



UK Health
Security
Agency

Cadmium

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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Contents

Main points.....	3
General.....	3
Health	3
Casualty decontamination at the scene.....	3
Environment	3
Hazard identification	4
Physicochemical properties	9
Reported effect levels from authoritative sources	10
Published emergency response guidelines.....	11
Exposure standards, guidelines or regulations	12
Health effects	13
Decontamination at the scene.....	14
Chemical specific advice	14
Disrobe	14
Improvised decontamination.....	15
Improvised dry decontamination.....	15
Improvised wet decontamination	16
Additional notes	16
Interim wet decontamination.....	17
Decontamination at the scene references	17
Clinical decontamination and first aid.....	18
Important notes	18
Clinical decontamination following surface contamination.....	18
Dermal exposure	19
Ocular exposure	19
Ingestion and inhalation.....	19
Clinical decontamination and first aid references	19
About the UK Health Security Agency	20

Main points

General

Cadmium is an odourless, insoluble solid at room temperature. Dust explosion is possible if in powder or granular form mixed with air.

Health

Toxicity most frequently results from ingestion or inhalation and is unlikely to occur from skin exposure.

Effects of inhalation exposure may be delayed 12–36 hours and include headache, muscular weakness, metallic taste, cough, dyspnoea, chest pain and metal fume fever type features.

Ingestion of small amounts may cause nausea, vomiting, abdominal pain and diarrhoea.

Ingestion of larger amounts may cause corrosive injury to the GI tract, acute kidney injury and hepatotoxicity.

Skin contact may cause irritation.

Casualty decontamination at the scene

Following disrobe, improvised dry decontamination should be considered for an incident involving cadmium compounds, 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 1. Standard (UK) dangerous goods emergency action codes for cadmium compound

UN		2570	Cadmium compound	
EAC		2X	Use fine water spray. Wear chemical protective clothing with liquid-tight connections for whole body 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	6.1	6.1	Toxic substance	
	-	-	-	
HIN		66/60	Highly toxic or slightly toxic/toxic substances	

Abbreviations

UN = United Nations number

EAC = emergency action code

APP = additional personal protection

HIN = hazard identification number








Notes to Table 1


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 1 October 2024)

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








Hazard class and category	Pyr. Sol. 1	Pyrophoric solids, category 1	
	Acute Tox. 2	Acute toxicity (inhalation), category 2	
	Muta. 2	Germ cell mutagenicity, category 2	
	Carc. 1B	Carcinogenicity, category 1B	
	Repr. 2	Reproductive toxicity, category 2	
	STOT RE 1	Specific target organ toxicity following repeated exposure, category 1	
	Aquatic Acute 1	Acute hazards to the aquatic environment, category 1	

	Aquatic Chronic 1	Chronic hazard to the aquatic environment, category 1	
Hazard statement	H250	Catches fire spontaneously if exposed to air	
	H330	Fatal if inhaled	
	H341	Suspected of causing genetic defects	
	H350	May cause cancer	
	H361fd	Suspected of damaging fertility. Suspected of damaging the unborn child	
	H372	Causes damage to organs through prolonged or repeated exposure	
	H400	Very toxic to aquatic life	
	H410	Very toxic to aquatic life with long-lasting effects	
Signal words	DANGER		

References

The Health and Safety Executive (HSE). '[GB CLP Regulation](#)' (viewed on 1 October 2024)

Table 2b. The GB classification, labelling and packaging (CLP) regulation for cadmium (non-pyrophoric)

	Acute Tox. 2	Acute toxicity (inhalation), category 2	
	Muta. 2	Germ cell mutagenicity, category 2	
	Carc. 1B	Carcinogenicity, category 1B	
	Repr. 2	Reproductive toxicity, category 2	
	STOT RE 1	Specific target organ toxicity following repeated exposure, category 1	
	Aquatic Acute 1	Acute hazards to the aquatic environment, category 1	
	Aquatic Chronic 1	Chronic hazard to the aquatic environment, category 1	
Hazard statement	H330	Fatal if inhaled	
	H341	Suspected of causing genetic defects	

