UK Health Security Agency

Hydrazine

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

A colourless, fuming, oily and hygroscopic liquid with a ammonia like odour. Above 40°C explosive vapour or air mixtures may be formed. It reacts violently with acids, many metals, metal oxides, and porous materials. It is a strong reducing agent and reacts violently with oxidants. Decomposes rapidly with heat releasing ammonia, hydrogen and nitrogen oxide combustion products

Health

Highly toxic by any route of exposure.

Inhalation causes irritation of the nose, sore throat, cough, chest tightness, shortness of breath and pulmonary oedema.

Ingestion may cause a burning sensation in the mouth and throat with retrosternal and abdominal pain.

Systemic toxicity may result in headaches, dizziness, and gastrointestinal upset. Coma can occur after a delay and may last for several days. Methemoglobinemia and metabolic acidosis have been reported as well. Additionally, hydrazine is hemolytic and can cause secondary tubular necrosis and renal impairment.

Significant skin exposure can result in caustic effects, whereas lesser exposure can lead to skin irritation, dermatitis and subsequent sensitisation. Eye exposure causes eye itching, burning and swelling of the eyes, blurred vision and conjunctivitis.

Casualty decontamination at the scene

Hydrazine liquid and vapour are corrosive. Therefore, following disrobe, improvised wet decontamination should be considered (see below for details on wet decontamination).

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 hydrazine, anhydrous

UN		2029	Hydrazine, anhydrous	
EAC		•2WE [note 1]	Use alcohol-resistant foam but, if not available, fine water spray can be used. 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. There may be a public safety hazard outside the immediate area of the incident. [note 3]	
APP		A(fl)	Gas-tight chemical protective suit with breathing apparatus Fire kit intended to protect against flammable liquid [note 4]	
Hazards	**Class**	8	Corrosive substances	
	Sub-risks	3	Flammable liquids and desensitised liquid explosives	
		6.1	Toxic substances	
HIN	-	-	-	

Abbreviations

UN = United Nations number.
EAC = emergency action code.
APP = additional personal protection.
HIN = hazard identification number.

Notes to table 1a

Note 1: Not applicable to the carriage of dangerous goods under 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.

Note 3: 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.

Note 4: Normal fire kit in combination with gas-tight chemical protective clothing conforming to BS EN 943 part 2 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'. 2025 (viewed on 11 February 2025)

Table 1b: Standard (UK) dangerous goods emergency action codes for hydrazine aqueous solution with more than 37% hydrazine by mass, packing group I

UN		2030	Hydrazine, Hydrazine aqueous solution with more than 37% hydrazine by mass, packing group I	
EAC		•2X	Use alcohol-resistant foam but, if not available, fine water spray can be used. 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		B	Gas-tight chemical protective suit with breathing apparatus.[note 2]	
Hazards	**Class**	8	Corrosive substances	

	Sub-risks	6.1	Toxic substances	
HIN		886	Highly corrosive substance, toxic	

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.

Note 2: Chemical protective clothing should be gas-tight conforming to BS EN 943 part 2 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'. 2025 (viewed on 11 February 2025)

Table 1c: Standard (UK) dangerous goods emergency action codes for hydrazine aqueous solution with more than 37% hydrazine by mass, packing group II & III

UN	2030	Hydrazine, aqueous solution with more than 37% hydrazine by mass, packing group II & III
EAC	•2X	Use alcohol-resistant foam but, if not available, fine water spray can be used. 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	**Class**	8	Corrosive substances	
	Sub-risks	6.1	Toxic substances	
HIN		86	Corrosive or slightly corrosive substance, toxic	

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'. 2025 (viewed on 11 February 2025)

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

Hazard class and category	Flam. Liq. 3	Flammable liquid, category 3	
	Carc. 1B	Carcinogenicity, categories 1B	

	Acute Tox. 3	Acute toxicity (oral, dermal, inhalation), category 3	
	Skin Corr. 1B	Skin corrosion, category 1	
	Skin Sens. 1	Skin sensitisation, category 1	
	Aquatic Acute 1	Acute hazards to the aquatic environment, category 1	
	Aquatic Chronic 1	Chronic hazards to the aquatic environment, category 1	
Hazard statement	H226	Flammable liquid and vapour	
	H350	May cause cancer	
	H331	Toxic if inhaled	
	H311	Toxic in contact with skin	
	H301	Toxic if swallowed	
	H314	Causes severe skin burns and eye damage	
	H317	May cause an allergic skin reaction	
	H400	Very toxic to aquatic life	
	H410	Very toxic to aquatic life with long lasting effects	
Signal words	DANGER		

