



**DEPARTMENT OF LABOR AND ECONOMIC OPPORTUNITY**  
**GENERAL INDUSTRY STANDARD**

Filed with the Secretary of State on February 1, 2018 (as amended March 31, 2021)

These rules take effect immediately upon filing with the secretary of state unless adopted under section 33, 44, or 45a(6) of the administrative procedures act of 1969, 1969 PA 306, MCL 24.233, 24.244, or 24.245a.

Rules adopted under these sections become effective 7 days after filing with the Secretary of State.

(By authority conferred on the director of the department of labor and economic opportunity by sections 14 and 24 of the Michigan occupational safety and health act, 1974 PA 154, MCL 408.1014 and 408.1024, and Executive Reorganization Orders Nos. 1996 1, 1996 2, 2003 1, 2008 4, 2011 4, and 2019-3, MCL 330.3101, 445.2001, 445.2011, 445.2025, 445.2030, and 125.1998)

R 325.34001 of the Michigan Administrative Code is amended, and R 325.34005 and R 325.34010 are rescinded, as follows:

**PART 340, BERYLLIUM**

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**R 325.34001 Scope, application, adoption, and availability of standards.**

**Rule 4001.** (1) This standard applies to occupational exposure to beryllium in all forms, compounds, and mixtures in general industry, except those articles and materials exempted by subrules (2) and (3) of this rule.

(2) This standard does not apply to articles, as defined in General Industry Standard Part 92. "Hazard Communication," that contain beryllium and that the employer does not process.

(3) This standard does not apply to materials containing less than 0.1% beryllium by weight where the employer has objective data demonstrating that employee exposure to beryllium will remain below the action level as an 8 hour TWA under any foreseeable conditions.

(4) The federal Occupational Safety and Health Administration (OSHA) regulation 29 CFR 1910.1024, "Beryllium," as amended September 14, 2020, is adopted by reference in these rules.

(5) The adopted federal regulations have the same force and effect as a rule promulgated under the Michigan occupational safety and health act (MIOSHA), 1974 PA 154, MCL 408.1001 to 408.1094.

(6) A reference to 29 CFR 1910.1020, "Access to employee exposure and medical records," means General Industry and Construction Safety and Health Standard Part 470. "Employee Medical Records and Trade Secrets."

(7) A reference to 29 CFR 1910.134, "Respiratory Protection," means General Industry and Construction Safety and Health Standard Part 451. "Respiratory Protection."

(8) A reference to 29 CFR part 1910, subpart I, "Personal Protective Equipment," means General Industry Safety and Health Standard Part 33. "Personal Protective Equipment" or General Industry Safety and Health Standard Part 433. "Personal Protective Equipment."

(9) A reference to 29 CFR 1910.1200, "Hazard communication," means Occupational Health Standard Part 430. "Hazard Communication."

(10) A reference to 29 CFR 1910.141, "Sanitation," means General Industry Safety and Health Standard Part 474. "Sanitation."

(11) The OSHA regulation adopted in these rules is available from the United States Department of Labor, Occupational Safety and Health Administration website:

[www.osha.gov](http://www.osha.gov), at no charge, as of the time of adoption of these rules.

(12) The regulations adopted in these rules are available for inspection at the Department of Labor and Economic Opportunity, MIOSHA Standards and FOIA Section, 530 West Allegan Street, P.O. Box 30643, Lansing, Michigan, 48909-8143.

(13) The regulations adopted in these rules may be obtained from the publisher or may be obtained from the Department of Labor and Economic Opportunity, MIOSHA Standards and FOIA, 530 West Allegan Street, P.O. Box 30643, Lansing, Michigan, 48909-8143, at the cost charged in this rule, plus \$20.00 for shipping and handling.

(14) The following Michigan occupational safety and health administration (MIOSHA) standards are referenced in these rules. Up to 5 copies of these standards may be obtained at no charge from the Department of Labor and Economic Opportunity, MIOSHA Standards and FOIA Section, 530 West Allegan Street, P.O. Box 30643, Lansing, Michigan, 48909-8143 or via the internet at website: [www.michigan.gov/mioshastandards](http://www.michigan.gov/mioshastandards). For quantities greater than 5, the cost, as of the time of adoption of these rules, is 4 cents per page.

(a) General Industry Safety and Health Standard Part 33. "Personal Protective Equipment," R 408.13301 to R 408.13398.

(b) Occupational Health Standard Part 430. "Hazard Communication," R 325.77001 to R 325.77004.

(c) General Industry and Construction Safety and Health Standard Part 451. "Respiratory Protection," R 325.60051 to R 325.60052.

(d) General Industry and Construction Safety and Health Standard Part 470. "Employee Medical Records and Trade Secrets," R 325.3451 to R 325.3476.

(e) General Industry Safety and Health Standard Part 474. "Sanitation," R 325.47401 to R 325.47425.

(f) General Industry Safety and Health Standard Part 433. "Personal Protective Equipment," R 325.60001 to R 325.60013.

**R 325.34005 Rescinded.**

**R 325.34010 Rescinded.**

## 1910.1024 BERYLLIUM

### 1910.1024(a) *Scope and application.*

(1) This standard applies to occupational exposure to beryllium in all forms, compounds, and mixtures in general industry, except those articles and materials exempted by paragraphs (a)(2) and (a)(3) of this standard.

(2) This standard does not apply to articles, as defined in the Hazard Communication standard (HCS) (1910.1200(c)), that contain beryllium and that the employer does not process.

(3) This standard does not apply to materials containing less than 0.1% beryllium by weight where the employer has objective data demonstrating that employee exposure to beryllium will remain below the action level as an 8-hour TWA under any foreseeable conditions.

### 1910.1024(b) *Definitions. As used in this standard:*

Action level means a concentration of airborne beryllium of 0.1 micrograms per cubic meter of air ( $\mu\text{g}/\text{m}^3$ ) calculated as an 8-hour time-weighted average (TWA).

*Airborne exposure* and *airborne exposure to beryllium* mean the exposure to airborne beryllium that would occur if the employee were not using a respirator.

*Assistant Secretary* means the Assistant Secretary of Labor for Occupational Safety and Health, United States Department of Labor, or designee.

*Beryllium lymphocyte proliferation test (BeLPT)* means the measurement of blood lymphocyte proliferation in a laboratory test when lymphocytes are challenged with a soluble beryllium salt.

*Beryllium sensitization* means a response in the immune system of a specific individual who has been exposed to beryllium. There are no associated physical or clinical symptoms and no illness or disability with beryllium sensitization alone, but the response that occurs through beryllium sensitization can enable the immune system to recognize and react to beryllium. While not every beryllium-sensitized person will develop chronic beryllium disease (CBD), beryllium sensitization is essential for development of CBD.

