



UK Health
Security
Agency

Aluminium

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

Aluminium is an odourless metal that is insoluble in water.

Aluminium powder is flammable, it ignites on contact with air. A dust explosion is possible if powder or granular form mixes with air.

Aluminium powder reacts with alcohols and water, and violently with, oxidants, strong acids, strong bases and chlorinated hydrocarbons causing fire and explosion hazard.

Health

Major routes of exposure include ingestion and inhalation.

Inhalation of aluminium dust may cause irritation.

Ingestion of aluminium salts may result in burning in the mouth and throat and mild gastrointestinal upset.

In severe cases ulceration of the lips and mouth, rarely haemorrhagic gastritis, circulatory collapse and multi-organ failure may occur.

Casualty decontamination at the scene

Following disrobe, improvised dry decontamination should be considered for an incident involving aluminium, 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, contaminated fire and decontamination run-off should be prevented from entering drains and surface and groundwaters.

Hazard identification

Table 1a. Standard (UK) dangerous goods emergency action codes for aluminium powder coated

UN		1309	Aluminium powder, coated.	
EAC		4Y	<p>Use dry agent – water must not be allowed to come into contact with substance. Substance can be violently or explosively reactive.</p> <p>Wear normal fire kit in combination with breathing apparatus [note 1].</p> <p>Spillages, contaminated fire and decontamination run-off should be prevented from entering drains and surface and groundwaters.</p>	
APP		–	–	
Hazards	Class	4.1	Flammable solids, self-reactive substances and desensitised explosives	
	Sub-risks	–	–	
HIN		40	Flammable solid, or self-reactive substance, or self-heating substance, or polymerising substance	

Abbreviations

UN = United Nations number.

EAC = emergency action code.

APP = additional personal protection.

HIN = hazard identification number.


Notes to Table 1a

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.

References

National Chemical Emergency Centre (NCEC), part of Ricardo-AEA. '[Dangerous Goods Emergency Action Code List](#)'. 2023 (viewed on 13 November 2024)

Table 1b. Standard (UK) dangerous goods emergency action codes for aluminium carbide, aluminium powder uncoated and sodium aluminium hydride

UN		1394	Aluminium carbide	
		1396	Aluminium powder, uncoated	
		2835	Sodium aluminium hydride	
EAC		4W	Use dry agent. – water must not be allowed to come into contact with substance. Wear chemical protective clothing with liquid tight connections for whole body in combination with breathing apparatus [note 1]. Danger that the substance can be violently or explosively reactive. Spillages, contaminated fire and decontamination run-off should be prevented from entering drains and surface and groundwaters.	
APP		–	–	
Hazards	Class	4.3	Substances which in contact with water emit flammable gases	
	Sub-risks	–	–	
HIN		423	Solid which reacts with water, emitting flammable gas, or flammable solid which reacts with water, emitting flammable gases or self-heating solid which reacts with water, emitting flammable gases	

Abbreviations

UN = United Nations number.

EAC = emergency action code.

APP = additional personal protection.

HIN = hazard identification number.


Notes to Table 1b

Note 1: Chemical protective clothing with liquid tight connections for whole body (Type 3) conforming to the relevant standards such as BS 8428 or EN 14605 in combination with breathing apparatus conforming to BS EN 137.

References

National Chemical Emergency Centre (NCEC), part of Ricardo-AEA. '[Dangerous Goods Emergency Action Code List](#)'. 2023 (viewed on 13 November 2024)

Table 1c. Standard (UK) dangerous goods emergency action codes for aluminium nitrate

UN		1438	Aluminium nitrate	
EAC		1Z	Use coarse water spray. Wear normal fire kit in combination with breathing apparatus [note 1]. Spillages, contaminated fire and decontamination run-off should be prevented from entering drains and surface and groundwaters.	
APP		—	—	
Hazards	Class	5.1	Oxidising substances	
	Sub-risks	—	—	
HIN		50	Oxidising (fire-intensifying) substance	

Abbreviations

UN = United Nations number.

EAC = emergency action code.

APP = additional personal protection.

HIN = hazard identification number.

