Acrylamide

Incident management

Key Points

Fire

- Combustible in its solid form
- Reacts when heated, exposed to ultraviolet light and spontaneously with compounds containing amino, hydroxyl, and sulfhydryl groups and is incompatible with ammonia, isocyanates, mineral acids, strong acids, oleum, and oxidisers
- Emits toxic fumes and oxides of nitrogen when heated to decomposition. Pure acrylamide can also give off ammonia, hydrogen and carbon monoxide
- In the event of a fire involving acrylamide, use fine water spray and wear liquid-tight chemical protective clothing in combination with breathing apparatus

Health

- Toxic by skin contact, inhalation and ingestion
- Harmful and irritant
- Possible carcinogen, mutagen and reproductive toxin
- Skin exposure can cause irritation, numbness, tingling, excessive sweating, rash and peeling of skin
- Ingestion may cause burning and ulceration of the mouth and throat, vomiting, and abdominal pain
- Inhalation can cause sore throat and cough
- Eye exposure can cause irritation and visual disturbances

Environment

- Avoid release into the environment
- Inform Environment Agency of substantial incidents

Prepared by CRCE HQ, HPA
2011
Version 1

Hazard Identification

Standard (UK) Dangerous Goods Emergency Action Codes[(a)]

UN		**2074**	Acrylamide, Solid	
EAC		**2X**	Use fine water spray. Wear liquid-tight chemical protective clothing in combination with breathing apparatus*. Spillages and decontamination run-off should be prevented from entering drains and watercourses.	
APP		**-**		
Hazards	**Class**	**6.1**	Toxic substance	
	Sub risks	**-**		
HIN		**60**	Toxic or slightly toxic substance	

UN		**3426**	Acrylamide, Solution	
EAC		**2X**	Use fine water spray. Wear liquid-tight chemical protective clothing in combination with breathing apparatus*. Spillages and decontamination run-off should be prevented from entering drains and watercourses.	
APP		**-**		
Hazards	**Class**	**6.1**	Toxic substance	
	Sub risks	**-**		
HIN		**60**	Toxic or slightly toxic substance	

UN – United Nations number; EAC – Emergency Action Code; APP – Additional Personal Protection; HIN - Hazard Identification Number

* Liquid-tight chemical protective clothing (BS 8428) in combination with self-contained open circuit positive pressure compressed air breathing apparatus (BS EN 137).

[a] Dangerous Goods Emergency Action Code List, HM Fire Service Inspectorate, Publications Section, The Stationery Office, 2009 (accessed 03/2011).

Chemical Hazard Information and Packaging for Supply Classification[a]

Classification	**Carc. Cat. 2**	Category 2 Carcinogen	
	Muta. Cat. 2	Category 2 Mutagen	
	Repr. Cat 3	Category 3 Reproductive Toxin	
	T	Toxic	
	Xn	Harmful	
	Xi	Irritant	
Risk phrases	**R45**	May cause cancer	
	R46	May cause heritable genetic damage	
	R20/21	Harmful by inhalation and in contact with skin	
	R25	Toxic if swallowed	
	R36/38	Irritating to eyes and skin	
	R43	May cause sensitisation by skin contact	
	R48/23/24/25	Toxic: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed	
	R62	Possible risk of impaired fertility	

[a] European Chemicals Bureau, Classification and Labelling, Annex I of Directive 67/548/EEC; http://ecb.jrc.it/classification-labelling/ (accessed 03/2011).

Safety phrases	**S45**	In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible)
	S53	Avoid exposure - obtain special instructions before use

Globally Harmonised System of Classification and Labelling of Chemicals (GHS)[a]

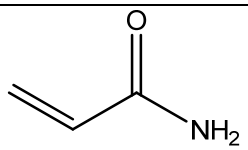
Hazard Class and Category	Carc. 1B	Carcinogenicity, category 1B	
	Muta. 1B	Germ cell mutagenicity, category 1B	
	Repr. 2	Reproductive toxicity, category 2	
	Acute Tox. 3	Acute toxicity (oral, dermal, inhalation), category 3	
	STOT RE 1	Specific target organ toxicity following repeated exposure, category 1	
	Acute Tox. 4	Acute toxicity (oral, dermal, inhalation), category 4	
	Eye Irrit. 2	Eye irritation, category 2A	

[a] Annex VI to Regulation (EC) No 1272/2008 on Classification, Labelling and Packaging of Substances and Mixtures- Table 3.1.
http://ecb.jrc.ec.europa.eu/classification-labelling/clp/ (accessed 03/2011).

