

# Toluene

## Incident management

### Key Points

#### **Fire**

- Highly flammable
- Toluene vapour is explosive when exposed to heat or flame
- Emits acrid smoke and irritating fumes when heated to decomposition
- In the event of a fire involving toluene, use normal foam and normal fire kit with breathing apparatus

#### **Health**


- Toxicity occurs following inhalation or ingestion
- Inhalation causes irritation to the nose, throat and respiratory tract
- Ingestion causes oropharyngeal and gastric irritation with vomiting
- Systemic features following acute inhalation or ingestion include drowsiness, nausea, vomiting, headache, slurred speech, hallucinations, coma and convulsions, as well as ventricular fibrillation and myocardial infarction
- Dermal exposure causes irritation, dryness, erythema and necrotic skin burns if contact is extensive or prolonged. Systemic effects may occur
- Ocular exposure causes burning, irritation, conjunctivitis and corneal injury which is usually reversible

#### **Environment**

- Avoid release into the environment
- Inform Environment Agency of substantial release incidents

## Hazard Identification

### Standard (UK) Dangerous Goods Emergency Action Codes<sup>(a)</sup>

<b>UN</b>		<b>1294</b>	Toluene	
<b>EAC</b>		<b>3YE</b>	Use normal foam. Wear normal fire kit in combination with breathing apparatus*. Spillages and decontamination run-off should be prevented from entering drains and watercourses. Substance can be violently or explosively reactive. There may be a public safety hazard outside the immediate area of the incident**.	
<b>APP</b>		-		
<b>Hazards</b>	<b>Class</b>	<b>3</b>	Flammable liquid	
	<b>Sub risks</b>	-		
<b>HIN</b>		<b>33</b>	Highly flammable liquid	





UN – United Nations number; EAC – Emergency Action Code; APP – Additional Personal Protection; HIN - Hazard Identification Number

\* Normal fire fighting clothing i.e. fire kit (BS EN 469), gloves (BS EN 659) and boots (HO specification A29 and A30) in combination with self-contained open circuit positive pressure compressed air breathing apparatus (BS EN 137).

\*\* 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.

<sup>a</sup> Dangerous Goods Emergency Action Code List 2011. National Chemical Emergency Centre (NCEC). The Stationary Office, London.







*Chemical Hazard Information and Packaging for Supply Classification<sup>(a)</sup>*

<b>Classification</b>	<b>F</b>	Flammable	
	<b>Xn</b>	Harmful	
	<b>Xi</b>	Irritant	
	<b>Repr cat 3</b>	Category 3 reproductive toxin	
<b>Risk phrases</b>	<b>R11</b>	Highly flammable	
	<b>R38</b>	Irritating to skin	
	<b>R48/20</b>	Harmful: danger of serious damage to health by prolonged exposure through inhalation	
	<b>R63</b>	Possible risk of harm to the unborn child	
	<b>R65</b>	Harmful: may cause lung damage if swallowed	
	<b>R67</b>	Vapours may cause drowsiness and dizziness	
<b>Safety phrases</b>	<b>S2</b>	Keep locked up and out of reach of children	
	<b>S36/37</b>	Wear suitable protective clothing and gloves	
	<b>S46</b>	If swallowed, seek medical advice immediately and show this container or label	
	<b>S62</b>	If swallowed, do not induce vomiting: seek medical advice immediately and show this container or label	

<sup>a</sup> Annex VI to Regulation (EC) No 1272/2008 on Classification, Labelling and Packaging of Substances and Mixtures- Table 3.2.

<http://esis.jrc.ec.europa.eu/index.php?PGM=cla> (accessed 03/2012)

*Globally Harmonised System of Classification and Labelling of Chemicals (GHS)<sup>(a)</sup>*

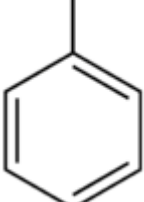
<b>Hazard Class and Category</b>	Flam. Liq. 2	Flammable liquid, category 2	
	Repr. 2	Toxic to reproduction, category 2	
	Asp. Tox. 1	Aspiration hazard, category 1	
	STOT RE 2	Specific target organ systemic toxicity following repeated exposure, category 2	
	Skin Irrit. 2	Skin irritant, category 2	
	STOT SE 3	Specific target organ systemic toxicity following single exposure, category 3	
<b>Hazard Statement</b>	<b>H225</b>	Highly flammable liquid and vapour	
	<b>H361d</b>	Suspected of damaging the unborn child	
	<b>H304</b>	May be fatal if swallowed and enters airways	

<sup>a</sup> Annex VI to Regulation (EC) No 1272/2008 on Classification, Labelling and Packaging of Substances and Mixtures- Table 3.1.  
<http://esis.jrc.ec.europa.eu/index.php?PGM=cla> (accessed 03/2012)

	<b>H373</b>	May cause damage to organs through prolonged or repeated exposure
	<b>H315</b>	Causes skin irritation
	<b>H336</b>	May cause drowsiness or dizziness
<b>Signal Words</b>	DANGER	

Implemented in the EU on 20 January 2009.

