LLE INSTRUCTION 6706G

SUBJECT: BERYLLIUM SAFETY PROCEDURES

REFERENCES:
a. 10 CFR Part 850 Chronic Beryllium Disease Prevention Program (CBDPP); Final Rule
b. 29 CFR 1910.1450 (OSHA Laboratory Standard)
c. University of Rochester/LLE Chemical Hygiene Plan
d. LLE Job Hazard Assessment Form
e. LLE INST 6610: Radiological Controls (RADCON) Manual
f. LLE Beryllium Workstation User's Manual (S-SA-M-040)
g. ASTM E1792; Standard Specification for Wipe Sampling Materials for Lead in Surface Dust, and ASTM D6966: Standard Practice for Collection of Settled Dust Samples Using Wipe Sampling Methods for Subsequent Determination of Metals
h. LLEINST 6550: Laboratory Safety Program
i. NIOSH 7300: Elemental Analysis by ICP
j. ASTM D7202: Determination of Beryllium in the Workplace Using Field-Based Extraction and Optical Fluorescence Detection
k. University of Rochester Respiratory Protection Program

1. Purpose: To promulgate procedures and protocols to ensure that beryllium is handled, processed, and used safely, whether it is used in the form of a solid "article" (e.g., a foil, film, stalk, or other shape) or integrated as a component of a piece of experimental equipment or diagnostic instrument. The procedures and protocols specified herein shall ensure that the concentration of both airborne and surface ("removable") beryllium particulate contamination remains below the accepted safe occupational exposure levels established by the Occupational Health and Safety Administration (OSHA) and the Department of Energy (DOE).

2. Background:

a. Beryllium is a silver-gray metal with a density of 1.85 g/cm^3 and a high stiffness. Beryllium in the form of a powder or dust can cause a granulomatous respiratory disorder called chronic beryllium disease (CBD) when the concentration of respirable beryllium particles (dust or fumes) in the workplace environment exceeds established safe exposure limits. The degree of hazard is a function of the toxicity of the various forms of beryllium and of the type, magnitude, and duration of exposure to insoluble beryllium particulates. The chemical composition, physical form, and morphology of beryllium are all important in determining its toxicity. Researchers believe that beryllium oxide may be the primary chemical composition of beryllium that causes CBD. Particles initially generated as metallic beryllium develop a coating of beryllium oxide because small beryllium metal particles readily oxidize in ambient air. The oxide

coating on respirable-sized beryllium metal particles makes up 25% to 30% of the particle by weight. Beryllium and beryllium compounds are also classified as known human carcinogens by the National Toxicology Program's Board of Scientific Counselors. Beryllium is ubiquitous in the environment and can be detected virtually anywhere if a sufficiently large air sample is taken. According to the Environmental Protection Agency's (EPA's) Integrated Risk Information System, the population of the United States is being exposed constantly to detectable background levels of beryllium without any appreciable risk of contracting CBD in their lifetime.

b. At LLE, beryllium is frequently used as a blast shield for x-ray optics, a filter material for x-ray diagnostics, a vacuum window for Kirkpatrick–Baez microscopes and pinhole cameras, and for specialized targets shot on the OMEGA and OMEGA EP lasers. The beryllium used for blast shields, filters, vacuum windows, and targets is normally purchased pre-cut to size and is classified in accordance with 10 CFR 850.3 as a "beryllium article" [defined in Sec. 3(d) of this Instruction] that neither releases beryllium dust nor will produce airborne particulate concentrations of beryllium under normal handling conditions prior to being exposed to an OMEGA or OMEGA EP target shot. Although it is believed that these beryllium articles in their as-received form present an insignificant health and safety risk and require no special handling or personal protective equipment (PPE) beyond that dictated by prudent laboratory safety practices (safety glasses and gloves), there are certain activities in which there may exist a finite risk to personnel of exposure to beryllium dust. These activities are subject to the provisions of this Instruction and include:

   - cutting or shaping of beryllium;
   - servicing diagnostic nose cones, film packs, and other experimental equipment that may contain beryllium residues;
   - handling of diagnostic equipment containing beryllium windows or filters that are under a substantial pressure differential; and
   - entry into either the OMEGA or OMEGA EP target chamber(s).

