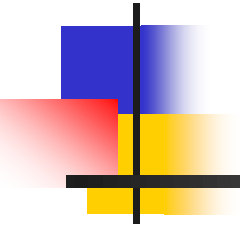


Exposure Assessment Strategies





Exposure Assessment

- Purpose
- Tools
- Strategies
- Analytical Chemistry
- Closing



Exposure Characterization- Purpose

- New/modified process baseline
- Respiratory protection (RP) decision making
- Problem Solving
- Intervention verification
- Surveillance

Exposure Characterization Flowchart

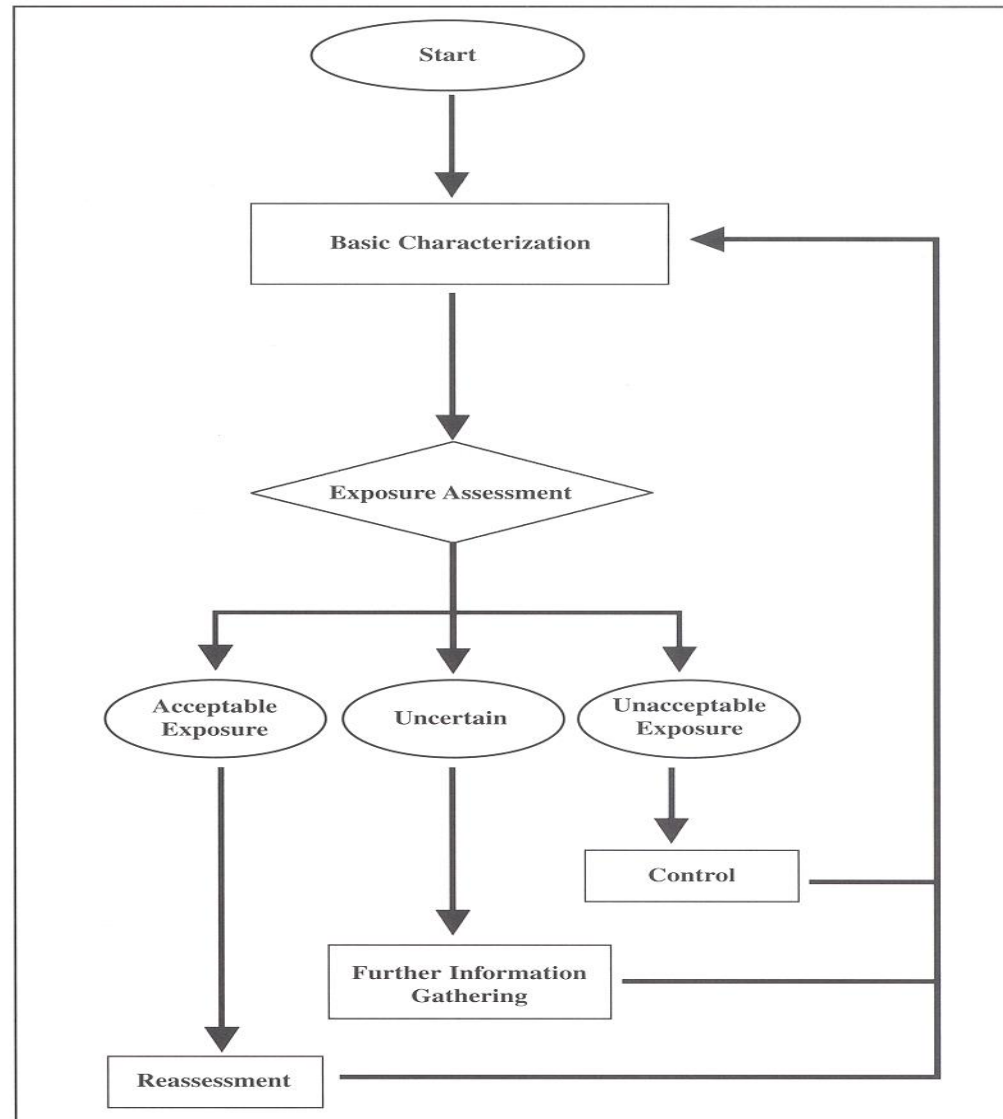


Figure 1.2 — A strategy for assessing and managing occupational exposures.



New/modified process- baseline

- **Purpose:** establish central tendency and variation for airborne beryllium levels (PROFILING)
 - Number of samples to be collected (N= 6-15)
 - Statistical treatments (% exceedance, GM, GSD, UTL 95/95)
 - Number/location of operators to be sampled
 - Shift schedule



Respiratory Protection Decision Making- Job Level

- **Purpose:** Determine if RP is required and what level
 - Use data generated during baseline sampling
 - Use statistical model to establish need (% exceedance of OEL/Action Level)
 - Use statistical model for level of protection (UTL 95/95)



Respiratory Protection Decision Making- Job Level

RP required when the following conditions are met for a given job:

- Total Mass:

- greater than 1.0 percent exceedance of 0.2 ug/m³ (95CI)

UTL 95/95 is used to determine the level of protection required. UTL 95/95 >2.0 ug/m³ exceeds the MUC for a half mask respirator.



