



Xylene

Incident Management

Key Points

Fire

- flammable
- reacts with strong acids and strong oxidisers
- emits acid smoke and fumes when heated to decomposition
- in the event of a fire involving xylene, use normal foam and normal fire kit with breathing apparatus

Health

- major routes of exposure are inhalation, ingestion, dermal and ocular; systemic toxicity can occur by all routes of exposure
- inhalation causes irritation of nose, throat and respiratory tract
- ingestion causes oropharyngeal and gastric irritation with nausea and vomiting
- dermal exposure will cause irritation, erythema and necrosis if contact is prolonged
- ocular exposure will cause irritation, conjunctivitis, blepharospasm and transient superficial corneal damage
- systemic features include gastrointestinal tract irritation, cardiac abnormalities, pulmonary oedema, metabolic acidosis, convulsions and CNS and respiratory depression


Environment

- avoid release to the environment; inform the Environment Agency of substantial incidents


Hazard Identification

Standard (UK) dangerous goods emergency action codes




Xylenes (packaging group II)

UN		1307	Xylenes (packaging group II)	
EAC		3YE	Use normal foam, ie protein based that is not alcohol resistant. Wear normal fire kit in combination with breathing apparatus*. There is a danger that the substance can be violently or explosively reactive. Spillages and decontamination run-off should be prevented from entering drains and surface and groundwaters. There may be a public safety hazard outside the immediate area of the incident [†]	
APP		–	–	
Hazards	Class	3	Flammable liquids	
	Sub-risks	–	–	
HIN		33	Highly flammable liquid (flash point below 23°C)	
<p>UN – United Nations number, EAC – emergency action code, APP – additional personal protection, HIN – hazard identification number</p> <p>* 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</p> <p>[†] People should stay indoors with windows and doors closed, ignition sources should be eliminated and ventilation stopped. Non-essential personnel should move at least 250 m away from the incident</p> <p>Reference Dangerous Goods Emergency Action Code List, National Chemical Emergency Centre (NCEC), Part of Ricardo-AEA, The Stationery Office, 2015.</p>				

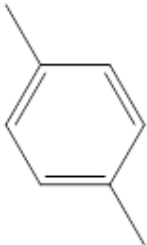
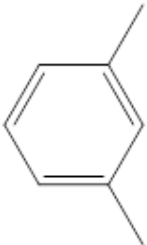
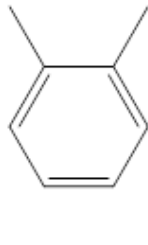
Xylenes (packaging group III)

UN		1307	Xylenes (packaging group III)	
EAC		3Y	Use normal foam, ie protein based that is not alcohol resistant. Wear normal fire kit in combination with breathing apparatus*. There is a danger that the substance can be violently or explosively reactive. Spillages and decontamination run-off should be prevented from entering drains and surface and groundwaters	
APP		–	–	
Hazards	Class	3	Flammable liquids	
	Sub-risks	–	–	
HIN		30	Flammable liquid (flash point between 23°C and 60°C inclusive) or flammable liquid or solid in the molten state with a flash point above 60°C, heated to a temperature equal to or above its flash point, or self-heating liquid	
<p>UN – United Nations number, EAC – emergency action code, APP – additional personal protection, HIN – hazard identification number</p> <p>* 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</p> <p>† People should stay indoors with windows and doors closed, ignition sources should be eliminated and ventilation stopped. Non-essential personnel should move at least 250 m away from the incident</p> <p>Reference</p> <p>Dangerous Goods Emergency Action Code List, National Chemical Emergency Centre (NCEC), Part of Ricardo-AEA, The Stationery Office, 2015.</p>				

Classification, labelling and packaging (CLP)*

Hazard class and category	Flam. Liq. 3	Flammable liquids, category 3	
	Acute Tox. 4	Acute toxicity (dermal, inhalation), category 4	
	Skin Irrit. 2	Skin irritation, category 2	
Hazard statement	H226	Flammable liquid and vapour	
	H332	Harmful if inhaled	
	H312	Harmful in contact with skin	
	H315	Causes skin irritation	
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 05/2015).			