## Physicochemical Properties

<b>CAS number</b>	108-88-3
<b>Molecular weight</b>	92
<b>Empirical formula</b>	C <sub>7</sub> H <sub>8</sub>
<b>Common synonyms</b>	Methylbenzene; Phenylmethane
<b>State at room temperature</b>	Liquid
<b>Volatility</b>	Vapour pressure = 37 mm Hg at 30 °C
<b>Specific gravity</b>	0.9 at 30 °C (water = 1)
<b>Flammability</b>	Highly flammable
<b>Lower explosive limit</b>	1.1%
<b>Upper explosive limit</b>	7.1%
<b>Water solubility</b>	Very slightly soluble in water
<b>Reactivity</b>	Toluene can react vigorously with oxidizing materials; toluene vapour is explosive when exposed to heat or flame Toluene will attack some plastics, rubber and coatings
<b>Reaction or degradation products</b>	Emits acrid smoke and irritating fumes when heated to decomposition
<b>Odour</b>	Sweet, aromatic
<b>Structure</b>	

References<sup>(a,b,c)</sup>

<sup>a</sup> Toluene (HAZARDTEXT<sup>®</sup> Hazard Management). In: Klasco RK (Ed): TOMES<sup>®</sup> System, Thomson Micromedex, Greenwood Village, Colorado, USA. (electronic version). RightAnswer.com, Inc., Midland, MI, USA, Available at: <http://www.rightanswerknowledge.com/data/dt/dt850.htm> (accessed 03/2012).

<sup>b</sup> The Merck Index (14<sup>th</sup> Edition). Entry 9529: Toluene, 2006.

<sup>c</sup> The Dictionary of Substances and their Effects. Ed. S Gangolli. Second Edition, Volume 7, 1999.

### Threshold Toxicity Values

<b>EXPOSURE VIA INHALATION</b>			
<b>ppm</b>	<b>mg m<sup>-3</sup></b>	<b>SIGNS AND SYMPTOMS</b>	<b>REFERENCES</b>
<b>50 - 100</b>	<b>188 - 375</b>	Subjective complaints (fatigue, drowsiness, mild headache)	a
<b>200</b>	<b>750</b>	Mild throat and eye irritation, prolonged eye-to-hand reaction time, some impaired cognitive function, mild headache, dizziness, sensation of intoxication, fatigue, general confusion and moderate insomnia	a
<b>400</b>	<b>1500</b>	Irritation of the eyes and throat, lacrimation, mental confusion and in-coordination (8 hours)	a
<b>500 - 600</b>	<b>1875 - 2250</b>	Anorexia, staggering gate, nausea, nervousness, momentary loss of memory, significant reduction in reaction time	a
<b>1500</b>	<b>5625</b>	Extreme weakness	a
<b>4000</b>	<b>15000</b>	Rapid impairment of reaction time and coordination. Exposures of 1 hour or longer may lead to narcosis and possibly death.	a
<b>10000 - 30000</b>	<b>37500 - 112500</b>	Onset of narcosis within minutes; longer exposures may be lethal	a

<sup>a</sup> International Programme on Chemical Safety, Environmental Health Criteria 52: Toluene, 1986.

## Published Emergency Response Guidelines

### Emergency Response Planning Guideline (ERPG) Values<sup>(a)</sup>

	Listed value (ppm)	Calculated value (mg m <sup>-3</sup> )
<b>ERPG-1*</b>	50	188
<b>ERPG-2**</b>	300	1131
<b>ERPG-3***</b>	1000	3769

\* Maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hr 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 hr 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 hr without experiencing or developing life-threatening health effects.

### Interim Acute Exposure Guideline Levels (AEGs)<sup>(b)</sup>

	ppm				
	10 min	30 min	60 min	4 hr	8 hr
<b>AEGL-1<sup>†</sup></b>	200	200	200	200	200
<b>AEGL-2<sup>††</sup></b>	3100 <sup>◇</sup>	1600 <sup>◇</sup>	1200	790	650
<b>AEGL-3<sup>†††</sup></b>	◇◇	6100 <sup>◇</sup>	4500 <sup>◇</sup>	3000 <sup>◇</sup>	2500 <sup>◇</sup>

<sup>†</sup> The level of the chemical in air at or above which the general population could experience notable discomfort.

