



UK Health  
Security  
Agency

# Acetonitrile

## Incident management

This document provides information needed for response to a chemical incident, such as physicochemical properties, health effects and decontamination advice.

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## Main points

### General

Acetonitrile is a colourless and a highly flammable liquid with a sweet aromatic odour.

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

Highly toxic by ingestion. Can cause toxicity by inhalation and skin 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.

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 and avoid release into the environment.

Spillages and contaminated fire and decontamination run-off should be prevented from entering drains and surface and groundwaters.

## Hazard identification

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

<b>UN</b>		1648	Acetonitrile	
<b>EAC</b>		●2YE	<p>Use alcohol-resistant foam but, if not available, fine water spray can be used. Wear normal fire kit in combination with breathing apparatus [note 1].</p> <p>Substance can be violently or explosively reactive.</p> <p>Spillages, contaminated fire and decontamination run-off should be prevented from entering drains and surface and groundwaters.</p> <p>There may be a public safety hazard outside the immediate area of the incident [note 2].</p>	
<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, self-contained open circuit positive pressure compressed air breathing apparatus conforming to BS EN 137 worn in combination with fire kit conforming to BS EN 469, fire fighters' gloves conforming to BS EN 659 and firefighters' footwear conforming to BS EN 15090 (Footwear for firefighters) type F3- Hazmat and structural firefighting [CH – marking for chemical resistance] or alternatively firefighters' boots conforming to Home Office Specification A29 (rubber boots) or A30 (leather boots). Leather footwear including those conforming to A30 may not provide adequate chemical resistance therefore caution should be exercised in the use of these boots.

Note 2: People should be warned to stay indoors with all doors and windows closed, preferably in rooms upstairs and facing away from the incident. Ignition sources should be eliminated and ventilation stopped. Effects may spread beyond the immediate vicinity. All non-essential personnel should be instructed to move at least 250 m away from the incident.

### References

National Chemical Emergency Centre (NCEC), part of Ricardo-AEA. '[Dangerous Goods Emergency Action Code List](#)'. 2023 (viewed on 04 November 2024)

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

<b>Hazard class, category and symbol</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		

### References

The Health and Safety Executive (HSE). '[GB CLP Regulation](#)' (viewed on 04 November 2024).

## Physicochemical properties

**Table 3. Physicochemical properties**

<b>CAS number</b>	75-05-8
<b>Molecular weight</b>	41.05
<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>	16%
<b>Water solubility</b>	Very soluble
<b>Reactivity</b>	Acetonitrile is considered a dangerous fire hazard when exposed to heat, flame or oxidisers.. 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>	Decomposes on heating or on burning and on contact with hot surfaces. forming toxic fumes of hydrogen cyanide and nitrogen oxides. Reacts with acids and bases producing hydrogen cyanide.
<b>Odour</b>	Sweet aromatic odour
<b>Structure</b>	$\text{H}_3\text{C} \text{---} \equiv \text{N}$

### References

World Health Organization. International Programme on Chemical Safety '[International Chemical Safety Card entry for Acetonitrile](#)' ICSC 0088, 2011 (viewed on 04 November 2024)

PubChem. Bethesda (MD): National Library of Medicine (US), National Center for Biotechnology Information. '[PubChem Compound Summary for CID 6342, Acetonitrile](#)' (viewed on 04 November 2024)

## Reported effect levels from authoritative sources

**Table 4. Exposure by inhalation of vapours**

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

**Table 5. Exposure by ingestion**

g/kg	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.

### References

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

## Published emergency response guidelines

**Table 6. Acute exposure guideline levels (AEGLs)**

	Concentration (ppm)				
	10 minutes	30 minutes	60 minutes	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 reported due to insufficient data

### Reference

US Environmental Protection Agency (EPA). '[Acute Exposure Guideline Levels](#)' (viewed on 04 November 2024)



## 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

Health and Safety Executive (HSE). '[EH40/2005 Workplace Exposure Limits Fourth Edition](#)' 2020 (viewed on 04 November 2024)

**Table 8. Public health standards and guidelines**

<b>Drinking water standard</b>	No value specified
<b>WHO guideline for drinking water quality</b>	No value specified
<b>UK indoor air quality guideline</b>	No value specified
<b>WHO indoor air quality guideline</b>	No value specified
<b>WHO air quality guideline</b>	No value specified

## Health effects

Highly toxic by ingestion. Can cause toxicity by inhalation and skin 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. 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' odour on the patient's breath can occur in some cases. 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>	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).
<b>Ocular</b>	Pain, blepharospasm, lacrimation, conjunctivitis, palpebral oedema and photophobia.

### Reference

National Poisons Information Service (NPIS). TOXBASE '[acetonitrile](#)' 2019 (viewed on 05 November 2024)

## 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 (UKHSA) Radiation, Chemicals, Climate and Environmental Hazards 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, disrobing should be conducted at the scene and by the casualty themselves. Disrobing should be systematic to prevent transfer of contaminant from clothing to skin. Clothing should not be pulled over the head if possible.

