

MATERION BRUSH INC.
BERYLLIUM HEALTH AND SAFETY UPDATE
MARCH 2021

Over many decades, Materion Brush Inc. (Materion) has provided health and safety communications and updates to our employees, customers and downstream users of beryllium-containing materials. Over the past several years, our communications have mostly centered around the development of the comprehensive Occupational Safety and Health Administration (OSHA) [Beryllium Standard for General Industry](#). This communication summarizes important information regarding Materion's beryllium product stewardship programs, web-based tools and useful guidance to continue promoting the safe handling of beryllium-containing products. We have structured this communication to address the questions we commonly receive from the beryllium user community.

What is Materion's model for protecting beryllium workers?

Materion's Beryllium Worker Protection Model¹ is a comprehensive and multifaceted approach for reducing worker exposures to beryllium particles. Its goal is to prevent sensitization² to beryllium (BeS), subclinical chronic beryllium disease (CBD)³ and clinical CBD⁴, the last of which can be fatal. The model focuses on keeping beryllium work areas clean and keeping particles and solutions containing beryllium out of the lungs, off the skin, off clothing, in the work process, in the work area and on the plant site. Worker and management education and motivation are important components. A combination of engineering, work practice and personal protection approaches are used, as needed, to reduce potential occupational exposures. The model is based on years of joint research with the National Institute for Occupational Safety and Health (NIOSH) and others. To communicate the model, we launched our award-winning computer based Interactive Guide for Working Safely with Beryllium and Beryllium-containing Materials (Interactive Guide)⁵ in 2008. Initially, the Interactive Guide was distributed to all of our direct customers on CDs. In February 2009, we launched the Interactive Guide as an internet, web-based version to make it easier for employers and employees downstream of our direct customer base to access the important health and safety information contained in the Interactive Guide.

Users of beryllium-containing materials are reminded to perform workplace exposure characterization, including air monitoring, to determine whether conditions or situations exist which dictate the need for improved engineering, work practices and personal protection. The health and safety guidance contained in the Interactive Guide remains current and can be easily accessed at www.berylliumssafety.com.

What is the current status of the OSHA beryllium standard?

The OSHA comprehensive occupational health standard for beryllium workers ([29 CFR 1910.1024 – Beryllium](#)) came into full effect September 14, 2020. The standard, as originally issued in February 2017, contained sections that were both impractical and unworkable. Materion and other affected parties filed a legal appeal addressing those sections. After 15 months of negotiations with OSHA, we reached a settlement agreement that resolved our concerns. In the settlement agreement, we worked to include the practical elements of the Materion Beryllium Worker Protection Model to better protect beryllium workers. Over the next two years, OSHA issued new rulemakings to complete the agreed revisions to the standard. OSHA is continuing to develop specific guidance and informational documents concerning these revisions. The OSHA Beryllium Standard and related documents are available at www.osha.gov.

What do I need to do to comply with OSHA's Beryllium Standard?

Since the OSHA Beryllium Standard for General Industry is a comprehensive occupational health standard, it requires employers who work with beryllium-containing products to comply with anywhere from a few to all of the requirements in the standard depending upon how the beryllium materials are being processed and handled at the facility. These requirements include exposure assessment, as well as methods for controlling exposure, respiratory protection, personal protective clothing and equipment, housekeeping, medical surveillance, hazard communication and recordkeeping.

To make the OSHA requirements clearer for workers and compliance easier for employers, Materion developed a practical, web-based tool to help you understand and comply with the OSHA Beryllium Standard for General Industry. This on-line tool, named the *Guide for Compliance*, is available at www.beryllium-safety.com. It contains a how-to guide of questions, tools and templates to assist employers in developing a program that complies with the OSHA Beryllium Standard for General Industry. Simply go to www.beryllium-safety.com, click on the *Guide for Compliance* icon and follow the directions and prompts.

We encourage you to contact us with your questions and comments on the *Guide for Compliance*, and any other beryllium-related health and safety questions that may arise. You can contact us by calling our Information Hotline at 1-800-862-4118 or sending an e-mail to Materion-PS@materion.com.

Has OSHA set a new Permissible Exposure Limit for beryllium?

