



QUINONE

CAS number: 106-51-4

Synonyms: p-Benzoquinone, p-Quinone

Chemical formula: C₆H₄O₂

Structural formula: —

Workplace exposure standard (retained)

TWA: TWA: 0.1 ppm (0.44 mg/m³)

STEL: —

Peak limitation: —

Notations: —

IDLH: 100 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 0.1 ppm (0.44 mg/m³) is recommended to protect for eye irritation and visual disturbances in exposed workers.

Discussion and conclusions

Quinone is primarily used as an intermediate in the production of hydroquinone, dyes, fungicides, as an oxidising agent and as a photographic chemical.

Critical effects of exposure are eye irritation and disturbances in vision.

No chronic exposure data are available. ACGIH (2018) set a TLV-TWA of 0.1 ppm based on multiple clinical and environmental studies (limited detail) with no systemic effects arising from inhalation exposure at 0.1 ppm. Localised effects are limited to mild ocular irritation. Exposure of rats at 0.6 to 0.8 ppm for four hours a day over four months resulted in weight loss, fatigue, transient anaemia and thrombopenia (DFG, 2000).

The SWA TWA of 0.1 ppm is recommended to be retained, as assigned by ACGIH (2018). The recommended TWA is considered to protect for eye irritation and visual disturbances.

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: 0.1 ppm (0.44 mg/m³)
ACGIH	2001	TLV-TWA: 0.1 ppm (0.44 mg/m³)
TLV-TWA recommended to minimise the risk of eye irritation and disturbances in vision in exposed workers. Summary of data: TLV-TWA is based on multiple studies with no systemic effects at 0.1 ppm (no further detail). Human data: - Occupational exposure to vapour combined with hydroquinone dust resulted in ocular injury from exposure durations greater than 5 yr, no systemic effects observed (no concentration noted) - Skin exposure symptoms include discoloration, severe irritation, erythema, swelling, papules and vesicle formation and necrosis - Vapour condensing on the eyes produces serious visual disturbance that subside upon removal from exposure - Based on clinical and environmental studies no systemic effects arise from inhalation exposure at 0.1 ppm, localised effects limited to mild ocular irritation (no further information). Animal data: - LD₅₀: 130 mg/kg (rats, oral) - Oral and subcutaneous administration resulted in local irritation, clonic convulsions, respiratory difficulties, decreased blood pressure and death from medullary centre paralysis (unknown concentration and duration) - Chronic carcinogenicity studies by inhalation, dermal and subcutaneous routes insufficient to confirm carcinogenicity. Insufficient data to recommend a skin, sensitiser or carcinogen notation.		
DFG	2000	Not assigned
The previous MAK is suspended (no justification given). - LC₅₀: 250 ppm (mice, 2 h, inhalation) - Exposure at 0.6–0.8 ppm (rats, 4 h/d, 4 mo, inhalation) symptoms included weight loss, fatigue, transient anaemia and thrombopenia - Exposure at 2 mg/kg/d (mice, 6 d/wk, 6 wk, oral) blood levels of erythrocytes and haemoglobin significantly reduced: - lymphocytes, bone marrow cells reduced - granulocytes, relative organ weights of the spleen, abdominal, thoracic, lymph nodes significantly increased, thymus significantly reduced - histologically there was a loss of the cytoplasmic details of the hepatocytes in the liver, decrease in the size of the lymph follicles in the spleen and the lobules in the thyroid gland - hyperplasia of the reticular cells particularly evident in the popliteal lymph nodes		

Source	Year set	Standard
		- o effects show similarities to those of benzene • Mutations, micronuclei formation, SCE, DNA damage and DNA adducts detected in mammalian cells <i>in vitro</i> • DNA adducts seen after <i>in vitro</i> incubation in human bone marrow and in rat cymbals • Inhibition of DNA and mRNA synthesis as well as topoisomerase II activity demonstrated <i>in vitro</i> • Increased micronuclei formation in polychromatic bone marrow erythrocytes observed in mice.
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
ECHA	✓ 2018	• <i>In vitro: In chemico</i> skin sensitisation • Direct Peptide Reactivity Assay yielded positive results.
US NIOSH	✓ 1994	• No additional information.

Carcinogenicity — non-threshold based genotoxic carcinogens

Is the chemical mutagenic? Yes

Is the chemical carcinogenic with a mutagenic mechanism of action? Insufficient data

Insufficient data are available to determine if the chemical is a non-threshold based genotoxic carcinogen.

Notations

Source	Notations
SWA	—
HCIS	—
NICNAS	NA
EU Annex	NA
ECHA	—
ACGIH	—



Source	Notations
DFG	Carcinogenicity – 3B, Sh (dermal sensitiser)
SCOEL	NA
HCOTN	NA
IARC	Carcinogenicity – Group 3
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

Insufficient data to assign a skin notation.

IDLH

Is there a suitable IDLH value available? Yes

Additional information

Molecular weight:	108.09
Conversion factors at 25°C and 101.3 kPa:	1 ppm = 4.42 mg/m ³ ; 1 mg/m ³ = 0.226 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](#) on the ACGIH website.

Deutsche Forschungsgemeinschaft (DFG) (2000) 1,4-Benzochinon – MAK value documentation.

European Chemicals Agency (ECHA) (2018) p-benzoquinone – REACH assessment.

International Agency for Research on Cancer (IARC) (1999) Quinone. IARC Monographs on the evaluation of the carcinogenic risk to humans.

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

DRAFT