Elmore Plant
Delta Utah Ore Processing Mill
Design Philosophy

- **Containment**
  - Equipment designed with complete containment of beryllium
  - Goal to have exposures no greater than 0.2 µg/M^3 throughout the facility with no more than one percent chance of exceeding limit

- **Isolation and migration control**
  - Cellular building structure to isolate major equipment or processes in separate rooms
  - Utilize air locks or quick opening/closing doors between rooms
  - Isolation ensures that incidents in any one room will not impact other operations
  - No outside storage
Ventilation

- Process exhaust ventilation is the primary control of workplace beryllium emissions
- General ventilation is used for removal of any beryllium equipment emissions
- No fugitive emissions should escape from the building during normal and upset conditions
- Utilize nuclear grade collectors with bag in/bag out change systems
- Use Best Available Technology
Zone Control

► Hot, Warm, Clean Zones
► Box in a Box in a Box
► Airflow and Air Pressure management
► Sequestration of ancillary and support equipment
  ► Circulation pumps, MCC, Electrical boxes
  ► Locate outside the Hot Zone
► HEPA filtration of support areas
  ► Offices
  ► Maintenance
Personal Protective Equipment (PPE)

- Appropriate secondary control to ventilation exhaust system
- Appropriate PPE is required for entry to Process Cells
- PPE worn for upset conditions
Migration Control

- Use transition zones
- Air showers
- PPE Donning/doffing areas
- PPE equipment storage
- Disposal of PPE
  - Can with lid
- Janitorial support
Hierarchy of Controls

**Source**
- Equipment Modification
- Ventilation – air flow

**Area**
- Migration control
- Housekeeping – 5S, Janitor
- Transition Zones
- Ventilation – air flow

**Person**
- Training - certifications
- PPE – gloves, suits, 100% RP, booties
Transition Areas

- MILL
- CENTRIFUGE
- ABF HANDLING
- AIR SHOWER
Exposure Control Strategies

CNC Machining
### Exposure Control Strategies

#### CNC Machining – Control Criteria

<table>
<thead>
<tr>
<th>Be/AlBeMet/BeO</th>
<th>Alloys</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full enclosure (for mist &amp; chip containment)</td>
<td>Full enclosure (for chip containment)</td>
</tr>
<tr>
<td>Flood coolant</td>
<td>Flood coolant</td>
</tr>
<tr>
<td>Local exhaust ventilation (LEV) (Minimum of 250 fpm average capture velocity at all enclosure openings)</td>
<td></td>
</tr>
<tr>
<td>10 cabinet volume air changes before opening enclosure</td>
<td></td>
</tr>
<tr>
<td>Enhanced coolant filtration</td>
<td></td>
</tr>
</tbody>
</table>
Exposure Control Strategies

- CNC Machining – Control Criteria
  - Enhanced coolant filtration – one shop’s practice
    - AlBeMet CNC machining
    - 50 μm pleated filter on recirculation loop
    - 5 μm pleated filter on supply to tooling
    - New coolant & track Be concentration over time

<table>
<thead>
<tr>
<th>Date</th>
<th>Be Result ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>9/6/2007</td>
<td>0.13</td>
</tr>
<tr>
<td>9/17/2007</td>
<td>0.15</td>
</tr>
<tr>
<td>11/7/2007</td>
<td>850</td>
</tr>
<tr>
<td>12/11/2007</td>
<td>1500</td>
</tr>
<tr>
<td>1/9/2008</td>
<td>1900</td>
</tr>
</tbody>
</table>
Exposure Control Strategies

CNC Machining – Control Criteria

- Enhanced coolant filtration – one shop’s practice

<table>
<thead>
<tr>
<th>Date</th>
<th>Be Result ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>2/20/2008</td>
<td>4.0</td>
</tr>
</tbody>
</table>

[Be] of coolant

50 µm Pleated Filter
100 µm Woven Filter

ChipBLASTER
High Pressure/H2O Apple coolant system

100 µm Woven Filter
Coolant Reservoir Loop

5 µm Pleated Filter
Feed to Tooling
Exposure Control Strategies

- Beware “Bubble Bursting” effect – Control Criteria
Exposure Control Strategies

- Sawing
## Exposure Control Strategies

### Sawing – Control Criteria

<table>
<thead>
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<th>Be/AlBeMet/BeO</th>
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<tbody>
<tr>
<td></td>
<td>Prohibit “dry” abrasive saws</td>
</tr>
<tr>
<td></td>
<td>Band saws whenever feasible</td>
</tr>
<tr>
<td></td>
<td>Flood coolant</td>
</tr>
<tr>
<td></td>
<td>Chip containment</td>
</tr>
</tbody>
</table>
Exposure Control Strategies

- CuBe Benching/Grinding/Deburring – One shop’s experience, before enhanced controls.