3. Definitions:

Reference (a) describes the Chronic Beryllium Disease Prevention Program (CBDPP) enacted by DOE that is applicable to DOE and contractor employees that may be exposed or potentially exposed to insoluble beryllium particulates. The CBDPP defines "beryllium" as elemental beryllium and any insoluble beryllium compound or alloy containing ≥0.1% beryllium that may be released as an airborne particulate. The handling and use of soluble forms of beryllium (e.g., salts other than oxides) that do not cause CBD are not specified in the DOE CBDPP program, and in the absence of specific DOE guidelines are instead covered under existing OSHA regulations {OSHA Laboratory Standard 29 CFR 1910.1450 and the UR/LLE Chemical Hygiene Plan [References (b) and (c), respectively]}.

Based on the DOE CBDPP, the following terms are defined in the scope and context of the LLE Beryllium Safety Program outlined in this document:

a. DOE contractor: any entity under contract with DOE with responsibility to perform beryllium activities. Because LLE is not contracted to perform beryllium activities, the

proposed DOE program is not applicable *per se* to LLE. However, LLE will ensure that beryllium levels are consistently maintained well below the acceptable exposure limits established in Reference (a).

b. Action level: the *airborne* concentration of beryllium particles as measured in the worker's breathing zone by personal monitoring expressed as an 8-h, time-weighted average (TWA) that, if met or exceeded, requires implementation of contamination mitigation and personnel protection procedures. Such procedures include decontamination protocols, periodic exposure monitoring, regulated areas, change rooms, protective clothing and equipment, and medical surveillance of exposed personnel. ***The action level currently defined by Reference (a) is 0.2 μg/m^3 (8-h TWA).***

c. Beryllium: elemental beryllium and any insoluble beryllium compound or alloy containing ≥0.1% beryllium that may be released as an airborne particulate.

d. Beryllium article: a pre-cut or pre-manufactured foil, film, stalk, or other shape made from beryllium that neither releases beryllium dust nor will produce airborne particulate concentrations of beryllium under normal handing conditions.

e. Beryllium-associated laboratory worker: any LLE laboratory personnel who work with beryllium and therefore potentially could be exposed to airborne concentrations of beryllium.

f. Removable contamination: beryllium contamination on surfaces in the form of dust or particulates that can be removed by casual contact, wiping, brushing, or washing.

g. Permissible exposure limit (PEL): the maximum concentration of *airborne* particulate beryllium that a beryllium-associated worker can be exposed to over a specified work interval. ***The PEL (8-h TWA) currently defined by Reference (a) is 0.2 μg/m^3.***

h. Removable contamination level: the acceptable level of residual beryllium contamination on routine working surfaces in operational areas [defined in (j) below] during *non-operational* periods. The removable contamination level is also widely referred to as the "housekeeping limit" in beryllium manufacturing organizations and the technical literature. Reference (a) specifically excludes the interior surfaces of installed, closed systems such as enclosures, glove boxes, chambers, or ventilation systems from this requirement. ***The currently accepted removable contamination level on working surfaces defined by Reference (a) is 3 μg/100 cm^2.***

i. Acceptable surface contamination limit (ASCL): the level of residual beryllium surface contamination deemed acceptable for releasing equipment or other items exposed to beryllium to the general public or for use in an uncontrolled area. At LLE the term "free release limit," defined in Reference (e) as the benchmark for the release of tritium-exposed items to general areas, is often used interchangeably with the ASCL by Omega Facility operations personnel. *The ASCL (or free release limit) for beryllium particulates currently defined by Reference (a) is 0.2 μg/100 cm^2.* ***At LLE, an ASCL value of 0.2 μg/100 cm^2 has been adopted.***

j. Operational area: areas where workers are routinely in the presence of beryllium as a part of their normal work activities.

