



Isopropanol

Incident Management

Key Points

Fire

- highly flammable
- incompatible with alkaline earth and alkali metals, crotonaldehyde, phosgene, strong acids, amines, ammonia, caustics and strong oxidisers; reacts with metallic aluminium at high temperatures
- emits acrid smoke and fumes when heated to decomposition
- in the event of a fire involving isopropanol, use alcohol resistant foam but, if not available, fine water spray can be used and normal fire kit with breathing apparatus

Health


- absorbed significantly by ingestion, inhalation and skin contact
- ingestion can cause a burning sensation in the mouth and throat, nausea, vomiting, dysarthria, acetone on the breath and abdominal pain, gastritis, haematemesis and melaena
- systemic features include CNS effects such as ataxia, headache, dizziness, drowsiness, stupor, hallucinations, areflexia and muscle weakness
- inhalation may cause mild irritation to the eyes, nose and throat
- dermal contact may cause paraesthesia and erythema
- ocular exposure may cause irritation to the eyes, causing an immediate stinging and burning sensation with lacrimation

Environment




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

Hazard Identification

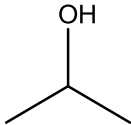
Standard (UK) dangerous goods emergency action codes

UN		1219	Isopropanol (isopropyl alcohol)	
EAC		●2YE	Use alcohol-resistant foam but, if not available, fine water spray can be used. Wear normal fire kit in combination with breathing apparatus*. Danger that the substance can be violently or explosively reactive. Spillages and decontamination run-off should be prevented from entering drains and watercourses. 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 EN 137 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>				

Classification, labelling and packaging (CLP)*

Hazard class and category	Flam. Liq. 2	Flammable liquid, category 2	
	Eye Irrit. 2	Eye irritation, category 2A	
	STOT SE 3	Specific target organ toxicity following single exposure, category 3	
Hazard statement	H225	Highly flammable liquid and vapour	
	H319	Causes serious eye irritation	
	H336	May cause drowsiness or dizziness	
Signal words	DANGER		
<p>* Implemented in the EU on 20 January 2009</p> <p>Reference</p> <p>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 08/2015).</p>			

Physicochemical Properties

CAS number	67-63-0
Molecular weight	60.1
Empirical formula	C ₃ H ₈ O / CH ₃ CHOHCH ₃
Common synonyms	Isopropyl alcohol, 2-propanol, propan-2-ol, dimethylcarbinol
State at room temperature	Colourless liquid
Volatility	Vapour pressure: 33 mmHg at 20°C
Specific gravity Vapour density	0.79 (water = 1) 2.1 (air = 1)
Flammability	Highly flammable
Lower explosive limit	2%
Upper explosive limit	12%
Water solubility	Miscible
Reactivity	Moderately explosive when exposed to heat or flame and forms an explosive mixture with air Incompatible with alkaline earth and alkali metals, crotonaldehyde, phosgene, strong acids, amines, ammonia, caustics and strong oxidisers. Reacts with metallic aluminium at high temperatures. Attacks some plastics and rubbers
Reaction or degradation products	When heated to decomposition, isopropanol emits acrid smoke and fumes
Odour	Pleasant odour resembling alcohol
Structure	
References International Programme on Chemical Safety. International Chemical Safety Card entry for isopropyl alcohol. ICSC 0554, 1999. World Health Organization: Geneva. Isopropyl Alcohol (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 08/2015).	

