# COBAlt (METAL and inorganic) (as co)

| CAS number: | 7440-48-4 |
| --- | --- |
| Synonyms: |  |
| Chemical formula: | Co |

Workplace exposure standard (amended)

| TWA: | **0.02 mg/m3** |
| --- | --- |
| STEL: | — |
| Peak limitation: | — |
| Notations: | Carc. 1B, DSEN, RSEN |
| IDLH: | 20 mg/m3 (elemental-cobalt and inorganic compound) |
| | **Sampling and analysis:** The recommended value is quantifiable through available sampling and analysis techniques. | | --- | | |

## Recommendation and basis for workplace exposure standard

A TWA of 0.02 mg/m3 is recommended to protect for the development of asthma and adverse pulmonary and myocardial effects in exposed workers.

## Discussion and conclusions

Cobalt metals and metal powders are used in various applications such as permanent magnets, heat-resistant alloys, high-strength alloys, and tool and die metals.

Cobalt is an essential element for humans, the absence of which results in anaemia. Numerous studies have linked pulmonary effects, asthma and myocardial effects with exposure to cobalt and its compounds at 0.06 mg/m3. Reversible acute effects in humans, including respiratory tract irritation and reduced forced vital capacity, are reported after short‐term exposure to cobalt at 0.038 mg/m3 (ACGIH, 2018). A sub-chronic study in miniature swine identified pulmonary effects occurring at exposures of 0.1 mg/m3 cobalt metal (DFG, 2007). A 14 week repeat dose study in rats and mice reported a LOAEC for lung weight changes at 0.61 mg/m3 (NICNAS, 2014).

Based on short-term acute effects in humans and the LOAEC in rats, a TWA of 0.02 mg/m3 is recommended to protect for the development of asthma, changes in pulmonary function and myocardial effects in exposed workers.

## Recommendation for notations

Classified as a category 1B carcinogen according to the Globally Harmonized System of Classification and Labelling of Chemicals (GHS).

Classified as a skin sensitiser and a respiratory sensitiser according to the GHS.

There are insufficient data to recommend a skin notation.

