



# Ammonia

## Incident Management

### Key Points

#### Fire

- flammable; the substance reacts with most organic and inorganic compounds, causing fire and explosion hazard
- emits toxic fumes of ammonia and oxides of nitrogen when heated to decomposition
- in the event of a fire involving ammonia, use fine water spray and chemical protective clothing with liquid-tight connections for whole body in combination with breathing apparatus

#### Health

- exposure by any route may be dangerous
- inhalation causes irritation of the eyes and nose, with sore throat, cough, chest tightness, headache, fever, wheeze tachycardia and confusion; pulmonary oedema may take up to 36 hours to develop
- ingestion causes immediate burning of the mouth, throat and stomach. Abdominal pain, vomiting, haematemesis and dyspnoea may follow; shock and airway obstruction from laryngeal and/or epiglottic oedema are features of severe cases
- dermal exposure causes deep, full thickness burns
- ocular exposure may cause significant damage, which may be irreversible in some cases and lead to loss of sight



#### Environment

- hazardous to the environment; inform the Environment Agency where appropriate

## Hazard Identification

### Standard (UK) dangerous goods emergency action codes

#### Ammonia, anhydrous

<b>UN</b>		1005	Ammonia, anhydrous	
<b>EAC</b>		2RE	Use fine water spray. Wear chemical protective clothing with liquid-tight connections for whole body in combination with breathing apparatus*. Spillages and decontamination run-off may be washed to drains with large quantities of water. Due care must, however, still be exercised to avoid unnecessary pollution to watercourses. There may be a public safety hazard outside the immediate area of the incident†	
<b>APP</b>		A(c)	Gas-tight chemical protective suit with breathing apparatus‡ Liquefied gas with boiling point below –20°C	
<b>Hazards</b>	<b>Class</b>	2.3	Toxic gases	
	<b>Sub-risks</b>	8	Corrosive substance	
<b>HIN</b>		268	Toxic gas, corrosive	

UN – United Nations number, EAC – emergency action code, APP – additional personal protection, HIN – hazard identification number

\* Chemical protective clothing with liquid-tight connections for whole body (type 3) conforming to relevant standards such as BS 8428 or EN 14605, in combination with breathing apparatus BS EN 137


† People should stay indoors with windows and doors closed, ignition sources should be eliminated and ventilation stopped. Non-essential personnel should move at least 250 m away from the incident

‡ Normal fire kit in combination with gas-tight chemical protective clothing conforming to BS EN 943 part 2; thermal-resistant gloves should be worn such as those conforming to BS EN 511:2006 or BS EN 407:2004


#### Reference

Dangerous Goods Emergency Action Code List. National Chemical Emergency Centre (NCEC), Part of Ricardo-AEA. The Stationery Office, 2015.



**Ammonia, Solution**

<b>UN</b>		2073	Ammonia solution, relative density less than 0.88 at 15°C in water, with more than 35% but not more than 50% ammonia	
<b>EAC</b>		2RE	Use fine water spray. Wear chemical protective clothing with liquid-tight connections for whole body in combination with breathing apparatus*. Spillages and decontamination run-off may be washed to drains with large quantities of water. Due care must, however, still be exercised to avoid unnecessary pollution to watercourses. There may be a public safety hazard outside the immediate area of the incident†	
<b>APP</b>		–	–	
<b>Hazards</b>	<b>Class</b>	2.2	Non-flammable, non-toxic gases	
	<b>Sub-risks</b>	–	–	
<b>HIN</b>		20	Asphyxiant gas or gas with no subsidiary risk	
<p>UN – United Nations number, EAC – emergency action code, APP – additional personal protection, HIN – hazard identification number</p> <p>* Chemical protective clothing with liquid-tight connections for whole body (type 3) conforming to relevant standards such as BS 8428 or EN 14605, in combination with breathing apparatus BS EN 137</p> <p>† People should stay indoors with windows and doors closed, ignition sources should be eliminated and ventilation stopped. Non-essential personnel should move at least 250 m away from the incident</p> <p><b>Reference</b></p> <p>Dangerous Goods Emergency Action Code List. National Chemical Emergency Centre (NCEC), Part of Ricardo-AEA. The Stationery Office, 2015.</p>				





