



Sodium Chlorate

Incident Management

Key Points

Fire

- non-flammable but enhances combustion of other substances
- reacts with combustible and reducing materials, generating a fire and explosion hazard
- reacts with many organic materials to produce shock-sensitive mixtures
- emits toxic fumes of chlorides and sodium oxides when heated to decomposition
- reacts with strong acids to give off carbon dioxide

Health

- ingestion causes nausea, vomiting, abdominal pain and diarrhoea
- a slate-grey or blue appearance due to methaemoglobin formation may occur
- there may be a delay of up to 12 hours before systemic toxicity manifests with varying degrees of hypoxaemia, general weakness, fatigue, dizziness, confusion, agitation, headache, initial CNS excitation with convulsions which may be followed by coma
- inhalation, dermal and ocular exposure causes irritation


Environment

- hazardous to the environment; inform the Environment Agency of substantial incidents


Hazard Identification

Standard (UK) dangerous goods emergency action codes




Sodium chlorate

| | | | | |
|---|------------------|------|--|---|
| UN | | 1495 | Sodium chlorate | |
| EAC | | 1Y | Use coarse water spray. Wear normal fire kit in combination with breathing apparatus*. There is a danger that the substance can be violently or explosively reactive. Spillages contaminated with fire and decontamination run-off should be prevented from entering drains and surface and groundwaters | |
| APP | | – | – | |
| Hazards | Class | 5.1 | Oxidising substances |  |
| | Sub-risks | – | – | |
| HIN | | 50 | Oxidising (fire-intensifying) substance | |
| <p>UN – United Nations number, EAC – emergency action code, APP – additional personal protection, HIN – hazard identification number</p> <p>* Normal firefighting clothing is appropriate, ie breathing apparatus conforming to BS EN137 worn in combination with fire kit conforming to BS EN 469, firefighters' gloves conforming to BS EN 659 and firefighters' boots conforming to Home Office specification A29 or A30</p> <p>Reference Dangerous Goods Emergency Action Code List, National Chemical Emergency Centre (NCEC), Part of Ricardo-AEA, The Stationery Office, 2015.</p> | | | | |

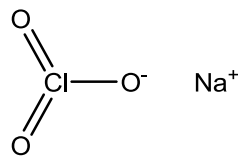
Sodium chlorate, aqueous solution

| | | | | |
|--|------------------|------|--|---|
| UN | | 2428 | Sodium chlorate, aqueous solution | |
| EAC | | 2Y | Use fine water spray. Wear normal fire kit in combination with breathing apparatus*. There is a danger that the substance can be violently or explosively reactive. Spillages contaminated with fire and decontamination run-off should be prevented from entering drains and surface and groundwaters | |
| APP | | – | – | |
| Hazards | Class | 5.1 | Oxidising substances |  |
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Classification, labelling and packaging (CLP)*

| | | | |
|--|-------------------|--|---|
| Hazard class and category | Ox. Sol. 1 | Oxidising solid, category 1 |  |
| | Acute Tox. 4 | Acute toxicity (oral), category 4 |  |
| | Aquatic Chronic 2 | Chronic hazards to the aquatic environment, category 2 |  |
| Hazard statement | H271 | May cause fire or explosion; strong oxidiser | |
| | H302 | Harmful if swallowed | |
| | H411 | Toxic to aquatic life with long lasting effects | |
| Signal words | DANGER | | |
| * Implemented in the EU on 20 January 2009 | | | |
| Reference | | | |
| European Commission. Harmonised classification – Annexe VI to Regulation (EC) No. 1272/2008 on Classification, Labelling and Packaging of Substances and Mixtures. http://echa.europa.eu/information-on-chemicals/cl-inventory-database (accessed 05/2015). | | | |