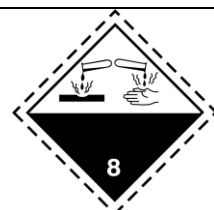
Notes to Table 1c

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.

References

National Chemical Emergency Centre (NCEC), part of Ricardo-AEA. '[Dangerous Goods Emergency Action Code List](#)'. 2023 (viewed on 13 November 2024)

Table 1d. Standard (UK) dangerous goods emergency action codes for aluminium bromide and aluminium chloride

UN		1725	Aluminium bromide, anhydrous	
		1726	Aluminium chloride, anhydrous	
EAC		4W	<p>Use dry agent. – water must not be allowed to come into contact with substance.</p> <p>Wear chemical protective clothing with liquid tight connections for whole body in combination with breathing apparatus [note 1].</p> <p>Danger that the 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>	
APP		–	–	
Hazards	Class	8	Corrosive substance	
	Sub-risks	–	–	
HIN		80	Corrosive or slightly corrosive substance	

Abbreviations

UN = United Nations number.

EAC = emergency action code.

APP = additional personal protection.

HIN = hazard identification number.



Notes to Table 1d

Note 1: Chemical protective clothing with liquid tight connections for whole body (Type 3) conforming to the relevant standards such as BS 8428 or EN 14605 in combination with breathing apparatus conforming to BS EN 137.

References

National Chemical Emergency Centre (NCEC), part of Ricardo-AEA. '[Dangerous Goods Emergency Action Code List](#)'. 2023 (viewed on 13 November 2024)



Table 2. The GB classification, labelling and packaging (CLP) regulation for aluminium powder, pyrophoric

Hazard class and category	Pyr. Sol. 1	Pyrophoric solid, category 1	
	Water-react. 2	Substances and mixtures, which in contact with water, emit flammable gases, category 2	
Hazard statement	H250	Catches fire spontaneously if exposed to air	
	H261	In contact with water releases flammable gases	
Signal words	DANGER		

References

The Health and Safety Executive (HSE). '[GB CLP Regulation](#)' (viewed on 13 November 2024).


Table 2b. The GB classification, labelling and packaging (CLP) regulation for aluminium powder, stabilised

Hazard class and category	Flam. Sol. 1	Flammable solid, category 1	
	Water-react. 2	Substances and mixtures, which in contact with water, emit flammable gases, category 2	
Hazard statement	H228	Flammable solid	
	H261	In contact with water releases flammable gases	
Signal words	DANGER		

References

The Health and Safety Executive (HSE). '[GB CLP Regulation](#)' (viewed on 13 November 2024).

Table 2c. The GB classification, labelling and packaging (CLP) regulation for aluminium chloride, anhydrous

Hazard class and category	Skin Corr. 1B	Skin corrosion/irritation, category 1	
Hazard statement	H314	Causes severe skin burns and eye damage	
Signal words	DANGER		

References

The Health and Safety Executive (HSE). '[GB CLP Regulation](#)' (viewed on 13 November 2024).

Physicochemical properties

Table 3. Physicochemical properties

CAS number	7429-90-5
Molecular weight	26.98
Formula	Al
Common synonyms	Aluminium, A 00, AD1M, Alumina fibre
State at room temperature	Solid
Volatility	Vapour pressure = 1 mmHg at 1284°C, non-volatile at room temperature
Specific gravity	2.70
Flammability	Aluminium powder is flammable
Lower explosive limit	Not available
Upper explosive limit	Not available
Water solubility	Insoluble
Reactivity	Aluminium powder is flammable, it ignites on contact with air. A dust explosion is possible if powder or granular form mixes with air. Aluminium powder reacts with alcohols and water, and violently with, oxidants, strong acids, strong bases and chlorinated hydrocarbons causing fire and explosion hazard.
Odour	Odourless

References

World Health Organization. International Programme on Chemical Safety '[International Chemical Safety Card entry for Aluminium](#)' ICSC 0988, 2019 (viewed on 13 November 2024)

PubChem. Bethesda (MD): National Library of Medicine (US), National Center for Biotechnology Information. '[PubChem Compound Summary for CID 5359268, Aluminium](#)' (viewed on 13 November 2024)