**Ammonia, solution**

<b>UN</b>		2672	Ammonia solution, relative density between 0.88 and 0.957 at 15°C in water, with more than 10% but no more than 35% ammonia	
<b>EAC</b>		2R	Use fine water spray. Wear chemical protective clothing with liquid-tight connections for whole body in combination with breathing apparatus*. Spillages and decontamination run-off may be washed to drains with large quantities of water. Due care must, however, still be exercised to avoid unnecessary pollution to watercourses	
<b>APP</b>		–	–	
<b>Hazards</b>	<b>Class</b>	8	Corrosive substance	
	<b>Sub-risks</b>	–	–	
<b>HIN</b>		80	Corrosive or slightly corrosive substance	
<p>UN – United Nations number, EAC – emergency action code, APP – additional personal protection, HIN – hazard identification number</p> <p>* Chemical protective clothing with liquid-tight connections for whole body (Type 3) conforming to relevant standards such as BS 8428 or EN 14605, in combination with breathing apparatus BS EN 137</p> <p><b>Reference</b></p> <p>Dangerous Goods Emergency Action Code List. National Chemical Emergency Centre (NCEC), Part of Ricardo-AEA. The Stationery Office, 2015.</p>				



**Ammonia, solution**

<b>UN</b>		3318	Ammonia solution, relative density less than 0.88 at 15°C in water, with more than 50% ammonia	
<b>EAC</b>		2RE	Use fine water spray. Wear chemical protective clothing with liquid-tight connections for whole body in combination with breathing apparatus*. Spillages and decontamination run-off may be washed to drains with large quantities of water. Due care must, however, still be exercised to avoid unnecessary pollution to watercourses. There may be a public safety hazard outside the immediate area of the incident†	
<b>APP</b>		B	Gas-tight chemical protective suit with breathing apparatus‡	
<b>Hazards</b>	<b>Class</b>	2.3	Toxic gases	
	<b>Sub-risks</b>	8	Corrosive substance	
<b>HIN</b>		268	Toxic gas, corrosive	
<p>UN – United Nations number, EAC – emergency action code, APP – additional personal protection, HIN – hazard identification number</p> <p>* Chemical protective clothing with liquid-tight connections for whole body (type 3) conforming to relevant standards such as BS 8428 or EN 14605, in combination with breathing apparatus BS EN 137</p> <p>† People should stay indoors with windows and doors closed, ignition sources should be eliminated and ventilation stopped. Non-essential personnel should move at least 250 m away from the incident</p> <p>‡ Chemical protective clothing should be gas tight conforming to BS EN 943 part 2, in combination with breathing apparatus conforming to BS EN 137</p> <p><b>Reference</b></p> <p>Dangerous Goods Emergency Action Code List. National Chemical Emergency Centre (NCEC), Part of Ricardo-AEA. The Stationery Office, 2015.</p>				

**Classification, labelling and packaging (CLP)\******Ammonia, anhydrous***

<b>Hazard class and category</b>	Press. Gas	Compressed gas	
	Flam. Gas 2	Flammable gas, category 2	-
	Skin Corr. 1B	Skin corrosion, category 1B	
	Acute Tox. 3	Acute toxicity (inhalation), category 3	
	Aquatic Acute 1	Acute hazard to the aquatic environment, category 1	
<b>Hazard statement</b>	H221	Flammable gas	
	H314	Causes severe skin burns and eye damage	
	H331	Toxic if inhaled	
	H400	Very toxic to aquatic life	
<b>Signal words</b>	DANGER		
* Implemented in the EU on 20 January 2009			
<b>Reference</b>			
European Commission. Harmonised classification – Annexe VI to Regulation (EC) No. 1272/2008 on Classification, Labelling and Packaging of Substances and Mixtures. <a href="http://echa.europa.eu/information-on-chemicals/cl-inventory-database">http://echa.europa.eu/information-on-chemicals/cl-inventory-database</a> (accessed 10/2015).			