	Skin Irrit. 2	Skin irritation, category 2	
	Skin Sens. 1	Skin sensitisation, category 1	
Hazard Statement	**H350**	May cause cancer	
	H340	May cause genetic defects	
	H361f	Suspected of damaging fertility	
	H301	Toxic if swallowed	
	H372	Causes damage to organs through prolonged or repeated exposure	
	H332	Harmful if inhaled	
	H312	Harmful in contact with skin	
	H319	Causes serious eye irritation	
	H315	Causes skin irritation	
	H317	May cause an allergic skin reaction	
Signal Words	DANGER		

Implemented in the EU on 20 January 2009.

Physicochemical Properties

CAS number	79-06-1
Molecular weight	71.1
Empirical formula	C_3H_5NO / $CH_2{=}CHCONH_2$
Common synonyms	Acrylamide monomer, 2-Propenamide, Acrylic acid amide, Vinyl amide, propanoic acid amide, etheylene carboxamide,
State at room temperature	Colourless to white crystalline powder
Volatility	Vapour pressure = 0.07 mm Hg at 25°C
Specific gravity **Vapour density**	1.05 at 25°C (water = 1) 2.45 (air=1)
Flammability	Acrylamide is combustible in its solid form
Lower explosive limit	Not available
Upper explosive limit	Not available
Water solubility	Soluble in water 2155 g L^{-1} at 30°C
Reactivity	Readily polymerises if heated above 85°C or exposure to ultraviolet light and oxidants
Reaction or degradation products	Fumes and toxic oxides of nitrogen are released when acrylamide is heated to decomposition. Pure acrylamide can decompose at temperatures of 175-300°C and give off ammonia, hydrogen and carbon monoxide. Reacts spontaneously with compounds containing amino, hydroxyl, and sulfhydryl groups and is incompatible with ammonia, isocyanates, mineral acids, strong acids, oleum, and oxidisers
Odour	Odourless
Structure	

References [a,b,c]

[a] International Chemical Safety Card (ICSC) entry for Acrylamide. ICSC 0091. International Occupational Safety and Health Information Centre (CIS), 2000.
[b] The Merck Index (14th Edition). Entry 9084: TCDD, 2006.
[c] Acrylamide (HAZARDTEXT® Hazard Management). In: Klasco RK (Ed): TOMES® System. Thomson Micromedex, Greenwood Village, Colorado (accessed 03/2011).

Threshold Toxicity Values

EXPOSURE VIA INGESTION	
mg kg^{-1}	**SYMPTOMS**
50-100	Can cause neurological deficits
>300	Severe central nervous system and cardiovascular effects
50 - 500	Probably lethal oral dose

EXPOSURE VIA INHALATION		
ppm	**mg m^{-3}**	**SYMPTOMS**
0.01 – 3.1	0.03 – 9.02	Peeling skin, excessively sweaty hands, leg muscle weakness, numbness and tingling in hands and feet, anorexia, sleepiness
0.02 – 0.82	0.06 – 2.39	Limb pain, numbness, sweating, peeling hands
0.10	0.3	No overt neurological symptoms
0.2 - 0.3	0.6 – 0.9	Neurological symptoms
0.6 – 0.83	1.8 – 2.5	Lowest observed adverse effect level
>1000	2908	Death may occur

References [(a)]

[a] Acrylamide (MEDITEXT® Hazard Management). In: Klasco RK (Ed): TOMES® System. Thomson Micromedex, Greenwood Village, Colorado (accessed 03/2011).

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***		

* Maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hr without experiencing other than mild transient adverse health effects or perceiving a clearly defined, objectionable odour.
** Maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hr without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action.
*** Maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to 1 hr without experiencing or developing life-threatening health effects.

