



UK Health  
Security  
Agency

# Hydrogen peroxide

## 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

Hydrogen peroxide is a colourless, non-flammable liquid at room temperature. It has a slightly sharp odour.

Strongly oxidising substance reacts violently with combustible and reducing materials, particularly in the presence of metals.

Attacks organic substances.

Decomposes under the influence of light and on warming to produce oxygen.

### Health

Hydrogen peroxide may cause respiratory tract irritation, which may be severe and lead to pulmonary oedema 24 to 72 hours after exposure.

Ingestion may cause nausea, vomiting and hematemesis.

Impaired consciousness, apnoea, stridor, cyanosis, convulsions and cardiac arrest may occur rapidly when concentrated solutions have been ingested.

Dermal exposure may cause a whitening of the skin, inflammation, blistering and burns.

Eye exposure to weaker solutions may cause blurred vision, burning and redness while stronger solutions may cause corneal ulceration or perforation.

Gas embolism may occur from ingestion, intravenous injection or wound irrigation.

## Casualty decontamination at the scene



Hydrogen peroxide is highly 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.

## Hazard identification

**Table 1a. Standard (UK) dangerous goods emergency action codes for hydrogen peroxide, aqueous solution**

<b>UN</b>		2014	Hydrogen peroxide, aqueous solution (with not less than 20% but not more than 60% hydrogen peroxide (stabilised as necessary))	
<b>EAC</b>		2P	Use fine water spray. 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. Where there is an immediate threat to people, spillages and decontamination run-off may be washed to drains with large quantities of water [note 2].	
<b>APP</b>		-	-	
<b>Hazards</b>	<b>Class</b>	5.1	Oxidising substances	
	<b>Sub-risks</b>	8	Corrosive substances	
<b>HIN</b>		58	Oxidising substance (fire-intensifying) corrosive	

### Abbreviations

UN = United Nations number.

EAC = emergency action code.

APP = additional personal protection.

HIN = hazard identification number.

### Note to Table 1a



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: In such cases due care must be exercised to avoid unnecessary pollution of surface and groundwaters and wherever possible control measures such as the sealing of drains should be employed.

## References

National Chemical Emergency Centre (NCEC), part of Ricardo-AEA. '[Dangerous Goods Emergency Action Code List](#)'. 2023 (viewed on 15 November 2024)

**Table 1b. Standard (UK) dangerous goods emergency action codes for hydrogen peroxide, stabilised or hydrogen peroxide, aqueous solution, stabilized**

<b>UN</b>		2015	Hydrogen peroxide, stabilised or hydrogen peroxide aqueous solution, stabilised with more than 60% hydrogen peroxide	
<b>EAC</b>		2P	Use fine water spray. Wear chemical protective clothing with liquid-tight connections for whole body in combination with breathing apparatus [note 1]. Substances can be violently or explosively reactive. Where there is an immediate threat to people, spillages and decontamination run-off may be washed to drains with large quantities of water [note 2].	
<b>APP</b>		–	–	
<b>Hazards</b>	<b>Class</b>	5.1	Oxidising substances	
	<b>Sub-risks</b>	8	Corrosive substances	
<b>HIN</b>		559	Strongly oxidising (fire-intensifying) substance, which can spontaneously lead to violent reaction	

## Abbreviations

UN = United Nations number.

EAC = emergency action code.

APP = additional personal protection.

HIN = hazard identification number.

## Note 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: In such cases due care must be exercised to avoid unnecessary pollution of surface and groundwaters and wherever possible control measures such as the sealing of drains should be employed.

### References

National Chemical Emergency Centre (NCEC), part of Ricardo-AEA. '[Dangerous Goods Emergency Action Code List](#)'. 2023 (viewed on 15 November 2024)

**Table 1c. Standard (UK) dangerous goods emergency action codes for hydrogen peroxide, aqueous solution**

<b>UN</b>		2984	Hydrogen peroxide, aqueous solution (with not less than 8% but less than 20% hydrogen peroxide (stabilised as necessary))	
<b>EAC</b>		2R	Use fine water spray. Wear chemical protective clothing with liquid-tight connections for whole body in combination with breathing apparatus [note 1]. Where there is an immediate threat to people, spillages and decontamination run-off may be washed to drains with large quantities of water [note 2].	
<b>APP</b>		-	-	
<b>Hazards</b>	<b>Class</b>	5.1	Oxidising substances	
	<b>Sub-risks</b>	-	-	
<b>HIN</b>		50	Oxidising (fire-intensifying) substance	

### Abbreviations

UN = United Nations number.

EAC = emergency action code.

APP = additional personal protection.

HIN = hazard identification number.