Physicochemical Properties

CAS number	1330-20-7
Molecular weight	106.17
Empirical formula	C ₈ H ₁₀
Common synonyms	Dimethylbenzene, xylol, methyltoluene, (o-xylene, m-xylene, p-xylene)
State at room temperature	Liquid
Volatility	Vapour pressure = 6.72 mmHg at 21°C
Specific gravity	0.86 (water = 1)
Flammability	Flammable
Lower explosive limit	1%
Upper explosive limit	7%
Water solubility	Practically insoluble
Reactivity	Reacts with strong acids such as acetic acid and nitric acid. Reacts violently with strong oxidisers such as chlorine, bromine and fluorine
Reaction or degradation products	When heated to decomposition it emits acrid smoke and fumes
Odour	Sweet odour
Structure	<div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;"> <p>para-</p>  </div> <div style="text-align: center;"> <p>meta-</p>  </div> <div style="text-align: center;"> <p>ortho-</p>  </div> </div>
References	<p>Hazardous Substances Data Bank [Internet]. Bethesda (MD): National Library of Medicine (US); [Last Revision Date 26/06/2009]. Xylenes; Hazardous Substances Databank Number: 4500. Available from: http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB (assessed 05/2015).</p> <p>Xylene (HAZARDTEXT™ Hazard Management). In: Klasco RK (Ed): TOMES® System. Truven Healthcare Analytics Inc., Greenwood Village, Colorado, USA. (electronic version). RightAnswer.com, Inc., Midland, MI, USA, Available at: http://www.rightanswerknowledge.com (assessed 05/2015).</p>

Reported Effect Levels from Authoritative Sources

Exposure by inhalation (see note)

ppm	mg/m ³	Duration	Signs and symptoms	Reference
110	479	Acute	Eye, nose and throat irritation	a
700	3,045	1 hour	Headache, nausea, dizziness, vertigo, vomiting and irritation of the eyes, nose and throat	b
690	3,000	15 mins	Dizziness (p-xylene)	b
10,000	43,500	Acute	Loss of consciousness	c

Note: Values relate to xylene mixtures unless otherwise stated

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 WHO. Xylenes in Drinking Water. Background document for development of WHO Guidelines for Drinking Water Quality, 2003. World Health Organization: Geneva.
- b International Programme on Chemical Safety. Environmental Health Criteria 190: Xylenes, 1997. World Health Organization: Geneva.
- c TOXBASE. Xylene, 2010. <http://www.toxbase.org> (accessed 05/2015).

Published Emergency Response Guidelines

Emergency response planning guideline (ERPG) values

	Listed value (ppm)	Calculated value (mg/m ³)
ERPG-1*	No guideline values available	
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 (AEGs)

	ppm				
	10 min	30 min	60 min	4 hours	8 hours
AEGL-1*	130	130	130	130	130
AEGL-2†	2,500 ⁽¹⁾	1,300 ⁽¹⁾	920 ⁽¹⁾	500	400
AEGL-3‡	⁽²⁾	3,600 ⁽¹⁾	2,500 ⁽¹⁾	1,300 ⁽¹⁾	1,000 ⁽¹⁾
<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 an 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> <p>Lower Explosive Limit (LEL) = 9,000 ppm</p> <p>⁽¹⁾ = >10% LEL</p> <p>⁽²⁾ = >50% LEL</p> <p>AEGL 3 - 10 min = ⁽²⁾ 7,200 ppm</p> <p>For values denoted as ⁽¹⁾ a safety considerations against the hazard(s) of explosion(s) must be taken into account</p> <p>For values denoted as ⁽²⁾ extreme safety considerations against the hazard(s) of explosion(s) must be taken into account</p> <p>Reference</p> <p>US Environmental Protection Agency. Acute Exposure Guideline Levels. http://www.epa.gov/oppt/aegl/pubs/chemlist.htm (accessed 05/2015).</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	50	220	100	441
WEL – workplace exposure limit, LTEL – long-term exposure limit, STEL – short-term exposure limit				
Reference				
Health and Safety Executive (HSE). EH40/2005 Workplace Exposure Limits (second edition, 2011).				

