An Improved Beryllium Determination for Air Filters and Surface Smears Utilizing High Throughput Automated Fluorescence

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- Instrumentation and analysis costs

Fluorescence method

Approved methods:

- ASTM D7202
- NIOSH 7704
- NIOSH 9110

Basic methods designed for field use, or small sample load.

Current instrumentation utilizes manual analysis.

Other analysis methods

ICP-OES

- Mature method used by many labs
- Highly automated
- Good detection limits
- Excellent dynamic range
- Problems with spectral interferences
- Instrument costs are high

Other analysis methods

ICP-Mass Spectroscopy

- Excellent detection limits (ppt)
- Require a lot of upkeep to maintain
- Instrument costs are high (>>ICP)
- Not well suited for large sample batches
- Daily use is difficult to maintain

Other analysis methods

Graphite furnace AAS

- Excellent detection limits
- Capable of handling difficult matrices
- Limited dynamic range
- High operating cost

Automated Fluorescence

- Utilizes robotic liquid handling system and microplate reader instrument.
- Analysis of 96 well plate possible in < 3 minutes.
- Excellent detection limits (0.00075 µg/wipe)
- Large analytical range (0.01µg - 20 µg)
- Highly specific for beryllium, few analytical interferences

Y-12 ICP method

Batch size = 45 air/smears

Sample digestion time = 63 minutes
ICP determination time = 180 minutes
Total analysis time = 243 minutes

Per sample time = 5.4 minutes/sample

Automated fluorescence method

Batch size = 80 air/smears

Sample prep time = 175 minutes

Fluorescence determination time = 2 minutes

Total analysis time = 177 minutes

Per sample time = 2.2 minutes/sample

Advantegeous

- Robotic liquid handling system reduces ergonomic issues with manual prep
- Instrumentation requires little maintenance
- Allows very large batches for increased capacity
- 4-tip system: 400 samples/8 hr shift
- 8-tip system: 800 samples/8 hr shift
- Decreases turnaround time by about 50%
- Overall analytical costs will decrease