

## Insufficient Water Leads to Elevated Airborne Concentrations of Beryllium During Decontamination

In May 2003, four workers, wearing respiratory protection, were decontaminating the firing chamber of the LLNL Contained Firing Facility (CFF) after the performance of a detonation experiment containing beryllium (Be). (See photo of chamber below.) The Hazards Assessment and Control (HAC) procedure called for the chamber to be wetted to reduce dust production, followed by wet sweeping to remove particulate contamination on the floor of the chamber.



**Inside chamber of the Contained Firing Facility**

Workers inspecting the chamber prior to commencing work in the morning found the chamber had puddles of water with some dry areas in between the puddles. Believing the chamber to be sufficiently wet, the workers proceeded with the decontamination.

Upon receipt and review of the personal exposure monitoring results for the morning work, it was determined that three of the four workers exceeded the Chronic Beryllium Disease Prevention Program (10 CFR 850) permissible exposure level (PEL) of  $2 \mu\text{g Be}/\text{m}^3$  averaged over 8 hours by a substantial margin, without taking into account their respiratory protection factors.

In the afternoon, the chamber was thoroughly wetted prior to decontamination work. The personal monitoring results for the afternoon work show a significant reduction in the airborne concentrations, although still elevated above the 10 CFR 850 action level. Due to all personnel wearing the required PPE, including respirators, none of the workers exceeded the Be PEL, and only one worker met the Be action level.

Note the action level for Be is 1/10 of the PEL, or 0.2 µg Be/m<sup>3</sup> averaged over 8 hours. If the action level is met or exceeded, 10 CFR 850 requires the implementation of worker protection provisions.

On subsequent days where the chamber was thoroughly wet prior to initiating decontamination work, the exposure monitoring results were all below the 10 CFR 850 action level.

### What Was Learned

- When using any beryllium decontamination technique (such as sweeping) that has even a minimal potential for light abrasive action causing airborne particulates, water must be applied prior to using the technique to prevent excess airborne beryllium concentrations.
- It is not adequate to rely upon the spread of water from puddles over adjacent damp or drying areas to reduce dust production.
- Once airborne, fine particles of beryllium will remain airborne for quite some time despite the application of water to surfaces or even misting water in air.

### Recommended Action

When performing area beryllium decontamination:

1. Thoroughly wet all surfaces, leaving no dry spots, prior to applying any potentially abrasive decontamination technique.

The HAC procedure for the CFF was modified to state that the chamber shall be "thoroughly wetted" prior to decontamination activities.

2. Utilize ample surface wetting to help prevent the spread of Be contamination to other areas.
3. Be alert to changing conditions such as accelerated drying caused by ventilation and exposure of previously inaccessible surfaces during cleanup operations. Reapply water liberally when dry surfaces are evident.
4. Substitute cleaning techniques that minimize abrasive potential where practicable.
5. Identify cracks, crevices and collection points associated with moving areas (e.g. door seals) that can create airborne beryllium particulates, and specify control methods in procedures.
6. Leave the area if you suspect that work may have resulted in airborne contamination. A combination of time, ventilation, and wet conditions is necessary to reduce airborne concentrations in the proximity of highly contaminated surfaces.
7. Use Wetting methods during the removal of dust and debris containing other hazardous materials such as asbestos and lead. Avoid dry clean up (e.g., dry sweeping and shoveling) which may cause the airborne release of particulates.

### Where to Get Help or More Information

- Your ES&H Team Industrial Hygienist.

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