



Nitrobenzene

Incident Management

Key Points

Fire

- combustible
- reacts violently with strong oxidants, reducing agents and strong acids generating fire and explosion hazard
- emits toxic fumes of nitrogen oxides when heated to decomposition
- In the event of a fire involving nitrobenzene, use fine water and wear chemical protective clothing with liquid-tight connections for whole body and breathing apparatus

Health

- systemic toxicity may develop following exposure by any route, symptoms may be delayed 1-4 hours
- features include headache, weakness, dizziness, ataxia, dyspnoea, tachycardia and drowsiness
- nitrobenzene typically causes methaemoglobinaemia; haemolytic anaemia, jaundice and renal failure are also common in severe cases
- pain, blepharospasm, lacrimation, conjunctivitis, palpebral oedema and photophobia may follow eye contact while skin contact may cause dermatitis


Environment

- hazardous to the environment; inform the Environment Agency of substantial incidents where appropriate





Hazard Identification

Standard (UK) dangerous goods emergency action codes

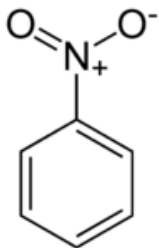
Nitrobenzene

UN		1662	Nitrobenzene	
EAC		2X	Use fine water spray. Wear chemical protective clothing with liquid-tight connections for whole body in combination with breathing apparatus*. Spillages and decontamination run-off should be prevented from entering drains and watercourses	
APP		–	–	
Hazards	Class	6.1	Toxic substance	
	Sub-risks	–	–	
HIN		60	Toxic or slightly toxic substance	
<p>UN – United Nations number, EAC – emergency action code, APP – additional personal protection, HIN – hazard identification number</p> <p>* Chemical protective clothing with liquid-tight connections for whole body (type 3) conforming to the relevant standards such as BS 8428 or EN 14605, in combination with breathing apparatus BS EN 137</p> <p>Reference Dangerous Goods Emergency Action Code List, National Chemical Emergency Centre (NCEC) Part of Ricardo-AEA. The Stationery Office, 2017.</p>				

Classification, labelling and packaging (CLP)***Nitrobenzene**

Hazard class and category	Acute Tox. 3	Acute toxicity (inhalation, dermal and oral), category 3	
	Carc. 2	Carcinogenicity, category 2	
	STOT RE 1	Specific target organ systemic toxicity following repeated exposure, category 1	
	Aquatic Chronic 3	Chronic hazard to the aquatic environment, category 3	
	Repr. 1B	Toxic to reproduction, category 1B	
Hazard statement	H301	Toxic if swallowed	
	H311	Toxic in contact with skin	
	H331	Toxic if inhaled	
	H351	Suspected of causing cancer	
	H372	Causes damage to blood through prolonged or repeated exposure	
	H412	Harmful to aquatic life with long lasting effects	
	H360F	May damage fertility	
Signal words	DANGER		
* Implemented in the EU on 20 January 2009			
Reference			
European Commission. Harmonised classification – Annexe VI to Regulation (EC) No. 1272/2008 on Classification, Labelling and Packaging of Substances and Mixtures. http://echa.europa.eu/information-on-chemicals/cl-inventory-database (accessed 05/2017).			

