



UK Health  
Security  
Agency

# Magnesium

## 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.....	10
Reported effect levels from authoritative sources.....	11
Published emergency response guidelines.....	12
Exposure standards, guidelines or regulations.....	13
Health effects.....	14
Decontamination at the scene.....	15
Chemical specific advice.....	15
Disrobe.....	15
Improvised decontamination.....	16
Improvised dry decontamination.....	16
Improvised wet decontamination.....	16
Additional notes.....	17
Interim wet decontamination.....	17
Decontamination at the scene references.....	18
Clinical decontamination and first aid.....	19
Important notes.....	19
Clinical decontamination following surface contamination.....	19
Dermal exposure.....	20
Ocular exposure.....	20
Inhalation.....	20
Ingestion.....	20
Clinical decontamination and first aid references.....	21
About the UK Health Security Agency.....	22

## Main points

### General

Magnesium appears as a light, silvery metal or grey powder. It may spontaneously ignite on contact with air liberating toxic fumes. It can react with many substances including water and dilute acids to form hydrogen.

### Health

Ingestion and inhalation are the main routes of exposure.

Inhalation of magnesium compounds may cause metal fume fever, symptoms include cough, dyspnoea, sore throat, sweating, tachycardia, mild hypertension, chest tightness, headache, fever, rhinitis, tiredness, myalgia, and arthralgia.

Ingestion of magnesium salts can cause GI upset and abdominal colic. Following acute ingestion, hypermagnesaemia is uncommon in people with normal renal function, but susceptible patients may develop flushing, thirst, drowsiness, lethargy, slurred speech, confusion, CNS depression, muscle weakness, depression of deep tendon reflexes, respiratory depression, hypotension, hypothermia, urinary retention, hypocalcaemia, and hypophosphataemia.

### Casualty decontamination at the scene

Following disrobe, improvised dry decontamination should be considered for an incident involving magnesium, 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 magnesium granules, coated**

<b>UN</b>	2950	Magnesium granules, coated	
<b>EAC</b>	4Y	Use dry agent, water must not be allowed to come into contact with substance. Wear normal fire kit in combination with breathing apparatus [note 1]. Substance can be violently or explosively reactive. Spillages, contaminated fire and decontamination run-off should be prevented from entering drains and surface and groundwaters.	
<b>APP</b>	-	-	
<b>Hazards</b>	<b>Class</b>	4.3	Substances which in contact with water emit flammable gases
	<b>Sub-risks</b>	-	-
<b>HIN</b>	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 1a

Note 1: Normal firefighting clothing is appropriate, that is, 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 23 October 2024)

**Table 1b. Standard (UK) dangerous goods emergency action codes for magnesium powder or magnesium alloys powder, packing group I**

<b>UN</b>		1418	Magnesium powder or magnesium alloys powder, packing group I	
<b>EAC</b>		4W [note 1]	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 2]. Substance can be violently or explosively reactive. Spillages, contaminated fire and decontamination run-off should be prevented from entering drains and surface and groundwaters.	
<b>APP</b>		-	-	
<b>Hazards</b>	<b>Class</b>	4.3	Substances which in contact with water emit flammable gases	
	<b>Sub-risks</b>	4.2	Substances liable to spontaneous combustion	
<b>HIN</b>		-	-	

## Abbreviations

UN = United Nations number.

EAC = emergency action code.

APP = additional personal protection.

HIN = hazard identification number.

## Notes to Table 1b



Note 1: Not applicable to carriage of goods under the Regulations Concerning the International Carriage of Dangerous Goods by Rail (RID), and the Agreement Concerning the International Carriage of Dangerous Goods by Road (ADR).