Reported Effect Levels from Authoritative Sources

Exposure by inhalation

ppm	Signs and symptoms	Reference
12,000	Immediately dangerous to health and life	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>Reference</p> <p>a International Programme on Chemical Safety. Isopropyl Alcohol. Poisons Information Monograph 290, 1990. World Health Organization: Geneva.</p>		

Exposure by ingestion

mL	Concentration	Signs and symptoms	Reference
1	>70%	May cause symptoms	a
240–550	>70%	Potentially fatal	a, b
<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. Isopropyl Alcohol. Poisons Information Monograph 290, 1990. World Health Organization: Geneva.</p> <p>b TOXBASE. Isopropanol, 2014. http://www.toxbase.org (accessed 07/2015).</p>			

Published Emergency Response Guidelines

Emergency response planning guideline (ERPG) values

	Listed value (ppm)	Calculated value (mg/m ³)
ERPG-1*	Data not 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 (AEGLs)

	ppm				
	10 min	30 min	60 min	4 hours	8 hours
AEGL-1*	Data not available				
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	400	999	500	1,250
WEL – workplace exposure limit, LTEL – long-term exposure limit, STEL – short-term exposure limit Reference HSE. EH40/2005 Workplace Exposure Limits, 2 nd Edition, 2011.				

Public health guidelines

Drinking water standards	No guideline value specified
Air quality guideline	No guideline value specified
Soil guideline values and health criteria values	No guideline value specified

Health Effects

Major route of exposure

- isopropanol is absorbed significantly by ingestion, inhalation and dermal exposure

Immediate signs or symptoms of acute exposure

Route	Signs and symptoms
Inhalation	Accidental inhalation may cause mild irritation to the eyes, nose and throat but would be unlikely to cause systemic effects. Prolonged inhalation may result in systemic features
Ingestion	Ingestion can cause a burning sensation in the mouth and throat, nausea, vomiting, dysarthria, acetone on the breath, abdominal pain, gastritis, haematemesis and melaena
Dermal	Dermal contact may cause paraesthesia and erythema. Prolonged skin contact may also result in systemic features
Ocular	Ocular exposure may cause irritation to the eyes, causing an immediate stinging and burning sensation with lacrimation
Systemic	<p>CNS effects include ataxia, headache, dizziness, drowsiness, stupor, hallucinations, areflexia and muscle weakness. In severe poisoning, CNS and respiratory depression may occur, leading to deep coma, cyanosis and convulsions</p> <p>Cardiovascular effects include initial tachycardia. In severe cases myocardial depression may develop, leading to bradycardia, hypotension and dysrhythmias</p> <p>Other complications may include hypoglycaemia or hyperglycaemia, red blood cell haemolysis, ketonuria, renal tubular acidosis, hepatic dysfunction, rhabdomyolysis, and bronchopneumonia</p>
References	
TOXBASE. Isopropyl alcohol (Isopropanol), 04/2014. 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 isopropanol **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

- secondary care staff should not need to wear protective equipment other than routine precautions against secondary contamination with vomit and body fluids

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 (as above) the patient following surface contamination
- systemic toxicity would not be expected unless exposure has been extensive or prolonged; in such cases follow the guidance for ingestion of isopropanol
- 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 or in a small cup held over the eye socket; an eye dropper is an alternative
- if symptoms persist seek medical assistance
- in hospital immediately irrigate the affected 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 ophthalmological assessment if there is doubt regarding the management of corneal damage
- other supportive measures as indicated by the patient's clinical condition

Inhalation

- maintain a clear airway and ensure adequate ventilation
- if systemic effects occur manage as for ingestion
- other supportive measures as indicated by the patient's clinical condition

Ingestion

- maintain a clear airway and ensure adequate ventilation
- in the event of cardiac arrest in hospital or witnessed out of hospital cardiac arrest with bystander CPR, resuscitation should be continued for at least 1 hour and only stopped after discussion with a senior clinician. Prolonged resuscitation for cardiac arrest is recommended following poisoning as recovery with good neurological outcome may occur
- gut decontamination is unlikely to be of benefit since isopropyl alcohol is rapidly absorbed and activated charcoal does not significantly reduce the rate of absorption
- monitor pulse, blood pressure and body temperature
- perform a 12 lead ECG
- other supportive measures as indicated by the patient's clinical condition

Clinical decontamination and first aid references

TOXBASE	http://www.toxbase.org (accessed 11/2016)
TOXBASE	Isopropyl alcohol, 04/2014
TOXBASE	Isopropyl alcohol – features and management, 04/2014
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

First published: January 2016

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