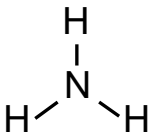
**Ammonia ....%**

<b>Hazard class and category</b>	Skin Corr. 1B	Skin corrosion, category 1B	
	Aquatic Acute 1	Acute hazard to the aquatic environment, category 1	
<b>Hazard statement</b>	H314	Causes severe skin burns and eye damage	
	H400	Very toxic to aquatic life	
<b>Signal words</b>	DANGER		
* Implemented in the EU on 20 January 2009			
<b>Reference</b>			
European Commission. Harmonised classification – Annexe VI to Regulation (EC) No. 1272/2008 on Classification, Labelling and Packaging of Substances and Mixtures. <a href="http://echa.europa.eu/information-on-chemicals/cl-inventory-database">http://echa.europa.eu/information-on-chemicals/cl-inventory-database</a> (accessed 10/2015).			

**Specific concentration limits**

Concentration	Hazard class and category	Hazard statement	
C ≥ 5%	STOT SE 3	H335	May cause respiratory irritation
* Implemented in the EU on 20 January 2009			
<b>Reference</b>			
European Commission. Harmonised classification – Annexe VI to Regulation (EC) No. 1272/2008 on Classification, Labelling and Packaging of Substances and Mixtures. <a href="http://echa.europa.eu/information-on-chemicals/cl-inventory-database">http://echa.europa.eu/information-on-chemicals/cl-inventory-database</a> (accessed 10/2015).			

## Physicochemical Properties

<b>CAS number</b>	7664-41-7
<b>Molecular weight</b>	17
<b>Empirical formula</b>	NH <sub>3</sub>
<b>Common synonyms</b>	Hydrogen nitride
<b>State at room temperature</b>	Gas
<b>Volatility</b>	Vapour pressure = 7,510 mmHg at 25°C
<b>Specific gravity</b>	0.59 (air = 1)
<b>Flammability</b>	Flammable; the substance reacts with most organic and inorganic compounds, causing fire and explosion hazard
<b>Lower explosive limit</b>	15%
<b>Upper explosive limit</b>	28%
<b>Water solubility</b>	Dissolves in water with a mild release of heat
<b>Reactivity</b>	Reacts with many compounds, causing a fire and explosion hazard. Strong base that reacts violently with acids and is corrosive. Reacts violently with strong oxidants, halogens and many other substances. Attacks copper, aluminium, zinc and their alloys. Mixtures with mercury, silver and gold oxides are shock-sensitive
<b>Reaction or degradation products</b>	Emits toxic fumes of ammonia and oxides of nitrogen when heated to decomposition
<b>Odour</b>	Characteristic, pungent odour of drying urine
<b>Structure</b>	
<b>References</b>	<p>Ammonia (HAZARDTEXT™ Hazard Management). In Klasco RK (Ed): TOMES® System, Truven Healthcare Analytics Inc, Greenwood Village CO, US. RightAnswer.com Inc, Midland MI, US. <a href="http://www.rightanswerknowledge.com">http://www.rightanswerknowledge.com</a> (accessed 11/2015).</p> <p>Hazardous Substances Data Bank. Ammonia. HSDB No. 162 (last revision date 03/05/2011). US National Library of Medicine: Bethesda MD. <a href="http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB">http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB</a> (accessed 11/2015).</p> <p>International Programme on Chemical Safety. International chemical safety card entry for ammonia (anhydrous). ICSC 0414, 2013. World Health Organization: Geneva.</p> <p>The Merck Index (14<sup>th</sup> Edition). Ammonia, Entry 492, 2006.</p>



## Reported Effect Levels from Authoritative Sources

### Exposure by inhalation

ppm	mg/m <sup>3</sup>	Signs and symptoms	Reference
100	70	Slightly irritating to eyes	a
250	175	Bearable by most for 30–60 minutes	a
500	350	Increases respiratory minute volume	a
698	489	Immediately irritating to eyes and throat	a
2,500–4500	1,742–3,150	Fatal in approximately 30 minutes	a
5,000–10,000	3,500–7,000	Rapidly fatal in humans	a

These values give an indication of levels of exposure that can cause adverse effects. They are not health protective standards or guideline values

**Reference**  
a Agency for Toxic Substances and Disease Registry. Toxicological Profile for Ammonia, 2004.

### Exposure by skin

Ammonia vapour			
ppm	mg/m <sup>3</sup>	Signs and symptoms	Reference
10,000	7,000	Skin damage	a

