TEID CAMERA-READY APPROVAL CHECKLIST

Creative Services

Please Return Proof & Signed Form to TEID

Project: Beryllium Awareness Brochure JO 9471 Account Number: _____

Client: J. Salazar Division: _____

Account Manager: C. Ventimiglia Date: 08-11-04

To Printer: _____ Publication date: _____

✓ Place a check mark next to items listed below that were proofed and approved

NO Use this to indicate items that were missing or incorrect

N/A Use this for those that don't apply to the proof

CK	NO	N/A		CK	NO	N/A		CK	NO	N/A	
☐	☐	☐	Page Content	☐	☐	☐	Numbers	☐	☐	☐	URLS
☐	☐	☐	Captions/Quotes	☐	☐	☐	Color	☐	☐	☐	Addresses
☐	☐	☐	Graphic Treatments	☐	☐	☐	Layout/Design	☐	☐	☐	Crop/fold/trim marks
☐	☐	☐	Logos	☐	☐	☐	Trims, bleeds	☐	☐	☐	Registration tabs
☐	☐	☐	Folds, perforations	☐	☐	☐	Screens	☐	☐	☐	Paper stock, weight
☐	☐	☐	Images: cropping, size	☐	☐	☐	Headlines/Subheads	☐	☐	☐	LBNL/PUB # _____
☐	☐	☐	Type proofed	☐	☐	☐	Call outs	☐	☐	☐	Other: _____
☐	☐	☐	Postal Indicia/codes/permits	☐	☐	☐	Phone numbers				

Other:

Quantity: _____ Ship to: _____ MS: _____ Ext: _____

This is to verify that I have thoroughly reviewed and approved the project materials described above. I understand that this is my last opportunity to request changes due to mistakes or preference. I further acknowledge that any mistakes or preference changes that were not discovered or specified at this time are not the responsibility of TEID. I authorize TEID to proceed with the approved materials listed above to the printer for the final phase of the project.

Client Approval Signature: _____ Date: _____

LBNL/PUB-902

Beryllium Hazard Awareness at Berkeley Lab

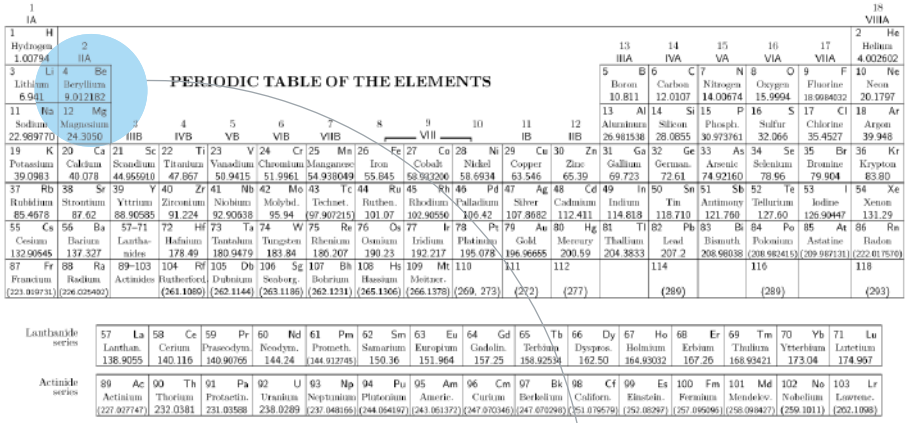
Beryllium Safety Program

/ Environment, Health and Safety Division of
Ernest Orlando Lawrence Berkeley National Laboratory

Modified from material developed by Lawrence Livermore National Laboratory
(Education and Training Division of Hazards Control,
UCRL-MI-139474-HS4258).

JULY 2004

BERKELEY LAB



INTRODUCTION

This pamphlet is intended to familiarize all Laboratory employees and guests with the potential hazards of beryllium metal, beryllium compounds, and beryllium-containing materials, and Berkeley Lab resources available to ensure all beryllium operations are conducted safely.

Beryllium is a naturally occurring metal with many industrial and R&D applications, particularly in the aerospace, nuclear, electronics, and automotive arenas. Despite its benefits, serious health problems are caused by exposure to airborne beryllium particles. The most common of these is a respiratory disease known as Chronic Beryllium Disease, or CBD.