*Beryllium work area* means any work area where materials that contain at least 0.1 percent beryllium by weight are processed either: (1) During any of the operations listed in Appendix A of this standard; or (2) Where employees are, or can reasonably be expected to be, exposed to airborne beryllium at or above the action level.

*CBD diagnostic center* means a medical diagnostic center that has a pulmonologist or pulmonary specialist on staff and on-site facilities to perform a clinical evaluation for the presence of chronic beryllium disease (CBD). The CBD diagnostic center must have the capacity to perform pulmonary function testing (as outlined by the American Thoracic Society criteria), bronchoalveolar lavage (BAL), and transbronchial biopsy. The CBD diagnostic center must also have the capacity to transfer BAL samples to a laboratory for appropriate diagnostic testing within 24 hours. The pulmonologist or pulmonary specialist must be able to interpret the biopsy pathology and the BAL diagnostic test results.

*Chronic beryllium disease (CBD)* means a chronic granulomatous lung disease caused by inhalation of airborne beryllium by an individual who is beryllium sensitized.

*Confirmed positive* means the person tested has had two abnormal BeLPT test results, an abnormal and a borderline test result, or three borderline test results, obtained from tests conducted within a three-year period. It also means the result of a more reliable and accurate test indicating a person has been identified as having beryllium sensitization.

*Contaminated with beryllium and beryllium-contaminated* mean contaminated with dust, fumes, mists, or solutions containing beryllium in concentrations greater than or equal to 0.1 percent by weight.

*Dermal contact with beryllium* means skin exposure to: (1) Soluble beryllium compounds containing beryllium in concentrations greater than or equal to 0.1 percent by weight; (2) Solutions containing beryllium in concentrations greater than or equal to 0.1 percent by weight; or (3) Visible dust, fumes, or mists containing beryllium in concentrations greater than or equal to 0.1 percent by weight. The handling of beryllium materials in non-particulate solid form that are free from visible dust containing beryllium in concentrations greater than or equal to 0.1 percent by weight is not considered dermal contact under the standard.

*Director* means the Director of the National Institute for Occupational Safety and Health (NIOSH), U.S. Department of Health and Human Services, or designee.

*Emergency* means any occurrence such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment, which may or does result in an uncontrolled and unintended release of airborne beryllium that presents a significant hazard.

*High-efficiency particulate air (HEPA) filter* means a filter that is at least 99.97 percent efficient in removing particles 0.3 micrometers in diameter.

*Objective data* means information, such as air monitoring data from industry-wide surveys or calculations based on the composition of a substance, demonstrating airborne exposure to beryllium associated with a particular product or material or a specific process, task, or activity. The data must reflect workplace conditions closely resembling or

with a higher airborne exposure potential than the processes, types of material, control methods, work practices, and environmental conditions in the employer's current operations.

*Physician or other licensed health care professional (PLHCP)* means an individual whose legally permitted scope of practice (*i.e.*, license, registration, or certification) allows the individual to independently provide or be delegated the responsibility to provide some or all of the health care services required by paragraph (k) of this standard.

*Regulated area* means an area, including temporary work areas where maintenance or non-routine tasks are performed, where an employee's airborne exposure exceeds, or can reasonably be expected to exceed, either the time-weighted average (TWA) permissible exposure limit (PEL) or short term exposure limit (STEL).

*This standard* means this beryllium standard, 29 CFR 1910.1024.

#### **1910.1024(c) Permissible Exposure Limits (PELs).**

**1910.1024(c)(1) Time-weighted average (TWA) PEL.** The employer must ensure that no employee is exposed to an airborne concentration of beryllium in excess of 0.2 µg/m<sup>3</sup> calculated as an 8-hour TWA.

**1910.1024(c)(2) Short-term exposure limit (STEL).** The employer must ensure that no employee is exposed to an airborne concentration of beryllium in excess of 2.0 µg/m<sup>3</sup> as determined over a sampling period of 15 minutes.

#### **1910.1024(d) Exposure assessment.**

**1910.1024(d)(1) General.** The employer must assess the airborne exposure of each employee who is or may reasonably be expected to be exposed to airborne beryllium in accordance with either the performance option in paragraph (d)(2) or the scheduled monitoring option in paragraph (d)(3) of this standard.

**1910.1024(d)(2) Performance option.** The employer must assess the 8-hour TWA exposure and the 15-minute short-term exposure for each employee on the basis of any combination of air monitoring data and objective data sufficient to accurately characterize airborne exposure to beryllium.

#### **1910.1024(d)(3) Scheduled monitoring option.**

(i) The employer must perform initial monitoring to assess the 8-hour TWA exposure for each employee on the basis of one or more personal breathing zone air samples that reflect the airborne exposure of employees on each shift, for each job classification, and in each work area.

(ii) The employer must perform initial monitoring to assess the short-term exposure from 15-minute personal breathing zone air samples measured in operations that are likely to produce airborne exposure above the STEL for each work shift, for each job classification, and in each work area.

(iii) Where several employees perform the same tasks on the same shift and in the same work area, the employer may sample a representative fraction of these employees in order to meet the requirements of this paragraph (d)(3). In representative sampling, the employer must sample the employee(s) expected to have the highest airborne exposure to beryllium.

(iv) If initial monitoring indicates that airborne exposure is below the action level and at or below the STEL, the employer may discontinue monitoring for those employees whose airborne exposure is represented by such monitoring.

(v) Where the most recent exposure monitoring indicates that airborne exposure is at or above the action level but at or below the TWA PEL, the employer must repeat such monitoring within six months of the most recent monitoring.

(vi) Where the most recent exposure monitoring indicates that airborne exposure is above the TWA PEL, the employer must repeat such monitoring within three months of the most recent 8-hour TWA exposure monitoring.

(vii) Where the most recent (non-initial) exposure monitoring indicates that airborne exposure is below the action level, the employer must repeat such monitoring within six months of the most recent monitoring until two consecutive measurements, taken 7 or more days apart, are below the action level, at which time the employer may discontinue 8-hour TWA exposure monitoring for those employees whose exposure is represented by such monitoring, except as otherwise provided in paragraph (d)(4) of this standard.

(viii) Where the most recent exposure monitoring indicates that airborne exposure is above the STEL, the employer must repeat such monitoring within three months of the most recent short-term exposure monitoring until two consecutive measurements, taken 7 or more days apart, are below the STEL, at which time the employer may discontinue short-term exposure monitoring for those employees whose exposure is represented by such monitoring, except as otherwise provided in paragraph (d)(4) of this standard.