### Note 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.

Note 2: In such cases due care must be exercised to avoid unnecessary pollution of surface and groundwaters and wherever possible control measures such as the sealing of drains should be employed.

### References

National Chemical Emergency Centre (NCEC), part of Ricardo-AEA. '[Dangerous Goods Emergency Action Code List](#)'. 2023 (viewed on 15 November 2024)

**Table 2a. The GB classification, labelling and packaging (CLP) regulation for hydrogen peroxide solution, varying concentrations**

<b>Hazard class and category</b>	Ox. Liq. 1	Oxidising liquid, category 1	
	Acute Tox. 4	Acute toxicity, category 4 (inhalation, ingestion)	
	Skin. Corr. 1A	Skin corrosive, category 1A	
<b>Hazard statement</b>	H271	May cause fire or explosion; strong oxidiser	
	H332	Harmful if inhaled	
	H302	Harmful if swallowed	
	H314	Causes severe skin burns and eye damage	
<b>Signal words</b>	DANGER		

### References

The Health and Safety Executive (HSE). '[GB CLP Regulation](#)' (viewed on 15 November 2024).

**Table 2b. Specific concentration limits for hydrogen peroxide**

Concentration	Hazard class and category	Hazard statement	
$C \geq 70 \%$	Ox. Liq. 1	H271	May cause fire or explosion; strong oxidiser
$50 \% \leq C < 70 \%$	Ox. Liq. 2	H272	May intensify fire; oxidiser

$C \geq 70 \%$	Skin Corr. 1A	H314	Causes severe skin burns and eye damage
$50 \% \leq C < 70 \%$	Skin Corr. 1B	H314	Causes severe skin burns and eye damage
$35 \% \leq C < 50 \%$	Skin Irrit. 2	H315	Causes skin irritation
$8 \% \leq C < 50 \%$	Eye Dam. 1	H318	Causes serious eye damage
$5 \% \leq C < 8 \%$	Eye Irrit. 2	H319	Causes serious eye irritation
$C \geq 35 \%$	STOT SE 3	H335	May cause respiratory irritation

### References

The Health and Safety Executive (HSE). '[GB CLP Regulation](#)' (viewed on 15 November 2024).



## Physicochemical properties

**Table 3. Physicochemical properties**

<b>CAS number</b>	7722-84-1
<b>Molecular weight</b>	34.0
<b>Formula</b>	H <sub>2</sub> O <sub>2</sub>
<b>Common synonyms</b>	Dihydrogen dioxide, hydrogen dioxide, hydroperoxide, oxydol, hydroperoxide
<b>State at room temperature</b>	Colourless liquid
<b>Volatility</b>	Vapour pressure = 1.97 mmHg at 25°C
<b>Specific gravity</b>	1.4 (90%) 1.3 (70%) (water = 1) 1 (air = 1)
<b>Flammability</b>	Not combustible. May ignite combustible materials
<b>Lower explosive limit</b>	-
<b>Upper explosive limit</b>	-
<b>Water solubility</b>	Miscible with water
<b>Reactivity</b>	Risk of fire and explosion on contact with heat or metal catalysts. Decomposes under the influence of light. Strong oxidant that reacts violently with combustible and reducing materials generating fire and explosion hazard, particularly in the presence of metals. Attacks many organic substances, for example, textiles and paper. Decomposes on warming to produce oxygen.
<b>Odour</b>	Slightly sharp odour
<b>Structure</b>	HO—OH

### References

World Health Organization. International Programme on Chemical Safety '[International Programme on Chemical Safety. International Chemical Safety Card entry for Hydrogen peroxide. ICSC 0164](#)' 2018 (viewed on 18 November 2024)

PubChem. Bethesda (MD): National Library of Medicine (US), National Center for Biotechnology Information. '[PubChem Compound Summary for CID 784, Hydrogen Peroxide](#)' (viewed on 18 November 2024)

## Reported effect levels from authoritative sources

**Table 4. Exposure by ingestion**

Conc. (%)	Dose (ml)	Signs and symptoms	Reference
3	30	Cerebral gas embolism, vomiting, reduced consciousness (adult female)	a
3	60-120	Multiple gastric ulcers and duodenal erosions (3-year-old child)	a
3	230	Death (16-month-old)	a
20	10	Vomiting, lethargy, respiratory distress, convulsions, cerebral oedema. Gas embolism leading to death. (3-year-old child)	a
35	250	Diffuse superficial erosions to the stomach mucosa, portal venous gas (adult male)	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

National Poisons Information Service (NPIS). TOXBASE '[Hydrogen Peroxide Toxicity Information](#)' 2020 (viewed on 18 November 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>	1	1.4	2	2.8

### 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 18 November 2024)

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

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

## Health effects

Hydrogen peroxide's toxicity is mainly due to the release of oxygen gas causing venous or arterial gas embolism. It also causes corrosive effects.