Regulated area: areas in which the airborne concentration of beryllium either exceeds or can be reasonably expected to exceed the action level. Only qualified personnel are allowed in these areas.

Beryllium work area: areas within LLE where beryllium articles are modified as described in Sec. 2(b) (e.g., cut or shaped) or where diagnostic nose cones, film packs, or other diagnostic or experimental equipment suspected to be contaminated with beryllium dust are serviced, disassembled, or decontaminated.

4. Procedures and Protocols:

a. Beryllium contamination limits: Table 1 below lists the acceptable limits for beryllium particulates at LLE. The equivalent levels established by the DOE CBDPP are also provided for reference. As shown in Table 1, LLE has adopted a more stringent requirement than called for by the DOE CBDPP for airborne beryllium particulate concentration in general areas.

Table 1: Exposure limits for beryllium particulates established at the LLE facility.

Area	Contamination type	DOE CBDPP	LLE
General Areas	Airborne (8-h TWA)	<0.2 μg/m^3	<0.1 μg/m^3
	Removable (surface)	<0.2 μg/100 cm^2	<0.2 μg/100 cm^2
Operational Areas	Airborne (8-h TWA)	<0.2 μg/m^3	<0.2 μg/m^3
	Removable (surface)	<3 μg/100 cm^2	<3 μg/100 cm^2
Regulated areas (internal target chambers)	Airborne (8-h TWA)	<0.2 μg/m^3	<0.2 μg/m^3
	Removable (surface)	<3 μg/100 cm^2	<3 μg/100 cm^2

b. Training: Reference (a) requires a separate training program on beryllium hazards be established for both those individuals working directly with beryllium and all other individuals that work at a site where beryllium activities are conducted. All individuals who purchase, store, shape, process, or otherwise use or handle beryllium, whether in the form of a beryllium article or incorporated into experimental equipment or diagnostics, must complete and satisfy all requirements of LLE's Beryllium Safety Training prior to their first assignment handling or using beryllium or beryllium-containing equipment. Individuals who are assigned to work in regulated or operational areas are also required to complete this training even if they do not handle or process beryllium as a part of their normal work duties. All individuals who require training

shall be identified through the LLE Job Hazard Assessment form [Reference (d)]. This training shall include the following elements:

- Explanation of the potential health risks resulting from uncontrolled contact with beryllium particulates.
- An overview of the goals, objectives, and requirements of the DOE CBDPP as it applies to beryllium activities at LLE.
- General awareness about beryllium hazards and control measures.
- Specific training on the procedures and protocols for beryllium handling at LLE in accordance with this Instruction.

General refresher training on beryllium safety is to be conducted annually when required by job duties. Training about the adverse health effects of beryllium as a respirable particulate also will be included as a part of the standard LLE Chemical Safety training.

The LLE Chemical Hygiene Officer functions as the Beryllium Safety Officer and is responsible for managing the beryllium safety program, which includes preparing and updating beryllium safety training materials and providing guidance on safe operating procedures for handling beryllium and beryllium articles. A database of individuals who have completed beryllium safety training is maintained by LLE's Administrative Division as part of the overall Laboratory Safety Program [Reference (h)].

c. Purchasing: The Mechanical Engineering Production Control Specialist is the *only* individual at LLE authorized to purchase and distribute beryllium articles.

d. Storage and inventory: Beryllium shall be stored in sealed containers (particle-impermeable plastic bags or other particle-impermeable containers) that are labeled in accordance with Sec. 4(f) of this Instruction. The Mechanical Engineering Production Control Specialist has the following duties with respect to beryllium distribution:

- Maintain a master storage area in a labeled, secure cabinet where bulk quantities of beryllium are stored;
- Manage and update an inventory of the number of beryllium articles stored in this area;
- Provide a regularly updated list of the master beryllium inventory to the Chemical Hygiene Officer or his/her designate for inclusion in the LLE Chemical Inventory;
- Keep a running log of the distribution of beryllium articles to experimentalists and LLE Omega Facility operations personnel;
- Personnel who use beryllium shall only store quantities of beryllium in their laboratories or work areas that are deemed sufficient for short-term operational needs. Beryllium storage locations in laboratories or work areas must be clearly labeled in accordance with Sec. 4(f). Table 2 lists normal locations where storage of beryllium is required to support Omega Facility operations.

