DINITROBENZENE (O-, M-, P- ISOMERS)

CAS number: 99-65-0, (o-dinitrobenzene)
528-29-0, (m-dinitrobenzene)
100-255-4, (p-dinitrobenzene)

Synonyms: Ortho-dinitrobenzene, 1,2-dinitrobenzene, 1,2-DNB
Meta-dinitrobenzene, 1,3-dinitrobenzene, 1,3-DNB
Para-dinitrobenzene, 1,4-dinitrobenzene, 1,4-DNB

Chemical formula: $C_6H_4N_2O_4$

Structural formula: —

Workplace exposure standard (retained)

TWA: **0.15 ppm (1 mg/m^3)**

STEL: **—**

Peak limitation: **—**

Notations: **Sk.**

IDLH: **—**

Sampling and analysis: The recommended value is readily quantifiable through currently available sampling and analysis techniques.

Recommendation and basis for workplace exposure standard

A TWA of 0.15 ppm (1 mg/m^3) is recommended to protect for anoxia due to the formation of methaemoglobin in exposed workers.

Discussion and conclusions

Ortho-, meta- and para-dinitrobenzene (DNB) are usually manufactured together and used in the manufacture of dyes, in explosives, as a camphor substitute in the production of celluloids and in organic syntheses.

No published reports with measured concentrations in humans are identified. Industrial experience reports DNB to be highly toxic resulting in methaemoglobinaemia. Chronic exposures of workers have caused anaemia; with liver damage reported in a few cases. DNB is reported to be readily absorbed by the skin, contributing to toxicity effects. There are no published reports in animals (ACGIH, 2018).

The ACGIH (2018) assign the TLV-TWA on the basis of an estimate of the comparative toxicities of the polynitro aromatic compounds relative to those of the mononitro derivatives. The TWA of 0.15 ppm (1 mg/m^3) has been directly adopted and is considered protective of the critical effects.

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.

A skin notation is recommended based on evidence of dermal uptake in humans and systemic effects.

APPENDIX

Primary sources with reports

Source	Year set	Standard
SWA	***1991***	***TWA: 0.15 ppm (1 mg/m^3)***
ACGIH	***2001***	***TLV-TWA: 0.15 ppm (1 mg/m^3)***
TLV-TWA recommended for ortho-, meta-, and para-dinitrobenzene (collectively referred as DNB) to minimise the potential for anoxia due to formation of methaemoglobin. Summary of data: Human data: • No published reports with measured concentrations in humans • Industrial experience reports DNB to be highly toxic; causing various signs and symptoms of involvement of the blood, primarily methaemoglobinaemia • Chronic exposures of workers have caused anaemia; liver injury has been reported in a few cases • Reduced visual acuity and loss or depression of vision within the central visual field • Readily absorbed by the skin, contributing to systemic toxicity and effects. Animal data • No published reports with measured concentrations in animals in this source • Comparative acute data for the dinitro aromatic derivatives and the corresponding mononitro compounds indicate that the dinitro compounds were more acutely toxic by a factor of at least 5. The TWA-TLV is an estimate of the comparative toxicities of the polynitro aromatic compounds relative to those of the mononitro derivatives. Based on ACGIH TWA-TLV for aniline of 2 ppm and the methemoglobin-producing capability of DNB (industrial experience). Readily absorbed through skin.		
DFG	***1958***	***MAK: 1 mg/m^3***
MAK established for the three isomers and based on ACGIH. No further information.		
SCOEL	***NA***	***NA***
No report.		
OARS/AIHA	***NA***	***NA***
No report.		

Source	Year set	Standard
HCOTN	***NA***	***NA***

Carcinogenicity report:

- No data on carcinogenicity of isomers in humans or animals available
- Available data on genotoxicity too limited for a definite conclusion on genotoxicity.

Secondary source reports relied upon

NIL.

Carcinogenicity — non-threshold based genotoxic carcinogens

Is the chemical mutagenic?	Insufficient data
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	Skin
HCIS	—
NICNAS	NA
EU Annex	NA
ECHA	—
ACGIH	Skin
DFG	H (skin)
SCOEL	NA
HCOTN	Carcinogenicity – category 3
IARC	NA
US NIOSH	SK:SYS

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	
Adverse effects in human case study:	yes
Dermal LD_{50} ≤1000 mg/kg:	
Dermal repeat-dose NOAEL ≤200 mg/kg:	
Dermal LD_{50}/Inhalation LD_{50} <10:	
In vivo dermal absorption rate >10%:	
Estimated dermal exposure at WES >10%:	
	a skin notation is warranted

IDLH

Is there a suitable IDLH value available?	No

Additional information

Molecular weight:	168.11
Conversion factors at 25°C and 101.3 kPa:	1 ppm = 6.87 mg/m^3; 1 mg/m^3 = 0.146 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) (1990) Dinitrobenzene (all isomers) – MAK value documentation.

European Chemicals Agency (ECHA) (2019) m-Dinitrobenzene – REACH assessment.

Health Council of the Netherlands. Dinitrobenzene isomers; Evaluation of the carcinogenicity and genotoxicity. The Hague: Health Council of the Netherlands, 2011; publication no. 2011/04OSH.

US National Institute for Occupational Safety and Health (NIOSH) (2001) NIOSH Skin Notation Profiles: Dinitrobenzene (All isomers).