

Week of November 1, 2010 – Beryllium; More than a Metal

Beryllium is a unique material. It is a lightweight metal with mechanical and thermal properties that make it ideal for use in many applications and industries including defense, aerospace, telecommunications, automotive electronics, and medical specialties. It has a modulus of elasticity almost 50 percent greater than that of steel at $\frac{1}{4}$ the weight! Its properties of high stiffness and light weight translate to accurate positioning of high-end instruments and optical equipment and the ability to withstand high stresses, such as those encountered during spacecraft liftoff and in military applications. It has a high thermal conductivity (i.e. high melting temperature), while being corrosion-resistant and extremely lightweight (atomic number 4 on the periodic table of elements: right behind hydrogen, helium and lithium). No wonder it has shown itself to be so beneficial in these industries. In DOE and power plant operations, it is used as a moderator and reflector for nuclear reactors, as well as a component in copper alloy used for springs, electrical contacts, and non-sparking tools.

Beryllium was discovered in France by Nicolas-Louis Vauquelin in beryl ore and in emeralds (yes, the main ingredient in emeralds is beryllium) in 1798. It was isolated as a metal by Friedrich Wöhler and A.A. Bussy in 1828 (independently of each other).

It is a naturally occurring metal found in beryl and bertrandite ores. Today, beryllium is classified as an "Alkaline Earth Metal," located in Group 2 of the Periodic Table. While these elements are found in the Earth's crust, they are rarely found in their elemental form because they are very reactive. As such, they are widely distributed in rock structures.

While beryllium and beryllium-containing alloys and compounds have been produced commercially in the US since the 1940s, with production of beryllium oxide beginning in the late 1950s, many companies began to recognize its hazardous nature. Nevertheless, when the Atomic Energy Commission tried to institute airborne controls for beryllium inhalation, the US Public Health Service questioned this concern and was initially opposed to classifying beryllium as a toxic material. And, while OSHA (created in 1970) established a permissible exposure limit of 2 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) for an 8-hour exposure period as well as an action level of $0.2 \mu\text{g}/\text{m}^3$ (1/10 the PEL), it has only been since 1999 that DOE has promulgated the Chronic Beryllium Disease Prevention Program (CBDPP): a very comprehensive regulation published as 10 CFR 850, providing specific protocol for DOE contractors to follow; thereby ensuring their employees are properly protected from occupational exposures.

It should be noted that the CBDPP is designed to protect workers from the materials that have been fabricated with beryllium and NOT from naturally-occurring materials, such as soils or beryl and bertrandite ores.

Chronic Beryllium Disease (CBD) is caused by the inhalation of beryllium particles, dust or fumes. Its symptoms include coughing, shortness of breath, fatigue, weight loss or loss of appetite, fever and sweating. Medical tests may reveal abnormal lung sounds, lung scars, decreased pulmonary function, granulomas (a nodular form of chronic inflammation) as well as a sensitization to beryllium. beryllium disease It is interesting to note that CBD is caused by our own defense mechanisms which ultimately lead to severe symptoms.

Depending on the severity of CBD, symptoms of pulmonary hypertension, cor pulmonale (pulmonary heart disease due to enlargement of the right ventricle of the heart), or respiratory

failure may be present. CBD is incurable, usually irreversible and may result in death. The acute form of the disease, involving skin disease with poor wound healing and rash or wart-like bumps can also occur but is rarely seen and is not nearly as serious as CBD.

CBD has a very slow onset. It can sometimes take thirty years or more after exposure before CBD will be seen or diagnosed.

The CBDPP institutes specific practices, that when followed, is designed to prevent persons with potential beryllium exposure to be well protected. DOE's CBDPP requires respiratory protection when there is a potential for an airborne exposure at the Action Level ($0.2 \mu\text{g}/\text{m}^3$) as well as establishing release criteria for equipment and materials that are designated to leave a beryllium area; thus ensuring persons not involved with beryllium operations, shall not be exposed. Specific postings, signs and waste transportation are also required. Medical surveillance for beryllium workers requires a special test, known as the beryllium lymphocyte proliferation test (Be-LPT). Basically, this test is designed to determine if a worker has a personal sensitivity to beryllium, making him/her more susceptible to beryllium than other workers. Being diagnosed with a sensitivity to beryllium does NOT mean one will contract the disease or that having a medical evaluation showing you are not sensitive, ensures you that you will not contract CBD; the Be-LPT only indicates who is more susceptible when placed in an environment where an exposure to beryllium exists.

When a person is diagnosed to be sensitive to beryllium, employers are required to be proactive and inform the specific worker that working in a beryllium area would increase their risk of contracting CBD; however, the employer still has the right to work in a beryllium regulated area. Workers that have been diagnosed as beryllium-sensitive cannot be removed from employment; as a matter of fact, the employer must find work (without any reduction in pay) where they are protected from this contaminant.

The CBDPP is applicable for DOE locations only; however, many Department of Defense sites are requiring compliance to this regulation.

10 CFR 850 has many aspects; therefore it is important that when beryllium is suspected at your work location, make sure you get your S&H professional involved up front- during the initial planning stages of your project. Otherwise, you may set yourself up, as well as your organization, for a complicated and frustrating time while creating an increased health risk to your fellow workers.

***It's not whether you get knocked down;
it's whether you get up.*** Vince Lombardi

*Courtesy of Robert Brounstein, Corporate Director Safety and Health with
TerranearPMC*