



Copper

Incident Management

Key Points

Fire

- non-combustible, except in powder form
- reacts violently with acetylene, ammonium nitrate, bromates, chlorates, iodates, chloride, ethylene oxide, sodium azide and potassium oxide

Health

- main exposure routes are ingestion or inhalation of dusts and fumes, or dermal contact
- inhalation may cause metal fume fever; symptoms include cough, dyspnoea, sore throat, chest tightness, headache, fever, rigors, myalgia and arthralgia
- ingestion may result in abdominal pain, nausea, vomiting and diarrhoea
- dermal exposure to molten copper causes burns
- copper foreign bodies can cause serious eye damage

Environment

- avoid release to the environment; inform the Environment Agency of substantial incidents

Hazard Identification

Standard (UK) dangerous goods emergency action codes

| | | |
|----------------|------------------|--------------------|
| UN | | Data not available |
| EAC | | |
| APP | | |
| Hazards | Class | |
| | Sub-risks | |
| HIN | | |

Classification, labelling and packaging (CLP)

| | |
|----------------------------------|------------------------------|
| Hazard class and category | No harmonised classification |
| Hazard statement | |
| Signal words | |

Physicochemical Properties

| | |
|--|---|
| CAS number | 7440-50-8 |
| Molecular weight | 63.546 |
| Formula | Cu |
| Common synonyms | – |
| State at room temperature | Solid |
| Volatility | Vapour pressure = 1 mmHg at 1628°C, non-volatile |
| Specific gravity | 8.9 (water = 1) |
| Flammability | Non-combustible, except in powder form |
| Lower explosive limit | – |
| Upper explosive limit | – |
| Water solubility | Insoluble |
| Reactivity | Copper ignites on contact with chlorine, chlorine trifluoride, fluorine (above 121°C) and hydrazinium nitrate (above 70°C). Reacts violently with acetylene, ammonium nitrate, bromates, chlorates, iodates, chloride, ethylene oxide, hydrazine mononitrate, hydrazoic acid, sodium azide and potassium oxide. Molten copper explodes on contact with water |
| Reaction or degradation products | Becomes dull when exposed to air. In moist air gradually becomes coated with green basic carbonate. May decompose upon heating to form corrosive and/or toxic fumes |
| Odour | Odourless |
| <p>References</p> <p>Hazardous Substances Data Bank [Internet]. Bethesda MD, US: National Library of Medicine (US); [Last Revision Date 14/02./2003]. Copper; Hazardous Substances Databank Number: 1622. http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB (as accessed 05/2015).</p> <p>International Programme for Chemical Safety (IPCS). International Chemical Safety Card (ICSC) entry for Copper. ISCS 0240, 1993. World Health Organization: Geneva.</p> <p>Copper (HAZARTEXT™ Hazard Management). In Klasco RK (Ed): TOMES® System, Truven Healthcare Analytics Inc, Greenwood Village CO, US (electronic version). RightAnswer.com, Inc, Midland MI, US. http://www.rightanswerknowledge.com (accessed 05/2015).</p> | |

Reported Effect Levels from Authoritative Sources

Exposure by ingestion

| mg/kg | Signs and symptoms | Reference |
|--|---|-----------|
| 140 | Mean fatal dose of various copper salts (there is considerable variability in individual sensitivity to copper) | a |
| mg | | |
| 10–15 | May cause nausea, vomiting and diarrhoea (copper salts) | 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</p> <p>a International Programme on Chemical Safety, Poisons Information Monograph (Group Monograph) G002, Copper and Copper Salts (1990). World Health Organization: Geneva.</p> | | |

Exposure by inhalation

| ppm | mg/m ³ | Signs and symptoms | Reference |
|--|-------------------|--------------------|-----------|
| >0.04 | >0.1 | Metal fume fever | 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</p> <p>a International Programme on Chemical Safety, Environmental Health Criteria 200: Copper (1998). World Health Organization: Geneva.</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 | Not given | 0.2 (fume) 1 (dusts and mists, as Cu) | Not given | 2 (dusts and mists, as Cu) |
| <p>WEL – workplace exposure limit, LTEL – long-term exposure limit, STEL – short-term exposure limit</p> <p>Reference EH40/2005 Workplace Exposure Limits (second edition, published 2011).</p> | | | | |