Table 2b. Specific concentration limits for hydrazine

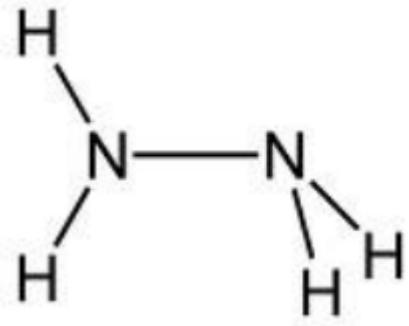
Concentration	Hazard class and category	Hazard statement	
C ≥ 10 %	Skin Corr. 1B	H314	Causes severe skin burns and eye damage
3 % ≤ C < 10 %	Skin Irrit. 2	H315	Causes skin irritation
3 % ≤ C < 10 %	Eye Irrit. 2	H319	Causes eye irritation

References

The Health and Safety Executive (HSE). 'GB CLP Regulation' (viewed on 19 February 2025).

Physicochemical properties

Table 3. Physicochemical properties

CAS number	302-01-2
Molecular weight	32.1
Formula	H_4N_2/N_2H_4/H_2N-NH_2
Common synonyms	Diamide, diamine, nitrogen hydride,levoxine, hydrazine base
State at room temperature	Colourless, fuming, oily and hygroscopic liquid
Volatility	Vapour pressure: 14.4 mmHg at 25°C
Specific gravity	1.01 (water = 1) 1.1 (air = 1)
Flammability	Flammable liquid and vapour
Lower explosive limit	4.7%
Upper explosive limit	100%
Water solubility	Miscible in water
Reactivity	Above 40°C explosive vapour/air mixtures may be formed. It reacts violently with acids, many metals, metal oxides and porous materials. It is a strong reducing agent and reacts violently with oxidants. The substance is a medium strong base. Decomposes rapidly with heat releasing ammonia, hydrogen and nitrogen oxide combustion products.
Odour	Ammonia odour
Structure	

References

World Health Organization. International Programme on Chemical Safety ‘ICSC 0281 - HYDRAZINE’ ICSC 0281, 2009 (viewed on 19 February2025)

PubChem. Bethesda (MD): National Library of Medicine (US), National Center for Biotechnology Information. ‘PubChem Compound Summary for CID 9321, Hydrazine’ (viewed on 19 February 2025)

Reported effect levels from authoritative sources

Table 4. Exposure by ingestion

mL	Signs and symptoms	Reference
20-50	Severe intoxication, may be lethal	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. International Programme on Chemical Safety. Hydrazine. Environmental Health Criteria No. 68, 1991. World Health Organization: Geneva.

Published emergency response guidelines

Table 5. Acute exposure guideline levels (AEGLs)

	Concentration (ppm)				
	10 minutes	**30 minutes**	**60 minutes**	**4 hours**	**8 hours**
AEGL-1 [note 1]	0.1	0.1	0.1	0.1	0.1
AEGL-2 [note 2]	23	16	13	3.1	1.6
AEGL-3 [note 3]	64	45	35	8.9	4.4

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' (viewed on 19 February 2025)

Exposure standards, guidelines or regulations

Table 6. Occupational standards

	LTEL (8-hour reference period)		STEL (15-min reference period)	
	ppm	mg/m³	ppm	mg/m³
WEL	0.01	0.013	0.1	0.13

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 19 February 2025)

Table 7. Public health standards and guidelines

Drinking water standard	No value specified
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

Health effects

Highly toxic, systemic toxicity can occur following ingestion, inhalation or skin contact. Skin and eye exposure can result in corrosive injury.

