Public Health England

Protecting and improving the nation's health

Naphthalene

Incident Management

Key Points

Fire

- flammable
- reacts with strong oxidisers and can react explosively with dinitrogen pentaoxide and chromic anhydride
- produces acrid smoke and carbon monoxide if involved in a fire
- in the event of a fire involving naphthalene, use coarse water spray and normal fire kit with breathing apparatus

Health

- toxic by all routes of exposure
- inhalation and ingestion of naphthalene can lead to nausea, vomiting, abdominal pain, diarrhoea, headache, confusion, profuse sweating, fever, tachycardia, tachypnoea, and agitation leading to convulsions and coma
- haemolysis and haemoglobinuria leading to acute renal failure may occur 3-5 days after exposure, particularly in patients with glucose-6-phosphate dehydrogenase deficiency
- dermal exposure can cause skin irritation and possibly dermatitis
- ocular exposure can lead to eye irritation

Environment

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

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Hazard Identification

Standard (UK) dangerous goods emergency action codes

Naphthalene, crude or naphthalene, refined

UN		1334	Naphthalene, crude or naphthalene, refined	
EAC		1Z	Use coarse water spray. Wear normal fire clothing in combination with breathing apparatus*. Spillages and decontamination run-off should be prevented from entering drains and watercourses	
APP		-	-	
Hazards	**Class**	4.1	Flammable solids, self-reactive substances and solid desensitised explosives	
	Sub-risks	–	–	
HIN		40	Flammable solid, or self-reactive substance, or self-heating substance, or polymerizing substance	

UN – United Nations number, EAC – emergency action code, APP – additional personal protection, HIN – hazard identification number

* Normal firefighting clothing is appropriate, ie breathing apparatus conforming to BS EN137 worn in combination with fire kit conforming to BS EN 469, firefighters' gloves conforming to BS EN 659 and firefighters' boots conforming to Home Office specification A29 or A30

Reference

Dangerous Goods Emergency Action Code List, National Chemical Emergency Centre (NCEC) Part of Ricardo-AEA. The Stationery Office, 2017.

Naphthalene, molten

UN		2304	Naphthalene, molten	
EAC		1Y	Use coarse water spray. Wear normal fire kit in combination with breathing apparatus*. There is a danger that the substance can be violently or explosively reactive. Spillages contaminated with fire and decontamination run-off should be prevented from entering drains and surface and groundwaters	
APP		-	-	
Hazards	**Class**	4.1	Flammable solids, self-reactive substances and solid desensitised explosives	
	Sub-risks	–	–	
HIN		44	Flammable solid, in the molten state at an elevated temperature	

UN – United Nations number, EAC – emergency action code, APP – additional personal protection, HIN – hazard identification number

* Normal firefighting clothing is appropriate, ie breathing apparatus conforming to BS EN137 worn in combination with fire kit conforming to BS EN 469, firefighters' gloves conforming to BS EN 659 and firefighters' boots conforming to Home Office specification A29 or A30

Reference

Dangerous Goods Emergency Action Code List, National Chemical Emergency Centre (NCEC) Part of Ricardo-AEA. The Stationery Office, 2017.

Classification, labelling and packaging (CLP)*

Naphthalene

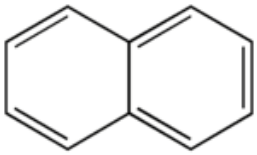
Hazard class and category	Acute Tox. 4	Acute toxicity (oral), category 4	
	Carc. 2	Carcinogenicity, category 2	
	Aquatic Acute 1	Acute hazard to the aquatic environment, category 1	
	Aquatic Chronic 1	Chronic hazard to the aquatic environment, category 1	
Hazard statement	H302	Harmful if swallowed	
	H351	Suspected of causing cancer	
	H400	Very toxic to aquatic life	
	H410	Very toxic to aquatic life with long lasting effects	
Signal words	Warning		

* 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 06/2017).

Physicochemical Properties

CAS number	91-20-3
Molecular weight	128
Formula	$C_{10}H_8$
Common synonyms	Naphthene; Naphthalin
State at room temperature	Solid, powder
Volatility	Vapour pressure 0.1 mm Hg at 25°C
Specific gravity **Vapour density**	1.16 at 20°C 4.42 (air = 1)
Flammability	Flammable in the presence of a source of ignition
Lower explosive limit	0.9%
Upper explosive limit	5.9%
Water solubility	Low solubility in water, 31 mg/L at 25°C.
Reactivity	Will react with strong oxidisers and can react explosively with dinitrogen pentaoxide and chromic anhydride
Reaction or degradation products	Will produce dense acrid smoke and carbon monoxide if involved in a fire
Odour	Aromatic
Structure	

References

Hazardous Substances Data Bank. Naphthalene HSDB No. 184 (last revision date 04/09/2014). US National Library of Medicine: Bethesda MD. http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB (accessed 01/2017).