In the [Beryllium Standard for General Industry](#), OSHA adopted an 8-hour time weighted average (TWA) Permissible Exposure Limit (PEL) for beryllium of 0.2 micrograms per cubic meter of air ($\mu\text{g}/\text{m}^3$) along with a 15-minute TWA Short Term Exposure Limit (STEL) of 2.0 $\mu\text{g}/\text{m}^3$. In addition, OSHA stated that the level of risk remaining at the new TWA PEL is still “significant” and that OSHA did not adopt a lower TWA PEL because the Agency “could not demonstrate technological feasibility of a lower TWA PEL.” OSHA stated that it adopted the STEL and ancillary provisions of the rule to further reduce the remaining significant risk. In summary, OSHA concluded that exposure to beryllium constitutes a significant risk of material impairment to health and that the final rule will “substantially lower,” but not eliminate that risk.

Is the occupational exposure limit (OEL) in Europe different than in the United States?

The EU-wide OEL was adopted at a level of 0.6 $\mu\text{g}/\text{m}^3$ in 2019. Although the level appears to be 3 times higher than in the United States, it is essentially the same exposure value because Europe utilizes a different air sampling method which measures a different, larger fraction of the airborne particles.

How is Chronic Beryllium Disease (CBD) diagnosed?

Before the late 1980s, workers were diagnosed with CBD only when they exhibited clinical (observable) symptoms of CBD such as dry cough and shortness of breath, along with changes in their chest x-ray or lung function test. During the late 1980s and early 1990s, the criteria for a diagnosis of CBD were changed to include workers without clinical symptoms or measurable impairment. Since that time, workers have often been diagnosed with “subclinical” or asymptomatic CBD based on (1) beryllium sensitization as determined from a blood test and (2) a biopsy finding in the lung of small lumps of immune cells and tissue called granulomas. The biopsy is taken during a bronchoscopy, a procedure that has significant health risks, such as a collapsed lung, bleeding or infection and in rare cases a possibility of death. Workers with subclinical CBD may never develop clinical CBD, or may develop clinical CBD over time⁶.

What is beryllium sensitization (BeS)?

The test most frequently used today to detect beryllium sensitization is the beryllium blood lymphocyte proliferation test (BeBLPT). A finding of beryllium sensitization means that a person’s immune system recognizes beryllium. Beryllium sensitization alone is not an illness or disability and has no symptoms. The BeBLPT, by itself, does not detect subclinical or clinical CBD.

I have heard there is a genetic factor in determining who is at risk of contracting CBD. Can I be tested to see if I am susceptible?

It is true that your genetic makeup plays a role in whether or not you can contract CBD. A 2016 NIOSH study⁷ of 853 beryllium workers identified groups of workers with specific genetic markers associated with a much higher rate of CBD. NIOSH suggested that workers may benefit from knowing their genetic susceptibility in

deciding whether to avoid future beryllium exposure. Studies are continuing to explore whether genetic testing could be a useful tool in providing workers greater information about their personal risk of contracting CBD. However, such information should not be used to relax the precautions being taken to reduce worker exposures to beryllium in manufacturing environments.

Can I get CBD from skin contact with beryllium or beryllium-containing materials?

No. Handling beryllium and beryllium-containing materials in solid form cannot cause CBD. CBD requires an inhalation of beryllium-containing airborne particulate.

Is beryllium a carcinogen?

Beryllium remains classified as either a carcinogen or probable carcinogen by occupational health organizations and agencies. None of the classifying groups, however, has yet taken into account the most recent scientific evidence on whether beryllium is carcinogenic.

In 2016, Dr. Paola Boffetta, et. al.⁸, published the largest ever beryllium study evaluating the potential carcinogenicity of beryllium in occupationally exposed workers. The study is far more extensive in its scope and coverage of the beryllium industry than any earlier study or risk assessment. This is the first study to isolate and separately analyze exposures to the very common insoluble beryllium forms (beryllium metal, beryllium alloys and beryllium ceramics) versus the very rare soluble forms of beryllium. Soluble forms of beryllium are formed during the chemical extraction of beryllium from beryllium ore, which occurs at only five plant sites worldwide. Soluble beryllium compounds are not used in general manufacturing, are not commercially available, and are not found in the end products used by consumers.

Dr. Boffetta's study involved the largest number of people for the longest period of time of any beryllium study: 16,115 workers (84% males) employed between 1925 and 2009 at the 15 U.S. manufacturing plants of primary beryllium producers. During the nearly 85-year study period, eight facilities had used only insoluble forms of beryllium and seven facilities had used mixed soluble and insoluble forms. As compared to the next largest study, this study added 75% more beryllium workers, doubled the number of beryllium facilities, and enlarged the cohort's employment years from 30 years to 85 years, while adding 20 more years of worker follow-up. It also included female workers, unlike some earlier studies.

