



UK Health
Security
Agency

Manganese

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

Manganese is a steel grey brittle metal. It reacts with aqueous solutions of sodium or potassium bicarbonate. It also reacts slowly with water and more rapidly with steam and acids, this produces flammable/explosive gases. Manganese dust or powder is flammable.

Health

Inhalation of manganese containing dust causes irritation of the respiratory tract impaired lung function and pneumonitis. It may also cause neurotoxicity.

Inhalation of freshly formed oxides of manganese may cause metal fume fever, onset of symptoms typically occurs 4-10 hours after exposure. Symptoms are often non-specific and may include fever, sore throat, tachycardia, mild hypertension, sweating, cough, dyspnoea, chest tightness, headache, rhinitis, tiredness, myalgia and arthralgia.

Ingestion of manganese may cause lethargy, abdominal pain, vomiting, diarrhoea and renal failure. Multi-organ failure and death has occurred.

Skin contact may cause irritation.

Eye contact may cause pain, watering, conjunctivitis, oedema and photophobia.

Casualty decontamination at the scene

Following disrobe, improvised dry decontamination should be considered for an incident involving manganese, 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.

Hazard identification

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

UN		No values specified
EAC		
APP		
Hazards	Class	
	Sub-risks	
HIN		

Abbreviations

UN = United Nations number.

EAC = emergency action code.

APP = additional personal protection.

HIN = hazard identification number.

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

Hazard class and category	No values specified
Hazard statement	
Signal words	

Physicochemical properties

Table 3. Physicochemical properties

CAS number	7439-96-5
Molecular weight	54.94
Formula	Mn
Common synonyms	None
State at room temperature	Steel grey, lustrous, hard, brittle metal
Volatility	Vapour pressure = 0 mmHg
Specific gravity	7.3 g/cm ³
Flammability	Powder or dust is flammable. Finely dispersed particles form explosive mixtures in air.
Lower explosive limit	Not available
Upper explosive limit	Not available
Water solubility	Elemental manganese is insoluble in water
Reactivity	Reacts with aqueous solutions of sodium or potassium bicarbonate. On heating, reacts directly with carbon, phosphorus, antimony or arsenic. Reacts slowly with water. Reacts more rapidly with steam and acids. This produces flammable/explosive gases.
Odour	Odourless

References

World Health Organization. International Programme on Chemical Safety '[International Chemical Safety Card entry for Manganese](#)' ICSC 0174, 2003 (viewed on 02 November 2024)

PubChem. Bethesda (MD): National Library of Medicine (US), National Center for Biotechnology Information. '[PubChem Compound Summary for CID 23930, Manganese](#)' (viewed on 02 November 2024)

Reported effect levels from authoritative sources

Table 4. Exposure by inhalation

ppm	mg/m ³	Signs and symptoms	Reference
0.89–2.22	2–5	Signs and symptoms of effects on the CNS may occur	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. World Health Organization International Programme for Chemical Safety. [Environmental Health Criteria 17: Manganese](#) 1981. Geneva (viewed on 15 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 for manganese and its inorganic compounds (as Mn)

	LTEL (8-hour reference period)		STEL (15-min reference period)	
	ppm	mg/m ³	ppm	mg/m ³
WEL	-	0.2 (inhalable fraction) 0.05 (respirable fraction)	-	-

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 02 November 2024)

Table 7. Public health standards and guidelines

Drinking water standard	0.05 mg/L
WHO guideline for drinking water quality	0.08 mg/L
WHO air quality guideline	0.15 µg/m ³

Reference

[The Private Water Supplies \(England\) Regulations 2016](#) and [The Private Water Supplies \(Wales\) Regulations 2017](#) (viewed on 01 October 2024)

[The Water Supply \(Water Quality\) Regulations 2018](#) (Water, England and Wales) (viewed on 01 October 2024)

World Health Organization. '[Guidelines for Drinking-water Quality, 4th Edition Incorporating First and Second Addendum](#)' 2022 (viewed on 01 October 2024)

World Health Organization Regional Office for Europe. '[Air Quality Guidelines for Europe, European Series, No. 91, 2nd Edition](#)' 2000 (viewed on 01 October 2024)

Health effects

The main routes of exposure are inhalation or ingestion.

Table 8. Signs or symptoms of acute exposure

Route	Signs and symptoms
Inhalation	<p>Inhalation of manganese containing dust causes irritation of the respiratory tract, impaired lung function and pneumonitis. It may also cause neurotoxicity.</p> <p>Inhalation of freshly formed oxides of manganese may cause metal fume fever, onset of symptoms typically occurs 4-10 hours after exposure. Symptoms are often non-specific and may include fever, sore throat, tachycardia, mild hypertension, sweating, cough, dyspnoea, chest tightness, headache, rhinitis, tiredness, myalgia and arthralgia. Symptoms are generally self-limiting and last for 12 to 48 hours. Rarely, pulmonary oedema has been reported.</p>
Ingestion	Clinical features may include lethargy, abdominal pain, vomiting, diarrhoea and renal failure. Multi-organ failure and death has occurred.
Eyes	Pain, watering, conjunctivitis, oedema and photophobia may occur.
Dermal	Inorganic manganese salts are minimally absorbed through the skin unless it is damaged. Skin may become irritated.

Reference

National Poisons Information Service (NPIS). TOXBASE '[manganese](#)' 2023 (viewed on 04 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 manganese 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 these 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

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

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 2015 (viewed on 02 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 02 November 2024)

Joint Emergency Service Interoperability Programme. [‘Initial Operational Response IOR to Incidents Suspected to Involve Hazardous Substances or CBRN Materials’](#) 2024 (viewed on 02 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

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.

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 final conjunctival pH of 7 to 7.2. The conjunctivae may be tested with indicator paper. Retest at 15-30 minute intervals after irrigation and use further irrigation if necessary.

Any particles lodges 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.

Gut decontamination (including 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.

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

Clinical decontamination and first aid references

National Poisons Information Service (NPIS). TOXBASE '[manganese](#)'20 (viewed on 01 October 2024)

National Poisons Information Service (NPIS). TOXBASE '[chemicals splashed or sprayed into the eyes - features and clinical management](#)' 2020 (viewed on 01 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](#).

This document from the UKHSA Radiation, Chemicals, Climate and Environmental Hazards Directorate reflects understanding and evaluation of the current scientific evidence as presented and referenced here.

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