# Appendix

### Primary sources with reports

| Source Year set Standard |
| --- |
| SWA 1991 TWA: 0.05 mg/m3 (elemental-Co and inorganic compound) | |
|  |
| ACGIH 2001 TLV-TWA: 0.02 mg/m3, as Co (elemental-Co and inorganic compound) |
| TWA-TLA recommended to minimise developing asthma, pulmonary function alterations and myocardial effects.  Summary of data:  Human data:   * Co in vitamin B12 is an essential element for humans, the absence of which results in anaemia * A case control study involving 21 co-exposed workers with asthma and 55 randomly selected workers without asthma; co-exposure to SO2 noted; asthma relative risk of 4.1 for exposed compared to controls; estimated 5-fold increase in risk of developing asthma in those exposed at <0.1 mg/m3 CoSO4 (as Co) * Studies on workers in the cemented carbide industry reported: * obstructive pulmonary changes in workers exposed at an average of 0.06 mg/m3 (no duration provided) * complaints of respiratory irritation from workers exposed at an average of 0.06 mg/m3 (no duration provided); positive correlation between concentration in urine and blood and the average exposure to Co * impaired pulmonary function persisting up to 4 wk following exposure at an average concentration of 0.06 mg/m3 (no duration provided) * development of ECG changes that reversed after 4 wk absence from work following exposure at an average concentration of 0.01 mg/m3 (no duration provided); authors did not considered changes as work-related * Mild fibrotic changes were observed in workers exposed to Co at 0.1–0.2 mg/m3; airway obstruction observed at 0.06 mg/m3 (no duration provided) * Available evidence suggests Co not likely to cause cancer in humans except under uncommon or unlikely routes or levels of exposure.   Animal data:   * Gross lung oedema and haemorrhage in animals following acute exposure to Co metal dust, no concentrations presented * A sub-chronic study in miniature swine identified thickening of the pulmonary septa caused by masses of collagen, elastic tissue and fibroblasts occurring at exposures of 0.1 mg/m3 Co metal * Chronic studies in guinea pigs with intratracheal administration of Co reported inflammatory and irritation effects * Intratracheal instillation studies reported 4 lung cancers found in a group of 20 rats administered 20 mg/kg Co weekly for 20 wk; 1 squamous cell carcinoma in 20 rats administered Co–Al–Cr spinel * Confirmed animal carcinogen.   Insufficient evidence to recommend a skin or sensitiser notation or a TLV-STEL. |
| DFG 2007 NA (Elemental cobalt and inorganic cobalt compounds) |
| No MAK recommended due to carcinogenic potential.  Assigned notations for skin and respiratory sensitisation.  Summary of additional data:   * Acute effects in humans such as respiratory tract irritation, reduced forced vital capacity reported after short‐term exposure at 0.038 mg/m3; effects were reversible * Clear signs of increases in the incidence of asthmatic diseases in exposed persons * Co dust inhibited DNA repair in lymphocytes of exposed workers * CoSO4 proved to be carcinogenic in an inhalation study in rats and mice; indication that soluble Co can induce systemic tumours * Mutagenicity tests with soluble Co salts in S. typhimurium were mainly negative * Based on available epidemiological and genotoxicity studies a threshold level cannot be derived to protect against carcinogenic effects * Contact sensitising effect demonstrated in several clinical studies and animal experiments both with and without adjuvant. |
| 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 |
| --- | --- | --- | --- |
| NICNAS |  | 2014 | * Toxicokinetics data shows low dermal absorption repeated dose toxicity *via* the dermal route is not expected * LOAEC in rats and mice of 0.61 mg/m³; 14 wk repeat dose inhalation toxicity study; for lung weight changes * Genotoxicity data can be read-across from soluble Co compounds; concluded that effective protective processes exist *in vivo* to prevent genotoxicity in humans * Carcinogenic potential is also likely to be contributed to by the indirect genotoxic mechanisms; inhibition of DNA repair and generation of ROS causing cellular oxidative stress * No significant effects reported in 35 workers exposed at an average of 20 mg/m3 when compared to matched controls for lymphocyte DNA damage using the comet assay or lymphocyte micronucleus frequencies. |
| IARC |  | 2006 | * Most materials evaluated were poorly soluble solid materials that deposited in particulate form in the lung where they may be retained for long periods * Evidence in workers for an increasing lung cancer risk with increasing duration of exposure in analyses which considered potential confounding by smoking and other occupational carcinogens * Co and compounds that release Co ions *in vivo* anticipated to be human carcinogens * Humans data studies inadequate to evaluate the relationship between human cancer and exposure * Mechanism(s) of action for Co-induced carcinogenic effects are not completely understood. |

### 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 | NA |
| HCIS | Carcinogenicity – category 1B, Skin sensitisation – category 1, Respiratory sensitisation – category 1 |
| NICNAS | Carc. Cat. 2. |
| EU Annex | Skin sensitisation – category 1, Respiratory sensitisation – category 1 |
| ECHA | NA |
| ACGIH | Carcinogenicity – A3 |
| DFG | Carcinogenicity – 2, Sh (dermal sensitiser),  Sa (respiratory sensitiser) |
| SCOEL | NA |
| HCOTN | NA |
| IARC | Carcinogenicity – Group 2B |
| US NIOSH | NA |

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 to assign a skin notation. |

### IDLH

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

## Additional information

| Molecular weight: | 58.93 (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) (2007) Cobalt and its compounds (as inhalable dusts or aerosols) – MAK value documentation.

Tenth Adaptation to Technical Progress Commission Regulation (EU) No 2017/776 amending, for the purposes of its adaptation to technical and scientific progress, Regulation (EC) No 1272/2008 of the European Parliament and of the Council on classification, labelling and packaging of substances and mixtures (the CLP Regulation).

International Agency for Research on Cancer (IARC) (2006) Volume 86, Cobalt in Hard Metals and Cobalt Sulfate, Gallium Arsenide, Indium Phosphide and Vanadium Pentoxide. IARC Monographs on the evaluation of the carcinogenic risk to humans.

National Industrial Chemicals Notification and Assessment Scheme (NICNAS) (2014) Cobalt: Human health tier II assessment – IMAP report.

US National Institute for Occupational Safety and Health (NIOSH) (1994) Immediately dangerous to life or health concentrations – Cobalt metal dust and fume (as Co).