Physicochemical Properties

CAS number	98-95-3
Molecular weight	123
Formula	C ₆ H ₅ NO ₂
Common synonyms	Nitrobenzol
State at room temperature	Liquid
Volatility	Vapour pressure 0.3 mm Hg at 25°C
Specific gravity Vapour density	1.2 at 20°C (water = 1) 4.2 (air = 1)
Flammability	Combustible
Lower explosive limit	1.8%
Upper explosive limit	40.0%
Water solubility	Slightly soluble in water
Reactivity	Reactive. Nitrobenzene reacts violently with strong oxidants, reducing agents and strong acids generating fire and explosion hazard.
Reaction or degradation products	Releases toxic fumes of nitrogen oxides when heated to decomposition.
Odour	Bitter almonds
Structure	
References	
<p>Hazardous Substances Data Bank. Nitrobenzene HSDB No. 104 (last revision date 30/04/2010). US National Library of Medicine: Bethesda MD. http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB (accessed 01/2017).</p> <p>International Programme on Chemical Safety. International Chemical Safety Card entry for Nitrobenzene. ICSC 0065, 2006. World Health Organization: Geneva.</p> <p>Nitrobenzene (HAZARDTEXT™ Hazard Management). In Klasco RK (Ed): TOMES® System, Truven Healthcare Analytics Inc, Greenwood Village CO, US. RightAnswer.com Inc, Midland MI, US. http://www.rightanswerknowledge.com (accessed 01/2017).</p>	

Reported Effect Levels from Authoritative Sources

Exposure by ingestion

mL	Signs and symptoms	Reference
5-10	Fatal in the absence of medical intervention	a
g		
4.3-11	Unconsciousness, cyanosis, circulatory collapse, rapid and shallow breathing and tachycardia	a
<p>These values give an indication of levels of exposure that can cause adverse effects. They are not health protective standards or guideline values</p> <p>References</p> <p>a International Programme on Chemical Safety. Nitrobenzene. Environmental Health Criteria 230, 2003. World Health Organization: Geneva.</p>		

Exposure by inhalation

mg/m ³	ppm	Signs and symptoms	Reference
210-419	40-80	Slight symptoms after several hours exposure	a
<p>These values give an indication of levels of exposure that can cause adverse effects. They are not health protective standards or guideline values</p> <p>References</p> <p>a International Programme on Chemical Safety. Nitrobenzene. Environmental Health Criteria 230, 2003. World Health Organization: Geneva.</p>			

Published Emergency Response Guidelines

Emergency response planning guideline (ERPG) values

	Listed value (ppm)	Calculated value (mg/m ³)
ERPG-1*	Not given	
ERPG-2 [†]		
ERPG-3 [‡]		
<p>* Maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing other than mild transient adverse health effects or perceiving a clearly defined, objectionable odour</p> <p>[†] Maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action</p> <p>[‡] Maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects</p>		

Acute exposure guideline levels (AEGLs)

	ppm				
	10 min	30 min	60 min	4 hours	8 hours
AEGL-1*	Not given				
AEGL-2 [†]					
AEGL-3 [‡]					
<p>* Level of the chemical in air at or above which the general population could experience notable discomfort</p> <p>[†] Level of the chemical in air at or above which there may be irreversible or other serious long-lasting effects or impaired ability to escape</p> <p>[‡] Level of the chemical in air at or above which the general population could experience life-threatening health effects or death</p>					

Exposure Standards, Guidelines or Regulations

Occupational standards

	LTEL (8-hour reference period)		STEL (15-min reference period)	
	ppm	mg/m ³	ppm	mg/m ³
WEL	0.2	1	Withdrawn	
<p>WEL – workplace exposure limit, LTEL – long-term exposure limit, STEL – short-term exposure limit</p> <p>Reference Health and Safety Executive (HSE). EH40/2005 Workplace Exposure Limits, 2nd Edition, 2011.</p>				

Public health guidelines

UK Drinking water standard WHO guideline value	Guideline values not given
Air quality guideline	Guideline value not given
Soil guideline values and health criteria values	Guideline value not given

Health Effects

Major route of exposure

- inhalation, ingestion and dermal exposure
- after ingestion, inhalation or skin contact the onset of symptoms may be delayed for 1-4 hours

