "**Danger, Contaminated with Beryllium, Do not remove dust by blowing or shaking, Cancer and Lung Disease Hazard**."

Step 11	Send workers to the Occupational Medicine Clinic (OMC) for evaluation if exposure to airborne beryllium has occurred from the following:
	
	• An emergency;
	• A planned operation that resulted in airborne level exceeding the action level;
	• Signs or symptoms of beryllium exposure are observed, such as
	  ○ At high air levels, acute beryllium disease that resembles pneumonia
	  ○ Sensitized individuals may develop an inflammatory reaction in the respiratory system with weakness, tiredness, difficulty in breathing, anorexia, weight loss, right-side heart enlargement, and heart disease
	  ○ Contact with scraped or cut skin may cause rashes or ulcers.

Step 12	Supervisors must use the OMC's Additional Medical Surveillance Form (AMS) and the Beryllium Addendum Form to identify employees who should be offered medical surveillance by OMC. See the Occupational Medicine Clinic Web Site.

	Supervisors with questions about whether medical surveillance is needed or advisable should contact their ES&H Coordinator, Facility Support Representative or Industrial Hygiene for guidance.
Step 13	Medical Surveillance for beryllium (for current employees who are or may have been exposed to beryllium) is performed by OMC in accordance with DOE requirements. The Beryllium Addendum Form is used to provide OMC with the information required by the DOE. Send the form to OMC. OMC will then contact the employee and offer medical surveillance. Participation in the medical surveillance program is voluntary, and OMC will complete the required enrollment process and medical surveillance in accordance with DOE requirements. Contact the OMC Senior Staff Specialist or the OMC Manager with questions on the OMC Beryllium Medical Surveillance Program.
Step 14	If beryllium has been spilled or used in a manner with the potential for surface contamination from particulates or oxides, surfaces must be sampled to determine compliance with DOE workplace housekeeping. Before the release of these areas to the general public, sampling must be done to determine compliance with release criteria. Contact your Facility Support Representative.

Guidelines

Coat, encapsulate, or enclose beryllium parts whenever possible.

Store beryllium articles in sealed plastic bags or containers whenever possible.

References

Additional Medical Surveillance Form (AMS), Occupational Medicine Clinic Web Site

Beryllium Addendum Form, Occupational Medicine Clinic Web Site

Chemical Management System (CMS)

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Subject Area: ***Beryllium***

Beryllium Use & Spill Clean-up

Effective Date: **August 2004**

Point of Contact: Beryllium Subject Matter Expert

Beryllium Use & Spill Clean-up is provided as a Word file.

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Beryllium Use & Spill Clean-up

1. Routine Articles/Parts Handling

Handling parts and articles made of >0.1% beryllium does not typically result in exposure to hazardous levels of airborne dust.

- For high-beryllium contents parts (>2%): Wear gloves such as disposable latex, Nitrile, or PVC to eliminate the potential for surface dust or oxides to be ingested. Gloves also help prevent cuts and scraps by beryllium parts, which can ulcer.
- For copper/beryllium alloys (≤2%): Under normal conditions, these alloys do not oxide or produce surface particulates and are safe to handle without gloves.

2. Laboratory Work with Powders and Oxides

- Handle powders of > 0.1% beryllium or their oxides in a laboratory hood to prevent exposure to hazardous levels of airborne dust. Handle parts, articles, and powders wearing gloves such as disposable latex, Nitrile, or PVC to eliminate the potential for surface dust or oxides to be ingested. Gloves also help prevent cuts and scraps by beryllium parts, which can ulcer.
- In areas where beryllium has been spilled, surfaces must be sampled to determine compliance with DOE workplace housekeeping and general public release criteria. Contact the Facility Support Representative.

