# Barium and soluble compounds

| CAS number: | 7440-39-3 (elemental) |
| --- | --- |
| Chemical formula: | Ba (elemental) |

Workplace exposure standard (interim)

| TWA: | **0.5 mg/m3 (as Ba)** |
| --- | --- |
| STEL: | **—** |
| Peak limitation: | **—** |
| Notations: | **—** |
| IDLH: | **50 mg/m3 (as Ba)** |
| Sampling and analysis: | The recommended value is readily quantifiable through currently available sampling and analysis techniques. |

## Recommendation and basis for workplace exposure standard

An interim TWA of 0.5 mg/m3 is recommended to protect for irritation of the eyes and skin, gastrointestinal distress and adverse muscular or myocardial stimulation.

A detailed examination of additional data sources is recommended to assess the suitability of this TWA in subsequent reviews.

## Discussion and conclusions

Barium compounds are used in ceramic applications and chemical manufacture. Once absorbed, the barium ion acts as a muscle poison, which first causes muscle stimulation followed by paralysis. Critical effects of intoxication are characterised by nausea, vomiting, colic and diarrhoea, followed by adverse muscular effects and tingling in the extremities. Inhalational exposure data is limited and does not lend itself to robust analysis to derive a WES (DFG, 2010).

The recommended TWA is based on a protective limit of 0.5 mg/m3 for laboratory workers exposed to barium nitrate, which satisfied control measures for barium nitrate exposure (ACGIH, 2001; DFG, 2010).

The recommended IDLH value of 50 mg/m3 is based on acute oral toxicity data due to the lack of inhalational data. The value is conservatively derived from a lethal oral dose in humans of   
43–57 mg/kg, equivalent to an exposure of 2,000–2,600 mg/m3 for 30 minutes.

## Recommendation for notations

Not classified as a carcinogen according to the Globally Harmonized System of Classification and Labelling of Chemicals (GHS).

Not classified as a skin sensitiser or respiratory sensitiser according to the GHS.

Insufficient data available to recommend a skin notation.

# Appendix

### Primary sources with reports

| Source Year set Standard |
| --- |
| SWA Year TWA: 0.5 mg/m3 (as Ba) | |
|  |
| ACGIH 2001 TLV-TWA: 0.5 mg/m3 (as Ba) |
| TLV-TWA intended to minimise potential for irritation of the eyes and skin, nausea, vomiting, colic, diarrhoea and adverse muscular or myocardial stimulation. TLV-TWA based on a NOAEL inferred from an internal limit of 0.5 mg/m3 (as Ba) in Ba(NO3)2 for laboratory workers.  Not classifiable as a human carcinogen based on a carcinogenicity study with barium chloride dihydrate in drinking water of rats and mice administered over 2 yr.  Insufficient data available to recommend skin or sensitiser notations or a TLV-STEL.  Summary of data:  Human data:   * Aqueous Ba(OH)2 and BaO are strongly alkaline and cause severe burns to eye and irritation to skin * The Ba ion targets muscles causing stimulation followed by paralysis * Severe cases (exposure not specified) cause loss of tendon reflexes, muscular paralysis, and death due to heart arrhythmia or respiratory arrest * Threshold toxic dose of 0.2–0.5 g (as Ba) absorbed from the gut; lethal dose of 3–4 g (no further information provided).   Animal data:   * LD50:> 1,980 mg/kg (rats, BaO3Zr, oral) * Subcutaneous injection of 5 mg/kg aqueous BaCl2 caused acute toxicity and death in rabbits (2–2.5 h) following administration * No evidence of carcinogenicity in rats and mice that received 500–2500 ppm BaCl2 in drinking water over 2 yr * No evidence for genotoxicity *in vitro*. |
| DFG 2010 MAK: 0.5 mg/m3 |
| Summary of additional data:  MAK derived on same basis as ACGIH, 2001. Attempted derivation using a NOAEC of 4.4 mg/m3 as Ba in welding fume study was not satisfactory and MAK was retained.  Human data:   * Ba disrupts cellular K transport; high acute doses cause kidney damage due to K imbalance * reported case of acute renal failure in a man following ingestion of 13 g BaCl2 * Lethal dose of 11.4 mg/kg (exposure route unspecified) * No clinical abnormalities or adverse effects reported in welders using various types of barium-containing welding devices with median exposures 0.3–4.4 mg/m3 (3.2 h, 5 d)   + 1 member of highest exposure group presented temporary heart arrhythmia; it is unclear if this was due to Ba exposure.   Animal data:   * No satisfactory inhalational studies available * LD50: 78–183 mg/kg as Ba (rats, oral) * LD50: 284 mg/kg as BaCl2 (mice, oral) * NOAEL of 60 mg/kg as Ba measured by body weight in repeat feeding study with BaCl2 in drinking water (rats, 15 d) * LOAEL of 66 mg/kg as Ba measured by blood urea nitrogen in repeat feeding study using BaCl2 (rats, 10 d) * No incidences of tumours in rats and mice fed 0–5 mg/L barium acetate in drinking water over lifetime. ­ |
| SCOEL NA NA |
| No report |
| OARS/AIHA NA NA |
| No report |
| HCOTN NA NA |
| No report |