Ammonia solution			
%	Signs and symptoms		Reference
5–10	Irritant		a
27–30	Highly corrosive		a

These values give an indication of levels of exposure that can cause adverse effects. They are not health protective standards or guideline values

**Reference**  
a TOXBASE. Ammonia, 2014. <http://www.toxbase.org> (accessed 11/2015).

## Published Emergency Response Guidelines

### Emergency response planning guideline (ERPG) values

	Listed value (ppm)	Calculated value (mg/m <sup>3</sup> )
ERPG-1*	25 <sup>(1)</sup>	18
ERPG-2 <sup>†</sup>	150	105
ERPG-3 <sup>‡</sup>	1,500	1,050

\* 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

<sup>†</sup> 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

<sup>‡</sup> 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

<sup>(1)</sup> Odour should be detectable near ERPG-1

**Reference**  
American Industrial Hygiene Association (AIHA). 2015 Emergency Response Planning Guideline Values. <https://www.aiha.org/get-involved/AIHAGuidelineFoundation/EmergencyResponsePlanningGuidelines/Documents/2015%20ERPG%20Levels.pdf> (accessed 10/2015).

### Acute exposure guideline levels (AEGLs)

	Concentration (ppm)				
	10 min	30 min	60 min	4 hours	8 hours
AEGL-1*	30	30	30	30	30
AEGL-2 <sup>†</sup>	220	220	160	110	110
AEGL-3 <sup>‡</sup>	2,700	1,600	1,100	550	390

\* Level of the chemical in air at or above which the general population could experience notable discomfort

<sup>†</sup> Level of the chemical in air at or above which there may be irreversible or other serious long-lasting effects or an impaired ability to escape

<sup>‡</sup> 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. Acute Exposure Guideline Levels. <http://www.epa.gov/oppt/aegl/pubs/chemlist.htm> (accessed 10/2015).

## Exposure Standards, Guidelines or Regulations

### 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>	25	18	35	25
<p>WEL – workplace exposure limit, LTEL – long-term exposure limit, STEL – short-term exposure limit</p> <p><b>Reference</b>            Health and Safety Executive (HSE). EH40/2005 Workplace Exposure Limits, 2<sup>nd</sup> Edition, 2011.  <a href="http://www.hse.gov.uk/pubns/priced/eh40.pdf">http://www.hse.gov.uk/pubns/priced/eh40.pdf</a> (accessed 11/2015).</p>				

### Public health guidelines

<b>Drinking water standard</b>	0.5 mg/L (as NH <sub>4</sub> )
<b>Air quality guideline</b>	No guideline values specified
<b>Soil guideline values and health criteria values</b>	No guideline values specified
<p><b>References</b>            The Private Water Supplies Regulations 2009 and the Private Water Supplies Regulations (Wales) 2010.            The Water Supply (Water Quality) Regulations 2000 (England) and the Water Supply (Water Quality) Regulations 2001 (Wales).</p>	

## Health Effects

### Major route of exposure

- exposure by any route (ingestion, inhalation, dermal or ocular exposure) may be dangerous; however, the most common route of exposure is inhalation

### Immediate signs or symptoms of acute exposure

Route	Signs and symptoms
<b>Inhalation</b>	<p>Irritation of eyes and nose, with sore throat, cough, chest tightness, headache, fever, wheeze, tachycardia and confusion. Chemical pneumonitis, tachypnoea, dyspnoea and stridor due to laryngeal oedema may follow. Pulmonary oedema with increasing breathlessness, wheeze, hypoxia and cyanosis may take up to 36 hours to develop. Optic neuropathy has been reported following acute inhalation</p> <p>In serious cases, corrosive damage to the mucous membranes of both the upper and lower respiratory tract occurs</p> <p>Prolonged exposure may result in systemic effects</p>
<b>Ingestion</b>	<p>Ingestion of corrosives can cause immediate pain, with burning in the mouth, throat and stomach. This may be followed by abdominal pain, vomiting, haematemesis and dyspnoea. Pain and oedema may make swallowing difficult, causing drooling. Haemorrhagic or hypovolaemic shock and airway obstruction from laryngeal and/or epiglottic oedema are features of severe cases</p> <p>Stridor and respiratory complications (including pneumonitis, pulmonary oedema, acute respiratory distress syndrome and pulmonary necrosis) can develop following aspiration of corrosive materials</p> <p>The presence of oropharyngeal burns does not correlate well with the presence of oesophageal injuries, but generally more extensive oral burns are associated with multiple site involvement. Gastric or oesophageal perforation may occur in the early stages of severe cases</p> <p>Alkalis often damage the oesophagus. However, ingestion of large volumes can also involve the stomach and small intestines</p> <p>Ulceration may be sufficiently severe to cause perforation with complications including mediastinitis, pneumonitis and cardiac injury. The depths of the burns are usually much greater with alkalis, and may continue to develop some time after exposure</p>