Table 8. Signs or symptoms of acute exposure

Route	Signs and symptoms
Inhalation	Vapours cause irritation of nose, sore throat, cough, chest tightness, shortness of breath and pulmonary oedema. Acute inhalation causes nausea, vomiting and dizziness. Features of systemic toxicity can occur.
Ingestion	Burning sensation in the mouth and throat with retrosternal and abdominal pain. There is a risk of oedema, airway compromise and burns to the oesophagus and gastro-intestinal tract with more concentrated solutions. Systemic toxicity can occur.
Systemic toxicity	Headache, dizziness and GI upset are common. Hypotension can occur. Agitation, lethargy, confusion, tremor and convulsions or coma can occur after a delay and/or be prolonged for several days. Methaemoglobinaemia and metabolic acidosis have been reported. Hepatic toxicity is common with liver transaminases, ammonia and bilirubin concentrations rising over several days and persisting for several weeks. Hypoglycaemia, or hyperglycaemia followed by hypoglycaemia can develop, depending upon liver glycogen stores. Hydrazine is haemolytic and can cause secondary tubular necrosis and renal impairment. Haematuria and oliguria can occur. Paraesthesia and peripheral neuropathy of the limbs can persist for several weeks after exposure.
Eyes	Hydrazine in the eyes is likely to cause corrosive injury. Exposure to hydrazine vapour causes itching, burning and swelling of the eyes, blurred vision and conjunctivitis. Features may develop over several hours after exposure to the vapour. Exposure to high concentrations of vapour may cause temporary blindness lasting for approximately 24 hours. Miosis followed by mydriasis, as well as nystagmus, have been reported.
Skin	Caustic effects are likely with significant exposure. Lesser exposure can cause skin irritation, dermatitis and subsequent sensitisation. Systemic toxicity is possible.

Reference

National Poisons Information Service (NPIS). TOXBASE ‘hydrazine’ 2022 (viewed on 19 February 2025)

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.

Hydrazine liquid and vapour are corrosive. Therefore, following disrobe, improvised wet decontamination should be considered (see below for details on wet decontamination).

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

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 19 February 2025)

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 19 February 2025)

Joint Emergency Service Interoperability Programme. ‘Initial Operational Response (IOR) to Incidents Suspected to Involve Hazardous Substances or CBRN Materials’ 2024 (viewed on 19 February 2025)

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

Note hydrazine can self-ignite on contact with clothing; remove soiled clothes rapidly but carefully.

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.

Note hydrazine can self-ignite on contact with clothing. Contaminated clothing should be removed rapidly but carefull and 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 or until pH of skin is normal (pH of the skin is 4.5 to 6 although it may be closer to 7 in children, or after

irrigation). The earlier irrigation begins, the greater the benefit. The earlier irrigation begins, the greater the benefit.

Pay particular attention to skin folds, fingernails and ears.

Skin exposure

Decontaminate (as above) the patient following surface contamination.

Recheck pH of affected areas after a period of 15 to 20 minutes and repeat irrigation if abnormal. Burns with strong solutions may require irrigation for several hours or more. Attention should be paid to avoiding hypothermia during prolonged irrigation with cool fluids. Once the pH is normal and stabilised, treat as per a thermal injury.

Burns totalling more than 15% of body surface area in adults (>10% in children) will require standard fluid resuscitation as for thermal burns.

Moderate/severe chemical burns should be reviewed by a burns specialist.

If feaures of systemic toxicity are present manage as per inhalation.

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

Ocular exposure

Remove contact lenses if present.

Aerosols sprayed directly into the eye may cause corneal damage.

Alkaline solutions in particular may penetrate and damage all layers of the eye and should be considered an ophthalmic emergency.

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 crytalloid (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 to 30 minutes 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.

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

Ingestion

Maintain airway and establish haemodynamic stability.

In severely affected patients, especially those with tachypnoea, stridor or upper airway damage, critical care input is essential with urgent assessment of the airway. A supraglottic-epiglottic burn with erythema and oedema is usually a sign that further oedema will occur that may lead to airway obstruction.

Children are at increased risk of airway obstruction.

Consider the use of water or milk (maximum initial volume = 100 to 200 mL in an adult; 2 mL/kg in a child) as diluents for symptomatic benefit early after corrosive ingestion provided the patient does not have swallowing or breathing problems (but caution is necessary following large ingestions where mucosal damage / perforation may have already developed).

Monitor vital signs and check cardiac rhythm. Check the capillary 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 condition.

Inhalation

Maintain a clear airway and ensure adequate ventilation.

In severely affected patients, especially those with tachypnoea, stridor or upper airway damage, critical care input is essential with urgent assessment of the airway. A supraglottic-epiglottic burn with erythema and oedema is usually a sign that further oedema will occur that may lead to airway obstruction

Children are at increased risk of airway obstruction.

Monitor vital signs and cardiac rhythm; and check capillary 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 'hydrazine' 2022 (viewed on 19 February 2025)

National Poisons Information Service (NPIS). TOXBASE 'chemicals splashed or sprayed into the eyes - features and clinical management' 2020 (viewed on 19 February 2025)

National Poisons Information Service (NPIS). TOXBASE 'skin decontamination - corrosives' 2020 (viewed on 19 February 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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For queries relating to this document, please contact chemcompendium@ukhsa.gov.uk or enquiries@ukhsa.gov.uk

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