International Programme on Chemical Safety. International Chemical Safety Card entry for Naphthalene. ICSC 0667, 2005. World Health Organization: Geneva.

Naphthalene (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).

Reported Effect Levels from Authoritative Sources

Exposure by ingestion

mg/kg	Signs and symptoms	Reference
80-100	Lethal oral dose (children)	a
g		
5-15	Lethal oral dose (adult)	a

These values give an indication of levels of exposure that can cause adverse effects. They are not health protective standards or guideline values

References

a Hazardous Substances Data Bank. Naphthalene HSDB No. 184 (last revision date 04/09/2014). US National Library of Medicine: Bethesda MD. http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB (accessed 01/2017).

Exposure by inhalation

ppm	mg/m^3	Signs and symptoms	Reference
15	78.6	Eye irritation	a
250	1,310	Immediately dangerous to life and health	a

These values give an indication of levels of exposure that can cause adverse effects. They are not health protective standards or guideline values

References

a Hazardous Substances Data Bank. Naphthalene HSDB No. 184 (last revision date 04/09/2014). US National Library of Medicine: Bethesda MD. http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB (accessed 01/2017).

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‡		

* 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

† 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

‡ 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

Acute exposure guideline levels (AEGLs)

	ppm				
	10 min	30 min	60 min	4 hours	8 hours
AEGL-1*	Not given				
AEGL-2†					
AEGL-3‡					

* Level of the chemical in air at or above which the general population could experience notable discomfort

† 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

‡ Level of the chemical in air at or above which the general population could experience life-threatening health effects or death

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	Not given			
WEL – workplace exposure limit, LTEL – long-term exposure limit, STEL – short-term exposure limit				

Public health guidelines

Drinking water standard **WHO guideline value**	Guideline not given
Air quality guideline	0.01 mg/m^3 (annual average concentration)
Soil guideline values and health criteria values	Guideline value not given
Reference WHO guidelines for indoor air quality: selected pollutants. World Health Organization Regional Office for Europe, Copenhagen WHO Regional Publications. 2010.	

Health Effects

Major route of exposure

- toxic by ingestion, inhalation and skin absorption

Immediate signs or symptoms of acute exposure

Route	Signs and symptoms
Inhalation/ Ingestion	Nausea, vomiting, abdominal pain, diarrhoea, headache, confusion, profuse sweating, fever, tachycardia, tachypnoea, and agitation leading to convulsions and coma. Haemolysis and haemoglobinuria leading to acute renal failure may occur after 3-5 days, particularly in patients with glucose-6-phosphate dehydrogenase deficiency The urine may be dark brown or black in colour, partly due to haemoglobinuria but also due to the presence of naphthalene metabolites. Methaemoglobinaemia occurs rarely
Dermal	irritation and possibly dermatitis
Ocular	Irritation and possible injury from particles in the eye

Reference

TOXBASE. Naphthalene, 09/2015. http://www.toxbase.org (accessed 06/2017).

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 naphthalene, **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

- ambulance staff, paramedics and emergency department staff treating chemically contaminated casualties should be equipped with appropriate personal protective equipment (PPE)

Clinical decontamination following surface contamination

- remove all contaminated clothing
- avoid contaminating yourself with this product and wash any exposed area
- any particulate matter adherent to skin should be removed and the patient washed with soap and water under low pressure for at least 10–15 minutes
- pay particular attention to mucous membranes, moist areas such as skin folds, fingernails and ears

Dermal exposure

- decontaminate (as above) the patient following surface contamination
- other supportive measures as indicated by the patient's clinical condition

Ocular exposure

- if symptomatic immediately irrigate the affected eye thoroughly
- for patients at home, use lukewarm tap water, trickled into the eye in a small cup held over the eye socket. An eye dropper is an alternative
- in hospital, immediately irrigate the effected eye thoroughly with 0.9% saline 1000 mL (for example via an infusion bag with a giving set). A Morgan Lens may be used if anaesthetic has been given. Irrigate for 10-15 minutes
- refer for an ophthalmological assessment if there is doubt regarding the management of corneal damage
- other supportive measures as indicated by the patient's clinical condition

Inhalation

- remove all contaminated clothing (see decontamination section above)

- management is otherwise symptomatic and supportive

Ingestion

- maintain a clear airway and ensure adequate ventilation
- activated charcoal is of no benefit
- fatty food including milk should be avoided because of the risk of enhancing absorption
- monitor pulse, BP and respiratory rate
- 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 06/2017)

TOXBASE Naphthalene, 09/2015

TOXBASE Skin decontamination – irritants, 05/2012

TOXBASE Eye irritants, 01/2016

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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For queries relating to this document, please contact generaltox@phe.gov.uk