	H350	May cause cancer
	H361fd	Suspected of damaging fertility. Suspected of damaging the unborn child
	H372	Causes damage to organs through prolonged or repeated exposure
	H400	Very toxic to aquatic life
	H410	Very toxic to aquatic life with long-lasting effects
Signal words	DANGER	

References

The Health and Safety Executive (HSE). '[GB CLP Regulation](#)' (viewed on 1 October 2024)

Physicochemical properties

Table 3. Physicochemical properties

CAS number	7440-43-9
Molecular weight	112
Formula	Cd
Common synonyms	-
State at room temperature	Solid
Volatility	Non-volatile at 20°C
Specific gravity	8.6 at 25°C (water = 1)
Flammability	Non-combustible within solid bulk form. Dust explosion possible if in powder or granular form, mixed with air
Lower explosive limit	-
Upper explosive limit	-
Water solubility	Insoluble in water
Reactivity	Dust reacts with oxidants, hydrogen azide, zinc, selenium and tellurium. This generates fire and explosion hazard
Odour	Odourless

References

International Labour Organization (ILO). '[International chemical safety card entry for cadmium. ICSC 0020](#)' World Health Organization 2005 (viewed on 30 September 2024)

PubChem. Bethesda (MD): National Library of Medicine (US), National Center for Biotechnology Information 2004. '[PubChem Compound Summary for CID 23973, Cadmium](#)' (viewed on 30 September 2024)

Reported effect levels from authoritative sources

Table 4. Exposure by inhalation of vapours

ppm	mg/m ³	Signs and symptoms	Reference
0.92 - 2.3	0.2-0.5	Metal fume fever-like symptoms (cadmium oxide)	c
>0.22	>1	May lead to acute chemical pneumonitis (8-hour exposure)	c
1.09	5	Destruction of lung epithelial cells, resulting in pulmonary oedema, tracheobronchitis and pneumonitis	a
1.88	8.63	Estimated fatal exposure (5-hour exposure) (cadmium oxide)	a
230	50	Fatal (1-hour exposure) (cadmium oxide)	b

Table 5. Dermal exposure to vapours

%	Signs and symptoms	Reference
2	Skin irritation	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. Agency for Toxic Substances and Disease Registry (ATSDR). '[Toxicological profile for Cadmium](#)' 2023 (viewed on 1 October 2024)
- b. International Programme on Chemical Safety. '[Cadmium. Environmental Health Criteria 134](#)' 1992 (viewed on 1 October 2024)
- c. International Programme on Chemical Safety. '[Cadmium. Poisons Information Monograph 089](#)' 1992 (viewed on 1 October 2024)

Published emergency response guidelines

Table 5. Acute exposure guideline levels (AEGLs) for cadmium (interim)

	Concentration (ppm)				
	10 minutes	30 minutes	60 minutes	4 hours	8 hours
AEGL-1 [note 1]	0.13	0.13	0.10	0.063	0.041
AEGL-2 [note 2]	1.4	0.96	0.76	0.40	0.20
AEGL-3 [note 3]	8.5	5.9	4.7	1.9	0.93

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.

Reference

US Environmental Protection Agency (EPA). '[Acute Exposure Guideline Levels](#)' 2024 (viewed on 1 October 2024)

Exposure standards, guidelines or regulations

Table 6. Occupational standards

	LTEL (8-hour reference period)		STEL (15-min reference period)	
	ppm	mg/m ³	ppm	mg/m ³
WEL	-	0.025	Not specified	

Abbreviations

WEL = workplace exposure limit

LTEL = long-term exposure limit

STEL = short-term exposure limit

Reference

Health and Safety Executive. '[EH40/2005 Workplace Exposure Limits Fourth Edition](#)' 2020 (viewed on 1 October 2024)

Table 7. Public health standards and guidelines

Drinking water standard	5 µg/L
WHO guideline for drinking water quality	0.003 mg/L (3 µg/L)
UK indoor air quality guideline	5 ng/m ³

Reference

[Private Water Supplies \(England\) Regulations 2016](#) and [Private Water Supplies \(Wales\) Regulations 2017](#) (viewed on 1 October 2024)

[Water Supply \(Water Quality\) Regulations 2018](#) (Water, England and Wales) (viewed on 1 October 2024)

World Health Organization. '[Guidelines for Drinking-water Quality, 4th Edition Incorporating First and Second Addendum](#)' 2022 (viewed on 1 October 2024)

Public Health England. '[Indoor Air Quality Guidelines for selected Volatile Organic Compounds \(VOCs\) in the UK](#)' 2019 (viewed on 1 October 2024)

Health effects

Highly toxic by ingestion, inhalation and skin contact. Acrylonitrile can be metabolised to cyanide.