**1910.1024(d)(4) Reassessment of exposure.** The employer must reassess airborne exposure whenever a change in the production, process, control equipment, personnel, or work practices may reasonably be expected to

result in new or additional airborne exposure at or above the action level or STEL, or when the employer has any reason to believe that new or additional airborne exposure at or above the action level or STEL has occurred.

**1910.1024(d)(5) *Methods of sample analysis.*** The employer must ensure that all air monitoring samples used to satisfy the monitoring requirements of paragraph (d) of this standard are evaluated by a laboratory that can measure beryllium to an accuracy of plus or minus 25 percent within a statistical confidence level of 95 percent for airborne concentrations at or above the action level.

**1910.1024(d)(6) *Employee notification of assessment results.***

(i) Within 15 working days after completing an exposure assessment in accordance with paragraph (d) of this standard, the employer must notify each employee whose airborne exposure is represented by the assessment of the results of that assessment individually in writing or post the results in an appropriate location that is accessible to each of these employees.

(ii) Whenever an exposure assessment indicates that airborne exposure is above the TWA PEL or STEL, the employer must describe in the written notification the corrective action being taken to reduce airborne exposure to or below the exposure limit(s) exceeded where feasible corrective action exists but had not been implemented when the monitoring was conducted.

**1910.1024(d)(7) *Observation of monitoring.***

(i) The employer must provide an opportunity to observe any exposure monitoring required by this standard to each employee whose airborne exposure is measured or represented by the monitoring and each employee's representative(s).

(ii) When observation of monitoring requires entry into an area where the use of personal protective clothing or equipment (which may include respirators) is required, the employer must provide each observer with appropriate personal protective clothing and equipment at no cost to the observer and must ensure that each observer uses such clothing and equipment.

(iii) The employer must ensure that each observer follows all other applicable safety and health procedures.

**1910.1024(e) *Beryllium work areas and regulated areas.***

**1910.1024(e)(1) *Establishment.***

(i) The employer must establish and maintain a beryllium work area wherever the criteria for a "beryllium work area" set forth in paragraph (b) of this standard are met.

(ii) The employer must establish and maintain a regulated area wherever employees are, or can reasonably be expected to be, exposed to airborne beryllium at levels above the TWA PEL or STEL.

**1910.1024(e)(2) *Demarcation.***

(i) The employer must identify each beryllium work area through signs or any other methods that adequately establish and inform each employee of the boundaries of each beryllium work area.

(ii) The employer must identify each regulated area in accordance with paragraph (m)(2) of this standard.

**1910.1024(e)(3) *Access.*** The employer must limit access to regulated areas to:

(i) Persons the employer authorizes or requires to be in a regulated area to perform work duties;

(ii) Persons entering a regulated area as designated representatives of employees for the purpose of exercising the right to observe exposure monitoring procedures under paragraph (d)(7) of this standard; and

(iii) Persons authorized by law to be in a regulated area.

**1910.1024(e)(4) *Provision of personal protective clothing and equipment, including respirators.*** The employer must provide and ensure that each employee entering a regulated area uses:

(i) Respiratory protection in accordance with paragraph (g) of this standard; and

(ii) Personal protective clothing and equipment in accordance with paragraph (h) of this standard.

**1910.1024(f) *Methods of compliance.***

**1910.1024(f)(1) *Written exposure control plan.***

(i) The employer must establish, implement, and maintain a written exposure control plan, which must contain:

(A) A list of operations and job titles reasonably expected to involve airborne exposure to or dermal contact with beryllium;

(B) A list of operations and job titles reasonably expected to involve airborne exposure at or above the action level;

- (C) A list of operations and job titles reasonably expected to involve airborne exposure above the TWA PEL or STEL;
  - (D) Procedures for minimizing cross-contamination, including the transfer of beryllium between surfaces, equipment, clothing, materials, and articles within beryllium work areas;
  - (E) Procedures for keeping surfaces as free as practicable of beryllium;
  - (F) Procedures for minimizing the migration of beryllium from beryllium work areas to other locations within or outside the workplace;
  - (G) A list of engineering controls, work practices, and respiratory protection required by paragraph (f)(2) of this standard;
  - (H) A list of personal protective clothing and equipment required by paragraph (h) of this standard; and
  - (I) Procedures for removing, laundering, storing, cleaning, repairing, and disposing of beryllium-contaminated personal protective clothing and equipment, including respirators.
- (ii) The employer must review and evaluate the effectiveness of each written exposure control plan at least annually and update it, as necessary, when:
- (A) Any change in production processes, materials, equipment, personnel, work practices, or control methods results, or can reasonably be expected to result, in new or additional airborne exposure to beryllium;
  - (B) The employer is notified that an employee is eligible for medical removal in accordance with paragraph (l)(1) of this standard, referred for evaluation at a CBD diagnostic center, or shows signs or symptoms associated with exposure to beryllium; or
  - (C) The employer has any reason to believe that new or additional airborne exposure is occurring or will occur.
- (iii) The employer must make a copy of the written exposure control plan accessible to each employee who is, or can reasonably be expected to be, exposed to airborne beryllium in accordance with OSHA's Access to Employee Exposure and Medical Records (Records Access) standard (1910.1020(e)).

**1910.1024(f)(2) *Engineering and work practice controls.***

- (i) The employer must use engineering and work practice controls to reduce and maintain employee airborne exposure to beryllium to or below the PEL and STEL, unless the employer can demonstrate that such controls are not feasible. Wherever the employer demonstrates that it is not feasible to reduce airborne exposure to or below the PELs with engineering and work practice controls, the employer must implement and maintain engineering and work practice controls to reduce airborne exposure to the lowest levels feasible and supplement these controls using respiratory protection in accordance with paragraph (g) of this standard.
- (ii) For each operation in a beryllium work area that releases airborne beryllium, the employer must ensure that at least one of the following is in place to reduce airborne exposure:
- (A) Material and/or process substitution;
  - (B) Isolation, such as ventilated partial or full enclosures;
  - (C) Local exhaust ventilation, such as at the points of operation, material handling, and transfer; or
  - (D) Process control, such as wet methods and automation.
- (iii) An employer is exempt from using the controls listed in paragraph (f)(2)(ii) of this standard to the extent that:
- (A) The employer can establish that such controls are not feasible; or
  - (B) The employer can demonstrate that airborne exposure is below the action level, using no fewer than two representative personal breathing zone samples taken at least 7 days apart, for each affected operation.

**1910.1024(f)(3) *Prohibition of rotation.*** The employer must not rotate employees to different jobs to achieve compliance with the PELs.