<sup>††</sup> The 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.

<sup>†††</sup> The level of the chemical in air at or above which the general population could experience life-threatening health effects or death.

Lower Explosive Limit (LEL) = 14000 ppm

◇ ≥ 10 % LEL; ◇◇ ≥ 50 % LEL

For values denoted as ◇ safety considerations against the hazard(s) of explosion(s) must be taken into account.

For values denoted as ◇◇ extreme safety considerations against the hazard(s) of explosion(s) must be taken into account

<sup>a</sup> American Industrial Hygiene Association (AIHA). 2011 Emergency Response Planning Guideline Values.

[http://www.aiha.org/insideaiha/GuidelineDevelopment/ERPG/Documents/2011erpgweelhandbook\\_table-only.pdf](http://www.aiha.org/insideaiha/GuidelineDevelopment/ERPG/Documents/2011erpgweelhandbook_table-only.pdf) (accessed 03/2012).

<sup>b</sup> U.S. Environmental Protection Agency. Acute Exposure Guideline Levels, <http://www.epa.gov/oppt/aegl/pubs/chemlist.htm> (accessed 03/2012).



## Exposure Standards, Guidelines or Regulations

### Occupational standards

<b>WEL</b> <sup>(a)</sup> <a href="http://www.hse.gov.uk/">http://www.hse.gov.uk/</a>	LTEL (8 hour reference period): 50 ppm (191 mg m <sup>-3</sup> )
	STEL (15 min reference period): 100 ppm (384 mg m <sup>-3</sup> )

### Public health guidelines

<b>DRINKING WATER QUALITY GUIDELINE</b> <sup>(b)</sup> <a href="http://www.who.int/en/">http://www.who.int/en/</a>	0.7 mg L <sup>-1</sup>
<b>AIR QUALITY GUIDELINE</b> <sup>(c)</sup> <a href="http://www.who.int/en/">http://www.who.int/en/</a>	0.26 mg m <sup>3</sup> (weekly average)
<b>SOIL GUIDELINE VALUE AND HEALTH CRITERIA VALUES</b> <sup>(d,e)</sup> <a href="http://www.environment-agency.gov.uk/">http://www.environment-agency.gov.uk/</a>	<b>Residential</b> 610 mg kg <sup>-1</sup> dry weight soil
	<b>Allotment</b> 120 mg kg <sup>-1</sup> dry weight soil
	<b>Commercial</b> 4400 mg kg <sup>-1</sup> dry weight soil
	<b>Tolerable Daily Intake</b> <sup>oral</sup> 223 µg kg <sup>-1</sup> bw day <sup>-1</sup>
	<b>Mean Daily Intake</b> <sup>oral</sup> 10 µg day <sup>-1</sup>
	<b>Tolerable Daily Intake</b> <sup>inhalation</sup> 1400 µg kg <sup>-1</sup> bw day <sup>-1</sup>
	<b>Mean Daily Intake</b> <sup>inhalation</sup> 520 µg day <sup>-1</sup>

WEL – Workplace exposure limit; LTEL - Long-term exposure limit; STEL – Short-term exposure limit

<sup>a</sup> EH40/2005 Workplace Exposure Limits (second edition, published 2011).  
<http://www.hse.gov.uk/pubns/priced/eh40.pdf> (accessed 03/2012)

<sup>b</sup> Guidelines for Drinking-Water Quality, Fourth Edition. WHO, Geneva. 2011.

<sup>c</sup> Air Quality Guidelines for Europe. World Health Organization Regional Office for Europe, Copenhagen WHO Regional Publications, European Series, No. 91, Second Edition, 2000.

<sup>d</sup> Environment Agency (EA). Soil Guideline Values for Toluene in soil. Science Report SC050021/Toluene SGV.2009. EA. Bristol, UK.

<sup>e</sup> Environment Agency (EA), Contaminants in soil: updated collation of toxicological data and intake values for humans. Toluene. Science Report SC050021. 2009, EA: Bristol, UK.

## Health Effects

### *Major routes of exposure<sup>(a)</sup>*

- Toxicity occurs following inhalation or ingestion.
- Toluene is only slowly absorbed through intact skin, although patients with significant dermal exposure are also likely to have inhalation exposure.

