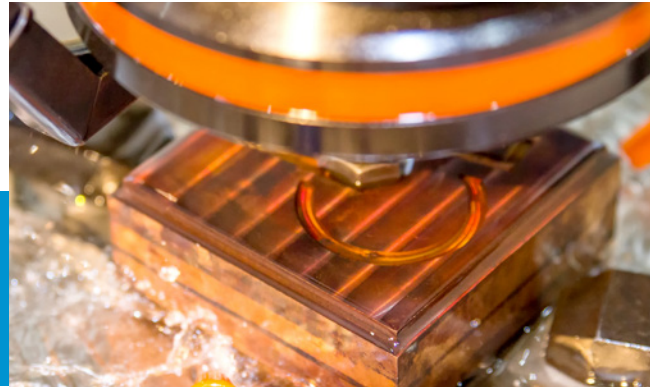


⁴Be Responsible

Beryllium Product Stewardship

BERYLLIUM-CONTAINING MATERIALS ELECTRICAL DISCHARGE MACHINING (EDM) EXPOSURE CONTROL GUIDE



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BERYLLIUM (BE) – CONTAINING ALLOYS

Beryllium-containing alloys, in solid form and as contained in finished products present no special health risks.

However, some manufacturing operations are known to generate airborne particulate and like many industrial materials, Electrical Discharge Machining (EDM) of beryllium-containing alloys present a health risk if effective controls are not implemented.

The inhalation of beryllium-containing dust, mist or fume can cause a serious lung condition in some individuals. The degree of hazard varies depending on the form of the product and how the material is processed and handled. You must read the product specific Safety Data Sheet (SDS) for additional environmental, health and safety information before working with any beryllium-containing alloys.

The use of engineering and work practice controls are the preferred methods of controlling exposure to beryllium-containing particulate reliably below the BeST Recommended Exposure Guideline (REG) of 0.6 microgram of beryllium per cubic meter of air ($\mu\text{g}/\text{m}^3$) (Inhalable), measured as an 8-hour time weighted average (TWA) or the occupational exposure limit (OEL) applicable to the Member State for airborne beryllium.

The Electrical Discharge Machining (EDM) process generates fine particulates and fumes that must be controlled. The machining action takes place in a dielectric fluid which serves to control the spark, cool the work and flush the particulate from the spark area. The particulate accumulates in a sump for eventual disposal. The dielectric fluid should be filtered to minimize particulate build-up in the solution.

While most of the metal particulate is contained in the dielectric fluid, visible fuming and surface agitation of the dielectric fluid often occurs. In this case, ventilation must be provided above the fluid to insure capture of the fume and particulate. Local exhaust ventilation (LEV) is the preferred control technology.



RAM EDM

EDM FLUID

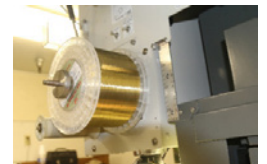
The proper use of EDM dielectric fluids is usually an effective method for controlling the airborne generation of beryllium containing particles. Care should be given to fluid containment and to prevent splashing onto the floor areas or operators' clothing. The recycling of EDM fluids containing finely divided beryllium particles in suspension can result in the buildup to a point where particles may become airborne during use. EDM dielectric fluids should be filtered or changed regularly to reduce the accumulation of beryllium-containing particulate.



WIRE EDM

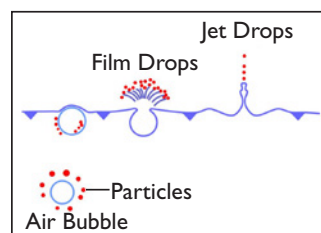
EDM WIRE

Used EDM wire will have residual beryllium-containing particulate on the surface of the wire. The subsequent handling of used, bulk EDM wire presents a potential for airborne beryllium exposure. The collection of used wire from the EDM machining center directly into disposal/recycle containers will reduce operator exposure during handling. In addition, used wire should be kept wet to suppress the potential for airborne generation of particulate during handling.



BUBBLE-BURSTING

Particles suspended in dielectric fluid can be released into the air when the surface of the solution is agitated.