**1910.1024(g) *Respiratory protection.***

**1910.1024(g)(1) *General.*** The employer must provide respiratory protection at no cost to the employee and ensure that each employee uses respiratory protection:

- (i) During periods necessary to install or implement feasible engineering and work practice controls where airborne exposure exceeds, or can reasonably be expected to exceed, the TWA PEL or STEL;
- (ii) During operations, including maintenance and repair activities and non-routine tasks, when engineering and work practice controls are not feasible and airborne exposure exceeds, or can reasonably be expected to exceed, the TWA PEL or STEL;
- (iii) During operations for which an employer has implemented all feasible engineering and work practice controls when such controls are not sufficient to reduce airborne exposure to or below the TWA PEL or STEL;
- (iv) During emergencies; and

(v) When an employee who is eligible for medical removal under paragraph (l)(1) chooses to remain in a job with airborne exposure at or above the action level, as permitted by paragraph (l)(2)(ii) of this standard.

**1910.1024(g)(2) *Respiratory protection program.*** Where this standard requires an employer to provide respiratory protection, the selection and use of such respiratory protection must be in accordance with the Respiratory Protection standard (1910.134).

**1910.1024(g)(3)** The employer must provide at no cost to the employee a powered air-purifying respirator (PAPR) instead of a negative pressure respirator when:

- (i) Respiratory protection is required by this standard;
- (ii) An employee entitled to such respiratory protection requests a PAPR; and
- (iii) The PAPR provides adequate protection to the employee in accordance with paragraph (g)(2) of this standard.

**1910.1024(h) *Personal protective clothing and equipment.***

**1910.1024(h)(1) *Provision and use.*** The employer must provide at no cost, and ensure that each employee uses, appropriate personal protective clothing and equipment in accordance with the written exposure control plan required under paragraph (f)(1) of this standard and OSHA's Personal Protective Equipment standards (subpart I of this part):

- (i) Where airborne exposure exceeds, or can reasonably be expected to exceed, the TWA PEL or STEL; or
- (ii) Where there is a reasonable expectation of dermal contact with beryllium.

**1910.1024(h)(2) *Removal and storage.***

(i) The employer must ensure that each employee removes all beryllium-contaminated personal protective clothing and equipment at the end of the work shift, at the completion of all tasks involving beryllium, or when personal protective clothing or equipment becomes visibly contaminated with beryllium, whichever comes first.

(ii) The employer must ensure that each employee removes beryllium-contaminated personal protective clothing and equipment as specified in the written exposure control plan required by paragraph (f)(1) of this standard.

(iii) The employer must ensure that each employee stores and keeps beryllium-contaminated personal protective clothing and equipment separate from street clothing and that storage facilities prevent cross-contamination as specified in the written exposure control plan required by paragraph (f)(1) of this standard.

(iv) The employer must ensure that no employee removes beryllium-contaminated personal protective clothing or equipment from the workplace, except for employees authorized to do so for the purposes of laundering, cleaning, maintaining or disposing of beryllium-contaminated personal protective clothing and equipment at an appropriate location or facility away from the workplace.

(v) When personal protective clothing or equipment required by this standard is removed from the workplace for laundering, cleaning, maintenance or disposal, the employer must ensure that personal protective clothing and equipment are stored and transported in sealed bags or other closed containers that are impermeable and are labeled in accordance with paragraph (m)(3) of this standard and the HCS (1910.1200).

**1910.1024(h)(3) *Cleaning and replacement.***

(i) The employer must ensure that all reusable personal protective clothing and equipment required by this standard is cleaned, laundered, repaired, and replaced as needed to maintain its effectiveness.

(ii) The employer must ensure that all reusable personal protective clothing and equipment required by this standard is cleaned, laundered, repaired, and replaced as needed to maintain its effectiveness.

(iii) The employer must inform in writing the persons or the business entities who launder, clean, or repair the personal protective clothing or equipment required by this standard of the potentially harmful effects of exposure to beryllium and that the personal protective clothing and equipment must be handled in accordance with this standard.

**1910.1024(i) *Hygiene areas and practices.***

**1910.1024(i)(1) *General.*** For each employee working in a beryllium work area or who can reasonably be expected to have dermal contact with beryllium, the employer must:

(i) Provide readily accessible washing facilities in accordance with this standard and the Sanitation standard (1910.141) to remove beryllium from the hands, face, and neck; and

(ii) Ensure that employees who have dermal contact with beryllium wash any exposed skin at the end of the activity, process, or work shift and prior to eating, drinking, smoking, chewing tobacco or gum, applying cosmetics, or using the toilet.

**1910.1024(i)(2) Change rooms.** In addition to the requirements of paragraph (i)(1)(i) of this standard, the employer must provide employees who are required to use personal protective clothing or equipment under paragraph (h)(1)(ii) of this standard with a designated change room in accordance with this standard and the Sanitation standard (1910.141) where employees are required to remove their personal clothing.

**1910.1024(i)(3) Showers.**

- (i) The employer must provide showers in accordance with the Sanitation standard (1910.141) where:
  - (A) Airborne exposure exceeds, or can reasonably be expected to exceed, the TWA PEL or STEL; and
  - (B) Employee's hair or body parts other than hands, face, and neck can reasonably be expected to become contaminated with beryllium.
- (ii) Employers required to provide showers under paragraph (i)(3)(i) of this standard must ensure that each employee showers at the end of the work shift or work activity if:
  - (A) The employee reasonably could have had airborne exposure above the TWA PEL or STEL; and
  - (B) The employee's hair or body parts other than hands, face, and neck could reasonably have become contaminated with beryllium.

**1910.1024(i)(4) Eating and drinking areas.** Wherever the employer allows employees to consume food or beverages at a worksite where beryllium is present, the employer must ensure that:

- (i) Beryllium-contaminated surfaces in eating and drinking areas are as free as practicable of beryllium;
- (ii) No employees enter any eating or drinking area with beryllium contaminated personal protective clothing or equipment unless, prior to entry, it is cleaned, as necessary, to be as free as practicable of beryllium by methods that do not disperse beryllium into the air or onto an employee's body; and
- (iii) Eating and drinking facilities provided by the employer are in accordance with the Sanitation standard (1910.141).

**1910.1024(i)(5) Prohibited activities.** The employer must ensure that no employees eat, drink, smoke, chew tobacco or gum, or apply cosmetics in regulated areas.

**1910.1024(j) Housekeeping.**

**1910.1024(j)(1) General.**

- (i) The employer must maintain all surfaces in beryllium work areas and regulated areas as free as practicable of beryllium and in accordance with the written exposure control plan required under paragraph (f)(1) and the cleaning methods required under paragraph (j)(2) of this standard; and
- (ii) The employer must ensure that all spills and emergency releases of beryllium are cleaned up promptly and in accordance with the written exposure control plan required under paragraph (f)(1) and the cleaning methods required under paragraph (j)(2) of this standard.

