



UK Health  
Security  
Agency

# Sodium chlorate

## 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

Sodium chlorate is a colourless crystalline or white granulated solid at room temperature. It is odourless.

Although sodium chlorate is non-flammable, it enhances the burning of other flammable materials as it is a strong oxidiser. It emits irritating or toxic fumes of chlorides and sodium oxides when heated to decomposition. It will react with strong acids to release carbon dioxide.

### Health

Toxic by ingestion. Can cause irritation through inhalation and skin and eye exposure.

Nausea, vomiting, abdominal pain, and diarrhoea are likely to occur within 2 hours. Systemic toxicity may be delayed for up to 12 hours.

A slate-grey or blue appearance (cyanosis) may occur due to the formation of methaemoglobin. Intravascular haemolysis may occur, resulting in urine that is red or dark in colour. Acute kidney injury can occur. Liver failure has been reported.

General weakness, fatigue, dizziness, confusion, agitation, headache, initial CNS excitation and convulsions may be followed by coma. Chest pain, dyspnoea and ataxia may develop. Hypotension, tachycardia, trismus, liver failure, rhabdomyolysis and respiratory arrest have been reported

Exposure to the eyes and skin, or by inhalation may result in localised irritation

### Casualty decontamination at the scene

Following disrobe, improvised dry decontamination should be considered for an incident involving sodium chlorate, 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 with 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 sodium chlorate**

|                |                  |      |  |  |
|----------------|------------------|------|--|--|
| <b>UN</b>      |                  | 1495 | Sodium chlorate  |  |
| <b>EAC</b>     |                  | 1Y   | Use coarse water spray.<br>Wear normal fire kit in combination with breathing apparatus [note 1].<br>There is a danger that the substance can be violently or explosively reactive.<br>Spillages contaminated with fire and decontamination run-off should be prevented from entering drains and surface and groundwaters. |  |
| <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.


### Notes to Table 1a

Note 1: Normal firefighting clothing is appropriate i.e., 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](#)'. The Stationery Office 2023 (viewed on 04 November 2024)

**Table 1b. Standard (UK) dangerous goods emergency action codes for sodium chlorate, aqueous solution**

|                |                  |      |  |   |
|----------------|------------------|------|--|---|
| <b>UN</b>      |                  | 2428 | Sodium chlorate, aqueous solution  |   |
| <b>EAC</b>     |                  | 2Y   | Use fine water spray.<br>Wear normal fire kit in combination with breathing apparatus [note 1].<br>There is a danger that the substance can be violently or explosively reactive.<br>Spillages contaminated with fire and decontamination run-off should be prevented from entering drains and surface and groundwaters. |   |
| <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.



### Notes to Table 1b

Note 1: Normal firefighting clothing is appropriate i.e., 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](#)'. The Stationery Office 2023 (viewed on 04 November 2024)

**Table 2. The GB classification, labelling and packaging (CLP) regulation for sodium chlorate**

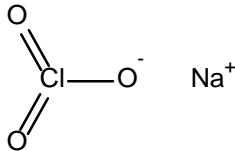
|                                  |              |  |   |
|----------------------------------|--------------|--|---|
| <b>Hazard class and category</b> | Ox. Sol. 1   | Oxidising solid, category 1                  |  |
|                                  | Acute Tox. 3 | Acute toxicity (oral), category 3            |  |
| <b>Hazard statement</b>          | H271         | May cause fire or explosion; strong oxidiser |   |
|                                  | H301         | Toxic if swallowed                           |   |
| <b>Signal words</b>              | DANGER       |  |   |

#### References

The Health and Safety Executive (HSE). '[GB CLP Regulation](#)' (viewed on 04 November 2024).

## Physicochemical properties

Table 3. Physicochemical properties

|                                  |  |
|----------------------------------|--|
| <b>CAS number</b>                | 7775-09-9  |
| <b>Molecular weight</b>          | 106.44   |
| <b>Formula</b>                   | NaClO <sub>3</sub>   |
| <b>Common synonyms</b>           | Chlorate of soda, chloric acid sodium salt   |
| <b>State at room temperature</b> | Colourless crystals or white granules  |
| <b>Volatility</b>                | Vapour pressure negligible at room temperature   |
| <b>Specific gravity</b>          | 2.5 (water = 1)  |
| <b>Flammability</b>              | Non-flammable, but enhances combustion of other substances   |
| <b>Lower explosive limit</b>     | No data available  |
| <b>Upper explosive limit</b>     | No data available  |
| <b>Water solubility</b>          | Soluble  |
| <b>Reactivity</b>                | <p>Reacts with combustible and reducing materials generating a fire and explosion hazard. Reacts with many organic materials to produce shock-sensitive mixtures resulting in an explosion hazard.</p> <p>Emits irritating or toxic fumes of chlorides and sodium oxides when heated to decomposition. Reacts with strong acids, releasing carbon dioxide.</p> |
| <b>Odour</b>                     | Odourless  |
| <b>Structure</b>                 |    |