Note 2: 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 23 October 2024)

**Table 1c. Standard (UK) dangerous goods emergency action codes for magnesium powder or magnesium alloys powder, packing groups II & III**

<b>UN</b>		1418	Magnesium powder or magnesium alloys powder, packing group II and III	
<b>EAC</b>		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]. Substance can be violently or explosively reactive. Spillages, contaminated fire and decontamination run-off should be prevented from entering drains and surface and groundwaters.	
<b>APP</b>		-	-	
<b>Hazards</b>	<b>Class</b>	4.3	Substances which in contact with water emit flammable gases	
	<b>Sub-risks</b>	4.2	Substances liable to spontaneous combustion	
<b>HIN</b>		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 1c

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 23 October 2024)

**Table 1d. Standard (UK) dangerous goods emergency action codes for magnesium or magnesium alloys with more than 50% magnesium in pellets, turnings or ribbons**

<b>UN</b>		1869	Magnesium or magnesium alloys with more than 50% magnesium in pellets, turnings or ribbons	
<b>EAC</b>		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]. Substance can be violently or explosively reactive. Spillages, contaminated fire and decontamination run-off should be prevented from entering drains and surface and groundwaters.	
<b>APP</b>		-	-	
<b>Hazards</b>	<b>Class</b>	4.1	Flammable solids, self-reactive substances and solid desensitised explosives	
	<b>Sub-risks</b>	-		
<b>HIN</b>		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 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 23 October 2024)




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

<b>Hazard class and category</b>	Water-react. 1	Substances and mixtures which in contact with water emit flammable gases, category 1	
	Pyr. Sol. 1	Pyrophoric solid, category 1	
<b>Hazard statement</b>	H260	In contact with water releases flammable gases which may ignite spontaneously	
	H250	Catches fire spontaneously if exposed to air	
<b>Signal words</b>	DANGER		

### References

The Health and Safety Executive (HSE). '[GB CLP Regulation](#)' (viewed on 23 October 2024).

**Table 2b. The GB classification, labelling and packaging (CLP) regulation for magnesium, powder or turnings**

<b>Hazard class and category</b>	Flam. Sol. 1	Flammable solid, category 1	
	Self-heat. 1	Self-heating substances and mixtures, category 1	
	Water-react. 2	Substances and mixtures which in contact with water emit flammable gases, category 2	



<b>Hazard statement</b>	H228	Flammable solid
	H252	Self-heating in large quantities; may catch fire
	H261	In contact with water releases flammable gases
<b>Signal words</b>	DANGER	

### References

The Health and Safety Executive (HSE). '[GB CLP Regulation](#)' (viewed on 23 October 2024).

## Physicochemical properties

**Table 3. Physicochemical properties**

<b>CAS number</b>	7439-95-4
<b>Molecular weight</b>	24.31
<b>Formula</b>	Mg
<b>Common synonyms</b>	Magnesium powder, Magnesium pellets, Magnesium turnings, Magnesium ribbon
<b>State at room temperature</b>	Silvery white metal/grey powder
<b>Volatility</b>	Vapour pressure = 1 Pa at 428°C
<b>Density</b>	1.74 at 20°C
<b>Flammability</b>	Flammable
<b>Lower explosive limit</b>	0.03 kg/m <sup>3</sup>
<b>Upper explosive limit</b>	-
<b>Water solubility</b>	Insoluble but reactive in water
<b>Reactivity</b>	Reacts with oxidants and many other substances. Reacts violently with fire extinguishing agents such as water, carbon dioxide, halons, powder and foam.
<b>Reaction or degradation products</b>	May spontaneously ignite on contact with air liberating irritating or toxic fumes. Reacts with water or dilute acids to form hydrogen.
<b>Odour</b>	None

### References

World Health Organization. International Programme on Chemical Safety '[International Chemical Safety Card entry for Magnesium powder \(pyrophoric\)](#)' ICSC 0289, 2019 (viewed on 23 October 2024)

World Health Organization. International Programme on Chemical Safety '[International Chemical Safety Card entry for Magnesium \(pellets\)](#)' ICSC 0701, 2011 (viewed on 23 October 2024)

PubChem. Bethesda (MD): National Library of Medicine (US), National Center for Biotechnology Information. '[PubChem Compound Summary for CID 5462224, Magnesium](#)' (viewed on 23 October 2024)