**1910.1024(j)(2) Cleaning methods.**

- (i) The employer must ensure that surfaces in beryllium work areas and regulated areas are cleaned by HEPA-filtered vacuuming or other methods that minimize the likelihood and level of airborne exposure.
- (ii) The employer must not allow dry sweeping or brushing for cleaning surfaces in beryllium work areas or regulated areas unless HEPA-filtered vacuuming or other methods that minimize the likelihood and level of airborne exposure are not safe or effective.
- (iii) The employer must not allow the use of compressed air for cleaning beryllium-contaminated surfaces unless the compressed air is used in conjunction with a ventilation system designed to capture the particulates made airborne by the use of compressed air.
- (iv) Where employees use dry sweeping, brushing, or compressed air to clean beryllium-contaminated surfaces, the employer must provide, and ensure that each employee uses, respiratory protection and personal protective clothing and equipment in accordance with paragraphs (g) and (h) of this standard.
- (v) The employer must ensure that cleaning equipment is handled and maintained in a manner that minimizes the likelihood and level of airborne exposure and the re-entrainment of airborne beryllium in the workplace.

**1910.1024(j)(3) Disposal, recycling, and reuse.**

- (i) Except for intra-plant transfers, when the employer transfers materials that contain at least 0.1 percent beryllium by weight or are contaminated with beryllium for disposal, recycling, or reuse, the employer must label the materials in accordance with paragraph (m)(3) of this standard;
- (ii) Except for intra-plant transfers, materials designated for disposal that contain at least 0.1 percent beryllium by weight or are contaminated with beryllium must be cleaned to be as free as practicable of beryllium or placed in enclosures that prevent the release of beryllium-containing particulate or solutions under normal conditions of use, storage, or transport, such as bags or containers; and

(iii) Except for intra-plant transfers, materials designated for recycling or reuse that contain at least 0.1 percent beryllium by weight or are contaminated with beryllium must be cleaned to be as free as practicable of beryllium or placed in enclosures that prevent the release of beryllium-containing particulate or solutions under normal conditions of use, storage, or transport, such as bags or containers.

**1910.1024(k) Medical surveillance.**

**1910.1024(k)(1) General.**

(i) The employer must make medical surveillance required by this paragraph available at no cost to the employee, and at a reasonable time and place, to each employee:

- (A) Who is or is reasonably expected to be exposed at or above the action level for more than 30 days per year;
- (B) Who shows signs or symptoms of CBD or other beryllium-related health effects;
- (C) Who is exposed to beryllium during an emergency; or
- (D) Whose most recent written medical opinion required by paragraph (k)(6) or (k)(7) of this standard recommends periodic medical surveillance.

(ii) The employer must ensure that all medical examinations and procedures required by this standard are performed by, or under the direction of, a licensed physician.

**1910.1024(k)(2) Frequency.** The employer must provide a medical examination:

- (i) Within 30 days after determining that:
  - (A) An employee meets the criteria of paragraph (k)(1)(i)(A), unless the employee has received a medical examination, provided in accordance with this standard, within the last two years; or
  - (B) An employee meets the criteria of paragraph (k)(1)(i)(B) of this standard.
- (ii) At least every two years thereafter for each employee who continues to meet the criteria of paragraph (k)(1)(i)(A), (B), or (D) of this standard.
- (iii) At the termination of employment for each employee who meets any of the criteria of paragraph (k)(1)(i) of this standard at the time the employee's employment terminates, unless an examination has been provided in accordance with this standard during the six months prior to the date of termination. Each employee who meets the criteria of paragraph (k)(1)(i)(C) of this standard and who has not received an examination since exposure to beryllium during the emergency must be provided an examination at the time the employee's employment terminates.
- (iv) For an employee who meets the criteria of paragraph (k)(1)(i)(C) of this standard:
  - (A) If that employee has not received a medical examination within the previous two years pursuant to paragraph (k)(1)(i) of this standard, then within 30 days after the employee meets the criteria of paragraph (k)(1)(i)(C) of this standard; or
  - (B) If that employee has received a medical examination within the previous two years pursuant to paragraph (k)(1)(i) of this standard, then at least one year but no more than two years after the employee meets the criteria of paragraph (k)(1)(i)(C) of this standard.

**1910.1024(k)(3) Contents of examination.**

(i) The employer must ensure that the PLHCP conducting the examination advises the employee of the risks and benefits of participating in the medical surveillance program and the employee's right to opt out of any or all parts of the medical examination.

- (ii) The employer must ensure that the employee is offered a medical examination that includes:
  - (A) A medical and work history, with emphasis on past and present airborne exposure to or dermal contact with beryllium, smoking history, and any history of respiratory system dysfunction;
  - (B) A physical examination with emphasis on the respiratory system;
  - (C) A physical examination for skin rashes;
  - (D) Pulmonary function tests, performed in accordance with the guidelines established by the American Thoracic Society including forced vital capacity (FVC) and forced expiratory volume in one second (FEV<sub>1</sub>);
  - (E) A standardized BeLPT or equivalent test, upon the first examination and at least every two years thereafter, unless the employee is confirmed positive. If the results of the BeLPT are other than normal, a follow-up BeLPT must be offered within 30 days, unless the employee has been confirmed positive. Samples must be analyzed in a laboratory certified under the College of American Pathologists/Clinical Laboratory Improvement Amendments (CLIA) guidelines to perform the BeLPT.
  - (F) A low dose computed tomography (LDCT) scan, when recommended by the PLHCP after considering the employee's history of exposure to beryllium along with other risk factors, such as smoking history, family medical history, sex, age, and presence of existing lung disease; and
  - (G) Any other test deemed appropriate by the PLHCP.

**1910.1024(k)(4)Information provided to the PLHCP.** The employer must ensure that the examining PLHCP (and the agreed-upon CBD diagnostic center, if an evaluation is required under paragraph (k)(7) of this standard) has a copy of this standard and must provide the following information, if known:

- (i) A description of the employee's former and current duties that relate to the employee's airborne exposure to and dermal contact with beryllium;
- (ii) The employee's former and current levels of airborne exposure;
- (iii) A description of any personal protective clothing and equipment, including respirators, used by the employee, including when and for how long the employee has used that personal protective clothing and equipment; and
- (iv) Information from records of employment-related medical examinations previously provided to the employee, currently within the control of the employer, after obtaining written consent from the employee.

