Beryllium Occupational Health Issues

John Bishop, MS, CIH
Navy & Marine Corps Public Health Center
## Report Documentation Page

Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

<table>
<thead>
<tr>
<th>1. REPORT DATE</th>
<th>2. REPORT TYPE</th>
<th>3. DATES COVERED</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEP 2003</td>
<td></td>
<td>00-00-2003 to 00-00-2003</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4. TITLE AND SUBTITLE</th>
<th>5a. CONTRACT NUMBER</th>
<th>5b. GRANT NUMBER</th>
<th>5c. PROGRAM ELEMENT NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beryllium Occupational Health Issues</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>6. AUTHOR(S)</th>
<th>5d. PROJECT NUMBER</th>
<th>5e. TASK NUMBER</th>
<th>5f. WORK UNIT NUMBER</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)</th>
<th>8. PERFORMING ORGANIZATION REPORT NUMBER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Navy &amp; Marine Corps Public Health Center, 620 John Paul Jones Circle, Suite 1100, Portsmouth, VA, 23708-2103</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)</th>
<th>10. SPONSOR/MONITOR’S ACRONYM(S)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>11. SPONSOR/MONITOR’S REPORT NUMBER(S)</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>12. DISTRIBUTION/AVAILABILITY STATEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approved for public release; distribution unlimited</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>13. SUPPLEMENTARY NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASETSDfense 2009: Sustainable Surface Engineering for Aerospace and Defense Workshop, August 31 - September 3, 2009, Westminster, CO. Sponsored by SERDP/ESTCP.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>14. ABSTRACT</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>15. SUBJECT TERMS</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>16. SECURITY CLASSIFICATION OF: a. REPORT b. ABSTRACT c. THIS PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>unclassified</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>17. LIMITATION OF ABSTRACT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Same as Report (SAR)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>18. NUMBER OF PAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>19a. NAME OF RESPONSIBLE PERSON</th>
</tr>
</thead>
</table>

---

Standard Form 298 (Rev. 8-98)  
Prescribed by ANSI Std Z39-18
Disclaimer

• The views expressed in this presentation are those of the author and do not necessarily reflect the official policy or position of the Department of the Navy, Department of Defense, nor the U.S. Government
OEL issues (true etiology for standard setting?)

• Maintain exposures below the occupational exposure limit

• However, it appears –
  – Rates of sensitization and chronic beryllium disease (CBD) could be related to work areas where particle sizes are small
  – Total mass measurement of beryllium in air is a poor marker of biological risk of CBD
Occupational Exposure Limits (OEL) issues (true etiology for standard setting?)

• Putting together what is suspected so far:
  – Sensitization and CBD related to particle size and relative to surface area
  – Sensitization and CBD related to chemical form

• Is measuring total beryllium mass concentration obscuring the exposure-response relationship?

• Evaluating the relationship of particle size and CBD
  – Are we currently using an exposure standard with the wrong metric?
OEL issues (true etiology for standard setting?)

- Define a safe air concentration limit? “Not likely” (K. Kreiss, 2007)
  - Need to know physicochemical characteristics of the aerosols
  - Characterized by:
    - Chemistry
    - Size
    - Surface area
    - Solubility in body fluid compartments
Workplace Exposure Assessment

Issues

• Current Occupational Exposure Limits (OELs)
  – Occupational Safety and Health Administration (OSHA) (29 CFR 1910.1000 Table Z-2)
    – 2 ug/m³ 8-Hour TWA
    – 5 ug/m³ Ceiling
    – 25 ug/m³ Acceptable Maximum Peak (30 Min)
  – National Institute for Occupational Safety and Health (NIOSH)
    – 0.5 ug/m³ any time
  – American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV)
    – New! 0.05 ug/m³ TWA Inhalable
  – Department of Energy (DoE 10 CFR 850)
    – 2 ug/m³ 8-Hour TWA with an Action Level of 0.2 ug/m³
Workplace Exposure Assessment Issues

• What OELs do the services use?
  – OSHA Permissible Exposure Limits (PELs) by law
  – Army, Air Force mainly the TLVs
  – Navy - OSHA but could suggest TLVs if supported by local resources
Impact of using new Threshold Limit Value (TLV)

- TLV mass currently under limit of quantification for current sampling and analytical methods to assess exposures.
- Need an increase of air volume sampled to get the Reporting Limit down to at least one half of the TLV.
- May require an increase in sample time (to gain necessary volume)
  - Reduces the ability to evaluate "transient" (short term) exposures or to determine the actual task that causes exposures.
Impact of using new TLV

• A change in the sampling and analysis methodology (inhalable) will most likely not be equated to previous airborne evaluations and exposure estimates of previously evaluated operations.

• Increase costs (Inhalable Sampler)
  – Management issues of sending the inhalable inserts to the lab with a needed protocol for appropriate cleaning and the ultimate return to the user
What are other agencies doing (DoE, NNSA)?

• National Nuclear Security Administration (NNSA) putting together a guidance document for non-beryllium work areas.
  – Includes surface wipe sampling. This effort may be cancelled.

• Department of Energy (DoE) looking at updating their rule.
  – DoE rule forces the responsibility of identifying Beryllium on the Safety and Health Community. This should be a Weapon System Program Manager responsibility.
Potential OSHA rulemaking issues

- OSHA rulemaking still on the agenda
- OSHA posed the question whether to adopt the DoE rule.
  - No!
Surface Contamination issues

• Recent research (proof of concept) that 1 micron particles can penetrate through the skin. If Beryllium particles present, there is a chance of sensitizing workers.

• Los Alamos incident – Surface contamination of a museum of Beryllium artifacts. They contacted over 2100 known visitors for follow-up
Air Force funded study - Of special concern are the recommendations
– Cannot define an appropriate OEL. This can be interpreted that if a beryllium exposure can be measured, it is an unacceptable risk. This would significantly increase the number of “workers exposed” regardless of actual risk.
The Genetic Information Nondiscrimination Act of 2008

- Genetic predisposition to become sensitized to Beryllium
- Regulations were to be promulgated by May 09. They are way behind.
- The law also prohibits most employers from using genetic information for hiring, firing, or promotion decisions, and for any decisions regarding terms of employment.
Beryllium Lymphocyte Proliferation Test

- A test to determine if an individual is sensitized to Beryllium.
  - Sensitized at work? Home? Previous job?

- Once declared positive for being sensitized, what will the employer need to do?
  - Note 1 – 2 % positives are being seen of new hire workers who have never worked with it.
• Uses of beryllium
Aircraft landing gear bushings - Copper/Beryllium
Flight surface actuator bearings – Copper/Beryllium
Beryllium windows for X-ray/electron beam units
Early Capsule Heat shield
Military Ruggedized Lap Top Computer Case
Copper/beryllium
Parts fabricated. Some
are in your computer
Beryllium oxide ceramic electronic parts. Beryllium ceramics are good electrical insulators and are very efficient in transferring heat.
Molds to make plastic bottles
Electrical Spring Contacts
Antenna Strong back – Used for its light weight and dimensional stability
An emerald is a crystalline form of beryllium aluminum silicate.
Discussion?