### Secondary source reports relied upon

| Source |  | Year | Additional information |
| --- | --- | --- | --- |
| US EPA |  | 1987 | * Chronic exposure studies in mice and rats did not report significant increases in tumour incidence. |
| US NIOSH |  | 1994 | * IDLH based on acute oral toxicity data in humans and animals due to lack of inhalational data. |

### Carcinogenicity — non-threshold based genotoxic carcinogens

| Is the chemical mutagenic? | No |
| --- | --- |
| **The chemical is not a non-threshold based genotoxic carcinogen.** |  |

## Notations

| Source | Notations |
| --- | --- |
| SWA | — |
| HCIS | — |
| NICNAS | NA |
| EU Annex | — |
| ECHA | NA |
| ACGIH | — |
| DFG | — |
| SCOEL | NA |
| HCOTN | NA |
| IARC | NA |
| US NIOSH | — |

NA = not applicable (a recommendation has not been made by this Agency); — = the Agency has assessed available data for this chemical but has not recommended any notations

### Skin notation assessment

| Calculation |
| --- |
| Insufficient data available to assign a skin notation. |

### IDLH

| Is there a suitable IDLH value available? | Yes |
| --- | --- |

## Additional information

| Molecular weight: | 137.3 (elemental) |
| --- | --- |
| Conversion factors at 25°C and 101.3 kPa: | 1 ppm = Number mg/m3; 1 mg/m3 = Number ppm |
| This chemical is used as a pesticide: |  |
| This chemical is a biological product: |  |
| This chemical is a by-product of a process: |  |
| A biological exposure index has been recommended by these agencies: | ACGIH  DFG  SCOEL |

## Workplace exposure standard history

| Year | Standard |
| --- | --- |
| Click here to enter year |  |

## References

American Conference of Industrial Hygienists (ACGIH®) (2018) TLVs® and BEIs® with 7th Edition Documentation, CD-ROM, Single User Version. Copyright 2018. Reprinted with permission. See the [*TLVs® and BEIs® Guidelines section*](http://www.acgih.org/tlv-bei-guidelines/policies-procedures-presentations) on the ACGIH website.

Deutsche Forschungsgemeinschaft (DFG) (2002) Bariumverbindungen, löslich – MAK value documentation German language edition.

US Environmental Protection Agency (US EPA) (1994) IRIS chemical assessment summary – Barium and Compounds; CASRN 7440-39-3

US National Institute for Occupational Safety and Health (NIOSH) (1994) Immediately dangerous to life or health concentrations – Barium (soluble compounds, as Ba)