Although current and projected uses of beryllium at Berkeley Lab are primarily limited to research and therefore pose a relatively low degree of risk compared to industrial or machining operations involving beryllium, everyone on site must be made fully aware of what the risks are. This pamphlet looks at these risks and how to safeguard against exposure (especially for those working with beryllium or in areas where beryllium may be present), as well as at the characteristics of beryllium and its applications.

WHAT IS BERYLLIUM?

Beryllium is a silver-gray metallic element that occurs naturally in about 30 minerals. It is the second lightest of the metals (lighter than aluminum), but is stiffer than steel. It has a high melting point, conducts heat well, and is corrosion resistant. Beryllium-containing minerals are found in rocks, coal, oil, soil, and volcanic dust. It is 46th in natural abundance in the Earth's crust, slightly more than uranium or tin. Beryllium is a key element in gems such as blue-green aquamarines and green emeralds.

MANY PRODUCTS AND PROCESSES USE BERYLLIUM

Beryllium metal has been used in industrial processes and products since the late 1950s. Both structural and instrument-grade beryllium-containing materials are manufactured, especially for the aerospace and defense industries, as well as for use in some research and development (R&D) applications, including windshield frames and other structures in high-speed aircraft and space vehicles; aircraft and space shuttle brakes; neutron moderators or reflectors in nuclear reactors; x-ray windows (such as those used at the Advanced Light Source); nuclear weapons components; nonsparking tools and springs (beryllium–copper alloy); and foil targets for accelerator experiments.

If your work at LBNL may involve handling or using beryllium, beryllium compounds, or beryllium-containing materials, it is essential that you contact the LBNL Beryllium Program Coordinator at x6571 or visit the Lab's Beryllium Safety web site (www.lbl.gov/ehs/ih/beryllium.shtml) to get assistance in evaluating your operation(s) and applicable controls.

MANY PRODUCTS IN THE HOME CONTAIN BERYLLIUM

In addition to industrial and R&D applications, beryllium alloys and compounds are used in products found in the home. Some examples are bicycles (more expensive models), golf clubs, jewelry, computer parts, air bags in automobiles, dental bridges, and television components.

Fortunately, none of these products poses a health risk. Beryllium in block form is not harmful and can be safely held in your hand. For example, a hand tool made of beryllium is perfectly safe to use.

BERYLLIUM HEALTH HAZARDS

Although a very useful material, beryllium does have drawbacks. It is expensive and brittle to work with in some applications. Most important, it is toxic under certain conditions and in certain forms.

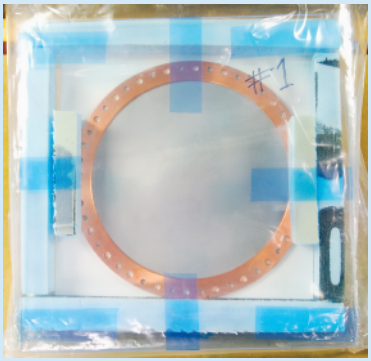
Unless ventilation and/or other controls are used, small particles or chips of insoluble beryllium-containing materials that break off during machining and other processes can spread through the air in the work area. Inhalation of these microscopic particles into the lungs, or even skin exposure to these particles, can lead to three health problems:

1. ACUTE BERYLLIUM DISEASE
2. BERYLLIUM SENSITIVITY
3. CHRONIC BERYLLIUM DISEASE

However, the mere presence of beryllium or beryllium-containing materials is not a health hazard. The hazard occurs if there is a possibility that beryllium particulate matter, i.e., particles or chips, will be generated or may be present.

Berkeley Lab's Beryllium Windows

Beryllium is a very good transmitter of x-rays. Because of this, Berkeley Lab's Advanced Light Source, which generates ultraviolet and soft x-ray beams for scientific and technological



research, uses beryllium windows to pass photons from high-vacuum to atmospheric pressure environments. Beryllium transmits x-rays well, has good thermal conductivity, and is relatively strong. However, corrosion can compromise the integrity of beryllium windows, so if a window does break, please do not clean it up by yourself. Instead, call the Beryllium Program Coordinator at x6571 to assist in proper clean up.