## Reported effect levels from authoritative sources

**Table 4. Exposure by ingestion**

mg	Signs and symptoms	Reference
>2500	Toxic hypermagnesaemia, presenting with hypotension or muscular weakness	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. Norwegian Scientific Committee for Food Safety (VKM). Scientific opinion of the Panel on Nutrition, Dietetic Products, Novel Food and Allergy. '[Risk assessment of magnesium in food supplements](#)' 2016 (viewed on 23 October 2024)

## Published emergency response guidelines

**Table 5. Acute exposure guideline levels (AEGLs)**

	Concentration				
	10 minutes	30 minutes	60 minutes	4 hours	8 hours
<b>AEGL-1</b> [note 1]	No values specified				
<b>AEGL-2</b> [note 2]					
<b>AEGL-3</b> [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**

	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>	No values specified			

### Abbreviations

WEL = workplace exposure limit.

LTEL = long-term exposure limit.

STEL = short-term exposure limit.

**Table 7. Public health standards and guidelines**

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

## Health effects

Common routes of exposure are through ingestion of magnesium salts and inhalation of magnesium compounds.

**Table 8. Signs or symptoms of acute exposure**

Route	Signs and symptoms
<b>Ingestion</b>	<p>Clinically significant hypermagnesaemia is uncommon but can occur after administration of magnesium salts to patients in renal failure or after high-dose or prolonged administration.</p> <p>Acute ingestion of magnesium salts can cause GI upset, and abdominal colic may occur.</p> <p>Hypermagnesaemia may lead to flushing, thirst, drowsiness, lethargy, slurred speech, confusion, CNS depression, muscle weakness, depression of deep tendon reflexes, respiratory depression, hypotension, hypothermia, urinary retention, hypocalcaemia, and hypophosphataemia. Bradycardia, prolongation of PR, QT and QRS intervals, T wave changes, conduction defects, heart block, and asystole have been reported.</p>
<b>Inhalation</b>	<p>Inhalation 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> <p>A rare more severe variant of the condition has been described where features including dyspnoea and hypoxia develop within minutes to 2 hours following exposure.</p>

### References

National Poisons Information Service (NPIS). TOXBASE '[Magnesium salts \(generic\)](#)' 2023 (viewed on 23 October 2024)

National Poisons Information Service (NPIS). TOXBASE '[Metal fume fever](#)' 2024 (viewed on 23 October 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 magnesium 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 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 magnesium 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 23 October 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 23 October 2024)

Joint Emergency Service Interoperability Programme. [‘Initial Operational Response IOR to Incidents Suspected to Involve Hazardous Substances or CBRN Materials’](#) 2024 (viewed on 23 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

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 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

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 10-15 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.

## Inhalation

Remove from exposure.

Maintain a clear airway and ensure adequate ventilation.

Give oxygen if required.

Monitor vital signs and check the capillary blood glucose. Check and record pupil size.

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

## Ingestion

Accidental ingestion of small amounts of magnesium salts is unlikely to cause problems in patients with normal renal function, symptomatic and supportive care only will be required in most cases.

Maintain a clear airway and ensure adequate ventilation

In the event of cardiac arrest in hospital or witnessed out of hospital cardiac arrest with bystander CPR, resuscitation should be continued for at least 1 hour and only stopped after discussion with a senior clinician.

Prolonged resuscitation for cardiac arrest is recommended following poisoning as recovery with good neurological outcome may occur.

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.

For hypothermia rewarm slowly using conventional methods

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

## Clinical decontamination and first aid references

National Poisons Information Service (NPIS). TOXBASE '[Magnesium salts \(generic\)](#)' 2023 (viewed on 23 October 2024)

National Poisons Information Service (NPIS). TOXBASE '[Eye irritants - features and management](#)' 2020 (viewed on 23 October 2024)

National Poisons Information Service (NPIS). TOXBASE '[skin decontamination - irritants](#)' 2019 (viewed on 16 October 2024)

National Poisons Information Service (NPIS). TOXBASE '[Metal Fume Fever](#)' 2024 (viewed on 23 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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