**1910.1024(k)(5)Licensed physician's written medical report for the employee.** The employer must ensure that the employee receives a written medical report from the licensed physician within 45 days of the examination (including any follow-up BeLPT required under paragraph (k)(3)(ii)(E) of this standard) and that the PLHCP explains the results of the examination to the employee. The written medical report must contain:

- (i) A statement indicating the results of the medical examination, including the licensed physician's opinion as to whether the employee has:
  - (A) Any detected medical condition, such as CBD or beryllium sensitization (*i.e.*, the employee is confirmed positive, as defined in paragraph (b) of this standard), that may place the employee at increased risk from further airborne exposure, and
  - (B) Any medical conditions related to airborne exposure that require further evaluation or treatment.
- (ii) Any recommendations on:
  - (A) The employee's use of respirators, protective clothing, or equipment; or
  - (B) Limitations on the employee's airborne exposure to beryllium.
- (iii) If the employee is confirmed positive or diagnosed with CBD or if the licensed physician otherwise deems it appropriate, the written report must also contain a referral for an evaluation at a CBD diagnostic center.
- (iv) If the employee is confirmed positive or diagnosed with CBD the written report must also contain a recommendation for continued periodic medical surveillance.
- (v) If the employee is confirmed positive or diagnosed with CBD the written report must also contain a recommendation for medical removal from airborne exposure to beryllium, as described in paragraph (l) of this standard.

**1910.1024(k)(6)Licensed physician's written medical opinion for the employer.**

- (i) The employer must obtain a written medical opinion from the licensed physician within 45 days of the medical examination (including any follow-up BeLPT required under paragraph (k)(3)(ii)(E) of this standard). The written medical opinion must contain only the following:
  - (A) The date of the examination;
  - (B) A statement that the examination has met the requirements of this standard;
  - (C) Any recommended limitations on the employee's use of respirators, protective clothing, or equipment; and
  - (D) A statement that the PLHCP has explained the results of the medical examination to the employee, including any tests conducted, any medical conditions related to airborne exposure that require further evaluation or treatment, and any special provisions for use of personal protective clothing or equipment;
- (ii) If the employee provides written authorization, the written opinion must also contain any recommended limitations on the employee's airborne exposure to beryllium.
- (iii) If the employee is confirmed positive or diagnosed with CBD or if the licensed physician otherwise deems it appropriate, and the employee provides written authorization, the written opinion must also contain a referral for an evaluation at a CBD diagnostic center.
- (iv) If the employee is confirmed positive or diagnosed with CBD and the employee provides written authorization, the written opinion must also contain a recommendation for continued periodic medical surveillance.
- (v) If the employee is confirmed positive or diagnosed with CBD and the employee provides written authorization, the written opinion must also contain a recommendation for medical removal from airborne exposure to beryllium, as described in paragraph (l) of this standard.
- (vi) The employer must ensure that each employee receives a copy of the written medical opinion described in paragraph (k)(6) of this standard within 45 days of any medical examination (including any follow-up BeLPT required under paragraph (k)(3)(ii)(E) of this standard) performed for that employee.

**1910.1024(k)(7) CBD diagnostic center.**

(i) The employer must provide an evaluation at no cost to the employee at a CBD diagnostic center that is mutually agreed upon by the employer and the employee. The evaluation at the CBD diagnostic center must be scheduled within 30 days, and must occur within a reasonable time, of:

- (A) The employer's receipt of a physician's written medical opinion to the employer that recommends referral to a CBD diagnostic center; or
- (B) The employee presenting to the employer a physician's written medical report indicating that the employee has been confirmed positive or diagnosed with CBD, or recommending referral to a CBD diagnostic center.

(ii) The employer must ensure that, as part of the evaluation, the employee is offered any tests deemed appropriate by the examining physician at the CBD diagnostic center, such as pulmonary function testing (as outlined by the American Thoracic Society criteria), bronchoalveolar lavage (BAL), and transbronchial biopsy. If any of the tests deemed appropriate by the examining physician are not available at the CBD diagnostic center, they may be performed at another location that is mutually agreed upon by the employer and the employee.

(iii) The employer must ensure that the employee receives a written medical report from the CBD diagnostic center that contains all the information required in paragraph (k)(5)(i), (ii), (iv), and (v) of this standard and that the PLHCP explains the results of the examination to the employee within 30 days of the examination.

(iv) The employer must obtain a written medical opinion from the CBD diagnostic center within 30 days of the medical examination. The written medical opinion must contain only the information in paragraph (k)(6)(i), as applicable, unless the employee provides written authorization to release additional information. If the employee provides written authorization, the written opinion must also contain the information from paragraphs (k)(6)(ii), (iv), and (v), if applicable.

(v) The employer must ensure that each employee receives a copy of the written medical opinion from the CBD diagnostic center described in paragraph (k)(7) of this standard within 30 days of any medical examination performed for that employee.

(vi) After an employee has received the initial clinical evaluation at a CBD diagnostic center described in paragraphs (k)(7)(i) and (ii) of this standard, the employee may choose to have any subsequent medical examinations for which the employee is eligible under paragraph (k) of this standard performed at a CBD diagnostic center mutually agreed upon by the employer and the employee, and the employer must provide such examinations at no cost to the employee.

**1910.1024(l) Medical removal.**

**1910.1024(l)(1)** An employee is eligible for medical removal, if the employee works in a job with airborne exposure at or above the action level and either:

- (i) The employee provides the employer with:
  - (A) A written medical report indicating a confirmed positive finding or CBD diagnosis; or
  - (B) A written medical report recommending removal from airborne exposure to beryllium in accordance with paragraph (k)(5)(v) or (k)(7)(iii) of this standard; or
- (ii) The employer receives a written medical opinion recommending removal from airborne exposure to beryllium in accordance with paragraph (k)(6)(v) or (k)(7)(iv) of this standard.

**1910.1024(l)(2)** If an employee is eligible for medical removal, the employer must provide the employee with the employee's choice of:

- (i) Removal as described in paragraph (l)(3) of this standard; or
- (ii) Remaining in a job with airborne exposure at or above the action level, provided that the employer provides, and ensures that the employee uses, respiratory protection that complies with paragraph (g) of this standard whenever airborne exposures are at or above the action level.

**1910.1024(l)(3)** If the employee chooses removal:

- (i) If a comparable job is available where airborne exposures to beryllium are below the action level, and the employee is qualified for that job or can be trained within one month, the employer must remove the employee to that job. The employer must maintain for six months from the time of removal the employee's base earnings, seniority, and other rights and benefits that existed at the time of removal.
- (ii) If comparable work is not available, the employer must maintain the employee's base earnings, seniority, and other rights and benefits that existed at the time of removal for six months or until such time that comparable work described in paragraph (l)(3)(i) becomes available, whichever comes first.

**1910.1024(l)(4)** The employer's obligation to provide medical removal protection benefits to a removed employee shall be reduced to the extent that the employee receives compensation for earnings lost during the period of removal

from a publicly or employer-funded compensation program, or receives income from another employer made possible by virtue of the employee's removal.