Physicochemical Properties

| | |
|--|--|
| CAS number | 7775-09-9 |
| Molecular weight | 106.44 |
| Formula | NaClO ₃ |
| Common synonyms | Chlorate of soda, chloric acid sodium salt |
| State at room temperature | Colourless crystals or white granules |
| Volatility | Vapour pressure negligible at room temperature |
| Specific gravity | 2.5 (water = 1) |
| Flammability | Non-flammable, but enhances combustion of other substances |
| Lower explosive limit | No data available |
| Upper explosive limit | No data available |
| Water solubility | Soluble |
| Reactivity | 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 |
| Reaction or degradation products | Emits toxic fumes of chlorides and sodium oxides when heated to decomposition. Reacts with strong acids giving off carbon dioxide |
| Odour | Odourless |
| Structure |  |
| References | |
| <p>Hazardous Substances Data Bank [Internet]. Bethesda (MD): National Library of Medicine (US); [Last Revision Date 05/01/2009]. Sodium chlorate; Hazardous Substances Databank Number: 732. Available from: http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB (assessed 05/2015).</p> <p>International Programme for Chemical Safety (IPCS). International Chemical Safety Card entry for sodium chlorate, ICS 1117, 1999. World Health Organization: Geneva.</p> <p>Sodium Chlorate (HAZARDTEXT™ Hazard Management). In: Klasco RK (Ed): TOMES® System. Truven Healthcare Analytics Inc., Greenwood Village, Colorado, USA. (electronic version). RightAnswer.com, Inc., Midland, MI, USA, Available at: http://www.rightanswerknowledge.com (assessed 05/2015).</p> | |

Reported Effect Levels from Authoritative Sources

Exposure by inhalation

| g | Signs and symptoms | Reference |
|---|----------------------------------|-----------|
| 2 | Suggested fatal dose in children | a |
| ~20–30 | Fatal dose in adults | a |
| <p>These values give an indication of levels of exposure that can cause adverse effects. They are not health protective standards or guideline values</p> <p>Reference TOXBASE. Sodium Chlorate, 2010. http://www.toxbase.org (accessed 05/2015).</p> | | |

Published Emergency Response Guidelines

Emergency response planning guideline (ERPG) values

| | Listed value (ppm) | Calculated value (mg/m ³) |
|---|--------------------|---------------------------------------|
| ERPG-1* | Data not available | |
| ERPG-2[†] | | |
| ERPG-3[‡] | | |
| <p>* Maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing other than mild transient adverse health effects or perceiving a clearly defined, objectionable odour</p> <p>[†] Maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action</p> <p>[‡] Maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects</p> | | |

Acute exposure guideline levels (AEGLs)

| | ppm | | | | |
|---|--------------------|--------|--------|---------|---------|
| | 10 min | 30 min | 60 min | 4 hours | 8 hours |
| AEGL-1* | Data not available | | | | |
| AEGL-2[†] | | | | | |
| AEGL-3[‡] | | | | | |
| <p>* Level of the chemical in air at or above which the general population could experience notable discomfort</p> <p>[†] 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</p> <p>[‡] Level of the chemical in air at or above which the general population could experience life-threatening health effects or death</p> | | | | | |

Exposure Standards, Guidelines or Regulations

Occupational standards

| | LTEL (8-hour reference period) | | STEL (15-min reference period) | |
|---|--------------------------------|-------------------|--------------------------------|-------------------|
| | ppm | mg/m ³ | ppm | mg/m ³ |
| WEL | No guideline value specified | | | |
| WEL – workplace exposure limit, LTEL – long-term exposure limit, STEL – short-term exposure limit | | | | |

Public health guidelines

| | |
|---|--------------------|
| Drinking water standard | Data not available |
| Air quality guideline | Data not available |
| Soil guideline values and health criteria values | Data not available |

Health Effects

Major route of exposure

- ingestion, systemic toxicity is not expected following contact with intact skin

Immediate signs or symptoms of acute exposure

| Route | Signs and symptoms |
|--|---|
| Ingestion | <p>Nausea, vomiting, abdominal pain and diarrhoea are likely within 2 hours after ingestion</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; the rate of methaemoglobin formation is relatively slow and clinically significant concentrations can occur insidiously</p> <p>Significant intravascular haemolysis is a common complication, rendering the urine red or dark in colour. Subsequently disseminated intravascular coagulation secondary to haemolytic anaemia and haemoglobinuria may develop. A decreased platelet count, haematuria, leucocytosis and metabolic acidosis can be present</p> <p>Acute renal failure may ensue due to renal tubular necrosis. Hyperkalaemia is likely to result from the combination of renal failure and haemolysis</p> <p>There may be a delay of up to 12 hours before systemic toxicity manifests with varying degrees of hypoxaemia, general weakness, fatigue, dizziness, confusion, agitation, headache, initial CNS excitation with convulsions which may be followed by coma</p> <p>Chest pain, dyspnoea and ataxia may develop</p> <p>Hypotension, tachycardia, trismus, liver failure, rhabdomyolysis and respiratory arrest have been reported</p> |
| Inhalation | Irritation |
| Dermal | Irritation |
| Ocular | Irritation |
| <p>Reference TOXBASE. Sodium Chlorate - Discontinued, 02/2016. http://www.toxbase.org (accessed 11/2016).</p> | |