Problem Solving

- **Purpose:** Discover tasks within job contributing to exposure profile magnitude
 - Perform qualitative exposure assessment
 - Rank tasks by potential for exposure
 - Characterize priority tasks using high volume sampling methods
 - Use solid problem solving skills (6 Sigma) to develop interventions



Intervention Verification

- **Purpose:** Verify interventions have reduced exposure levels
 - Resample priority tasks and compare with pre-intervention data set
 - Conduct baseline sampling when satisfied
 - Re-characterize profiles
 - Adjust RP requirements if appropriate



Surveillance

- **Purpose:** Verify exposure conditions have not changed
 - Use exposure magnitude and variability from baseline survey to determine surveillance frequency
 - Elevated central tendency and variability decreases time between sampling events
 - Compare against baseline



Sampling Techniques and Their Applications

- Four different types of air samples and their uses
 - Low flow lapel sampling
 - High volume sampling
 - Process capability sampling
 - Particle size sampling



Sampling Techniques and Their Applications

- Low Flow (full shift, personal sampling)
 - 2.0 LPM, 37mm 0.8 MCE filter cassette (typical for metals).
 - Placed in the employees breathing zone.
 - Left vs. right handedness is an important consideration during sampling.
 - Smoke test work area for general air patterns.
 - The usual



Sampling Techniques and Their Applications

- Low Flow Lapel Samples
 - Good for assessing the person's 8-hour average total mass exposure
 - Equipment to take samples readily available
 - Familiar method
 - Sample bias due to employee wearing filter.
 - Possible bias from clothing contamination.
 - Difficult to account for short-term low exposures.



Sampling Techniques and Their Applications

- High Volume Sample

- Collect sample with 15-20 LPM pumps equipped with 37 mm closed face cassette
- Use for area sampling or task sampling of >20 minutes in duration



Sampling Techniques and Their Applications

- High Volume Sample
 - Good for assessing short-term exposure.
 - Uses conventional equipment and filters.
 - Quieter and limited interference with operator.
 - Can be hand held or tethered.
 - Good for sampling processes to detect sources of emission.



Sampling Strategies and Their Applications

- Who should be monitored?
 - Operations employees
 - Maintenance employees
 - Anyone with incidental Be contact with manufacturing associated beryllium-containing particulate
 - Support areas



Sampling Strategies and Their Applications

- **Wipe samples- Technique**
 1. Find a nonporous surface with suspect beryllium contamination.
 2. Obtain a ghost wipe
 3. With clean hands, wipe a 100 cm² surface until visually clean.
 4. Place in sample container and send to lab for analysis.



Sampling Strategies and Their Applications

- Wipe samples- Pros
 - Gives a general indication of whether beryllium is being released into the work or non-work environment.
 - Assesses cleanliness of material released to general public
 - General indication of effectiveness of housekeeping programs
 - General indication of effectiveness of dermal protection programs



Sampling Strategies and Their Applications

- Wipe samples- Cons
 - Semi-quantitative at best
 - No standardized ANSI method on the technique of wipe sampling
 - Can't sample porous surfaces
 - Not correlated with airborne exposures
 - No relationship with CBD
 - Linkage between level present on skin and sensitization not established



Analytical Chemistry

- Sample Analysis- Analytical Methods (3)
 - Flame AA
 - ICP
 - NIOSH Method 7102 – Graphite Furnace
 - NIOSH Method 7300 – ICP-AES



Analytical Chemistry

- Limit of detection (LOD) - is beryllium present or not?
 - 3 sigma above mean blank signal. Many labs mistakenly report this value as the PQL.
- Limit of quantification (LOQ) - lowest measurable value.
 - How much Be is there? This value is often not reported in an obvious fashion.
 - 5-10X LOD



Analytical Chemistry

- Sample Analysis- Flame Atomic Absorption
 - Flame AA is good for concentrations of beryllium from 0.1 ug and up.
 - Cheap and easy.
 - Not very good if you need to resolve lower detection limits



Analytical Chemistry

- Sample Analysis- Inductively Coupled Plasma
 - Detection limits of 0.007ug are possible
 - More expensive
 - When to use it?
 - Particle size sampling
 - Proving the negative



Exposure Assessment Strategy

- Total IH Survey of Beryllium Operations
 - The rule of thumb is to suspect all operations that involve beryllium.
 - 2.0 ug/m^3 is undetectable by the naked eye.
 - Ask a lot of questions about the operation, downstream and upstream operations.
 - Be very investigative.



Exposure Assessment Strategy

- Familiarize yourself with: AIHA text entitled "A Strategy for Occupational Exposure Assessment".
- Establish similar exposure groups (SEG)
- Rank order exposures based on variability and central tendency.
- Develop prioritization scheme



Statistical Treatment of Air Sample Data

- Use statistical methods described in AIHA text
- Air sampling data used to establish **CONFIDENCE** in prospective exposures
- Exceedance Fraction of OEL
- Upper Tolerance Limit (UTL) 95/95



Closing

- Determine purpose of sampling effort
- Use the right tool for the job
- Be careful interpreting results between LOD and LOQ