
Beryllium Contamination on Internal Surfaces of Personal Air Sampling Pumps Used in a Beryllium Machine Shop

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Background

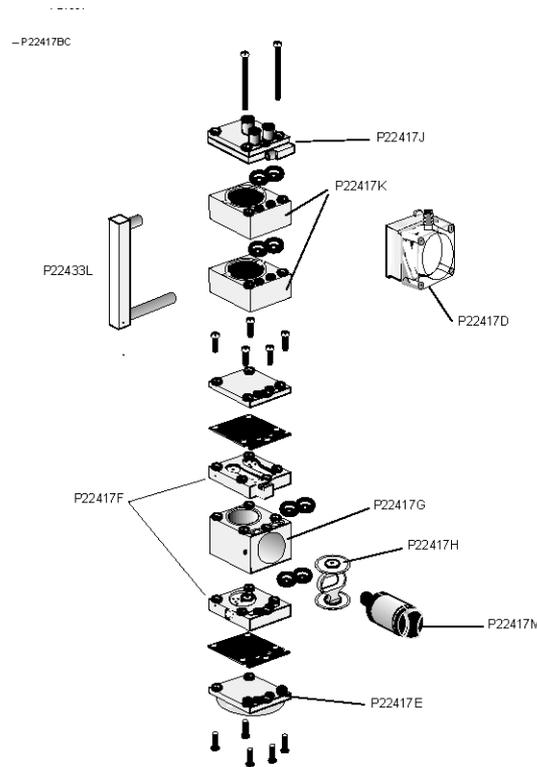
- A set of 8 personal air sampling pumps were dedicated for use in a former beryllium machine shop.
- The pumps were in service for up to six years and did not leave that area until they were packaged for storage.
- Pumps were typically in use 3 to 5 days per week.
- Sampling times were typically 4 to 12 hours per day.
- Pump batteries were replaced once.
- Inlet filter replacement history was not documented.
- Periodic external wet wiping was employed to keep outer pump surfaces relatively clean.

Pump Disposal Process

- Pumps contained NiCd batteries, circuit boards, and soldered connections that required dismantling for separation of components into appropriate waste streams.
- Dismantling and component separation took place on a table directly in front of a fume hood. Air flow averaged 75 fpm across the tabletop away from the worker.
- For the filter housing all 8 pumps were sampled. For other pump areas, 4 pumps were randomly selected.
- Surface samples were collected on pump surfaces using Whatman 541 filter papers wetted with distilled water.
- High volume area and personal breathing zone were collected during this process.

Results - Pump Diaphragms

- Surfaces of diaphragms and valve plates (n = 4; 3 < RL).
 - mean = 0.025 ug/sample
 - maximum = 0.031 ug/sample