Immediate signs or symptoms of acute exposure

Route	Signs and symptoms
Inhalation	May cause cough, wheeze, dyspnoea, and respiratory distress before systemic toxicity develops
Ingestion	May cause nausea, vomiting and diarrhoea. Systemic features are common but may be delayed.
Dermal	May cause dermatitis
Ocular	Pain blepharospasm, lacrimation, conjunctivitis, palpebral oedema and photophobia are possible
Systemic features	<p>Systemic features include headache, weakness, dizziness, ataxia, dyspnoea, tachycardia and drowsiness</p> <p>Nitrobenzene typically causes methaemoglobinaemia. Haemolytic anaemia, jaundice and renal failure are also common in severe cases. The urine may be discoloured brown or black if methaemoglobinaemia is present</p> <p>In severe poisoning it is suggested that delayed release of nitrobenzene from adipose tissue may be a cause for a reoccurrence of toxicity</p> <p>There may be the characteristic "bitter almond" odour on the patient's breath. However it is estimated that 20-40% of people are genetically unable to detect this odour</p>
Reference	TOXBASE. Nitrobenzene, 02/2014. http://www.toxbase.org (accessed 05/2017).

Decontamination at the Scene

Summary

The approach used for decontamination at the scene will depend upon the incident, location of the casualties and the chemicals involved. Therefore, a risk assessment should be conducted to decide on the most appropriate method of decontamination.

Following disrobe, improvised dry decontamination should be considered for an incident involving nitrobenzene, **unless casualties are demonstrating signs or symptoms of exposure to caustic or corrosive substances.**

People who are processed through improvised decontamination should subsequently be moved to a safe location, triaged and subject to health and scientific advice. Based on the outcome of the assessment, they may require further decontamination.

Emergency services and public health professionals can obtain further advice from Public Health England (Centre for Radiation, Chemical and Environmental Hazards) using the 24-hour chemical hotline number: 0344 892 0555.

Disrobe

The disrobe process is highly effective at reducing exposure to HAZMAT/CBRN material when performed within 15 minutes of exposure.

Therefore, disrobe must be considered the primary action following evacuation from a contaminated area.

Where possible, disrobe at the scene should be conducted by the casualty themselves and should be systematic to avoid transferring any contamination from clothing to the skin. Consideration should be given to ensuring the welfare and dignity of casualties as far as possible.

Improvised decontamination

Improvised decontamination is an immediate method of decontamination prior to the use of specialised resources. This should be performed on all contaminated casualties, unless medical advice is received to the contrary. Improvised dry decontamination should be considered for an incident involving chemicals **unless the agent appears to be corrosive or caustic.**

Improvised dry decontamination

- any available dry absorbent material can be used such as kitchen towel, paper tissues (eg blue roll) and clean cloth
- exposed skin surfaces should be blotted and rubbed, starting with the face, head and neck and moving down and away from the body

- rubbing and blotting should not be too aggressive, or it could drive contamination further into the skin
- all waste material arising from decontamination should be left in situ, and ideally bagged, for disposal at a later stage

Improvised wet decontamination

- water should only be used for decontamination where casualty signs and symptoms are consistent with exposure to caustic or corrosive substances such as acids or alkalis
- wet decontamination may be performed using any available source of water such as taps, showers, fixed installation hose-reels and sprinklers
- when using water, it is important to try and limit the duration of decontamination to between 45 and 90 seconds and, ideally, to use a washing aid such as cloth or sponge
- improvised decontamination should not involve overly aggressive methods to remove contamination as this could drive the contamination further into the skin
- where appropriate, seek professional advice on how to dispose of contaminated water and prevent run-off going into the water system

Additional notes

- following improvised decontamination, remain cautious and observe for signs and symptoms in the decontaminated person and in unprotected staff
- if water is used to decontaminate casualties this may be contaminated, and therefore hazardous, and a potential source of further contamination spread
- all materials (paper tissues etc) used in this process may also be contaminated and, where possible, should not be used on new casualties
- the risk from hypothermia should be considered when disrobe and any form of wet decontamination is carried out
- people who are contaminated should not eat, drink or smoke before or during the decontamination process and should avoid touching their face
- consideration should be given to ensuring the welfare and dignity of casualties as far as possible. Immediately after decontamination the opportunity should be provided to dry and dress in clean robes/clothes

Interim wet decontamination

Interim decontamination is the use of standard fire and rescue service (FRS) equipment to provide a planned and structured decontamination process prior to the availability of purpose-designed decontamination equipment.