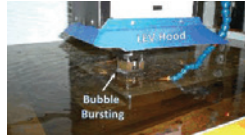


**Bubble-Bursting
can Generate Aerosols**

**Wet machining reduces,
but does not eliminate
aerosol production**

EXHAUST VENTILATION

Process ventilation is required when there is potential for worker exposure. Local exhaust ventilation (LEV) is the preferred control technology. Where utilized, exhaust inlets to the ventilation system are generally positioned as close as possible to the source of generated airborne particulate (EDM electrode). The type and capacity of the LEV will depend on the EDM process and equipment.



As part of the ventilation equipment, process exhaust air should be directed through a High Efficiency Particulate Air (HEPA) filtering device to the outdoors where it will not be recirculated back to the work area.

Ventilation equipment must be inspected regularly to ensure it is functioning properly. Provide training on the use, operation and maintenance of ventilation systems to all users.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

When engineering and/or work practice controls are not practical or effective, personal protective equipment (PPE) must be used to prevent skin contact and inhalation of beryllium-containing particulate. Instruct operators to wear gloves when handling parts that are not visibly clean.



Ensure that work clothing, e.g. pants and shirts, are maintained in a visibly clean condition when there is potential for contact with beryllium-containing particulate or solutions.

When airborne exposures exceed or have the potential to exceed REG or OEL, approved respirators must be used as specified by an industrial hygienist or other qualified professional.

MAINTENANCE

Under certain conditions the repair or maintenance of equipment can generate airborne particles. Protecting workers can require the use of specific work practices or procedures involving the combined use of ventilation, wet and vacuum cleaning methods, respiratory protection, decontamination, special protective clothing and when necessary, restricted work zones. Detailed procedures for safely maintaining the process equipment and ventilation systems should be developed. All operators and maintenance personnel need to be trained in the established procedures prior to performing maintenance or service activities. The procedures should detail the use of wet methods or HEPA vacuuming, ventilation and appropriate PPE to prevent exposures to airborne particles.



ADDITIONAL INFORMATION

Additional worker protection guidance can be obtained online at www.beryllium.eu or by contacting the Beryllium Science & Technology Association (BeST) at: Rue Belliard 40, 1040 Brussels, Tel: +32 (0)2 213 74 20 | Email: info@beryllium.eu

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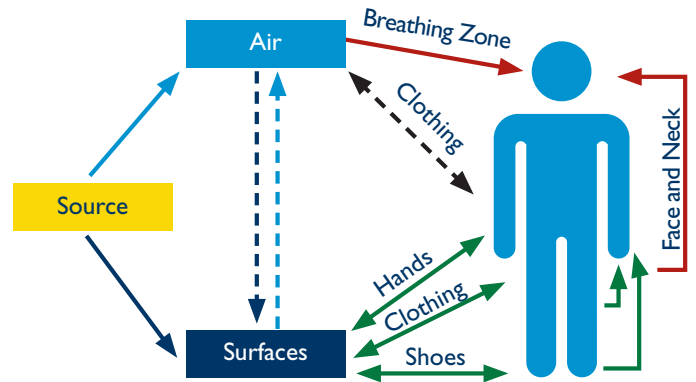
HOUSEKEEPING

Good work practices and the implementation of procedures for keeping the EDM work area and floors clean and free of beryllium-containing alloy particulate accumulations are important methods for maintaining exposures reliably below the REG or applicable OEL. The use of compressed air or brooms for cleaning should be prohibited. Wet cleaning and HEPA vacuuming are effective methods for cleaning. Disposable rags, towels or wipes should be used to wet clean, not be allowed to dry out and must be kept in a closed container. Rags and towels should not be reused. EDM processes can deposit fine beryllium-containing particulate on machine surfaces and fabricated parts. Fabricated parts should be kept clean between processing steps to avoid potential re-suspension of fine particles into the air.



WORKPLACE EXPOSURE CHARACTERIZATION

In accordance with good industrial hygiene practice, a characterization of worker exposure, including air monitoring, should be conducted for operations where a potential for beryllium exposure exists.



RECYCLING / DISPOSAL

Beryllium-containing scrap is a valuable material and should be recycled whenever possible. Beryllium-containing scrap should be kept segregated from other metals to retain its higher value as a recyclable material.



If not recyclable, materials containing beryllium are considered waste and must be disposed in accordance with applicable EU and Member State regulations. Beryllium-containing wastes should be maintained in a moist condition during collection, storage and disposal, double bagged in plastic and sealed in an appropriate container to minimize the potential for release and exposure.