Route	Signs and symptoms
<b>Dermal</b>	<p>Symptoms are more likely to occur following direct contact with solid or liquid corrosive materials although features can also occur through contact with corrosive gases and fumes</p> <p>Alkalis can directly damage tissue by the saponification of fats and the solubilisation of proteins and collagen. This causes liquefaction burns and necrosis with a softening of the tissues which can further lead to deep tissue penetration and full thickness burns</p> <p>Dermal alkali injuries may be initially painless, leading to a delay in treatment. Alkali injuries can also progress over several hours and it can be difficult to assess the extent of the resulting burn due to quickly developing skin discolouration. Recurring skin breakdown over extended periods after the initial injury may complicate and delay recovery</p> <p>Large or prolonged exposure may result in systemic effects</p>
<b>Ocular</b>	<p>Splashes in the eye may cause significant damage, which may be irreversible in some cases and lead to loss of sight</p>
<b>Reference</b> TOXBASE. Ammonia, 2014. <a href="http://www.toxbase.org">http://www.toxbase.org</a> (accessed 11/2015).	

## 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.

Anhydrous ammonia (liquid or gas) reacts with tissue water to form the corrosive solution, ammonium hydroxide. Therefore, following disrobe, improvised wet decontamination should be considered (see below for details).

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 people individually.

Detailed information on clinical management can be found on TOXBASE – [www.toxbase.org](http://www.toxbase.org).

### Important notes

- if the patient has not been decontaminated following surface contamination, secondary carers must wear appropriate NHS PPE for chemical exposure to avoid contaminating themselves
- anhydrous ammonia (liquid or gas) reacts with tissue water to form the strongly alkaline solution, ammonium hydroxide

### Clinical decontamination following surface contamination

- carry out decontamination after resuscitation
- this should be performed in a well-ventilated area, preferably with its own ventilation system
- do **not** apply neutralising chemicals as heat produced during neutralization reactions may cause thermal burns, and increase injury
- 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 10–15 minutes, or until the pH of the skin is normal (pH of the skin is 4.5–6, although it may be closer to 7 in children, or after irrigation). **The earlier irrigation begins, the greater the benefit**
- 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
- following decontamination, recheck the 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
- 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; excision or skin grafting may be required
- **note alkalis in particular may penetrate deeply within a few minutes**
- 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 discussed urgently with an ophthalmologist**
- other supportive measures as indicated by the patient's clinical condition

## Inhalation

- ensure a clear airway and adequate ventilation
- give oxygen
- monitor respiratory rate and oxygen saturation
- perform a 12 lead ECG
- other supportive measures as indicated by the patient's clinical condition

## Ingestion

- **maintain airway and establish haemodynamic stability**
- in severely affected patients critical care input is essential. Urgent assessment of the airway is required. A supraglottic-epiglottic burn with erythema and oedema is usually a sign that further oedema will occur that may lead to airway obstruction
- do **not** attempt gastric lavage
- do **not** give neutralising chemicals as heat produced during neutralisation reactions may increase injury

- monitor blood pressure, pulse and oxygen saturation
- other supportive measures as indicated by the patient's condition

## Clinical decontamination and first aid references

TOXBASE <http://www.toxbase.org> (accessed 01/2016)

TOXBASE Ammonia, 09/2014

TOXBASE Chemicals splashed or sprayed into the eyes, 07/2014

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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