Decontamination at the Scene

Summary

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.**

Emergency services and public health professionals can obtain further advice from Public Health England (Centre for Radiation, Chemical and Environmental Hazards) 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, disrobe at the scene should be conducted by the casualty themselves and should be systematic to avoid transferring any contamination from clothing to the skin. Consideration should be given to ensuring the welfare and dignity of casualties as far as possible.

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.**

Improvised dry decontamination

- any available dry absorbent material can be used such as kitchen towel, paper tissues (eg blue roll) and clean cloth
- exposed skin surfaces should be blotted and rubbed, starting with the face, head and neck and moving down and away from the body
- rubbing and blotting should not be too aggressive, or it could drive contamination further into the skin

- all waste material arising from decontamination should be left in situ, and ideally bagged, for disposal at a later stage

Improvised wet decontamination

- water should only be used for decontamination where casualty signs and symptoms are consistent with exposure to caustic or corrosive substances such as acids or alkalis
- wet decontamination may be performed using any available source of water such as taps, showers, fixed installation hose-reels and sprinklers
- when using water, it is important to try and limit the duration of decontamination to between 45 and 90 seconds and, ideally, to use a washing aid such as cloth or sponge
- improvised decontamination should not involve overly aggressive methods to remove contamination as this could 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 etc) 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
- 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/clothes
- 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

Interim wet decontamination

Interim decontamination is the use of standard fire and rescue service (FRS) equipment to provide a planned and structured decontamination process prior to the availability of purpose-designed decontamination equipment.

Decontamination at the scene references

National Ambulance Resilience Unit. Joint Emergency Services Interoperability Programme (JESIP). Initial operational response to a CBRN incident. Version 1.0, September 2013.

NHS England. Emergency Preparedness, Resilience and Response (EPRR). Chemical incidents: planning for the management of self-presenting patients in healthcare settings. April 2015.

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 – www.toxbase.org.

Important notes

- ambulance staff, paramedics and emergency department staff treating chemically-contaminated casualties should be equipped with appropriate personal protective equipment (PPE)
- carry out decontamination after resuscitation; resuscitate the patient according to standard guidelines

Clinical decontamination following surface contamination

- avoid contaminating yourself with this product and wash any exposed area
- any particulate matter adherent to skin should be removed and the patient washed with soap and water under low pressure for at least 10 – 15 minutes
- pay particular attention to mucous membranes, moist areas such as skin folds, fingernails and ears

Dermal exposure

- decontaminate (as above) the patient following surface contamination
- other supportive measures as indicated by the patient's clinical condition

Ocular exposure

- if symptomatic, immediately irrigate the affected eye thoroughly
- for patients at home, use lukewarm tap water, trickled into the eye or in a small cup held over the eye socket; an eye dropper is an alternative
- if symptoms persist seek medical assistance
- in hospital immediately irrigate the affected eye thoroughly with 0.9% saline 1000 mL (for example via an infusion bag with a giving set). A Morgan Lens may be used if anaesthetic has been given. Irrigate for 10-15 minutes
- refer for ophthalmological assessment if there is doubt regarding the management of corneal damage
- other supportive measures as indicated by the patient's clinical condition

Inhalation

- maintain a clear airway and ensure adequate ventilation
- give oxygen if required
- perform a 12 lead ECG
- other supportive measures as indicated by the patient's clinical condition

Ingestion

- maintain a clear airway and ensure adequate ventilation
- give high flow oxygen. If this is ineffective for hypoxia consider ventilator support
- activated charcoal does not absorb chlorates
- monitor vital signs
- other supportive measures as indicated by the patient's condition

Clinical decontamination and first aid references

| | |
|---------|--|
| TOXBASE | http://www.toxbase.org (accessed 11/2016) |
| TOXBASE | Sodium chlorate – discontinued, 02/2016 |
| TOXBASE | Chlorates and chlorites – features and management, 02/2016 |
| TOXBASE | Corrosives – inhalation, 02/2012 |
| TOXBASE | Skin decontamination – irritants, 05/2012 |
| TOXBASE | Eye irritants, 01/2016 |

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