

# MATERIAL SAFETY DATA SHEET

SODIUM HYDROXIDE FLAKES AND SOLUTION  
CAUSTIC SODA FLAKES AND SOLUTION  
NaOH

MSDS 003/R5  
2012-10-11

Reg. No. 2001/019171/07

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## 1. PRODUCT IDENTIFICATION

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TRADE NAME	Sodium Hydroxide Flake / Solution
CHEMICAL FAMILY	Alkali Hydroxide
CHEMICAL NAME	Sodium Hydroxide
MOLECULAR FORMULA	NaOH
SYNONYMS	Caustic Soda Flake / Lye
CHEMICAL ABSTRACTS No.	1310-73-2
EINECS No.	215-185-5
NIOSH No.	WB 4900000 (Flake) WB 4905000 (Lye)
HAZCHEM CODE	2R
UN No.	1823 / 1824

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## 2. COMPOSITION

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EEC HAZARD CLASSIFICATION Corrosive [C]

RISK PHRASES R35- Causes severe burns.

SAFETY PHRASES S1/2, S26-S37/39-S45 – Keep locked out of the reach of children. In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. Wear suitable gloves. Wear eye/face protection. In case of accident or if you feel unwell, seek medical advice immediately (show label where possible).

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## 3. HAZARD IDENTIFICATION

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### MAIN HAZARDS

Flash Point	Not applicable
USA TLV (TWA)	2 mg/m <sup>3</sup>
USA TLV (STEL)	Not available

Hazard Rating (NFPA 704)	Hazard Rating Scale:
Health: 3	0=Minimal 3=Serious
Fire: 0	1=Slight 4=Severe
Reactivity: 1	
Special: ALK	

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## CHEMICAL HAZARDS

Sodium hydroxide reacts explosively, or forms explosive compounds, with: warm ammoniacal silver nitrate (1,2); 4-chloro-2-methylphenol (3); 2-nitroanisole and zinc (4); *N,N'*-bis(trinitroethyl)urea; cyanogen azide (5); 3-methyl-2-pentene-4-yn-1-ol (6,7); nitrobenzene; sodium tetrahydroborate (8); 1,1,1-trichloroethanol; and zirconium. Reaction with oxime and diborane is very exothermic, and a mild explosion occurred on one occasion. Eight serious explosions have occurred (1949 -1976) during commercial preparation of 2,4,5-trichlorophenol by alkali partial hydrolysis of 1,2,4,5-tetrachlorobenzene (9,10). Trichloroethylene (alone or as an impurity in tetrachloroethylene) is decomposed with the evolution of the spontaneously flammable gas dichloroacetylene (11).

Vigorous or violent reactions have been reported with: bromine (12); chloroform and methanol (13); trichloronitromethane (14); and with limited amounts of water, violent eruption (15) and even ignition of adjacent combustibles (16) have been reported. Failure to agitate a large scale mixture of 4-methyl-2-nitrophenol, sodium carbonate and methanol also resulted in eruption (17). Accidental mixing with hot crude 1,4-benzenediol led to extensive exothermic decomposition, as do mixtures with ethylene glycol or diethylene glycol (heated in DSC capsules).

Ignition has occurred with: zinc; rags soaked with sodium hydroxide and cinnamaldehyde overheated and ignited when they came into contact in a waste bin.

An aluminium ladder used to gain access to a tank of alkaline arsenical mixture (arsenic trioxide and sodium arsenate) was attacked by the alkali and the hydrogen produced generated arsine and resulted in the poisoning of 3 workers (18).

## BIOLOGICAL HAZARDS

Sodium hydroxide is irritating and corrosive to all tissues. Most frequent exposures involve direct skin and eye contact, although inhalation of mist or dust can occur. Cases of ingestion are unlikely in industry, but may occur accidentally in young children, or intentionally.

## HEALTH EFFECTS - EYES

Sodium hydroxide is extremely corrosive to the eye and splashes are especially hazardous. Damage can range from severe irritation and mild corneal scarring to fluid accumulation, disintegration, ulceration, and severe corneal scarring and clouding. Permanent blindness may result in severe cases (25-28), and immediate first aid is vital to avoid permanent damage (25,27).