3. Machining Beryllium

- Machining, grinding, turning, cutting, sanding, buffing, polishing with abrasives, filing, welding, drilling, tapping, brazing, burning, or any other modification of the physical shape of an article is **prohibited at BNL.** See the Beryllium Subject Matter Expert for any parts modification that will create airborne dust.
- In areas where beryllium has been previously machined surfaces should be sampled to determine compliance with DOE's workplace housekeeping and general public release criteria. Contact the Facility Support Representative.

4. Spill Clean up

Personal Protective Equipment (PPE)

- Gloves: Nitrile, PVC, Natural rubber, and Polyethylene disposal gloves all provide adequate resistance to penetration by beryllium dusts. Thicker gloves such as neoprene or natural rubber should be used when handling sharp objects. Cotton or leather gloves, with a disposable glove underneath, may also be used for protection against cuts and punctures.
- Suits: Paper, Tyvek®, Klean-guard® or Saranex®, or similar coated suits provide adequate resistance to penetration by beryllium dusts. Body PPE should provide coverage of exposed personal clothing. Clothing contaminated with beryllium may not be taken home.

- Shoe covering: Rubbers, PVC, polyethylene, and Tyvek shoe coverings all provide adequate resistance to penetration by beryllium dusts. Foot PPE should provide coverage of exposed personal shoes. Shoes contaminated with beryllium may not be taken home or leave the spill site.
- Eye: Safety glasses with side shields are the minimum eye protection. A full-face respirator also provides adequate resistance to penetration by beryllium dusts.
- Respirator: When there is potential for activities that will create airborne dust in excess of the action level (0.2 ug/m^3), a respirator is required. Acceptable respirators are as follows:
    - Half-face Air purifying respirator (APR) with HEPA filter for concentrations up to 2 ug/m^3
    - Full-face APR with HEPA Filter for concentrations up to10 ug/m^3
    - Full-face Powered APR with HEPA Filter for concentrations up to 200 ug/m^3

5. Clean-up Techniques

- Pick up sharp objects with tongs. (Beryllium cuts cause more severe injury than typical sharps).
- Wet wipe appropriate surfaces (typically with ethanol).
- Use a HEPA vacuum. (Do not use a non-HEPA filtered vacuum). Vacuum cleaners should be dedicated to beryllium to prevent mixed wastes and should be labeled “Beryllium.”

6. Area and Personnel Sampling

- In areas where beryllium has been spilled or articles such as accelerator windows have been broken surfaces must be sampled to determine compliance with DOE’s workplace housekeeping and general public release criteria. Contact the Facility Support Representative.
- Air sampling for breathing zone exposure of clean-up worker is to be done, when available.

Subject Area: ***Beryllium***

Beryllium Use Review Form (BURF)

Effective Date: **August 2004**
Point of Contact: Beryllium Subject Matter Expert

The Beryllium Use Review Form is provided as a Word file.

The use of the Beryllium Use Review Form (BURF) is not mandatory provided that written documentation on beryllium use of equivalent content is maintained in a timely manner and is available to the Beryllium Subject Matter Expert and affected employees. Required contents in the written documentation are

- Location of use, including department, building, room or area
- Identification of users by name and life number or generic job titles
- Status, frequency, amount and description of use
- Potential for airborne exposure
- Precautions during use and storage
- Personal Protective Equipment requirements
- Spill, release, Breakage Clean-up Plan
- End of project plan

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BNL Beryllium Use Review Form