Decontamination at the scene references

National Ambulance Resilience Unit. Joint Emergency Services Interoperability Programme (JESIP). Initial operational response to a CBRN incident. Version 1.0, September 2013.

NHS England. Emergency Preparedness, Resilience and Response (EPRR). Chemical incidents: planning for the management of self-presenting patients in healthcare settings. April 2015.

Clinical Decontamination and First Aid

Clinical decontamination is the process where trained healthcare professionals using purpose-designed decontamination equipment treat contaminated people individually.

Detailed information on clinical management can be found on TOXBASE – www.toxbase.org.

Important note

- if the patient has not been decontaminated following surface contamination, secondary carers must wear appropriate NHS PPE for chemical exposure to avoid contaminating themselves. The area should be well ventilated.

Clinical decontamination following surface contamination

- carry out decontamination after resuscitation
- this should be performed in a well-ventilated area, preferably with its own ventilation system
- the patient should remove soiled clothing and wash him/herself if possible
- put soiled clothing in a sealed container to prevent escape of volatile substances
- wash hair and all contaminated skin with liberal amounts of water (preferably warm) and soap
- pay special attention to skin folds, fingernails and ears
- other supportive measures as indicated by the patients clinical condition

Dermal exposure

- if systemic features are present, manage as per systemic features
- decontaminate (as above) following surface contamination
- other supportive measures as indicated by the patient's clinical condition

Ocular exposure

- if systemic features are present, manage as per systemic features
- remove contact lenses if present
- anaesthetise the eye with a topical local anaesthetic (eg oxybuprocaine, amethocaine or similar); **however, do not delay irrigation if local anaesthetic is not immediately available**
- immediately irrigate the affected eye thoroughly with 1,000 mL 0.9% saline (eg by an infusion bag with a giving set). A Morgan Lens may be used if anaesthetic has been given. Irrigate for 10–15 minutes irrespective of initial conjunctival pH. Aim for a final

conjunctival pH of 7.5–8.0. The conjunctivae may be tested with indicator paper. Retest 20 minutes after irrigation and use further irrigation if necessary

- repeated instillation of local anaesthetics may reduce discomfort and help more thorough decontamination; however, prolonged use of concentrated local anaesthetics is damaging to the cornea
- patients with corneal damage, those who have been exposed to strong acids or alkalis and those whose symptoms do not resolve rapidly should be discussed **urgently** with an ophthalmologist
- if features of systemic toxicity are present manage as for ingestion/inhalation
- other supportive measures as indicated by the patient's clinical condition

Inhalation

- maintain a clear airway and ensure adequate ventilation
- give oxygen to symptomatic patients
- for management of systemic features see below

Ingestion

- monitor pulse, blood pressure, respiratory rate, temperature and oxygen saturation
- for management of systemic features see below

Systemic features

- monitor pulse, blood pressure, respiratory rate, temperature and oxygen saturation
- in the presence of methaemoglobinaemia pulse oximetry is unreliable
- monitor cardiac rhythm and perform a 12-lead ECG in all patients who require assessment
- other supportive measures as indicated by the patient's clinical condition

Health effects and decontamination references

TOXBASE	http://www.toxbase.org (accessed 05/2017)
TOXBASE	Nitrobenzene, 02/2014
TOXBASE	Chemicals Splashed or Sprayed into the eyes – features and management, 02/2014
TOXBASE	Skin decontamination – solvents, 05/2012

This document from the PHE Centre for Radiation, Chemical and Environmental Hazards reflects understanding and evaluation of the current scientific evidence as presented and referenced here.

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