Exploded view of stack # P22433RS2

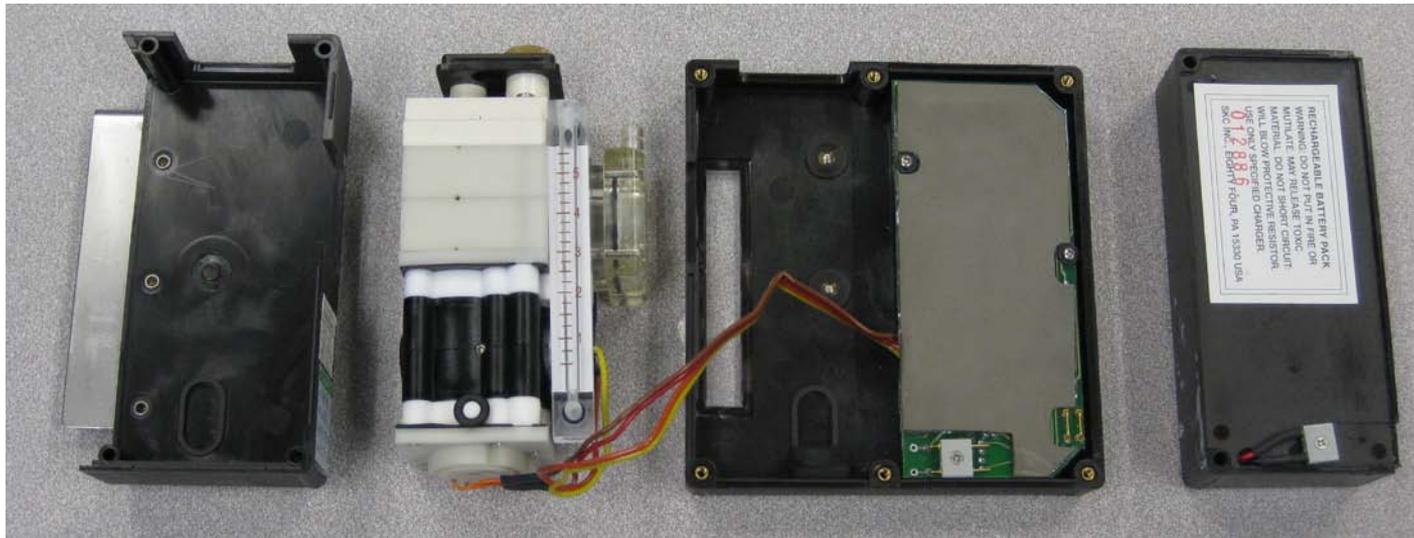
Results - Filter Housing

- Filter and wipe of pre-filter housing (n = 8; 1 < RL).
 - mean = 3.54 ug/sample maximum = 8.5 ug/sample
- Wipe of post-filter housing (n = 8; 4 < RL).
 - mean = 0.13 ug/sample maximum = 0.21 ug/sample



Results - Surfaces Inside of Case

- Inner surfaces of battery (n = 4; 0 < RL).
 - mean = 0.42 ug/100 cm² maximum = 0.71 ug/100 cm²
- Inner surfaces of case around pump stack (n = 4; 0 < RL).
 - mean = 0.42 ug/100 cm² maximum = 0.66 ug/100 cm²



Results - Outer Surfaces

- Outer surface of case (n = 4; 0 < RL).
 - mean = 0.09 ug/100 cm² maximum = 0.19 ug/100 cm²
- Top of pump under cap screws (n = 4; 0 < RL).
 - mean = 8.06 ug/100 cm² maximum = 14.6 ug/100 cm²



Results - Belt Clip

- Surfaces between pump and belt clip (n = 4; 0 < RL).
 - mean = 29.7 ug/100 cm²
 - maximum = 50.0 ug/100 cm²



Air Monitoring Results

- All air monitoring samples (3 high volume area and 2 personal breathing zone) were below the analytical reporting limit of 0.023 ug/filter.
- Calculated 8hr TWA:
 - Personal Breathing Zone < 0.013 ug/m³
 - High Volume Area < 0.003 ug/m³
- No airborne beryllium was detected. However, in this case ventilation was employed and the worker used careful, deliberate actions to prevent the expected contamination from becoming airborne.

Conclusions

- The levels of beryllium contamination found on normally enclosed surfaces may represent an **exposure risk** to technicians servicing sampling pumps.
- This would apply to contaminants other than beryllium. Areas of concern might be:
 - Other toxic metals, pesticides, pharmaceuticals, engineered nano materials, etc.
 - “Dirty” industries where high levels of airborne contaminants might be expected.
- Internal pump contamination is **not** believed to be an exposure concern for the workers wearing the pumps.

Recommendations

- All servicing of air sampling pumps should assume that pump surfaces may be contaminated with toxic materials and adopt “universal precautions”:
 - Perform all dismantling and service work in a hood or with other appropriate ventilation controls.
 - PPE such as gloves and lab coat as a minimum.
 - Wet-wipe outer pump surfaces after servicing.
- Users of air sampling pumps should:
 - Ensure that a sampling filter is always in place when the pump is running (i.e. during warm-up).
 - Cover pump when sampling in “dirty” environments.
 - Wet-wipe outer pump surfaces after using.

Questions



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