



UK Health  
Security  
Agency

# Acetonitrile

## Incident management

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## Main points

### General

Acetonitrile is a colourless and a highly flammable liquid. It is an industrial chemical used in the production of plastics and other industrial chemicals.

Acetonitrile reacts with strong oxidants causing a fire and explosion hazard. It also emits toxic fumes of hydrogen cyanide and nitrogen oxides when heated to decomposition.

### Health

Major routes of exposure include ingestion, inhalation and dermal contact.

Early features include headache, nausea, dizziness and anxiety followed by confusion, drowsiness, tachycardia, palpitations and tachypnoea.

In cases of moderate toxicity there may be brief episodes of loss of consciousness, convulsions, vomiting, profound lactic acidosis and hypotension.

In severe cases, coma, fixed unreactive pupils, cardiovascular collapse, respiratory depression, myocardial ischaemia, cardiac arrhythmia and pulmonary oedema may occur.

Toxicity from dermal exposure requires a large surface area to be affected.

Ocular exposure may result in pain, blepharospasm, lacrimation, conjunctivitis, palpebral oedema and photophobia.

### Casualty decontamination at the scene

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


### Environment

Inform the [Environment Agency](#) where appropriate.

Spillages and decontamination run-off should be prevented from entering drains and watercourses.

# Hazard identification

**Table 1. Standard (UK) dangerous goods emergency action codes**

<b>UN</b>		1648	Acetonitrile	
<b>EAC</b>		●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 <sup>†</sup>	
<b>APP</b>		–	–	
<b>Hazards</b>	<b>Class</b>	3	Flammable liquids	
	<b>Sub-risks</b>	–	–	
<b>HIN</b>		33	Highly flammable liquid (flashpoint below 23°C)	

## Abbreviations

UN = United Nations number

EAC = emergency action code

APP = additional personal protection

HIN = hazard identification number

## Notes to Table 1




[note 1] Normal firefighting clothing is appropriate, that is, 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.

[note 2] 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 metres away from the incident.

## Reference

[Dangerous Goods Emergency Action Code List](#). National Chemical Emergency Centre (NCEC), part of Ricardo-AEA. The Stationery Office (2021).

**Table 2. The GB classification, labelling and packaging (CLP) regulation**

<b>Hazard class and category</b>	Flam. Liq. 2	Flammable liquid, category 2	
	Acute Tox. 4	Acute toxicity (oral, dermal, inhalation), category 4	
	Eye Irrit. 2	Eye irritation, category 2	
<b>Hazard statement</b>	H225	Highly flammable liquid and vapour	
	H332	Harmful if inhaled	
	H312	Harmful in contact with skin	
	H302	Harmful if swallowed	
	H319	Causes serious eye irritation	
<b>Signal words</b>	DANGER		

**Reference**

The Health and Safety Executive (HSE). [GB CLP Regulation](#) (viewed February 2022).

## Physicochemical properties

**Table 3. Physicochemical properties**

<b>CAS number</b>	75-05-8
<b>Molecular weight</b>	41.0
<b>Formula</b>	C <sub>2</sub> H <sub>3</sub> N / CH <sub>3</sub> CN
<b>Common synonyms</b>	Methyl cyanide, cyanomethane, ethanenitrile, methanecarbonitrile
<b>State at room temperature</b>	Colourless liquid
<b>Volatility</b>	Vapour pressure: 73 mmHg at 20°C
<b>Specific gravity</b>	0.8 (water = 1)
<b>Vapour density</b>	1.4 (air = 1)
<b>Flammability</b>	Highly flammable
<b>Lower explosive limit</b>	3%
<b>Upper explosive limit</b>	17%
<b>Water solubility</b>	Very soluble
<b>Reactivity</b>	Acetonitrile is considered a dangerous fire hazard when exposed to heat, flame or oxidisers. It reacts with strong oxidants causing a fire and explosion hazard. Attacks some forms of plastic, rubber and coatings. The vapour mixes well with air. Explosive mixtures are easily formed
<b>Reaction or degradation products</b>	When heated to decomposition, acetonitrile can form toxic fumes of hydrogen cyanide and nitrogen oxides. Reacts with acids and bases producing hydrogen cyanide
<b>Odour</b>	Characteristic odour
<b>Structure</b>	$\text{H}_3\text{C} \text{---} \equiv \text{N}$

### References

International Programme on Chemical Safety. '[International chemical safety card entry for Acetonitrile](#)'. ICSC 0088, 2011. World Health Organization (WHO) Geneva.

PubChem. Bethesda (MD): National Library of Medicine (US), National Center for Biotechnology Information (2004-). '[PubChem Compound Summary for CID 6342, Acetonitrile](#)' (viewed February 2022).

## Reported effect levels from authoritative sources

**Table 4. Exposure by inhalation**

ppm	mg/m <sup>3</sup>	Signs and symptoms	Reference
>500	>840	Level that may cause toxicity	a

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

### Reference

a. International Programme on Chemical Safety. '[Acetonitrile. Environmental Health Criteria 154](#)' (1993) WHO Geneva.

**Table 5. Exposure by skin**

g	Signs and symptoms	Reference
1–2	Potentially fatal	a

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

### Reference

a. International Programme on Chemical Safety. '[Acetonitrile. Environmental Health Criteria 154](#)'. (1993) WHO Geneva.

## Published emergency response guidelines

**Table 6. Acute exposure guideline levels (AEGLs) showing concentrations in ppm**

	Concentration (ppm)				
	10 min	30 min	60 min	4 hours	8 hours
<b>AEGL-1</b> [note 1]	13	13	13	13	NR
<b>AEGL-2</b> [note 2]	80	80	50	21	14
<b>AEGL-3</b> [note 3]	240	240	150	64	42

### Notes to Table 6

[note 1] Level of the chemical in air at or above which the general population could experience notable discomfort.