Public health guidelines

| | |
|--|--------------------|
| Drinking water standard | 2 mg/L |
| Air quality guideline | Data not available |
| Soil guideline values and health criteria values | Data not available |
| <p>Reference The Water Supply (Water Quality) Regulations 2000 (England) and the Water Supply (Water Quality) Regulations 2001 (Wales).</p> | |

Health Effects

Major route of exposure

- ingestion, inhalation of fumes or dust or by dermal absorption

Immediate signs or symptoms of acute exposure

| Route | Signs and symptoms |
|--|---|
| Inhalation | Occupational exposure to copper dusts and fumes has been associated with cough, dyspnoea, fever and headache. |
| Ingestion | <p>Ingestion of small amounts (a few milligrams) is likely to cause only nausea and vomiting. Larger ingestions, particularly of water-soluble salts, causes a metallic taste within minutes followed by abdominal pain and diarrhoea. Severe gastrointestinal irritation may result in haematemesis and/or melaena with hypovolaemic shock.</p> <p>Severe poisoning is associated with the development of renal failure, intravascular haemolysis (usually manifest 24-48 hours post-poisoning) and hepatocellular and obstructive liver damage. Methaemoglobinaemia, coma, convulsions, rhabdomyolysis and death may occur. There is a high risk of aspiration of gastric contents in unconscious patients.</p> |
| Dermal | Mild irritant to intact skin. Systemic copper uptake may result from repeated application to broken skin. Exposure to copper-contaminated water can cause blue/green skin discolouration of hair and of pre-existing skin lesions. Contact dermatitis has been reported. |
| Ocular | Irritant to the eye. May cause corneal necrosis and opacification if crystals remain in the conjunctival sac. |
| References | |
| TOXBASE. Copper, 2015. http://www.toxbase.org (accessed 11/2016). | |

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 copper **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 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

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 people individually.

Detailed information on clinical management can be found on TOXBASE – www.toxbase.org.

Important note

- 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

Clinical decontamination following surface contamination

- remove all soiled clothing
- wash the contaminated area thoroughly with soap and water

Dermal exposure

- decontaminate (as above) the patient following surface contamination
- treat symptomatically
- 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 (eg oxybuprocaine, amethocaine or similar); **however, do not delay irrigation if local anaesthetic is not immediately available**
- immediately irrigate the affected eye thoroughly with 1,000 mL 0.9% saline (eg by an infusion bag with a giving set). A Morgan Lens may be used if anaesthetic has been given. Irrigate for 10–15 minutes irrespective of initial conjunctival pH. Aim for a final conjunctival pH of 7.5–8.0. The conjunctivae may be tested with indicator paper. Retest 20 minutes after irrigation and use further irrigation if necessary
- 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 referred **urgently** to an ophthalmologist**
- other supportive measures as indicated by the patient's clinical condition

Inhalation

- remove from exposure and administer supplemental oxygen by face-mask if there is evidence of respiratory distress
- other supportive measures as indicated by the patient's clinical condition

Ingestion

- gut decontamination is contraindicated
- a small glass of water or milk may be of some symptomatic benefit
- perform 12 lead ECG
- monitor vital signs, cardiac rhythm and measure blood sugar (BM)
- other supportive measures as indicated by the patient's clinical condition

Clinical decontamination and first aid references

TOXBASE: <http://www.toxbase.org> (accessed 11/2016)

TOXBASE: Copper, 2015

TOXBASE: Copper salts – features and management, 2015

TOXBASE: Chemicals splashed or sprayed into the eyes, 2014

This document from the PHE Centre for Radiation, Chemical and Environmental Hazards reflects understanding and evaluation of the current scientific evidence as presented and referenced here.

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