BeST
Beryllium Science & Technology Association

Overview of Occupational Exposure Levels for Beryllium Metal

1. OELs Are Set Depending of the Size of the Particles

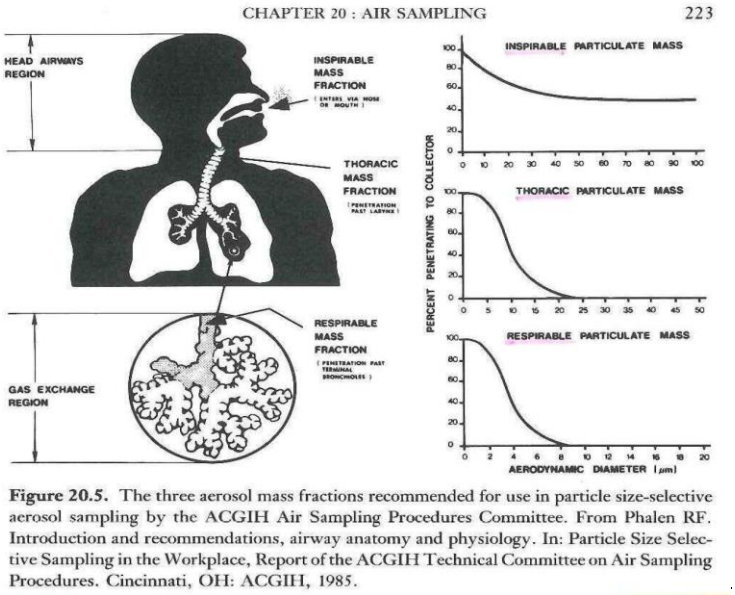


Figure 20.5. The three aerosol mass fractions recommended for use in particle size-selective aerosol sampling by the ACGIH Air Sampling Procedures Committee. From Phalen RF. Introduction and recommendations, airway anatomy and physiology. In: Particle Size Selective Sampling in the Workplace, Report of the ACGIH Technical Committee on Air Sampling Procedures. Cincinnati, OH: ACGIH, 1985.

Large

Inhalable OEL

CFC Total OEL

Respirable OEL

Small

2. Different Scientific Ways to set an OEL

Levels	Definition of Acronyms	Comments
LOAEL	Lowest Observed Adverse Effect Level	Discrete value obtained from studies
NOAEL	No Adverse Effect Exposure Level	Discrete value obtained from a study. A value obtained by applying a safety factor to the LOAEL.
PEL (OSHA)	Permissible Exposure Limit	Risk based and/or technical/economic feasibility based value.
BMD	Benchmark Dose	Transparent quantitative method to derive OEL based on a critical health effect.
DNEL	Derived No Effect Limit	Limit derived by manufacturers for REACH registration

3. Air Exposure Measurement Methods Vary by Region

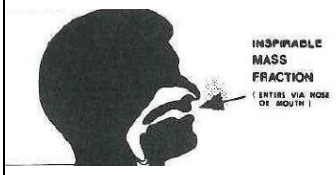
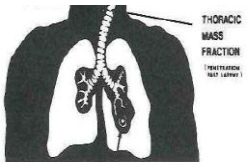
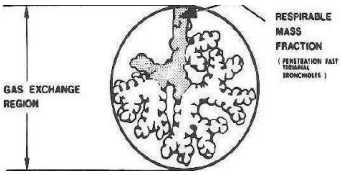
4. Air Sampling Conversion Factor for Be from Scientific Study

Conversion of Epidemiology Data from Closed-Faced Filter Cassette (CFC) Total Particulate to Inhalable requires a Factor of 2.88

0.2 µg/m^3 (CFC Total Particulate) x 2.88 = 0.58 µg/m^3 Inhalable

"A field study was carried out in order to derive a factor for the conversion of historic data on Be concentrations obtained by sampling according to the CFC 'total' particulate method into concentration values to be expected when sampling following the inhalable convention. Workplaces, selected to represent the different CuBe work processing operations that typically occur in Germany and the EU, as well as the USA, were monitored revealing a broad spectrum of prevailing Be size distributions. The data set and the statistical evaluation from this study reveal a geometric mean value of 2.88 for the factor used to convert Be concentrations from CFC sample to concentrations obtained from inhalable samplers. This fact has to be taken into account for the derivation of an OEL from Be epidemiology studies that have been based on the CFC 'total' particulate method, where the inhalable fraction sampling method is to be the basis for assessing compliance. The findings of this study mirror results found in previous studies with in other metal processing plants." Kock W. Beryllium Concentrations at European Workplaces: Comparison of 'Total' and Inhalable Particulate Measurements. *Ann. Occup. Hyg.*, 2015, 1–9, DOI:10.1093/annhyg/mev009.

5. On-going Recommendations for a Be OEL – Overview

Institution	***Inhalable fraction*** **(<100 µm)**	**CFC Total Particulate fraction (<30 µm)**	**Respirable fraction (< 10 µm)**
			
BeST		0.2	
US OSHA		0.2	
Germany	0.14		0.06
Spain	0.2		
Ireland		0.2	
Finland	0.1		
Poland		0.2	
Conversion Factors Fraunhofer	2.88	1	
Proctor DNEL Study (ECHA Protocol)	0.41	0.14	0.065

6. BeST Beryllium Exposure and Disease Statistics Survey of Member State Authorities and Customers

Member State Responses: Two cancer cases reported in the EU. Both cancer cases were in industries not served by the Be industry. 21 CBD cases EU-wide over ten years. Most cases were from the dental industry where use of Be has been eliminated for many years.

Customer Survey: (Downstream users of beryllium): 54 companies - 1317 employees exposed. No cases of CBD or Cancer. 824 employees exposed between 0.06 - 2.0 µg/m^3

7. Recommended OEL from Scientific Studies

Study	Date	Comments	Recommended OEL
Madl	2007	Maintaining beryllium exposures below 0.2 µg/m^3 95% of the time may prevent beryllium sensitisation and CBD. Functionally, this would be equivalent to not allowing the daily 8-hr time weighted average concentration to exceed 0.2 µg/m^3	0.2 µg/m^3 CFC (Total)
Proctor	2015	Our assessment developed occupational DNELs of 0.065 µg/m^3, 0.14 µg/m^3, and 0.41 µg/m^3 for respirable, total mass and inhalable Be, respectively based on NOAELs. These DNELs are consistent with ECHA guidance and inherently conservative …	0.065 µg/m^3 Respirable 0.14 µg/m^3 CFC (Total) 0.41 µg/m^3 Inhalable
Schuler	2012	No BeS was observed when total mass concentration exposures for average and highest job were < 0.09 and 0.12 µg/m^3. Highest exposure for which no CBD was observed = 0.199 µg/m^3.	0.2 µg/m^3 CFC (Total)
Schuler	2005	Sensitization and CBD were associated with an area in which beryllium air levels exceeded 0.2 µg/m^3 and not with areas where this level was rarely exceeded.	0.2 µg/m^3 CFC (Total)
Arjomandi	2010	These workers with BeS, characterized by a long duration of potential Be exposure and long latency, had a low prevalence of CBD.	0.2 µg/m^3 CFC (Total)
Stanton	2006	No CBD or BeS was observed when 97% of exposure measurements were less than 0.2 µg/m^3. The highest exposures (95th percentile) at the service center handling bulk products was 0.26 µg/m^3 with no detected BeS or CBD.	0.2 µg/m^3 CFC (Total)