The study found that the lung cancer mortality rate for the workers exposed to the common insoluble forms of beryllium was actually 12% below the expected number of cancer deaths. The cancer mortality rate for workers whose exposures included soluble forms of beryllium was 9% higher than the expected number of cancer deaths, but only in workers hired before 1955, when beryllium exposures were 10 to 10000 times higher than today.

In Materion's opinion, the Boffetta study demonstrates that there is no significant cancer risk among workers processing beryllium metal, beryllium alloys and beryllium ceramics, which are the only forms available for use in manufacturing worldwide. Reclassification of insoluble forms of beryllium as non-carcinogenic in humans would be justified in light of this study. We are unaware, however, of any organization that is proposing to do so.

Is the use of beryllium or materials containing beryllium banned or restricted worldwide?

No. The use of beryllium and beryllium-containing materials is not banned, restricted or otherwise limited by any international, federal, state or local regulations. This includes directives and regulations on restrictions of hazardous substances (RoHS) in electrical and electronic equipment and the Registration, Evaluation and Authorization of Chemicals (REACH) legislation in the European Union. Also, REACH and RoHS-like regulations in Asia, South America and all other jurisdictions have not banned or restricted beryllium.

Can beryllium-containing materials be safely recycled?

Yes. Beryllium-containing materials can be safely recycled by applying the precautions and methods found in the Beryllium Worker Protection Model. Certain higher risk processes, such as melting, utilized in the recycling of metals and materials, can require additional engineering, work practice controls and personal protective equipment to reduce potential exposures to the many hazardous materials encountered during recycling, including beryllium.

Whom can I contact for beryllium health and safety assistance?

For important health, safety and environmental information and guidance on the use of beryllium-containing materials, please see the product-specific Safety Data Sheets (SDS), research studies and other useful information available at www.berylliumsafety.com and www.berylliumsafety.eu. The European product stewardship website "*Be Responsible*" includes introductory information in 24 languages. If you have additional questions or any questions regarding the information provided or referred to herein, or wish to provide feedback on our information and tools, please contact your sales representative or e-mail us at Materion-PS@materion.com or call our Product Safety Hotline at (800) 862-4118.

Beryllium health, safety and environmental information can also be obtained through other organizations such as OSHA, NIOSH, AIHA and ACGIH. You can obtain information from these organizations by accessing their websites at www.osha.gov, www.cdc.gov/niosh, www.aiha.org, and www.acgih.org.

In the United States, we have developed a Beryllium Consultant Network consisting of professional industrial hygienists who have either attended an industrial hygiene training seminar on beryllium or have previous experience in controlling occupational exposure to beryllium. These consultants provide services independent of Materion. Materion assists the network consultants by offering them periodic updates through refresher courses and written correspondence. A listing of consultants in the [Beryllium Consultant Network](#) can be obtained from our website or by calling the Product Safety Hotline.

¹ Deubner D., Kent M. Keeping Beryllium Workers Safe: An Enhanced Preventive Model. JOEH 4:D23-D30 (2007).

² Beryllium sensitization is defined as a confirmed positive beryllium blood lymphocyte proliferation test or positive beryllium broncho-alveolar lavage lymphocyte proliferation test without granuloma upon lung biopsy.

³ Subclinical CBD is defined as beryllium sensitization plus granuloma upon lung biopsy with normal chest X-ray and normal lung function test.

⁴ Clinical CBD is defined as symptomatic lung disease with abnormal chest x-ray or lung function test.

⁵ Knudson, Theodore L., Kolanz, Marc E., "An Innovative Safety Model and E-Learning Guide to Working Safely with Beryllium Throughout the Industrial Supply Chain," Journal of Occupational and Environmental Hygiene, 6: 758-761, JOEH, LLC (2009).

⁶ Maier L.A. Beryllium Health Effects in the Era of the Beryllium Lymphocyte Proliferation Test. Appl Occup Environ Hyg 16(5): 514-520 (2001).

⁷ Kreiss K., et al. Research to Practice Implications of High-Risk Genotypes for Beryllium Sensitization and Disease. JOEM Vol. 58, No. 9: 855-860 (2016).

⁸ Boffetta P., Fordyce T., Mandel J. A mortality study of beryllium workers. Cancer Med. Dec;5(12):3596-3605 (2016).