ACUTE BERYLLIUM DISEASE

In the 1940s and 1950s, it was discovered that workers who breathed air having very high concentrations of beryllium (many orders of magnitude above current levels) could develop a type of chemical pneumonia called acute beryllium disease. Its symptoms include coughing, burning and pain in the chest, and shortness of breath. Recovery takes a week to six months, with occasional recurrence of symptoms.

Generally, acute beryllium disease is a result of short-term, high-level exposure, and the symptoms appear within a few days or weeks. It is very unlikely that anyone working in beryllium operations today would be exposed to concentrations high enough to cause acute beryllium disease, as engineering controls and practices are much improved. However, be aware of this hazard.

BERYLLIUM SENSITIVITY

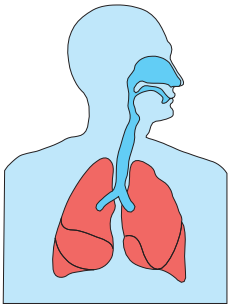
Exposure to beryllium dust may cause sensitization, an immune system response to beryllium. Individuals who are sensitized to beryllium have white blood cells in the blood or lungs that react to beryllium. This reaction may be present in workers who have no lung disease. Medical studies have shown that even small amounts of beryllium particles breathed deeply into the lungs may trigger this sensitivity in 2 to 5 percent of the people exposed. In studies of people in certain occupations where exposure to beryllium is greatest (for example, machinists in beryllium operations), this figure rises to as high as 10 to 14 percent.

Currently, there is no available test to determine who is at risk for becoming sensitive to beryllium. Blood tests can only indicate those individuals already sensitized to beryllium.

CHRONIC BERYLLIUM DISEASE

Individuals who have become allergic or sensitized to beryllium can have Chronic Beryllium Disease (CBD). As with beryllium sensitivity, these individuals have white blood cells in the blood or lungs that react to beryllium, but the reaction causes the lungs to become inflamed and develop scar tissue, which can hinder the transfer of oxygen when breathing.

Although current U.S. Department of Energy (DOE) medical surveillance programs are identifying more people at the sensitization stage before they actually have CBD, some individuals already have the disease by the time they are evaluated.



CBD CAN TAKE MANY YEARS TO DEVELOP

The average time from first beryllium exposure to the development of symptoms (latency period) of CBD is 10 to 15 years. This means you can be exposed to beryllium today and not suffer any health effects for decades. Health effects can appear a few months after exposure in some people, but can take as long as 30 years to show up in others. Doctors and researchers believe that some individuals lived with CBD and died from other causes without even knowing they had it.

At this time, there is no way to determine who is susceptible to beryllium prior to exposure. DOE and Berkeley Lab assume that all workers may be susceptible, so have implemented controls to protect everyone.

SYMPTOMS OF CHRONIC BERYLLIUM DISEASE

CBD symptoms resemble those of other lung diseases, particularly a disease called sarcoidosis. Studies have found that in some cases doctors have misdiagnosed CBD as sarcoidosis or other diseases. Symptoms of CBD may include:

- PERSISTENT COUGHING
- SHORTNESS OF BREATH WITH PHYSICAL EXERTION
- FATIGUE
- CHEST AND JOINT PAIN
- BLOOD IN THE SPUTUM (SPUTUM IS SALIVA, MUCUS, AND OTHER DISCHARGES THAT CAN BE COUGHED UP FROM THE RESPIRATORY SYSTEM)
- RAPID HEART RATE
- LOSS OF APPETITE
- FEVERS AND NIGHT SWEATS

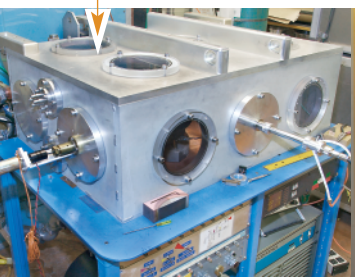
A true diagnosis of CBD can only be made through medical tests specific for beryllium disease. CBD is rare, and it is unlikely that a person exhibiting the above symptoms actually has the disease.

BERYLLIUM USE AT BERKELEY LAB

Beryllium is used on site in R&D applications. These operations are primarily short term, small scale, and pose a relatively low risk of exposure. R&D operations at Berkeley Lab include ultraviolet irradiation of silicon wafers with beryllium coating; implanting carbon atoms in a foil of beryllium; and incorporation of beryllium oxide in microchip hybrids and conductors.