Table 2: Laboratory and work areas within LLE where limited quantities of beryllium may be stored.

Storage area	Room number	Beryllium form
Target fabrication laboratory	2828	Foils
	2839	Mounted targets
X-ray laboratory	1228	Foils
LaCave	146	Foils and targets
Diagnostic workshop	6106	Foils
OMEGA Target Bay	247	Targets

All locations in the LLE facility where beryllium is stored and the quantities stored in these locations shall be included in the LLE Chemical Inventory as required under the OSHA Laboratory Standard and the UR/LLE Chemical Hygiene Plan [References (b) and (c), respectively].

e. Initial baseline monitoring and hazard assessment: For all areas where beryllium is stored or handled, an initial, one-time baseline monitoring for both airborne and surface beryllium particulates is to be conducted under the supervision of a Certified Industrial Hygienist from the University's Environmental Health & Safety (EHS) Department to ensure that the levels of beryllium particulates are below the limits shown in Table 1. Depending on the nature of experimental operations in these areas, routine additional airborne and surface monitoring of these areas may be required [Secs. 4(l) and (m)].

f. Labeling: Warning labels shall be affixed to (1) all beryllium storage areas; (2) beryllium storage containers; (3) equipment and diagnostics containing beryllium windows or filters; (4) equipment that is contaminated with beryllium debris, and (5) beryllium waste containers. The following labels shall be used:

- For beryllium storage areas and containers:

BERYLLIUM
DANGER!
CANCER AND LUNG DISEASE HAZARD
DO NOT REMOVE DUST BY BLOWING OR SHAKING

- For contaminated equipment and beryllium waste containers:

DANGER
CONTAMINATED WITH BERYLLIUM
CANCER AND LUNG DISEASE HAZARD
DO NOT REMOVE DUST BY BLOWING OR SHAKING

- For experimental and diagnostic equipment containing beryllium windows or filters:

CONTAINS BERYLLIUM OPTICAL ELEMENT ***EXTREMELY BRITTLE-DO NOT TOUCH, CLEAN, OR CONTACT WITH ANY OBJECT WHILE UNDER VACUUM*** Thickness: _____ Diameter: _____

Labels for beryllium optical elements must contain information on the dimensions of the beryllium window and the maximum allowable pressure differential [see Sec. 4 (i)].

g. Waste disposal: All beryllium-contaminated waste shall be collected in sealed, impermeable bags or containers that are labeled in accordance with both Sec. 4(f) and EPA hazardous waste disposal requirements. Beryllium-contaminated wipes used in decontamination operations are exempt from this requirement and can be disposed of in the regular trash.

(1) Labeled containers of ordinary (non-radioactive) beryllium waste are placed in the LLE Central Hazardous Waste Storage area in the shipping and receiving area for collection by the University's Hazardous Waste Management Unit.

(2) Beryllium waste that is potentially contaminated with tritium must be disposed of as radioactive waste through the University of Rochester's Radiation Safety Unit. Such radioactive beryllium waste must be segregated from other tritium waste and labeled as radioactive in accordance with in Reference (e).

h. Cutting, shaping, or other processing of beryllium foils: To the maximum extent possible, beryllium should be purchased precut to size to preclude the necessity of cutting it at LLE. Should this not be possible, the only processing to be done at LLE is wet crimp cutting. ***Under no circumstances is beryllium to be sawed, drilled, machined, or otherwise abraded.***