Public health guidelines

Drinking water quality guideline	0.5 mg/L
Air quality guideline	Data not available
Soil guideline values and health criteria values	Residential o-xylene – 250 mg/kg dry weight soil m-xylene – 230 mg/kg dry weight soil p-xylene – 240 mg/kg dry weight soil
	Allotments o-xylene – 160 mg/kg dry weight soil m-xylene – 180 mg/kg dry weight soil p-xylene – 160 mg/kg dry weight soil
	Commercial/industrial o-xylene – 2,600 mg/kg dry weight soil m-xylene – 3,500 mg/kg dry weight soil p-xylene – 3,200 mg/kg dry weight soil
	Tolerable daily intake <small>oral</small> 180 µg/kg bw/day
References	
Environment Agency. Soil Guideline Values for Xylene in Soil. Science Report SC050021/Xylene SGV, 2009. Environment Agency: Bristol.	
WHO. Guidelines for Drinking-Water Quality (fourth edition), 2011. World Health Organization: Geneva.	

Health Effects

Major route of exposure

- xylene is highly toxic; it is readily absorbed via the lungs, and can also be absorbed through the GI tract and skin
- systemic toxicity may occur through all routes of exposure

Immediate signs or symptoms of acute exposure

Route	Signs and symptoms
Inhalation	Causes irritation of the nose, throat, and respiratory tract. Systemic features may develop. High concentration exposures will lead to hypoxia. Olfactory fatigue is reported
Ingestion	Causes oropharyngeal and severe gastric irritation with burning sensation in the throat, nausea and vomiting. Systemic features may ensue. Pulmonary aspiration can cause pneumonitis and acute lung injury/acute respiratory distress syndrome (ARDS)
Dermal	Will cause irritation and erythema with possibly necrosis if contact is prolonged
Ocular	Will cause irritation, conjunctivitis, blepharospasm and transient superficial corneal damage
Systemic	Symptoms include nausea, vomiting, dizziness, headache, vertigo, anorexia, confusion, drowsiness, dysarthria, ataxia, deafness, respiratory depression and coma. Pulmonary oedema, cyanosis, convulsions, metabolic acidosis, hypokalaemia, acute liver or kidney injury may occur. Cardiac features include cardiomyopathy, ventricular dysrhythmias, ventricular fibrillation, cardiac arrest and myocardial infarction
References TOXBASE. Xylene, 08/2016. http://www.toxbase.org (accessed 11/2016).	

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 xylene **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 persons individually.

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

Important notes

- 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

- avoid contaminating yourself
- do NOT allow smoking nearby. There may be a risk of fire
- carry out decontamination 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

Dermal exposure

- decontaminate the patient following surface contamination
- if features of systemic toxicity are present manage as for inhalation/ingestion
- other supportive measures as indicated by the patient's clinical condition

Ocular exposure

- 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
- other supportive measures as indicated by the patient's clinical condition

Inhalation

- maintain a clear airway and adequate ventilation; give oxygen if required
- monitor vital signs, cardiac rhythm and measure blood sugar (BM)
- perform a 12 lead ECG in all patients who require assessment
- other supportive measures as indicated by the patient's clinical condition

Ingestion

- gut decontamination is contraindicated
- maintain a clear airway and adequate ventilation; give oxygen if required
- monitor vital signs, cardiac rhythm and measure blood sugar (BM)
- 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 11/2016)
TOXBASE	Xylene features and management, 08/2016
TOXBASE	Skin decontamination – solvents, 05/2012
TOXBASE	Chemicals splashed or sprayed into the eyes, 02/2014

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.

© Crown copyright 2015, www.gov.uk/phe

Re-use of Crown copyright material (excluding logos) is allowed under the terms of the Open Government Licence, visit www.nationalarchives.gov.uk/doc/open-government-licence/version/3/ for terms and conditions.

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

First published: October 2015

Update: November 2016 Health Effects, Decontamination at the Scene & Clinical Decontamination and First Aid