Table 8. Signs or symptoms of acute exposure

Route	Signs and symptoms
Inhalation	<p>Features may be delayed 12 to 36 hours and include headache, muscular weakness, metallic taste, cough, dyspnoea, chest pain and metal fume fever type features.</p> <p>Chemical pneumonitis and pulmonary oedema may develop within 1 to 4 days.</p> <p>Recovery may be complicated by interstitial lung disease. In severe cases, death due to respiratory failure and acute tubular necrosis.</p> <p>Metal fume fever symptoms include: cough, dyspnoea, sore throat, chest tightness, headache, tachycardia, mild hypertension, sweating, dyspnoea, rhinitis, tiredness, fever, rigors, myalgia and arthralgia may occur and sometimes a metallic taste, abdominal pain, nausea, vomiting and blurred vision.</p>
Ingestion	<p>Small amounts cause irritation of the GI tract with nausea, vomiting, abdominal pain and diarrhoea, usually within 15 to 30 minutes.</p> <p>Larger amounts can cause corrosive injury to the GI tract (pharyngeal burns, drooling, pain, dysphagia, vomiting, stridor).</p> <p>Severe poisoning results in multiple organ failure with hypotension, circulatory failure, acute kidney injury, haemolytic anaemia, hepatotoxicity, and facial and pulmonary oedema.</p>
Eyes	<p>Eyeliner (Khol) contaminated with cadmium and lead was reported to cause keratitis.</p>
Dermal	<p>Causes irritation but is not a major route of absorption.</p>

Reference

National Poisons Information Service. TOXBASE. '[Cadmium Compounds](#)' 2022 (viewed on 30 September 2024)

National Poisons Information Service. TOXBASE. '[Metal Fume Fever](#)' 2024 (viewed on 30 September 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 cadmium compounds unless casualties are demonstrating obvious signs 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 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, 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 cadmium 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.

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 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 July 2015 (viewed on 1 October 2024)

NHS England. [‘Emergency Preparedness, Resilience and Response \(EPRR\): Guidance for the initial management of self-presenters from incidents involving hazardous materials’](#) February 2019 (viewed on 1 October 2024)

Joint Emergency Service Interoperability Programme. [‘Initial Operational Response IOR to Incidents Suspected to Involve Hazardous Substances or CBRN Materials’](#) June 2024 (viewed on 1 October 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.

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.

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

Ocular exposure

If symptomatic immediately irrigate the affected eye thoroughly.

At home, use lukewarm water, trickled into the eye or in a small cup held over the eye socket. An eye dropper is an alternative.

In hospital, immediately irrigate the affected eye thoroughly with 1000 mL 0.9% saline or equivalent crystalloid (for example via an infusion bag with a giving set) for a minimum of 10 to 15 minutes. A Morgan Lens may be used if anaesthetic has been given.

If symptoms persist seek medical assistance.

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

Ingestion and inhalation

Administer oxygen to achieve adequate oxygenation.

Maintain a clear airway and adequate ventilation.

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

Clinical decontamination and first aid references

National Poisons Information Service. [TOXBASE](#). (viewed on 1 October 2024)

National Poisons Information Service. TOXBASE '[Cadmium – features and management](#)' 2022 (viewed on 1 October 2024)

National Poisons Information Service. TOXBASE. '[Eye irritants – features and management](#)' 2020 (viewed on 1 October 2024)

National Poisons Information Service. TOXBASE '[Skin decontamination – irritants](#)' 2019 (viewed on 1 October 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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