[note 2] 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.

[note 3] Level of the chemical in air at or above which the general population could experience life-threatening health effects or death.

NR = not recommended

### Reference

US Environmental Protection Agency. '[Acute Exposure Guideline Levels](#)' (viewed in February 2022).



# Exposure standards, guidelines or regulations

**Table 7. Occupational standards**

	LTEL (8-hour reference period)		STEL (15-min reference period)	
	ppm	mg/m <sup>3</sup>	ppm	mg/m <sup>3</sup>
<b>WEL</b>	40	68	60	102

### Abbreviations

WEL = workplace exposure limit

LTEL = long-term exposure limit

STEL = short-term exposure limit

### Reference

HSE. '[EH40/2005 Workplace Exposure Limits](#) . Fourth Edition' (2020).

**Table 8. Public health guidelines**

<b>Drinking water standard</b>	No guideline value specified
<b>WHO air quality guideline</b>	No guideline value specified

## Health effects

### Major route of exposure

#### Inhalation, ingestion or dermal contact

Acetonitrile is metabolised to hydrogen cyanide. Toxicity after ingestion of acetonitrile can be delayed for 3 to 12 hours due to slow metabolic release of cyanide.

**Table 9. Immediate signs or symptoms of acute exposure**

Route	Signs and symptoms
<b>Inhalation or ingestion</b>	<p>Early features include headache, nausea, dizziness and anxiety followed by confusion, drowsiness, tachycardia, palpitations and tachypnoea.</p> <p>In cases of moderate toxicity there may be brief episodes of loss of consciousness, convulsions, vomiting and hypotension.</p> <p>Cherry red skin and 'bitter almond' on the patient's breath can occur in some cases.</p> <p>It is estimated that 20 to 40% of people are genetically unable to detect this odour.</p> <p>In severe poisoning deep coma, fixed unreactive pupils, cardiovascular collapse, respiratory depression, myocardial ischaemia, cardiac arrhythmias and pulmonary oedema may develop. Profound sinus bradycardia or AV dissociation may occur in pre-terminal patients. Cyanosis is often a late sign and may not occur, even in patients with cardiovascular collapse.</p> <p>A profound lactic acidosis causing a high anion gap metabolic acidosis is usually seen in cases of moderate and severe cyanide poisoning.</p>
<b>Dermal</b>	<p>Systemic toxicity from skin exposure requires a large surface area to be affected. Onset of toxicity may be delayed for several hours (symptoms as for inhalation or ingestion).</p>
<b>Ocular</b>	<p>Pain, blepharospasm, lacrimation, conjunctivitis, palpebral oedema and photophobia.</p>

#### Reference

[TOXBASE](#). Acetonitrile. February 2019 (viewed February 2022).

# Decontamination at the scene

## Chemical-specific advice

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 acetonitrile 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 the UK Health Security Agency (Radiation, Chemicals and Environment Directorate) 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 (for example 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 and so on) 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 or 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

Home Office. [Initial operational response to a CBRN incident](#). Version 2.0 (July 2015).

NHS England. [Emergency Preparedness, Resilience and Response \(EPRR\): Guidance for the initial management of self-presenters from incidents involving hazardous materials](#). (February 2019).

## 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.

### Important notes

Once body surface contaminants have been removed or if your patient was exposed by ingestion or inhalation, the risk that secondary care givers may become contaminated is very low. Secondary carers should wear standard hospital PPE as a precaution against secondary contamination from vomit and body fluids.

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.

Avoid contaminating yourself with this product and wash any exposed area.

Contaminated clothing should be removed, double-bagged, sealed and stored safely.

Decontaminate open wounds first and avoid contamination of unexposed skin.

Any particulate matter adherent to skin should be removed and the patient washed with soap and copious amounts of water under low pressure for at least 10 to 15 minutes.

Pay particular attention to mucous membranes, moist areas such as skin folds, fingernails and ears.

The earlier irrigation begins, the greater the benefit.

## Dermal exposure

Maintain a clear airway and ensure adequate ventilation.

Give oxygen if required.

Decontaminate (as above) the patient following surface contamination.

If features of systemic toxicity are present manage as for inhalation or 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 (for example, 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 (for example, by an infusion bag with a giving set). A Morgan Lens may be used if anaesthetic has been given.

Irrigate for 10 to 15 minutes irrespective of initial conjunctival pH. Aim for a final conjunctival pH of 7.5 to 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 or ingestion

Maintain a clear airway and ensure adequate ventilation.

Administer oxygen to achieve adequate oxygenation.

Monitor vital signs and cardiac rhythm. Check the capillary blood glucose.

Check and record pupil size.

In symptomatic patients monitor cardiac rhythm and perform 12 lead ECG.

Other supportive measures as indicated by the patient's clinical condition.

## Antidotes

Several antidotes exist for the treatment of cyanide poisoning. Further information is available on [TOXBASE](#).

## Clinical decontamination and first aid references

### [TOXBASE](#):

- acetonitrile (2019)
- cyanide and cyanide salts – features and management (2020)
- chemicals splashed or sprayed into eyes – features and management (2020)
- skin decontamination – irritants (2019)
- cyanides antidotes index (2020)



# About the UK Health Security Agency

UKHSA is responsible for protecting every member of every community from the impact of infectious diseases, chemical, biological, radiological and nuclear incidents and other health threats. We provide intellectual, scientific and operational leadership at national and local level, as well as on the global stage, to make the nation health secure.

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