**1910.1024(m) Communication of hazards.**

**1910.1024(m)(1) General.**

(i) Chemical manufacturers, importers, distributors, and employers must comply with all requirements of the HCS (1910.1200) for beryllium.

(ii) In classifying the hazards of beryllium, at least the following hazards must be addressed: Cancer; lung effects (CBD and acute beryllium disease); beryllium sensitization; skin sensitization; and skin, eye, and respiratory tract irritation.

(iii) Employers must include beryllium in the hazard communication program established to comply with the HCS. Employers must ensure that each employee has access to labels on containers of beryllium and to safety data sheets, and is trained in accordance with the requirements of the HCS (§1910.1200) and paragraph (m)(4) of this standard.

**1910.1024(m)(2) Warning signs.**

(i) *Posting.* The employer must provide and display warning signs at each approach to a regulated area so that each employee is able to read and understand the signs and take necessary protective steps before entering the area.

(ii) *Sign specification.*

(A) The employer must ensure that the warning signs required by paragraph (m)(2)(i) of this standard are legible and readily visible.

(B) The employer must ensure each warning sign required by paragraph (m)(2)(i) of this standard bears the following legend:

**DANGER  
REGULATED AREA  
BERYLLIUM  
MAY CAUSE CANCER  
CAUSES DAMAGE TO LUNGS  
AUTHORIZED PERSONNEL ONLY  
WEAR RESPIRATORY PROTECTION AND  
PERSONAL PROTECTIVE CLOTHING  
AND EQUIPMENT IN THIS AREA**

**1910.1024(m)(3) Warning labels.** Consistent with the HCS (1910.1200), the employer must label each immediate container of clothing, equipment, and materials contaminated with beryllium, and must, at a minimum, include the following on the label:

**DANGER  
CONTAINS BERYLLIUM  
MAY CAUSE CANCER  
CAUSES DAMAGE TO LUNGS  
AVOID CREATING DUST  
DO NOT GET ON SKIN**

**1910.1024(m)(4) Employee information and training.**

- (i) For each employee who has, or can reasonably be expected to have, airborne exposure to or dermal contact with beryllium:
  - (A) The employer must provide information and training in accordance with the HCS (1910.1200(h));
  - (B) The employer must provide initial training to each employee by the time of initial assignment; and
  - (C) The employer must repeat the training required under this standard annually for each employee.
- (ii) The employer must ensure that each employee who is, or can reasonably be expected to be, exposed to airborne beryllium can demonstrate knowledge and understanding of the following:
  - (A) The health hazards associated with airborne exposure to and dermal contact with beryllium, including the signs and symptoms of CBD;
  - (B) The written exposure control plan, with emphasis on the location(s) of beryllium work areas, including any regulated areas, and the specific nature of operations that could result in airborne exposure, especially airborne exposure above the TWA PEL or STEL;
  - (C) The purpose, proper selection, fitting, proper use, and limitations of personal protective clothing and equipment, including respirators;
  - (D) Applicable emergency procedures;
  - (E) Measures employees can take to protect themselves from airborne exposure to and dermal contact with beryllium, including personal hygiene practices;
  - (F) The purpose and a description of the medical surveillance program required by paragraph (k) of this standard including risks and benefits of each test to be offered;
  - (G) The purpose and a description of the medical removal protection provided under paragraph (l) of this standard;
  - (H) The contents of the standard; and
  - (I) The employee's right of access to records under the Records Access standard (1910.1020).
- (iii) When a workplace change (such as modification of equipment, tasks, or procedures) results in new or increased airborne exposure that exceeds, or can reasonably be expected to exceed, either the TWA PEL or the STEL, the employer must provide additional training to those employees affected by the change in airborne exposure.
- (iv) *Employee information.* The employer must make a copy of this standard and its appendices readily available at no cost to each employee and designated employee representative(s).

**1910.1024(n) Recordkeeping.**

**1910.1024(n)(1) Air monitoring data.**

- (i) The employer must make and maintain a record of all exposure measurements taken to assess airborne exposure as prescribed in paragraph (d) of this standard.
- (ii) This record must include at least the following information:
  - (A) The date of measurement for each sample taken;
  - (B) The task that is being monitored;
  - (C) The sampling and analytical methods used and evidence of their accuracy;
  - (D) The number, duration, and results of samples taken;
  - (E) The type of personal protective clothing and equipment, including respirators, worn by monitored employees at the time of monitoring; and
  - (F) The name and job classification of each employee represented by the monitoring, indicating which employees were actually monitored.
- (iii) The employer must ensure that exposure records are maintained and made available in accordance with the Records Access standard (1910.1020).

**1910.1024(n)(2) Objective data.**

- (i) Where an employer uses objective data to satisfy the exposure assessment requirements under paragraph (d)(2) of this standard, the employer must make and maintain a record of the objective data relied upon.
- (ii) This record must include at least the following information:
  - (A) The data relied upon;
  - (B) The beryllium-containing material in question;
  - (C) The source of the objective data;
  - (D) A description of the process, task, or activity on which the objective data were based; and
  - (E) Other data relevant to the process, task, activity, material, or airborne exposure on which the objective data were based.
- (iii) The employer must ensure that objective data are maintained and made available in accordance with the Records Access standard (1910.1020).

**1910.1024(n)(3) Medical surveillance.**

- (i) The employer must make and maintain a record for each employee covered by medical surveillance under paragraph (k) of this standard.
- (ii) The record must include the following information about each employee:
  - (A) Name and job classification;
  - (B) A copy of all licensed physicians' written medical opinions for each employee; and
  - (C) A copy of the information provided to the PLHCP as required by paragraph (k)(4) of this standard.
- (iii) The employer must ensure that medical records are maintained and made available in accordance with the Records Access standard (1910.1020).

**1910.1024(n)(4) Training.**

- (i) At the completion of any training required by this standard, the employer must prepare a record that indicates the name and job classification of each employee trained, the date the training was completed, and the topic of the training.
- (ii) This record must be maintained for three years after the completion of training.

**1910.1024(n)(5) Access to records.** Upon request, the employer must make all records maintained as a requirement of this standard available for examination and copying to the Assistant Secretary, the Director, each employee, and each employee's designated representative(s) in accordance the Records Access standard (1910.1020).

**1910.1024(n)(6) Transfer of records.** The employer must comply with the requirements involving transfer of records set forth in the Records Access standard (1910.1020).

**1910.1024(o) Dates.**

**1910.1024(o)(1) Effective date.** This standard shall become effective March 10, 2017.

**1910.1024(o)(2) Compliance dates.**

- (i) Obligations contained in paragraphs (c), (d), (g), (k), and (l) of this standard: March 12, 2018;
- (ii) Change rooms and showers required by paragraph (i) of this standard: March 11, 2019;
- (iii) Engineering controls required by paragraph (f) of this standard: March 10, 2020; and
- (iv) All other obligations of this standard: December 12, 2018.