Wet crimp cutting should be performed in such a manner so as to preclude beryllium splinters or chips from being spread. The recommended procedure is to place the beryllium foil on a tissue soaked with ethanol prior to cutting. After crimping, the tissue is used to wipe the beryllium pieces clean of debris. The tissue must then be disposed of in accordance with Sec. 4(g). Required personal protective equipment for this operation consists of safety glasses and disposable latex-, nitrile-, or chloroprene gloves. Although optionally the operator may wear a disposable dust mask if he/she so desires, any particulate exposure risk concerns will be completely eliminated when *crimp cutting is conducted in one of the Beryllium Workstations (BWS) described in Sec. 4(j).*

i. The Mechanical Engineering Group is responsible for evaluating applications where beryllium is used as a pressure or vacuum barrier (e.g., window). Thin beryllium windows

(~1 mil or 25 μm thick), such as those found on x-ray cameras, are extremely brittle and can be shattered with a seemingly insignificant contact pressure (e.g., lightly wiping with a tissue). If a system is either above or below ambient pressure, beryllium fragments (and, potentially, particulates) would be generated in the event of a window rupture.

(1) ***Under no circumstances are beryllium windows under vacuum or pressure ever to be wiped, cleaned, or contacted in any way***. If it becomes necessary to clean the window, the apparatus containing the window must be vented to room pressure before such operations can proceed.

(2) Vessels having ***a beryllium pressure barrier must have a pressure-relief device (PRD) to prevent rupture of the window in the event of a pressure excursion.*** As a secondary precaution, the window should be covered with a plastic or metal cap when the apparatus is not in use to confine beryllium debris in the event of an unexpected window failure.

j. Decontamination of diagnostics and other equipment exposed to beryllium debris: Equipment used during OMEGA or OMEGA EP experiments may become contaminated with beryllium from target debris or failed beryllium components. These items must be serviced in a manner that contains and collects the beryllium debris and prevents collateral contamination. Potentially beryllium-contaminated equipment must be serviced and decontaminated in one of the four Beryllium Workstations (BWS) installed in several locations within LLE. These workstations recirculate air through ULPA[1] or HEPA[2] filters and are designed specifically to control and prevent the spread of airborne particulate. *For operations conducted in a BWS unit, safety glasses and disposable gloves as specified in Sec. 4(h) are the only PPE required.* Table 3 below lists the location of these units. Reference (f) provides details on the specifications and proper operations of these BWS units.

Table 3: Beryllium workstation (BWS) locations at LLE.

Location	BWS unit installed
OMEGA Target Bay	ESCO Labculture Biosafety Cabinet Model LA2-6A2
OMEGA EP Laser Bay	
OMEGA EP diagnostics workshop (Room 6106)	
LaCave (Room 146)	LABCONCO Purifier Biosafety Cabinet Model 3980402

(1) All beryllium-contaminated debris generated during servicing, cleaning, and decontamination of equipment must be handled in accordance with Sec. 4(g).

(2) Before removing any diagnostics or equipment from inside the BWS unit, care must be taken to insure that the diagnostic or equipment has been decontaminated

[1] ULPA (Ultra-Low Penetration Air) Filters rated 99.999% efficient with particles 0.12 μm in diameter.
[2] HEPA (High-Efficiency Particulate Air) Filters rated 99.99% efficient with particles 0.3 μm and larger in diameter.

to remove beryllium particulates. This operation is best accomplished by using a wet-wipe procedure as outlined in Reference (f).

(3) After decontamination has been verified, equipment can be moved freely within operational areas of the facility. Surface swipe analysis is required to ensure that the surface contamination is at or below the ASCL ("free release limit") defined in Sec. 3(i) before equipment is:

(i) transported or relocated from operational areas to general areas (as defined in Table 1) without a secondary containment enclosure;

(ii) transported from one operational area to another operational area through general areas (e.g., hallways) without a secondary containment enclosure;

(iii) shipped by common carrier, as described in Sec. 4(k) below.

k. Decontamination of diagnostics and other equipment before leaving the LLE facility: Because of collaborative research efforts with other laboratories, it is necessary to ship diagnostics to other locations by common carrier. The procedure below has been established with Lawrence Livermore National Laboratory (LLNL) for transfer of diagnostics directly from LLE to LLNL.