### *Immediate Signs or Symptoms of Acute Exposure<sup>(b)</sup>*

- Inhalation may cause irritation to the eyes, nose, throat and respiratory tract. Respiratory complications include acute bronchitis, bronchospasm, pneumonitis, asphyxia and pulmonary oedema. Systemic features may occur.
- Ingestion may cause abdominal pain, oropharyngeal and gastric irritation with vomiting. Systemic features may occur.
- Dermal exposure may cause irritation, dryness, erythema, defatting, blistering and necrotic skin burns if contact is extensive or prolonged. Systemic effects may occur.
- Systemic features of exposure can include drowsiness, confusion, ataxia, headache, slurred speech, euphoria, hallucinations, coma, respiratory failure, convulsions and death. Cardiovascular features include hypertension, hypotension, tachycardia or bradycardia, ventricular fibrillation, cardiac arrest and myocardial infarction. Rhabdomyolysis, hepatic and renal damage with severe metabolic acidosis (anion gap may be raised due to acidic metabolites), fluid and electrolyte disturbances including hypokalaemia and hypophosphataemia, can occur. Other features of exposure include nausea, vomiting, paraesthesia and peripheral neuropathy.
- Ocular exposure can cause burning, irritation, conjunctivitis and corneal injury which is usually reversible.

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TOXBASE - <http://www.toxbase.org> (accessed 03/2012)

<sup>a</sup> TOXBASE: Toluene, 2010.

<sup>b</sup> TOXBASE: Toluene – features and features and management, 2010.

## Decontamination and First Aid

### Important Notes

- Ambulance staff, paramedics and emergency department staff treating chemically-contaminated casualties should be equipped with Department of Health approved, gas-tight (Respirex) decontamination suits based on EN466:1995, EN12941:1998 and prEN943-1:2001, where appropriate.
- Decontamination should be performed using local protocols in designated areas such as a decontamination cubicle with adequate ventilation.
- Flammability warning: prevent exposure to all sources of ignition such as naked flames, electrical equipment, oxidising chemicals and smoking.

### Dermal exposure<sup>(a)</sup>

- Remove patient from exposure.
- The patient should remove all clothing and personal effects.
- Double-bag soiled clothing and place in a sealed container clearly labelled as a biohazard.
- Gently blot away any adherent liquid from the patient.
- Wash hair and all contaminated skin with copious amounts of water (preferably warm) and soap for at least 10-15 minutes. Decontaminate open wounds first and avoid contamination of unexposed skin.
- Pay special attention to skin folds, axillae, ears, fingernails, genital areas and feet.

### Ocular exposure<sup>(b)</sup>

- Remove patient from exposure.
- Remove contact lenses if necessary and immediately irrigate the affected eye thoroughly with water or 0.9% saline for at least 10-15 minutes.
- Patients with corneal damage or those whose symptoms do not resolve rapidly should be referred for urgent ophthalmological assessment.

### Inhalation<sup>(c)</sup>

- Remove patient from exposure.
- Ensure a clear airway and adequate ventilation.
- Give oxygen to symptomatic patients.
- Other measures as indicated by the patient's clinical condition.

### Ingestion<sup>(c)</sup>

- Ensure a clear airway and adequate ventilation.
- Give oxygen to symptomatic patients.

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TOXBASE - <http://www.toxbase.org> (accessed 03/2012)

<sup>a</sup> TOXBASE: Skin decontamination – solvents, 1996.

<sup>b</sup> TOXBASE: Chemicals splashed or sprayed into the eyes, 2007.

<sup>c</sup> TOXBASE: Toluene – features and management, 2010.

- Patients who are asymptomatic or those who have minor gastrointestinal features should be observed for a minimum of 6 hours after ingestion, when they may be discharged with advice to return if symptoms develop.
- Monitor pulse, BP, cardiac rhythm and GCS in symptomatic patients. Perform a 12 lead ECG.
- Other measures as indicated by the patient's clinical condition.

### **Systemic toxicity<sup>(a)</sup>**

- Ensure a clear airway and adequate ventilation.
- Give oxygen to symptomatic patients.
- If systemic features develop, observe for at least 12 hours after exposure. Patients asymptomatic at this stage may be discharged with advice to return if symptoms redevelop.
- Monitor pulse, blood pressure and cardiac rhythm and perform a 12 lead ECG.
- Other measures as indicated by the patient's clinical condition.

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

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TOXBASE - <http://www.toxbase.org> (accessed 03/2012)

<sup>a</sup> TOXBASE: Toluene – features and management, 2010.