**1910.1024(p) Appendix.** Table A.1 in this appendix sets forth the operations that, where performed under the circumstances described in the column heading above the particular operations, trigger the requirement for a beryllium work area.

[82 FR 2736, Jan. 9, 2017, as amended at 83 FR 19948, May 7, 2018; 83 FR 39360, Aug. 9, 2018; 85 FR 42625-42627 July 14, 2020]

**APPENDIX A**  
**CONTROL STRATEGIES TO MINIMIZE BERYLLIUM EXPOSURE**  
**NON-MANDATORY**

Paragraph (f)(2)(i) of this standard requires employers to use one or more of the control methods listed in paragraph (f)(2)(i) to minimize worker exposure in each operation in a beryllium work area, unless the operation is exempt under paragraph (f)(2)(ii). This appendix sets forth a non-exhaustive list of control options that employers could use to comply with paragraph (f)(2)(i) for a number of specific beryllium operations.

<b>TABLE A.1—EXPOSURE CONTROL RECOMMENDATIONS</b>		
<b>Operation</b>	<b>Minimal control strategy *</b>	<b>Application group</b>
Beryllium Oxide Forming (e.g., pressing, extruding).	For pressing operations: .....	Primary Beryllium Production; Beryllium Oxide Ceramics and Composites.
	<ol style="list-style-type: none"> <li>1. Install local exhaust ventilation (LEV) on oxide press tables, oxide feed drum breaks, press tumblers, powder rollers, and die set disassembly stations;</li> <li>2. Enclose the oxide presses; and</li> <li>3. Install mechanical ventilation (make-up air) in processing areas</li> </ol>	
	For extruding operations:	
	<ol style="list-style-type: none"> <li>1. Install LEV on extruder powder loading hoods, oxide supply bottles, rod breaking operations, centerless grinders, rod laydown tables, dicing operations, surface grinders, discharge end of extrusion presses;</li> <li>2. Enclose the centerless grinders; and</li> <li>3. Install mechanical ventilation (make-up air) in processing areas.</li> </ol>	
Chemical Processing Operations (e.g., leaching, pickling, degreasing, etching, plating).	For medium and high gassing operations: .....  <ol style="list-style-type: none"> <li>1. Perform operation with a hood having a maximum of one open side; and</li> <li>2. Design process so as to minimize spills; if accidental spills occur, perform immediate cleanup.</li> </ol>	Primary Beryllium Production; Beryllium Oxide Ceramics and Composites; Copper Rolling, Drawing and Extruding.
Finishing (e.g., grinding, sanding, polishing, deburring).	<ol style="list-style-type: none"> <li>1. Perform portable finishing operations in a ventilated hood. The hood should include both downdraft and backdraft ventilation, and have at least two sides and a top.</li> <li>2. Perform stationary finishing operations using a ventilated and enclosed hood at the point of operation. The grinding wheel of the stationary unit should be enclosed and ventilated</li> </ol>	Secondary Smelting; Fabrication of Beryllium Alloy Products; Dental Labs.

**TABLE A.1—EXPOSURE CONTROL RECOMMENDATIONS**

Operation	Minimal control strategy *	Application group
Furnace Operations (e.g., Melting and Casting).	<ol style="list-style-type: none"> <li>1. Use LEV on furnaces, pelletizer; arc furnace ingot machine discharge; pellet sampling; arc furnace bins and conveyors; beryllium hydroxide drum dumper and dryer; furnace rebuilding; furnace tool holders; arc furnace tundish and tundish skimming, tundish preheat hood, and tundish cleaning hoods; dross handling equipment and drums; dross recycling; and tool repair station, charge make-up station, oxide screener, product sampling locations, drum changing stations, and drum cleaning stations</li> <li>2. Use mechanical ventilation (make-up air) in furnace building</li> </ol>	Primary Beryllium Production; Beryllium Oxide Ceramics and Composites; Nonferrous Foundries; Secondary Smelting.
Machining .....	<p>Use</p> <ol style="list-style-type: none"> <li>1. LEV consistent with ACGIH® ventilation guidelines on deburring hoods, wet surface grinder enclosures, belt sanding hoods, and electrical discharge machines (for operations such as polishing, lapping, and buffing);</li> <li>2. high velocity low volume hoods or ventilated enclosures on lathes, vertical mills, CNC mills, and tool grinding operations;</li> <li>3. for beryllium oxide ceramics, LEV on lapping, dicing, and laser cutting; and</li> <li>4. wet methods (e.g., coolants).</li> </ol>	Primary Beryllium Production; Beryllium Oxide Ceramics and Composites; Copper Rolling, Drawing, and Extruding; Precision Turned Products.
Mechanical Processing (e.g., material handling (including scrap), sorting, crushing, screening, pulverizing, shredding, pouring, mixing, blending).	<ol style="list-style-type: none"> <li>1. Enclose and ventilate sources of emission;</li> <li>2. Prohibit open handling of materials; and</li> <li>3. Use mechanical ventilation (make-up air) in processing areas</li> </ol>	Primary Beryllium Production; Beryllium Oxide Ceramics and Composites; Aluminum and Copper Foundries; Secondary Smelting.
Metal Forming (e.g., rolling, drawing, straightening, annealing, extruding).	<ol style="list-style-type: none"> <li>1. For rolling operations, install LEV on mill stands and reels such that a hood extends the length of the mill;</li> <li>2. For point and chamfer operations, install LEV hoods at both ends of the rod;</li> <li>3. For annealing operations, provide an inert atmosphere for annealing furnaces, and LEV hoods at entry and exit points;</li> <li>4. For swaging operations, install LEV on the cutting head;</li> <li>5. For drawing, straightening, and extruding operations, install LEV at entry and exit points; and</li> <li>6. For all metal forming operations, install mechanical ventilation (make-up air) for processing areas.</li> </ol>	Primary Beryllium Production; Copper Rolling, Drawing, and Extruding; Fabrication of Beryllium Alloy Products.

**TABLE A.1—EXPOSURE CONTROL RECOMMENDATIONS**

Operation	Minimal control strategy *	Application group
Welding .....	For fixed welding operations: ..... 1. Enclose work locations around the source of fume generation and use local exhaust ventilation; and 2. Install close capture hood enclosure designed so as to minimize fume emission from the enclosure welding operation. For manual operations: 1. Use portable local exhaust and general ventilation	Primary Beryllium Production; Fabrication of Beryllium Alloy Products; Welding.
* All LEV specifications should be in accordance with the ACGIH® Publication No. 2094, "Industrial Ventilation—A Manual of Recommended Practice" wherever applicable.		

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