(1) Diagnostics can be shipped directly from LLE to LLNL provided that they have first gone through the cleaning processes described in Reference (e) and have been tested and cleared for tritium contamination. Part of this cleaning involves disposing of any large beryllium shards that may be found in the detector head resulting from a broken filter. If a beryllium filter has been broken within the diagnostic, this information must be conveyed to the receiver of the instrument in the form of hard-copy attached documentation followed up with an e-mail notice.

(2) With regard to containment failure during transport for instruments with potential beryllium contamination, the U.S. Department of Transportation has verified that as long as the beryllium contamination is in the form of large pieces that are non-*dispersible, no regulation is necessary*. Because instruments are wiped down during the cleaning process prior to shipment, it is reasonable to assume that no dispersible particulates are present that could pose a respiratory inhalation hazard. Air sampling conducted at LLE in locations where these instruments are used has only shown airborne contamination levels well below the action level of 0.2 μg/m^3.

l. Beryllium monitoring: LLE conducts routine monitoring of both airborne and surface beryllium contamination in locations where beryllium is stored, handled, and used in experimental operations. Additional airborne and surface sampling may be conducted on a non-routine basis if directed by the Chemical Hygiene Officer or the Chief Safety Officer. Workers may request monitoring of other areas if there is cause to suspect contamination may be present.

(1) Airborne sampling: The OMEGA and OMEGA EP target chambers (regulated areas) shall be monitored at least semi-annually for airborne beryllium particulates to verify that levels remain below the limits shown in Table 1. Other areas where beryllium is in use are to be monitored at least annually for airborne

contamination; as an additional precaution, *air sampling will be implemented at the discretion of the Chemical Hygiene Officer or the Chief Safety Officer anytime when the measured surface contamination in these areas approaches or exceeds the maximum value of the removable contamination level ("housekeeping limit") in Table 1.* With the exception of the one-time baseline monitoring described in Sec. 4(e), general areas need not be routinely monitored so long as the procedures of this Instruction are followed.

(2) Surface contamination monitoring: The internal surfaces of the OMEGA and OMEGA EP target chambers, the work surfaces of the BWS units, and any other areas where beryllium may be processed or cut should be monitored at least semi-annually for removable beryllium surface contamination. Collection of swipe samples for analysis of beryllium contamination is conducted using procedures described in References (e) and (g) (ASTM E1792 and D6966). If beryllium is detected at levels above the maximum value of the removable contamination level ("housekeeping limit") established in Table 1, these areas must be cleaned (decontaminated) immediately.

Table 4 provides details on the required intervals for airborne and surface beryllium particulate monitoring at LLE.

Table 4: Minimum monitoring requirements for areas at LLE where beryllium is used, handled, or stored.

Area	**Classification**	**Minimum monitoring requirements**	
		Airborne	**Surface**
Target chambers (OMEGA and OMEGA EP)	Regulated	Semi-annual	Semi-annual
Beryllium workstations (BWS)	Operational	N/A	Semi-annual†
LaCave	General	Annual*	Semi-annual
OMEGA EP grating compression chamber (GCC)			
Target fabrication	General	One-time baseline	Semi-annual
X-ray laboratory			

*Additional airborne monitoring to be conducted if surface swipe sampling detects beryllium above the ASCL [Table 1, Sec. 4(a)].

†Work surfaces only.

m. Beryllium analytical procedures: Both airborne and surface swipe samples are to be analyzed for beryllium content in accordance with the analytical methods in either Reference (i) [NIOSH 7300] or Reference (j) [ASTM D7202].

n. Respiratory protection: Respiratory protection for airborne particulates is not required as long as the level of beryllium particulate contamination remains below the action level of 0.2 μg/m^3. Because of the potential for exposure levels in the target chamber to exceed the action level due laser ablation of beryllium contained in the chamber, LLE treats the inside of the OMEGA and OMEGA EP target chambers as a "regulated" area as defined by Reference (a) and in Sec. 3(k) of this Instruction and requires respiratory protection for all personnel who enter the target chambers. LLE provides a HEPA particle filter respiratory half-face protection mask to individuals who are performing tasks for which airborne and surface beryllium contamination analyses indicate the potential for exposures at or above the action level. Such respiratory protection is worn with appropriate eye protection at all times while in the target chambers, as well as during periods of entry and egress.