"Burning/redness" has been reported by workers exposed to airborne concentrations as low as 0,005-0,7 mg/m<sup>3</sup>, although other solvents, including Stoddard solvent were also present at concentrations up to 780 mg/m<sup>3</sup> (20). Eye watering has been noted by persons briefly exposed to concentrations of 0,24, 1,86 and 0,8 mg/m<sup>3</sup> (21).

## HEALTH EFFECTS - SKIN

Solid sodium hydroxide and concentrated solutions are highly corrosive to the skin (29), and although skin contact may not lead to immediate pain, damage begins at once (30,31). Severe ulceration and scarring may result in serious cases. Skin biopsies from volunteers having 1N sodium hydroxide applied to their arms for 15 - 180 minutes showed progressive changes beginning with the dissolution of cells in the horny layer and progressing through oedema to total destruction of the epidermis in 60 minutes (32). Solutions as weak as 0,12% may damage healthy skin within an hour (29). A concentrated solution dripped onto a workers head caused dissolution of hair, reversible baldness and scalp burns as treatment was delayed for several hours (30). A 5% aqueous solution resulted in severe necrosis when applied to the skin of rabbits for 4 hours (33), and skin corrosion occurred with a 2% solution, but not with 1% potassium hydroxide (34). Although little published information is available on the effects of chronic exposure, drying, cracking, and dermatitis are likely.

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## HEALTH EFFECTS - INGESTION

The oral LD<sub>50</sub> in rabbits is 500 mg/kg of a 10% solution (35). A value for the LD<sub>50</sub> mouse ip (intraperitoneal) is given in the literature as 40 mg/kg. Ingestion will cause severe mouth burns, and if swallowed, extensive damage to the oesophagus (36,37) and may lead to vomiting, prostration, collapse, and constrictive scarring.

## HEALTH EFFECTS - INHALATION

Inhalation of the dust or concentrated mist may cause irritation and damage to the respiratory tract. Although prolonged exposure to high concentrations may cause discomfort and even ulceration of the nasal passages, subjective symptoms are often relied upon as an indication of the need for control. A concentration of 2 mg/m<sup>3</sup> is reported as being noticeably but not excessively irritant. Other reports indicate noticeable irritation at concentrations below 2 mg/m<sup>3</sup> (19), with burning/redness of the nose and throat noted by some workers exposed to airborne concentrations of 0,005 - 0,7 mg/m<sup>3</sup> (solvents including Stoddard solvent were also present up to 780 mg/m<sup>3</sup>) (20). Throat irritation has been reported in persons briefly exposed to 0,24, 1,86 and 0,8 mg/m<sup>3</sup> (21). While exposure to 0,28 mg/m<sup>3</sup> has been reported as not producing irritation (21).

In animal studies severe damage to the respiratory tract has been reported after chronic exposure (22, 23). However, in an investigation into causes of death of 291 men occupationally exposed to sodium hydroxide dust for about 30 years, no significant correlation was found between cause of death and exposure (24).

## CARCINOGENICITY

Sodium hydroxide has been implicated as a possible cause of cancer of the oesophagus 12 to 42 years after ingestion (38-43). Carcinogenesis in these cases, however, may be due to tissue destruction and scar formation rather than sodium hydroxide itself.

## MUTAGENICITY

Sodium hydroxide has been found to be non-mutagenic (44, 45).

## REPRODUCTIVE HAZARDS

Sodium hydroxide was not teratogenic in mice (46).

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## FIRST AID MEASURES

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### PRODUCT IN EYE

Immediately flush the contaminated eye(s) with lukewarm, gently flowing water for 30 minutes, holding the eyelid(s) open. Take care not to rinse contaminated water into the non-affected eye. If irritation persists repeat flushing. If available a neutral saline solution may be used to flush the contaminated eye(s) an additional 30 minutes. Obtain medical attention immediately.

### PRODUCT ON SKIN

Avoid direct contact with this chemical. Wear impervious protective gloves. As quickly as possible, flush contaminated area with lukewarm, gently running water for at least 30 minutes. Under running water, remove contaminated clothing, shoes and leather goods. If irritation persists, repeat flushing. Obtain medical attention immediately. Completely decontaminate clothing, shoes and leather goods before re-use or discard.