Reported effect levels from authoritative sources

Table 4. Exposure by ingestion

g	Signs and symptoms	Reference
5	Death (aluminium ammonium sulphate)	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

a. National Poisons Information Service (NPIS). TOXBASE '[Aluminium ammonium sulphate](#)', November 2024 (viewed on 13 November 2024)

Published emergency response guidelines

Table 5. Acute exposure guideline levels (AEGLs)

	Concentration				
	10 minutes	30 minutes	60 minutes	4 hours	8 hours
AEGL-1 [note 1]	No values specified				
AEGL-2 [note 2]					
AEGL-3 [note 3]					

Notes to Table 5

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.

Exposure standards, guidelines or regulations

Table 6. Occupational standards

	Chemicals	LTEL (8-hour reference period)		STEL (15-min reference period)	
		ppm	mg/m ³	ppm	mg/m ³
WEL	Aluminium metal and aluminium oxides	-	Inhalable dust: 10 Respirable dust: 4	No values specified	
	Aluminium salts, soluble	-	2	No values specified	

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 13 November 2024)

Table 7. Public health standards and guidelines

Drinking water standard	200 µg/L
WHO guideline for drinking water quality	No value specified
UK indoor air quality guideline	No value specified
WHO indoor air quality guideline	No value specified
WHO air quality guideline	No value specified

Reference

[The Private Water Supplies \(England\) Regulations 2016](#) and [The Private Water Supplies \(Wales\) Regulations 2017](#) (viewed on 13 November 2024)

[The Water Supply \(Water Quality\) Regulations 2018](#) (Water, England and Wales) (viewed on 13 November 2024)

Health effects

Inhalation or ingestion are the main routes of exposure.

Table 8. Signs or symptoms of acute exposure

Route	Signs and symptoms
Inhalation	Inhalation of aluminium dust may cause irritation.
Ingestion	<p>Accidental ingestion of small amounts of dilute preparations of aluminium salts may cause mild gastrointestinal upset only.</p> <p>Ingestion of larger amounts of aluminium salts may lead to ulceration of the lips and mouth, rarely haemorrhagic gastritis, circulatory collapse and multi-organ failure.</p> <p>Increased aluminium absorption and retention in bone has been reported following acute ingestion without apparent adverse sequelae.</p>

Reference

National Poisons Information Service (NPIS). TOXBASE '[Aluminium metal](#)' 2024 (viewed on 13 November 2024).

National Poisons Information Service (NPIS). TOXBASE '[Aluminium soluble salts](#)' 2024 (viewed on 13 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 aluminium 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 a more structured intervention, such as an Interim Operational Response is conducted, or Specialist Operational Response are present.

Improvised dry decontamination

Improvised dry decontamination should be considered for an incident involving aluminium 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 13 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 13 November 2024)

Joint Emergency Service Interoperability Programme. ['Initial Operational Response \(IOR\) to Incidents Suspected to Involve Hazardous Substances or CBRN Materials'](#) 2024 (viewed on 13 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

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.

For comprehensive clinical advice consult [TOXBASE](#) directly.

Clinical decontamination following surface contamination

Avoid contaminating yourself.

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

Decontaminate (as above) the patient following surface contamination.

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.

Carry out other supportive measures as indicated by the patient's clinical condition.

Ingestion

Gut decontamination (including activated charcoal) is unlikely to be of benefit.

Monitor vital signs and check the capillary blood glucose.

Check and record pupil size.

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

Carry out other supportive measures as indicated by the patient's clinical condition.

Inhalation

Specific management is unlikely to be required. Treat symptomatically.

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

Clinical decontamination and first aid references

National Poisons Information Service (NPIS). TOXBASE '[aluminium soluble salts](#)' 2024 (viewed on 14 November 2024)

National Poisons Information Service (NPIS). TOXBASE '[chemicals splashed or sprayed into the eyes - features and clinical management](#)' 2020 (viewed on 14 November 2024)

National Poisons Information Service (NPIS). TOXBASE '[skin decontamination - irritants](#)' 2019 (viewed on 14 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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