Acute Exposure Guideline Levels (AEGLs)

	ppm				
	10 min	**30 min**	**60 min**	**4 hr**	**8 hr**
AEGL-1†	Data not available				
AEGL-2††					
AEGL-3†††					

† The level of the chemical in air at or above which the general population could experience notable discomfort.
†† The 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.
††† The 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

Occupational Standards

WEL[a]	LTEL (8 hour reference period): 0.3 mg m^{-3} (ppm not given)
	STEL (15 min reference period): No guideline value specified

Public Health Guidelines

DRINKING WATER QUALITY GUIDELINE[b]	0.1 µg L^{-1}
AIR QUALITY GUIDELINE	No guideline value specified
SOIL GUIDELINE VALUE AND HEALTH CRITERIA VALUES	No guideline value specified

WEL – Workplace exposure limit; LTEL - Long-term exposure limit; STEL – Short-term exposure limit

[a] List of approved workplace exposure limits (as consolidated with amendments October 2007). http://www.hse.gov.uk/coshh/table1.pdf (An update to EH40/2005: Workplace Exposure Limits 2005. The Stationery Office, London).
[b] The Water Supply (Water Quality) Regulations 2000 (England) and the Water Supply (Water Quality) Regulations 2001 (Wales) (accessed 03/2011).

Health Effects

Major Route of Exposure[a]

- Toxic by skin contact, inhalation and ingestion. Contact with the skin is the most common route of exposure, and ingestion.

Immediate Signs or Symptoms of Acute Exposure [a,b]

- Symptoms of acute exposure may be delayed for several hours, and include confusion, hallucinations, tremors, convulsions, tachycardia, cardiovascular collapse and respiratory depression. Encephalopathy may occur. Thrombocytopenia and ecchymosis have been reported. Metabolic acidosis may occur in severe cases. Peripheral neuropathy may occur several weeks after a significant exposure.
- Subacute exposure (days to weeks) may cause drowsiness, ataxia, loss of concentration, anorexia, urinary retention, nystagmus and dysarthria. Peripheral neuropathy may follow several weeks later.
- Inhalation can cause sore throat and cough, respiratory irritation as well as fatigue, memory problems, dizziness and muscular weakness.
- Ingestion may cause burning and ulceration of the mouth and throat, vomiting and abdominal pain. Nervous system damage with symptoms including fatigue, memory problems, dizziness, muscular weakness, numbness in limbs and difficulty walking may also occur.
- Dermal exposure can cause irritation, numbness, tingling, excessive sweating, erythematous rash and peeling of skin. If absorbed through the skin similar symptoms such as those for ingestion may occur.
- Ocular exposure can cause irritation and visual disturbances.

TOXBASE - http://www.toxbase.org
[a] TOXBASE: Acrylamide, 2003
[b] TOXBASE: Acrylamide - SEPA, 2005 (accessed 03/2011).

Decontamination and First Aid

Important Notes

- Ambulance staff, paramedics and emergency department staff treating chemically-contaminated casualties should be equipped with Department of Health approved, gas-tight (Respirex) decontamination suits based on EN466:1995, EN12941:1998 and prEN943-1:2001, where appropriate.

Dermal Exposure[(a)]

- Remove patient from exposure.
- The patient should remove all clothing and personal effects.
- Double-bag soiled clothing and place in a sealed container clearly labelled as a chemical hazard.
- Brush away any adherent solid particles and gently blot away any adherent liquid from the patient.
- Wash hair and all contaminated skin with copious amounts of water (preferably warm) and soap for at least 10-15 minutes. Decontaminate open wounds first and avoid contamination of unexposed skin.
- Pay special attention to skin folds, axillae, ears, fingernails, genital areas and feet.

Ocular Exposure[(b)]

- Remove patient from exposure.
- Remove contact lenses if necessary and immediately irrigate the affected eye thoroughly with water or 0.9% saline for at least 10-15 minutes.
- Patients with corneal damage or those whose symptoms do not resolve rapidly should be referred for urgent ophthalmological assessment.

Inhalation[(a)]

- Remove patient from exposure.
- Ensure a clear airway and adequate ventilation.
- Give oxygen to symptomatic patients.
- Respiratory support may be required, invasive or non-invasive. Monitor BP and pulse.
- Correct hypotension by raising the foot of the bed and/or expanding the intravascular volume.
- Apply other supportive measures as indicated by the patient's clinical condition.

Ingestion[(a)]

- Ensure a clear airway and adequate ventilation.
- Give oxygen to symptomatic patients.
- Observe for at least 6 hours after acute exposure.

TOXBASE - http://www.toxbase.org
[a] TOXBASE: Acrylamide, 2003.
[b] TOXBASE: Eye irritants, 2002 (accessed 03/2011).

- The benefit of gastric decontamination is uncertain. Consider gastric aspiration (not lavage) or activated charcoal (50 g for adults; 10-15 g for children) if the patient presents within 1 hour of ingestion.
- Apply other supportive measures as indicated by the patient's condition.