# Osmium tetroxide

| CAS number: | 20816-12-0 |
| --- | --- |
| Synonyms: | Osmic acid |
| Chemical formula: | OsO4 |
| Structural formula: | — |

Workplace exposure standard (amended)

| TWA: | **0.0002 ppm (0.002 mg/m3)** |
| --- | --- |
| STEL: | **—** |
| Peak limitation: | **—** |
| Notations: | **—** |
| IDLH: | **1 mg/m3** |
| **Sampling and analysis:** The recommended value is quantifiable through available sampling and analysis techniques. | |

## Recommendation and basis for workplace exposure standard

A TWA of 0.0002 ppm (0.002 mg/m3) is recommended to protect for irritation of the eyes, mucous membranes, skin and respiratory tract in exposed workers.

The previous STEL is recommended to be withdrawn as there is a lack of evidence for immediate acute toxicity within ten times of the recommended TWA.

## Discussion and conclusions

Osmium tetroxide is used as a biological stain for adipose tissues in histopathological laboratories, used in photography and as a catalyst in organic synthesis.

The critical effects are irritation of the eyes, skin and upper respiratory tract.

It is reported to have a strong odour and irritation of the nose and throat can persist for up to 12 hours after cessation of exposure. Workers at a refining plant are reported to have experienced lacrimation, vision disturbances, headache, conjunctivitis and cough at concentrations ranging from 0.1 to 0.6 mg/m3; no further information was provided. No irritation or other harmful effects were experienced in humans exposed at 0.0001 ppm (0.001 mg/m3) for 6 hours. Rabbits exposed for 30 minutes at or greater than 13 ppm (130 mg/m3) vapour concentrations died after four days from pulmonary oedema; no further information was provided. Severe corneal damage, permanent opacity and superficial vascularisation was observed following application in rabbit’s eyes (ACGIH, 2018).

The current TWA of 0.0002 ppm (0.002 mg/m3) is the same as the TLV-TWA by ACGIH (2018) and is recommended to be retained to limit irritant effects in exposed workers.

Insufficient data are available to warrant the recommendation of STEL.

## 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.

There are insufficient data to recommend a skin notation.

# Appendix

### Primary sources with reports

| Source Year set Standard |
| --- |
| SWA 1991 TWA: 0.0002 ppm (0.0016 mg/m3) STEL: 0.0006 ppm (0.0047 mg/m3) | |
|  |
| ACGIH 2001 TLV-TWA: 0.0002 ppm (0.0016 mg/m3) (as Os); TLV-STEL: 0.0006 ppm (0.0047 mg/m3) (as Os) |
| TLV-TWA and TLV-STEL recommended to minimise the potential for irritation of the eyes, mucous membranes, skin and respiratory tract.  Summary of data:  OELs based on no adverse effects in humans up to 0.0001 ppm for 6 h.  Human data:   * Strong odour; irritation of the nose and throat can persist for up to 12 h after cessation of exposure; no further details * Delayed lacrimation and "halo" effects after brief exposure following opening of 0.25 g ampoules * Workers experienced lacrimation, vision disturbances; headache, conjunctivitis, and cough at a refining plant with concentrations ranging from 0.1–0.6 mg/m3; no further information * No irritation or other harmful effects when exposed at 0.001 mg/m3 (0.0001 ppm) for 6 h; no further information * Fatality resulting from inhalation exposure reported in 1874; no exposure information; caused capillary bronchitis; autopsy revealed frank pulmonary oedema.   Animal data:   * 4 h LC50 of 40 ppm in rats and mice * Rabbits exposed to osmium tetroxide vapour for 30 minutes at ≥13 ppm died after 4 d from pulmonary oedema; no further information * Severe corneal damage, permanent opacity, and superficial vascularisation in rabbit’s eye following application of 1 drop of 1% solution. |
| DFG 2014 Not assigned |
| No human and animal studies that can be used to establish a MAK.  No additional data. |
| SCOEL NA NA |
| No report. |
| OARS/AIHA NA NA |
| No report. |
| HCOTN 2002 TWA: 0.0002 ppm (0.002 mg/m3) |
| Current TWA is an administrative OEL.  Insufficient data to recommend a health-based TWA.  No additional data. |

### Secondary source reports relied upon

NIL.

### 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 | NA |
| NICNAS | NA |
| EU Annex | NA |
| ECHA | NA |
| ACGIH | NA |
| DFG | NA |
| SCOEL | NA |
| HCOTN | NA |
| IARC | NA |
| 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: | 254.20 |
| --- | --- |
| 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) (2014) Osmium tetroxide – MAK value documentation.

Health Council of the Netherlands (HCOTN) (2002) Osmium tetraoxide. Health-based Reassessment of Administrative Occupational Exposure Limits. The Hague: Health Council of the Netherlands; publication no. 2000/15OSH/051.

US National Institute for Occupational Safety and Health (NIOSH) (1994) Immediately dangerous to life or health concentrations – osmium tetroxide (as Os).