Dept	**Building**	**Room (Area, location)**
Users (Name/Life#) or (Job Title):		
Status of beryllium use: ___ In use on frequent basis ___ Planned use in the near future ___ Possible Future Use ___ No planned use: ___ keep ____ dispose ___ Legacy (inherited): ___ keep ____ dispose		
Describe Use or Process (such as Analytical Standard, Window, Beam Tube, Attenuator, Sample holder, Stock material, etc): ___Meets definition of "Article" ____ Meets definition of "laboratory use"		
Describe Handling Procedure: (such as "*article removed from storage bag, and inserted into holder, without the need for physical alteration of article*")		
Potential for Airborne Exposure Assessment: (include measured or predicted air concentration and method of determining concentration)		
Amount used: (such as grams per month)		
Frequency of use: (such as # days per year or month, # tests per year, in continuous use, etc.)		
Precautions during Use: (check all that apply) ___ Always opened and used in lab hood ___ Handled on lab bench or room ___ Used in closed system ___ Other: ___ Parts encapsulated ___ Parts coated		**Storage:** (check all that apply) ___ In vented cabinet ___ On lab shelf , lab bench, or cabinet ___ Inside lab hood Other: ___ Stored in bags or bottles ___ Locked area/cabinet, access control
Written Documentation: ___ Experimental Review (Work Planning and Control for Experiments and Operations Subject Area) ___ Material recorded in CMS Inventory ___ Static inventory ___ Work Permit (Work Planning and Control for Experiments and Operations Subject Area) ___ Written SOP (describe): ___ Each part bar coded		
Personal Protective Equipment used: ___ Gloves (describe material, thickness): ___ Impervious suit ___ Lab coat ___BNL laundered clothing ___ Respirator, type:		

Spill, Release, Breakage Clean-up Plan (Describe possible release scenario and action, including clean-up worker training, exposure monitoring, personal protective equipment, and disposal):	
Pollution Prevention Plan: (Describe pollution prevention and waste minimization measures):	
End of Project Plan: (Describe the actions when the use of beryllium is no longer needed, including accounting for material consumption and funding of disposal):	
Completed by:	**Date:**
Reviewed by:	**Date:**
Approved by:	**Date:**

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Definitions: Beryllium

Effective Date: **August 2004**
Point of Contact: Beryllium Subject Matter Expert

Term	Definition
article	A manufactured item that is formed to a specific shape or design during manufacture that has end-use functions that depend in whole or in part on its shape or design. An article does not release beryllium or otherwise result in exposure to airborne concentrations of beryllium under normal conditions of use. Examples of articles include beam windows, beam filters, beam tubes, sample holders, targets, and copper/beryllium electric components and contacts.
beryllium	Elemental beryllium and any insoluble beryllium compound or alloy containing 0.1 percent beryllium or greater.
beryllium-associated worker	A current worker who is or was exposed or potentially exposed to airborne concentrations of beryllium at a DOE facility, including 1) A beryllium worker; 2) A current worker whose work history shows that the worker may have been exposed to airborne concentrations of beryllium at a DOE facility; 3) A current worker who exhibits signs or symptoms of beryllium exposure; and 4) A current worker who is receiving medical removal protection benefits.
beryllium worker	A current worker who is regularly employed in a DOE beryllium activity.
container	A bottle, box, jar, bag, vial, or other vessel in which beryllium metal powder or a beryllium containing compound is stored.
laboratory use of hazardous chemicals	Work with substances in which the containers used for reactions, transfers, and other handling of substances are designed to be easily and safely manipulated by one person. Handling or use of such chemicals in which all of the following conditions are met: 1. Multiple chemical procedures or chemicals are used;

	2. The procedures involved are not part of a production process, nor in any way simulate a production process; and 3. Protective laboratory practices and equipment (that BNL health and safety experts agree are effective) are available and in common use to minimize the potential for employee exposure to hazardous chemicals.

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Revision History: Beryllium

Point of Contact: Beryllium Subject Matter Expert

Revision History of this Subject Area

Date	Description	Management System
August 2004 -- major 2.0	Section 1 Planning to Use Beryllium was added to the subject area. Section 3 Administration and Recordkeeping was deleted; its procedures were added to Section 2 Using and Disposing of Beryllium. Procedures on characterizing and responding to employee exposure to beryllium, and medical surveillance also were added to this section. The exhibit Beryllium Use & Spill Clean-up also was added.	Worker Safety and Health
November 1999	This information was developed by a team using the process for Standards-Based Management development. This subject area is a new document and does not replace any existing requirements.	Worker Safety and Health

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