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## PRODUCT INGESTED

Never give anything by mouth if victim is rapidly losing consciousness, or is unconscious or convulsing. Rinse mouth thoroughly with water. Do not induce vomiting. If victim can swallow, have him/her drink  $\pm$  300 ml of water to dilute material in stomach. If vomiting occurs naturally, have victim lean forward to reduce risk of aspiration. Repeat administration of water. Obtain medical attention immediately.

## PRODUCT INHALED

Remove casualty from area of exposure. If unconscious do not give anything to drink, place in recovery position and administer oxygen. If conscious place the casualty in a semi-upright position. Give oxygen if available. Obtain medical attention immediately

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5.

## FIRE FIGHTING MEASURES

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### SPECIAL HAZARDS

Sodium hydroxide and its solutions will not burn or support combustion. However, reaction of sodium hydroxide with a number of commonly encountered materials such as strong acids, water, metals, organohalogen compounds, and nitro and chloro organic compounds can generate sufficient heat to ignite nearby combustible materials. Sodium hydroxide can react with metals, such as aluminum, tin and zinc, to form flammable hydrogen gas.

### EXTINGUISHING MEDIA

Use extinguishing media suitable for the surrounding fire. If water is used, care should be taken, since it can generate heat and cause spattering if applied directly to sodium hydroxide.

### FIRE FIGHTING INSTRUCTIONS

Evacuate area and fight fire from a safe distance or a protected location. Approach the fire from upwind. If possible, isolate materials not involved in the fire and protect personnel. Move containers from fire area if it can be done without risk. Water can be used with extreme caution to extinguish a fire in an area where sodium hydroxide is stored. The water must not come into contact with the sodium hydroxide. Water can be used in flooding quantities as a spray or fog to keep fire-exposed containers cool and absorb heat. At high temperatures, fuming may occur, giving off a strong, corrosive gas. Do not enter without wearing specialized protective equipment suitable for the situation.

### PROTECTIVE CLOTHING

Protective clothing should be worn, boots, splash suit, apron, gloves, safety goggles with side shields, if the possibility of splashing exists a full face shield should be worn. Butyl or natural rubber gloves are recommended.

Firefighter's normal protective clothing (Bunker Gear) will not provide adequate protection. Chemical resistant clothing (e.g. chemical splash suit) and a positive pressure self-contained breathing apparatus (MSHA/NIOSH approved or equivalent) may be necessary.

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## ACCIDENTAL RELEASE MEASURES

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## PERSONAL PRECAUTIONS

Chemical resistant clothing should be worn, boots, splash suit, apron, gloves, safety goggles with side shields, if the possibility of splashing exists a full face shield should be worn. Butyl or natural rubber gloves are recommended.

Approved respiratory protection such as a positive pressure self-contained breathing apparatus (MSHA/NIOSH approved or equivalent) should be worn

## ENVIRONMENTAL PRECAUTIONS

Dangerous to aquatic life in high concentrations. Do not allow un-neutralized spillage to enter rivers or water systems.

Notify local Health and Pollution Control Authorities

## CLEAN-UP METHODS

### Small Spills

Ventilate the area and wear chemical resistant overalls, safety glasses, gloves, and an approved respirator. Neutralise with dilute hydrochloric acid (10-15%), mop up with plenty of water and run to waste. Sweep up spilled caustic flake and transfer to a dry container.

### Large Spills

Wear chemical resistant overalls, safety glasses, gloves, and an approved respirator. Spilled solutions should be contained by diking with inert material, such as sand or earth. Solutions can be recovered or carefully diluted with water and cautiously neutralised with acids such as acetic acid or hydrochloric acid. Contact fire and emergency services and supplier for advice.

Sweep up spilled caustic flake and transfer to a dry container. Neutralise residue with dilute acids such as hydrochloric or acetic acid. Flush area well with water.

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## HANDLING AND STORAGE

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### SUITABLE MATERIALS

Sodium hydroxide should be kept in a dry place, protected against moisture, water, and physical damage, and away from acids, metals, explosives, organic peroxides and easily ignitable materials. Protective clothing should be worn, especially approved respiratory protection, butyl or natural rubber, Neoprene or nitrile gloves (NOT polyethylene), and safety goggles. Sodium hydroxide should only be used in a chemical fume hood.