Machining of beryllium metal, which has the potential to generate beryllium particulate, was discontinued at Berkeley Lab in 1985. The machine shop in Building 77, the site of this activity, was formally decontaminated and decommissioned in 2000. Therefore, no operations of this type exist at Berkeley Lab.

Current Beryllium R&D Use at Berkeley Lab.



Electrical Discharge Machine from Building 77 Machine Shop.

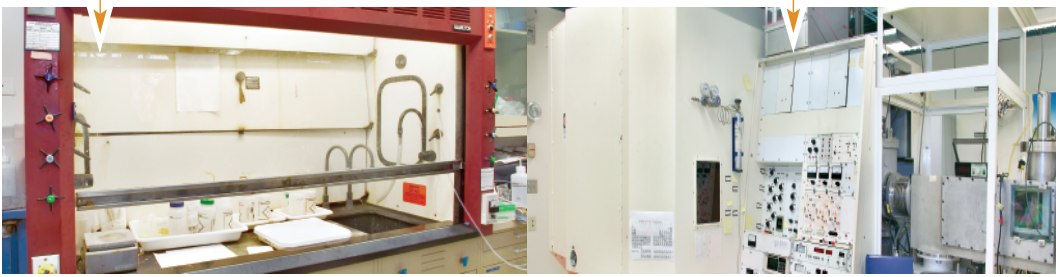
CONTROLLING BERYLLIUM EXPOSURE

Berkeley Lab and DOE have mandated that exposure to beryllium particles, dust, and fumes be minimized to the greatest extent possible. The best defense is simply to not use or handle beryllium or be present in areas where beryllium is used. Since this is not always possible, Berkeley Lab uses the following three types of controls to ensure employee safety and minimize beryllium exposure to anyone entering beryllium work areas or working around beryllium: engineering controls, administrative controls, and personal protective equipment.

ENGINEERING CONTROLS

Engineering controls are the most effective employee protection as they involve designing equipment and facilities to physically prevent any beryllium particles from entering the atmosphere. Examples of engineering controls include enclosing all beryllium work, employing exhaust hoods and high-efficiency particulate air (HEPA) filters for all operations where beryllium particulate might be generated, not grinding or sharpening beryllium-copper nonsparking tools, reordering replacements when beryllium alloy tools lose their shape, or substituting with a different alloy (aluminum/bronze) that has nonsparking properties.

Fume Hood (left) and Enclosure (right) — two types of engineering controls.



ADMINISTRATIVE CONTROLS

Contact the Beryllium Program Coordinator at x6571 or visit the Lab's Beryllium Safety web site (www.lbl.gov/ehs/ih/beryllium.shtml) to get assistance in evaluating your beryllium use, posting required signs, and establishing appropriate controls.

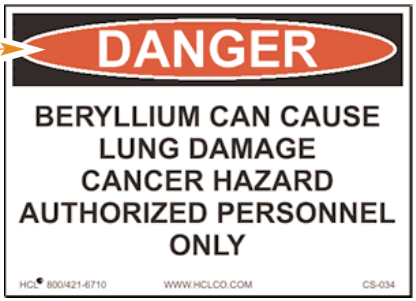
Post signs where beryllium is used. Always obey these signs.

Treat beryllium-contaminated hazardous waste.

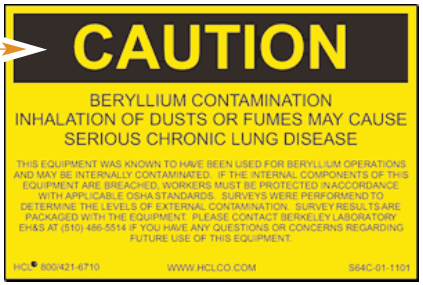
Personnel who work with beryllium metal, alloys, and/or beryllium-containing compounds must complete Beryllium Hazard Communication Training (EHS0342).

Prepurchase approval by the Environment, Health & Safety Division (EH&S) on all orders of beryllium or beryllium-containing items such as alloys (even those containing as little as 1–2 % beryllium).

If there is any likelihood of exposure to airborne particles of beryllium in the course of their work, employees must enroll in the Berkeley Lab Medical Surveillance Program for Beryllium. Contact Health Services at x6266 for more information.



This sign would be posted in an area where potential exposure might exceed the Berkeley Lab action level of 0.2 micrograms of beryllium per cubic meter of air.