Clothing stuck to the casualty by the contaminant should not be forcefully removed, as this risks causing further harm.

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.

## 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.

Unprotected first responders and members of the public should not approach casualties incapacitated by exposure to administer improvised decontamination, as they may be exposed to contaminants and become a casualty themselves.

Important note: Improvised decontamination should continue until more structured interventions such as Interim or Specialist Operational Response are present.

## Improvised dry decontamination

Improvised dry decontamination should be considered for an incident involving acetonitrile unless casualties are demonstrating obvious signs of chemical burns or skin irritation.

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 first and then rubbed, starting with the face, head, and neck, and moving down and away from the body.

Blotting and rubbing should not be too aggressive, as it could drive contamination further into the skin.

Casualties should also blow their nose to remove contaminants from the nasal cavities.

All waste material arising from decontamination should be left in situ, and ideally bagged, for disposal at a later stage.

## Improvised wet decontamination

Wet decontamination should be used if contamination with a caustic chemical substance is suspected.

Wet decontamination may be performed using copious amounts of water from any available source such as taps, showers, water bottles, fixed installation hose-reels and sprinklers to gently rinse the affected skin. Other natural sources of water may be considered unless this

creates greater risks to the individuals affected. Wet wipes or baby wipes may be used as an effective alternative.

Improvised decontamination should not involve overly aggressive methods to remove contamination as this could further damage affected tissues and 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.

When vulnerable people are affected by a hazardous substance, they may need additional support to remove themselves, their clothing or the substance.

Casualties should remain in the area and should not leave to seek care at a hospital, as this presents a contamination risk. Further care will be administered on site by the appropriate emergency services.

## Interim wet decontamination

Interim decontamination is the use of standard Fire and Rescue Service 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 2015 (viewed on 05 November 2024)

National Health Service England. [‘Emergency Preparedness, Resilience and Response \(EPRR\): Guidance for the initial management of self-presenters from incidents involving hazardous materials’](#) 2019 (viewed on 05 November 2024)

Joint Emergency Service Interoperability Programme. [‘Initial Operational Response \(IOR\) to Incidents Suspected to Involve Hazardous Substances or CBRN Materials’](#) 2024 (viewed on 05 November 2024)

## 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

Acetonitrile can be metabolised to cyanide. There are antidotes available for the treatment of cyanide poisoning. Further information is available on [TOXBASE](#).

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

Toxic fumes (hydrogen cyanide) may be released after exposure to water, moist air, acids and acid salts; if essential wash in a well-ventilated area and minimise risk of inhalation of toxic fumes. Avoid contaminating yourself.

Carry out decontamination after resuscitation. This should be performed in a well-ventilated area preferably with its own ventilation system.

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 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

Decontaminate (as above) the patient following surface contamination.

Maintain a clear airway and ensure adequate ventilation.

If features of systemic toxicity are present, manage as per ingestion/inhalation.

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 1,000mL 0.9% saline or equivalent crystalloid (for example, by an infusion bag with a giving set) for a minimum of 10 to 15 minutes irrespective of initial conjunctival pH. A Morgan Lens may be used if anaesthetic has been given.

Aim for a neutral conjunctival pH of 7 to 7.2. The conjunctivae may be tested with indicator paper. Retest at 15 to 30 minutes after irrigation and use further irrigation if necessary.

Any particles lodged in the conjunctival recesses should be removed.

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.

## Ingestion and Inhalation

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.

Perform a 12-lead ECG in all patients who require assessment.

Gut decontamination following ingestion: gastric decontamination is unnecessary in asymptomatic patients or those with features of mild toxicity only.

Where the practical expertise exists, consider gastric lavage within 1 hour of ingestion in patients with features of moderate or severe toxicity, providing the airway can be protected.

In a clinically symptomatic patient other measures should be undertaken first, see [TOXBASE](#) for further advice

Activated charcoal may be an alternative if gastric lavage is impractical or will be delayed.

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

## Clinical decontamination and first aid references

National Poisons Information Service (NPIS). TOXBASE '[acetonitrile](#)' 2019 (viewed on 08 November 2024)

National Poisons Information Service (NPIS). TOXBASE '[chemicals splashed or sprayed into the eyes - features and clinical management](#)' 2020 (viewed on 08 November 2024)

National Poisons Information Service (NPIS). TOXBASE '[skin decontamination - irritants](#)' 2019 (viewed on 08 November 2024)

National Poisons Information Service (NPIS). TOXBASE '[cyanide and cyanide salts - features and management](#)' 2020 (viewed on 08 November 2024)

## 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.

UKHSA is an executive agency, sponsored by the [Department of Health and Social Care](#).

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