### HANDLING/STORAGE PRECAUTIONS

#### Storage Conditions

Store in water-tight containers in a cool, dry place separate from the normal work area. Materials that react violently with sodium hydroxide and easily ignitable materials should not be stored in the same area. Use corrosion-resistant structural materials and lighting and ventilation systems in the storage area. Store in suitable, labelled containers. Keep containers tightly closed when not in use and when empty. Protect from damage. Containers made of nickel alloys are preferred. Steel containers are acceptable if temperatures are not elevated.

Storage tanks for solutions should be above ground and surrounded with dikes capable of holding entire contents. Avoid any dust build-up by frequent cleaning and suitable construction of storage area. Limit quantity of

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material in storage. Restrict access to storage area. Post warning signs when appropriate. Keep storage area separate from populated work areas. Inspect periodically for deficiencies such as damage or leaks.

## Handling

Avoid generating mist or dust. Keep solid sodium hydroxide away from water. Post "DO NOT USE WATER" signs in area of use. When diluting or preparing solution, add caustic to water in small amounts to avoid boiling and splattering. Label containers. Keep containers closed when not in use. Empty containers may contain residues which are hazardous. Use smallest possible amounts in designated areas with adequate ventilation. Have emergency equipment (for fires, spills, leaks, etc.) readily available.

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## 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

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### OCCUPATIONAL EXPOSURE STANDARDS

HSE	No data available
MAK	2 mg/m <sup>3</sup>
ACGIH	2 mg/m <sup>3</sup>

### UK EXPOSURE LIMITS:

Long-term (8 hr. TWA value) 2 mg/m<sup>3</sup>  
Short-term (10 min TWA value) 2 mg/m<sup>3</sup>

### ENGINEERING CONTROL MEASURES

Engineering methods to control hazardous conditions are preferred. General methods include mechanical ventilation (dilution and local exhaust), process or personnel enclosure, control of process conditions and process modification (e.g. substitution of a less hazardous material). Administrative controls and personal protective equipment may also be required. Use a corrosion-resistant ventilation system separate from other exhaust ventilation systems. Exhaust directly to the outside. Use local exhaust ventilation and process enclosure if necessary, to control airborne dust and mist. Supply sufficient replacement air to make up for air removed by exhaust systems.

### PERSONAL PROTECTION - RESPIRATORY

Full respiratory protection should be readily available in case of spillage.

### PERSONAL PROTECTION - HAND

Wear butyl or natural rubber, Neoprene or nitrile gloves (NOT Polyethylene).

### PERSONAL PROTECTION - EYE

Safety goggles or approved safety glasses. Contact lenses should not be worn.

### PERSONAL PROTECTION - SKIN

Wear overall, safety shoes/boots.

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## 9. PHYSICAL AND CHEMICAL PROPERTIES

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<b>APPEARANCE</b>	Flake:- White deliquescent solid. Lye:- Colourless, viscous, slightly cloudy liquid.
<b>ODOUR</b>	Odourless
<b>pH</b>	
<b>BOILING POINT/RANGE</b>	1390°C at 1013 mbar (Flake) 142°C (48% concentration) (Lye)
<b>MELTING POINT/RANGE</b>	319°C (Flake) ~10°C (Lye)
<b>FLASH POINT</b>	Not applicable
<b>FLAMMABILITY</b>	Not applicable
<b>AUTOFLAMMABILITY</b>	Not Applicable
<b>EXPLOSIVE PROPERTIES</b>	None
<b>OXIDISING PROPERTIES</b>	None
<b>VAPOUR PRESSURE</b>	10 mm Hg at 20°C (Lye)
<b>DENSITY</b>	2,13 g/cm <sup>3</sup> at 20°C (Flake) 1,5 g/cm <sup>3</sup> at 15,5°C (Lye)
<b>SOLUBILITY - WATER</b>	52% (by weight) at 20°C and 42% (by weight) at 0°C
<b>SOLUBILITY - SOLVENT</b>	

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## 10. STABILITY AND REACTIVITY

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### CONDITIONS TO AVOID

Sodium hydroxide reacts explosively, or forms explosive compounds, with: warm ammoniacal silver nitrate (1,2); 4-chloro-2-methylphenol (3); 2-nitroanisole and zinc (4); *N,N'*-bis(trinitroethyl)urea; cyanogen azide (5); 3-methyl-2-pentene-4-yn-1-ol (6,7); nitrobenzene; sodium tetrahydroborate (8); 1,1,1-trichloroethanol; and zirconium. Reaction with oxime and diborane is very exothermic, and a mild explosion occurred on one occasion.