Beryllium Contamination Label. This label indicates a machine or piece of equipment that was used in a beryllium operation. Handle it carefully, especially if you plan to take it apart.

Beryllium Content Label. You might see this label on a container of beryllium, beryllium compounds, or beryllium-contaminated clothing, equipment, scraps, or debris. **DO NOT HANDLE** unless it is part of your job and you have completed the proper training, Beryllium Hazard Communication (EHS0342). At this time, there is no requirement to label premanufactured, unaltered beryllium items or articles (such as nonsparking tools or springs) that are used for their original purpose.

PERSONAL PROTECTIVE EQUIPMENT

Personal protective equipment is also used to protect people from the harmful effects of beryllium. Some examples are respirators, gloves, and lab coats.

Not only does this equipment help protect workers, it also helps prevent the transport of beryllium outside the work area where others could be exposed.

It should be noted that in laboratory operations involving beryllium, respirators are generally not necessary as long as the operation is confined to a properly functioning ventilation device (such as a fume hood).

BERYLLIUM PREVENTION PROGRAM

The U.S. Department of Energy has mandated that all DOE sites with beryllium activities institute a Chronic Beryllium Disease Prevention Program (CBDPP). A copy of the CBDPP plan for Berkeley Lab can be obtained by contacting the Berkeley Lab Beryllium Coordinator, at x6571, or you can view it on the Web at: www.lbl.gov/ehs/ih/cbdpp.pdf.

The plan provides details about Berkeley Lab's program to minimize personnel exposure to beryllium, including provisions on exposure monitoring, housekeeping, medical surveillance, and training.

ISM AND BERYLLIUM

ISM, which stands for "Integrated Safety Management," is a Laboratory-wide work safety system that requires each employee to define the scope of work, evaluate the hazards associated with that work, then implement controls for those hazards. In defining the scope of a job task, if you find the task takes you into or near an area where beryllium or beryllium-containing items are located, check with your supervisor or your Industrial Hygienist (see the list of Industrial Hygienists at: www.lbl.gov/ehs/ih/ih_members.shtml) for help in determining what, if any, measures or controls need to be taken to protect you and your coworkers.

MORE INFORMATION

If you plan to work with beryllium or have questions about your current use . . .

Visit the LBNL Beryllium Safety web site
www.lbl.gov/ehs/ih/beryllium.shtml

Contact your Industrial Hygienist
www.lbl.gov/ehs/ih/ih_members.shtml

Contact the Beryllium Program Coordinator at x6571

Take the Beryllium Hazard Communication course
ehswprod.lbl.gov/EHSTraining/BE

Download Berkeley Lab's Chronic Beryllium Disease Prevention Program
www.lbl.gov/ehs/ih/cbdpp.pdf

If you think you have been exposed to beryllium (either at Berkeley Lab or a previous job) . . .

Contact Health Services immediately at x6266

For more information on Integrated Safety Management . . .

Go to www.lbl.gov/ehs/pub811/

The following Web sites provide both historical and current information on beryllium, beryllium-related activities, and chronic beryllium disease.

UC, DOE, OSHA, AND DEPARTMENT OF LABOR

Lawrence Livermore National Laboratory's Beryllium Disease Prevention Program: www.llnl.gov/Be-prevention/home.html

U.S. Department of Energy Chronic Beryllium Disease Prevention Program:
tis-nt.eh.doe.gov/be/

Occupational Safety & Health Administration Hazard Information Bulletins:
www.osha-slc.gov/dts/hib/hib_data/hib19990902.html

U.S. Department of Labor–Office of Workers' Compensation Programs, Division of Energy Employees Occupational Illness Compensation:
www.dol.gov/esa/regs/compliance/owcp/eeoicp/main.htm

ELEMENTAL AND INDUSTRIAL BERYLLIUM INFORMATION

Web Elements Periodic Table: www.Web Elements.com/Web Elements.html

Brush-Wellman Web Site, Manufacturer of Beryllium-Copper Alloys:
www.brushwellman.com/index.asp

Brush-Wellman Beryllium Facts Page: www.befacts.com/

This work was supported by the Office of Science of the U.S. Department of Energy
under Contract No. DE-AC03-76SF00098.

TEID JO 9471


Berkeley Lab