

Biological Monitoring Without Limits

What is N_q

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Topics for Discussion

- Biological monitoring and BEIs[®]
- What about BEIs[®] without numbers?
- Definition of N_q
- Rationale for N_q
- Examples
- A case study
- Other guidelines

General Reasons for Biological Monitoring

- Assess exposure and uptake by all routes
 - TLV[®] not protective for systematic effects from skin absorption - skin
 - Includes workload
 - More closely related to systemic effects
- Assess effectiveness of PPE
- Legal or ethical drivers
 - Regulations
 - Control workers' compensation costs

Basis of BEIs[®] -Traditional

- Relationship between airborne exposure at TLV[®] and biomarker of exposure
 - Most volatile organics
- Relationship between health effects and biomarker of exposure
 - Lead, Cadmium, Mercury

What About These Cases?

- Chemicals readily absorbed through the skin or carcinogens with long lag times between exposure and cancer
 - EGME, Cyclohexanol, MBOCA, PAHs
- Cannot relate to airborne limits
 - Irrelevant
- Cannot relate to health effect
 - Wrong timeline
- Chemicals with good BM methods and “associations” with health effects or exposure

BEIs[®] without numbers – N_q

Biological monitoring should be considered for this compound based on the Committee's review of the literature; however, a specific BEI[®] could not be determined due to insufficient data

Criteria for an N_q

- Dermal route of exposure significant
- Good measurement methods
- Good qualitative data on human exposure and biomarker concentration
- Poor quantitative data relating exposure and biomarker
 - Dermal exposure and biomarker
 - Long lag time between exposure and early health effect

Rationale for use

- There are good analytical methods
- There are documented human workplace studies showing efficacy of biomarkers of exposure
- Background levels are low
- Dermal exposure may be the principal route of exposure
- Suggestions often given from literature
 - Not sufficient data for a numerical BEI[®]

Examples - Cyclohexanol

- BEI[®] - 1,2-Cyclohexanediol and Cyclohexanol in urine
- Primary route of exposure – dermal
- Good methods and data on exposure
- Limited data on dose-response

2-Methoxyethanol (EGME)

- BEI[®] - 2-Methoxyacetic acid in urine
- Primary route of exposure - dermal
- Good methods and data on exposure
- Limited laboratory data on human hematological & reproductive effects
- Limited human field data

4,4'-Methylene-Bis (2-Chloroaniline) [MBOCA]

- BEI[®] - MBOCA in urine
- Principle route of exposure - dermal
- Alleged health effect in humans - cancer
- Good methods and human data on exposure, good practice & controls
- Industry practice guidance from the UK HSE

Polycyclic Aromatic Hydrocarbons (PAHs)

- BEI[®] - 1-Hydroxypyrene in urine
- Human health effects – cancer
- 1-HP a marker of pyrene content
- Association with 1-HP and smoking
- Good methods and human data on exposure - response
- More info – concurrent roundtable

A Case Study, Methyl Parathion

- Inappropriate use of methyl parathion as a household insecticide
- Metabolized like parathion to p-nitrophenol
- BEI[®] for parathion – applicability to MP?
 - Pharmacokinetics differences?
- Assess exposure – above NHANES II baseline ($< 2 \mu\text{g/g}$ creatinine, 90th percentile)
- Evaluate residents – if exceed baseline, look for source

Other Guidelines

- Levels in the general population (NHANES)
 - 1-Hydroxypyrene (<0.4 µg/g creat 90th percentile)
- Biological monitoring guidance values developed by HSE
 - MbOCA (< 35 µg/g creatinine)
- German EKA for carcinogens
 - No N_q substances listed

The Benchmark or Biological Monitoring Guidance Value - HSE

- Good analytical methods
- All specimens analyzed by one laboratory or with a single method
- Establish “good industry practice” using an upper 90% confidence limit of the “good” industries
- Benchmark or biological monitoring guidance value - provide users with assessment of their results

Questions

- How to deal with an N_q BEI[®]?
- What do I tell workers/managers that results mean?
- How do BEIs[®] with N_q relate to TLVs[®]?
- What actions are appropriate?