Eight serious explosions have occurred (1949 -1976) during commercial preparation of 2,4,5-trichlorophenol by alkali partial hydrolysis of 1,2,4,5-tetrachlorobenzene (9,10). Trichloroethylene (alone or as an impurity in tetrachloroethylene) is decomposed with the evolution of the spontaneously flammable gas dichloroacetylene (11).

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Ignition has occurred with: zinc; rags soaked with sodium hydroxide and cinnamaldehyde overheated and ignited when they came into contact in a waste bin.

An aluminium ladder used to gain access to a tank of alkaline arsenical mixture (arsenic trioxide and sodium arsenate) was attacked by the alkali and the hydrogen produced generated arsine and resulted in the poisoning of 3 workers (18).

### INCOMPATIBLE MATERIALS

Strong Acids - may react violently.

Water - reaction may generate enough heat to ignite combustible materials

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Metals - reaction may produce flammable and explosive hydrogen gas.  
Organohalogen Compounds - may react to form spontaneously combustible compounds  
Nitro and Chloro Organic Compounds - may react explosively.

## HAZARDOUS DECOMPOSITION PRODUCTS

None.

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## 11. TOXICOLOGICAL INFORMATION

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### ACUTE TOXICITY

Toxic by contact with skin, inhalation and ingestion.  
Sodium hydroxide is irritating and corrosive to all tissues. Most frequent exposures involve direct skin and eye contact, although inhalation of mist or dust can occur. Cases of ingestion are unlikely in industry, but may occur accidentally in young children, or intentionally.

### HEALTH EFFECTS - INGESTION

The oral LD<sub>50</sub> in rabbits is 500 mg/kg of a 10% solution (35). A value for the LD<sub>50</sub> mouse ip (intraperitoneal) is given in the literature as 40 mg/kg. Ingestion will cause severe mouth burns, and if swallowed, extensive damage to the oesophagus (36,37) and may lead to vomiting, prostration, collapse, and constrictive scarring

### SKIN AND EYE CONTACT

Solid sodium hydroxide and concentrated solutions are highly corrosive to the skin (29), and although skin contact may not lead to immediate pain, damage begins at once (30,31). Severe ulceration and scarring may result in serious cases. Skin biopsies from volunteers having 1N sodium hydroxide applied to their arms for 15 - 180 minutes showed progressive changes beginning with the dissolution of cells in the horny layer and progressing through oedema to total destruction of the epidermis in 60 minutes (32). Solutions as weak as 0,12% may damage healthy skin within an hour (29). A concentrated solution dripped onto a workers head caused dissolution of hair, reversible baldness and scalp burns as treatment was delayed for several hours (30). A 5% aqueous solution resulted in severe necrosis when applied to the skin of rabbits for 4 hours (33), and skin corrosion occurred with a 2% solution, but not with 1% potassium hydroxide (34). Although little published information is available on the effects of chronic exposure, drying, cracking, and dermatitis are likely. Sodium hydroxide is extremely corrosive to the eye and splashes are especially hazardous. Damage can range from severe irritation and mild corneal scarring to fluid accumulation, disintegration, ulceration, and severe corneal scarring and clouding. Permanent blindness may result in severe cases (25-28), and immediate first aid is vital to avoid permanent damage (25,27).

"Burning/redness" has been reported by workers exposed to airborne concentrations as low as 0,005-0,7 mg/m<sup>3</sup>, although other solvents, including Stoddard solvent were also present at concentrations up to 780 mg/m<sup>3</sup> (20). Eye watering has been noted by persons briefly exposed to concentrations of 0,24, 1,86 and 0,8 mg/m<sup>3</sup> (21).