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

Route	Signs and symptoms
<b>Inhalation</b>	May cause respiratory tract irritation which may be severe, and lead to pulmonary oedema 24 to 72 hours after exposure. Optic neuropathy has been reported following inhalation exposure.
<b>Ingestion</b>	May cause nausea, vomiting and haematemesis. Concentrated solutions may cause blistering of the mucosae and oropharyngeal burns. Foaming at the mouth may occur with a risk of obstruction to the respiratory tract and pulmonary aspiration. Impaired consciousness, apnoea, stridor, cyanosis, convulsions and cardiac arrest may occur rapidly when concentrated solutions have been ingested. Release of oxygen gas may cause belching and painful gastric distension.
<b>Eyes</b>	Weak solutions may cause burning, redness and blurred vision. Stronger solutions (10% or more) may cause corneal ulceration or perforation
<b>Dermal</b>	May cause a whitening of the skin, inflammation, blistering and skin burns. Symptoms are expected to be mild when dilute solutions are involved
<b>Other effects</b>	Gas embolism may occur from ingestion, intravenous injection or wound irrigation

### Reference

National Poisons Information Service (NPIS). TOXBASE '[Hydrogen Peroxide](#)' 2020 (viewed on 18 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.

Hydrogen peroxide is highly 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 18 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 18 November 2024)

Joint Emergency Service Interoperability Programme. [‘Initial Operational Response \(IOR\) to Incidents Suspected to Involve Hazardous Substances or CBRN Materials’](#) 2024 (viewed on 18 November 2024)

## Clinical decontamination and first aid

Clinical decontamination is the process where trained healthcare professionals, using purpose-designed decontamination equipment, treat contaminated persons individually.

[Detailed information on clinical management](#) can be found on TOXBASE.

### Important notes

Once body surface contaminants have been removed or if your patient was exposed by ingestion or inhalation, the risk that secondary care givers may become contaminated is very low. Secondary carers should wear standard hospital PPE as a precaution against secondary contamination from vomit and body fluids.

If the patient has not been decontaminated following surface contamination, secondary carers must wear appropriate NHS PPE for chemical exposure to avoid contaminating themselves.

The area should be well ventilated.

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

## Clinical decontamination following surface contamination

Avoid contaminating yourself.

Carry out decontamination after resuscitation. This should be performed in a well-ventilated area, preferably with its own ventilation system.

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 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).

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.

Recheck pH of affected areas after a period of 15-20 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 for a thermal injury

Burns totalling more than 15% of body surface area in adults (more than 10% in children) will require standard fluid resuscitation as for thermal burns. Moderate/severe chemical burns should be reviewed by a burns specialist

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 7.0 to 7.2. The conjunctivae may be tested with indicator paper. Retest 20 minutes after irrigation and use further irrigation if necessary.

Any particles lodged in the conjunctival recesses should be removed.

Repeated instillation of local anaesthetics may reduce discomfort and help more thorough decontamination. However, prolonged use of concentrated local anaesthetics is damaging to the cornea.

Patients with corneal damage, those who have been exposed to strong acids or alkalis and those whose symptoms do not resolve rapidly should be discussed urgently with an ophthalmologist.

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

## Inhalation

Maintain a clear airway and ensure adequate ventilation.

Administer oxygen to achieve adequate oxygenation.

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 check the capillary blood glucose.

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

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

## Ingestion

Maintain a clear airway and ensure adequate ventilation

Gut decontamination is contraindicated. Hydrogen peroxide is rapidly decomposed, releasing oxygen gas.

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 '[Hydrogen Peroxide](#)' 2020 (viewed on 18 November 2024)

National Poisons Information Service (NPIS). TOXBASE '[Corrosives – inhalation](#)' 2020 (viewed on 18 November 2024)

National Poisons Information Service (NPIS). TOXBASE '[Skin decontamination – corrosives](#)' 2020 (viewed on 18 November 2024)

National Poisons Information Service (NPIS). TOXBASE '[Chemicals Splashed or Sprayed into the Eyes – features and management](#)' 2020 (viewed on 18 November 2024)

## About the UK Health Security Agency

UKHSA is responsible for protecting every member of every community from the impact of infectious diseases, chemical, biological, radiological and nuclear incidents and other health threats. We provide intellectual, scientific and operational leadership at national and local level, as well as on the global stage, to make the nation health secure.

UKHSA is an executive agency, sponsored by the Department of Health and Social Care.

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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