All personnel who wear respiratory protection[3] at LLE must be enrolled in the University's Respiratory Protection Program [Reference (k)] through LLE, receive medical clearance as a respirator wearer, and have their respirator fit-tested by the University Health Service at yearly intervals in accordance with the OSHA Personal Protective Equipment (PPE) Standard (OSHA 29 CFR 1910.134 (f)(2), (3) and the University of Rochester Respiratory Protection Program. Such individuals are to be retested if they experience any problems with respirator fit integrity that could be caused by changes to the facial contour or skin surface. It is the responsibility of the work area supervisor to ensure proper PPE is used.

o. Records and reports: Records of all monitoring results will be maintained in a database by the Experimental Operations Group Leader and forwarded to the Chemical Hygiene Officer and Chief Safety Officer as needed at regular intervals for review. In the event the limits shown in Table 1 are exceeded, the Chief Safety Officer and Chemical Hygiene Officer will be informed.

5. Responsibilities:

a. Personnel who use, process, or could potentially be exposed to beryllium:

(1) Receive training prior to handling beryllium and/or beryllium-containing equipment or diagnostics.

(2) Forward all requests to purchase beryllium to the Mechanical Engineering Production Control Specialist.

(3) Comply with the procedures of this Instruction for handling, labeling, and disposing of beryllium, beryllium-contaminated items, beryllium waste, and any equipment or diagnostic that contains beryllium optical elements.

[3]Persons who chose to wear disposable dust masks are not required to participate in the respiratory protection program. Wearers must also understand that disposable dust masks do NOT provide sufficient protection to allow the wearer to work in regulated areas, or those known to exceed airborne contamination in the limits established in Table 1.

b. Mechanical Engineering Supervisor:

(1) Ensure that all beryllium vacuum and pressure barriers have been reviewed, are properly protected against overpressure, and are deemed safe for operation.

c. Experimental Operations Group Leader:

(1) Manage the airborne and surface monitoring for the OMEGA and OMEGA EP target chambers, GCC, LaCave, and other general areas within LLE where beryllium is stored and handled.

(2) Train and supervise Experimental Operations personnel on the procedures in this Instruction.

d. Scientists, Research Engineers, and Supervisors:

(1) Ensure that all individuals they supervise have successfully completed LLE's Beryllium Safety Training, have been made aware of the hazards of working with beryllium and beryllium-containing experimental equipment, and have reviewed and understand this Instruction.

e. Mechanical Engineering Production Control Specialist:

(1) Order all beryllium.

(2) Ensure operational supplies are given only to trained personnel.

(3) Maintain a record of all beryllium ordered and distributed including the names of requestors/recipients, date, and quantity.

e. Departmental Chemical Hygiene Officer:

(1) Prepare and update beryllium safety training materials and provide guidance on safe operating procedures for handling beryllium and beryllium articles.

(2) Review the training database of individuals maintained by LLE's Administrative Division who have completed beryllium safety training.

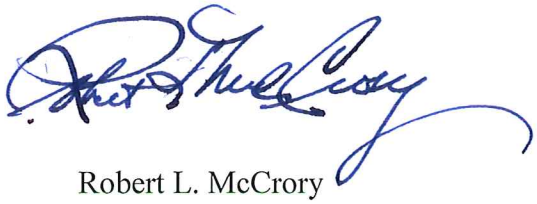
(3) Maintain quantity and location information on beryllium in the facility Chemical Inventory.

(4) Ensure that beryllium is disposed of in accordance with this Instruction and all University, State, and Federal requirements.

f. Laboratory Safety Officer:

(1) Provide overall direction to ensure an effective beryllium safety program.

6. Approval:



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