### SUB-CHRONIC TOXICITY

Inhalation of the dust or concentrated mist may cause irritation and damage to the respiratory tract. Although prolonged exposure to high concentrations may cause discomfort and even ulceration of the nasal passages, subjective symptoms are often relied upon as an indication of the need for control. A concentration of 2 mg/m<sup>3</sup> is reported as being noticeably but not excessively irritant. Other reports indicate noticeable irritation at concentrations below 2 mg/m<sup>3</sup> (19), with burning/redness of the nose and throat noted by some workers exposed to airborne concentrations of 0,005 - 0,7 mg/m<sup>3</sup> (solvents including Stoddard solvent were also present up to 780 mg/m<sup>3</sup>) (20). Throat irritation has been reported in persons briefly exposed to 0,24, 1,86 and 0,8 mg/m<sup>3</sup> (21).

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While exposure to 0,28 mg/m<sup>3</sup> has been reported as not producing irritation (21).

In animal studies severe damage to the respiratory tract has been reported after chronic exposure (22, 23). However, in an investigation into causes of death of 291 men occupationally exposed to sodium hydroxide dust for about 30 years, no significant correlation was found between cause of death and exposure (24).

## CARCINOGENICITY

Sodium hydroxide has been implicated as a possible cause of cancer of the oesophagus 12 to 42 years after ingestion (38-43). Carcinogenesis in these cases, however, may be due to tissue destruction and scar formation rather than sodium hydroxide itself.

## MUTAGENICITY

Sodium hydroxide has been found to be non-mutagenic (44, 45).

## REPRODUCTIVE HAZARDS

Sodium hydroxide was not teratogenic in mice (46).

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## ECOLOGICAL INFORMATION

### AQUATIC TOXICITY - FISH

Dangerous to aquatic life in high concentrations. Notify local Health and Pollution Control authorities

### AQUATIC TOXICITY - DAPHNIA

No data available

### AQUATIC TOXICITY - ALGAE

No data available

### BIODEGRADABILITY

No data available

### BIO-ACCUMULATION

No data available

### MOBILITY

No data available

### GERMAN WGK

No data available

13.

## DISPOSAL CONSIDERATIONS

### DISPOSAL METHODS

This material is highly corrosive. Disposal must be made in accordance with the applicable Government regulations at approved chemical dumpsites.

### DISPOSAL OF PACKAGING

Empty containers can contain residues, gases and mists and are subject to proper waste disposal.

Always obey hazard warnings and handle empty containers as if they were full.

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## 14. TRANSPORT INFORMATION

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UN No.	1823/1824
ADR/RID CLASS	8
ADR/RID ITEM No.	Not available
ADR/RID HAZARD IDENTITY No.	Not available
IMDG - SHIPPING NAME	Sodium hydroxide Solid / Sodium hydroxide Solution
IMDG - CLASS	8
IMDG - PACKAGING GROUP	II
IMDG - MARINE POLLUTANT	Corrosive
IATA - SHIPPING NAME	Sodium Hydroxide Solid / Sodium Hydroxide Solution
IATA - CLASS	8
IATA - SUBSIDIARY RISK(S)	Corrosive
ADNR - CLASS	Not available
UK - DESCRIPTION	Not available
UK - EMERGENCY ACTION CODE	Not available
UK - CLASSIFICATION	Not available
TREMCARD No.	

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## 15. REGULATORY INFORMATION

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<u>EEC HAZARD CLASSIFICATION</u>	Corrosive [C]
<u>RISK PHRASES</u>	R35- Causes severe burns.
<u>SAFETY PHRASES</u>	S1/2, S26-S37/39-S-45 – Keep locked out of the reach of children. In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. Wear suitable gloves. Wear eye/face protection. In case of accident or if you feel unwell, seek medical advice immediately (show label where possible).
<u>NATIONAL LEGISLATION</u>	Hazardous Substances Act 15 of 1973 and Regulations, Occupational Health and Safety Act 85 of 1993,

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## 16. OTHER INFORMATION

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CAS No.	1310-73-2
EINECS No.	215-185-5
EEC ANNEX 1 No.	Not available
MITI No.	Not available
FDA LIST No.	Not available
LISTING - TOSCA	Not available
LISTING - ACOIN	Not available
LISTING - CANADIAN DSL/NDSL	Not available
NOTIFICATION - EEC	Not available
NOTIFICATION - USA	Not available