### References

World Health Organization. International Programme on Chemical Safety '[International Chemical Safety Card entry for Sodium Chlorate](#)' ICSC 1117, 2023 (viewed on 04 November 2024)

PubChem. Bethesda (MD): National Library of Medicine (US), National Center for Biotechnology Information. '[PubChem Compound Summary for CID 516902, Sodium Chlorate](#)' (viewed on 04 November 2024)

## Reported effect levels from authoritative sources

**Table 4. Exposure by ingestion**

| <b>g</b> | <b>Signs and symptoms</b>  | <b>Reference</b> |
|----------|--|------------------|
| ~20-30   | Fatal dose in adults   | a                |
| 27       | Acute renal failure, anuria, disseminated intravascular coagulation, methaemoglobinaemia and haemolytic anaemia. | 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. National Poisons Information Service (NPIS). TOXBASE '[Sodium Chlorate](#)' 2021 (viewed on 04 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> | 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 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

Toxic by ingestion. Systemic toxicity is not expected following contact with intact skin.

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

| Route             | Signs and symptoms  |
|-------------------|---|
| <b>Ingestion</b>  | <p>Nausea, vomiting, abdominal pain and diarrhoea are likely within 2 hours after ingestion, but there may be a delay of up to 12 hours before systemic toxicity manifests.</p> <p>A slate-grey or blue appearance due to methaemoglobin formation may occur. Methaemoglobinaemia can be severe, concentrations of 50–80% have been reported at variable intervals after ingestion.</p> <p>Significant intravascular haemolysis is a common complication, rendering the urine red or dark in colour. Acute kidney injury and disseminated intravascular coagulation can occur. Leucocytosis and a metabolic acidosis may be present. Hyperkalaemia can result from the combination of AKI and haemolysis. Liver failure has been reported.</p> <p>General weakness, fatigue, dizziness, confusion, agitation, headache, initial CNS excitation and convulsions may be followed by coma. Chest pain, dyspnoea and ataxia may develop.</p> <p>Hypotension, tachycardia, trismus, liver failure, rhabdomyolysis and respiratory arrest have been reported.</p> |
| <b>Inhalation</b> | Irritation  |
| <b>Eyes</b>       | Irritation  |
| <b>Dermal</b>     | Irritation  |

### Reference

National Poisons Information Service (NPIS). TOXBASE '[Sodium Chlorate](#)' 2021 (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 sodium chlorate 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 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 sodium chlorate 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 18 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 18 October 2024)

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

## Clinical decontamination and first aid

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

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

### Important notes

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

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

The area should be well ventilated.

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

### Clinical decontamination following surface contamination

Avoid contaminating yourself.

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

Contaminated clothing should be removed, double-bagged, sealed and stored safely.

Decontaminate open wounds first and avoid contamination of unexposed skin.

Any particulate matter adherent to skin should be removed and the patient washed with soap and water under low pressure for at least 10 to 15 minutes.

Pay particular attention to mucous membranes, moist areas such as skin folds, fingernails and ears.

The earlier irrigation begins, the greater the benefit.



## Dermal exposure

Decontaminate (as above) the patient following surface contamination.

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

## Ocular exposure

If symptomatic immediately irrigate the affected eye thoroughly.

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

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

If symptoms persist seek medical assistance.

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

## Ingestion

Maintain a clear airway and ensure adequate ventilation.

Administer oxygen to achieve adequate oxygenation.

Where the practical expertise exists consider gastric lavage within 1 hour of a life threatening ingestion, provided the airway can be protected.

Note - activated charcoal does not adsorb chlorates.

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.

## 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 and treating clinicians should have a low threshold for establishing a protected airway.

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 measures as indicated by the patient's clinical condition.

## Clinical decontamination and first aid references

National Poisons Information Service (NPIS). TOXBASE '[Sodium Chloride](#)' 2021 (viewed on 04 November 2024)

National Poisons Information Service (NPIS). TOXBASE '[Corrosives - inhalation](#)' 2020 (viewed on 04 November 2024)

National Poisons Information Service (NPIS). TOXBASE '[Skin decontamination - irritants](#)' 2019 (viewed on 04 November 2024)

National Poisons Information Service (NPIS). TOXBASE '[Eye irritants – features and management](#)' 2022 (viewed on 04 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 and Environment Directorate reflects understanding and evaluation of the current scientific evidence as presented and referenced here.

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