Baseline Exposure Evaluation

Seventeen (17) full shift exposure samples were collected in the breathing zone of operators performing Benching on internal injection mold cavity surfaces containing CuBe Alloy 25.

Personal Sample Results

<table>
<thead>
<tr>
<th>Number of Samples</th>
<th>Range $\mu g/m^3$</th>
<th>Percent Exceedance$^1$ at 0.2 $\mu g/m^3$</th>
<th>UTL$^{(95/95)}$$^2$ $\mu g/m^3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>0.012 - 0.900</td>
<td>43.5</td>
<td>2.62</td>
</tr>
</tbody>
</table>

$^1$Percentage of exposures expected to exceed 0.2 $\mu g/m^3$. A percent exceedance of < 5% is considered to be “Well Controlled”.

$^2$Upper Tolerance Limit – one can be ninety-five-percent confidence that fewer than 5% of measurements are above the UTL(95/95)
Exposure Control Strategies

- CuBe Benching/Grinding/Deburring – Hood Design Criteria
Exposure Control Strategies

- CuBe Benching/Grinding/Deburring – Hood Design Criteria
  - Target $Q_{\text{hood}} = 250 \text{ cfm/ft}^2$ of face opening
  - Open face area of hood = 54” x 30” x 24” = 11.25 ft$^2$
  - Required $Q_{\text{hood}} = 250 \text{ fpm} \times 11.25 \text{ ft}^2 = 2,813 \text{ cfm}$
  - Target $V_{\text{slot}}$ minimum = 2000 fpm
  - 5 (52”x 0.75”) slots/hood = 1.354 ft$^2$ total slot area
  - $V_{\text{slot}} = 2,813 \text{ cfm}/1.354 \text{ ft}^2 = 2,091 \text{ fpm}$
Exposure Control Strategies

■ CuBe Benching/Grinding/Deburring

Post Intervention Exposure Evaluation

Twenty-eight (28) full shift exposure samples were collected in the breathing zone of operators performing Benching on internal injection mold cavity surfaces containing CuBe Alloy 25.

• Personal Sample Results

<table>
<thead>
<tr>
<th>Number of Samples</th>
<th>Range (\mu g/m^3)</th>
<th>Percent Exceedance(^1) at 0.2 (\mu g/m^3)</th>
<th>UTL(_{(95/95)})(^2) (\mu g/m^3)</th>
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<tbody>
<tr>
<td>28</td>
<td>0.0084 - 0.0577</td>
<td>0.27%</td>
<td>0.088</td>
</tr>
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</table>

\(^1\)Percentage of exposures expected to exceed 0.2 \(\mu g/m^3\). A percent exceedance of < 5% is considered to be “Well Controlled”.

\(^2\)Upper Tolerance Limit – one can be ninety-five-percent confidence that fewer than 5% of measurements are above the UTL(95/95)
## Exposure Control Strategies

**Benching/Grinding/Deburring – Control Criteria**

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<tr>
<th>Be/AlBeMet/BeO</th>
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<tr>
<td>Full enclosure LEV glove-box, backdraft/ downdraft table (Minimum of 250 fpm capture velocity at all enclosure openings)</td>
<td>Partial LEV enclosure, backdraft/downdraft table</td>
</tr>
<tr>
<td>10 cabinet volume air changes before opening enclosure</td>
<td>Minimum of 250 fpm average at face of hood</td>
</tr>
<tr>
<td>Must control cross drafts</td>
<td></td>
</tr>
</tbody>
</table>

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- Be/AlBeMet/BeO alloys require controlled environments to manage exposure.
- Full enclosure LEV glove-box systems with backdraft/downdraft tables are recommended.
- Minimum capture velocity at all enclosure openings is 250 fpm.
- 10 cabinet volume air changes are necessary before opening enclosures.
- Cross drafts must be controlled to ensure effective exposure control.

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[1] Be/AlBeMet/BeO: Be and AlBeMet are alloys with low melting points, necessitating controlled environments to prevent exposure.

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Materiol
Exposure Control Strategies

- Sandblasting
Exposure Control Strategies

- Sandblasting

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Questions

Materion Contact

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