Task # (as given on WERC Website)	6	
School Name	University of Texas at Arlington	
Team Name	UTA61	
Name/Title of Experiment:	Cyanuric acid effect on swimming pool water hardness	
	EMERGENCY → **911**	
Contact Function	Contact Name	Contact Phone (at Event)
Safety Coordinator	Juanita Miller	575-000-0000
Compliance Officer/Samples	Jalal Rastegary	915-000-0000
Faculty Advisor	Dr. Andrew Kruzic	469-000-0000
Team Leader	Samantha Huff	972-000-000
Team Member		
Team Member		
Team Member		
Team Member		
Team Member		

Required attachments to the ESP:

Attachment 1: Experiment Scope

Attachment 2: Drawing of the Experimental Layout including P&ID

Attachment 3: Normal Operations, Startup and Shutdown Procedures

Attachment 4: Emergency Shutdown Procedure and medical emergency instructions.

Attachment 5: Waste Management Procedure

Attachment 6: Hazard Identification and Mitigation

Attachment 7: Safety Data Sheets

Attachment 1 – Experiment Scope

Provide a concise description of the laboratory experiment to be undertaken.

1. *Explain why the work is being performed, the goal(s) of the experimental program*
    a. *If this is an update/revision of previous ESP describe all changes*
2. *Provide the stoichiometry of any chemical reactions and their heats of reaction*
3. *Demonstrate the inherent thermal safety of your experiment through calculation or through the use of accelerating rate calorimetry data.* *(*http://chme.nmsu.edu/admin/ehs/experimental-safety-plan-esp/esp-energetics-calculation/ *)*
4. *Include a complete list of all chemicals (reactants and products) involved in the work.*
5. *Include a complete list of all equipment (e.g. autoclave, centrifuge, pump, heat bath etc.) involved in this work*
6. *Include a timeline for this experiment including setup, sample runtime(s)and teardown*

Note that this example is based on gradate research conducted by Juanita Miller, at UTA, in completion of her master's degree in Civil Engineering, December 2006. This is a semi-fictious example since ESPs were not used at UTA during the course of these experiments.

The water conditions for both commercial and home must be maintained within established ranged to ensure the water is sanitary for people to swim in. A compound called cyanuric acid or 1,3,5-triazine-2,4,6-triol is added to traditional disinfectants such as bleach or sodium hypochlorite to enhance the effectiveness of these compounds in killing harmful bacteria, algae and viruses from the swimming pool water.

A current method of synthesis of cyanuric acid is to thermally decompose urea in the following reaction [1]:

$3\ H2N\text{-}CO\text{-}NH2 \rightarrow [C(O)NH]3 + 3\ NH3$

CYA crystallizes from water as the dihydrate

The cyanuric acid follows the following dissociation processes in water :

$[C(O)NH]_3 \rightleftharpoons [C(O)NH]_2[C(O)N]^- + H^+$ ($pK_a = 6.88$)[3]

$[C(O)NH]_2[C(O)N]^- \rightleftharpoons [C(O)NH][C(O)N]_2^{2-} + H^+$ ($pK_a = 11.40$)

$[C(O)NH][C(O)N]_2^{2-} \rightleftharpoons [C(O)N]_3^{3-} + H^+$ ($pK_a = 13.5$)

The theory is that the cyanuric acid is simply an additive to the disinfection process and not consumed during chemical reactions. Thus the concentration will increase in the water which will contribute to the hardness value. If the hardness value in the water exceeds a set level, the water may need to be renewed in the swimming pool. This replacement process is time consuming, expensive and frequently not allowed due to water use restrictions in certain communities.

Attachment 1 – Experiment Scope

This work will investigate the correlation between cyanuric acid concentration and established industry hardness testing methods. In addition, a correlation between cyanuric acid concentration and dissolution rates of actual disinfected swimming pool water will also be established. Swimming pool water will be provided from the researcher's home and it will be tested using conventional techniques for pH, free chlorine, total alkalinity, hardness and acid demand.

Water samples will be prepared with various known concentrations of cyanuric acid, in deionized water, along with test samples from the swimming pool which will contain sodium hypochlorite (bleach) and cyanuric acid. These samples will be analyzed using a gas chromatograph to create a concentration curve.

Chemicals used:

DI Water

Cyanuric acid

Sodium hypochlorite

Equipment used:

Stirring hot plate

Analytical balance

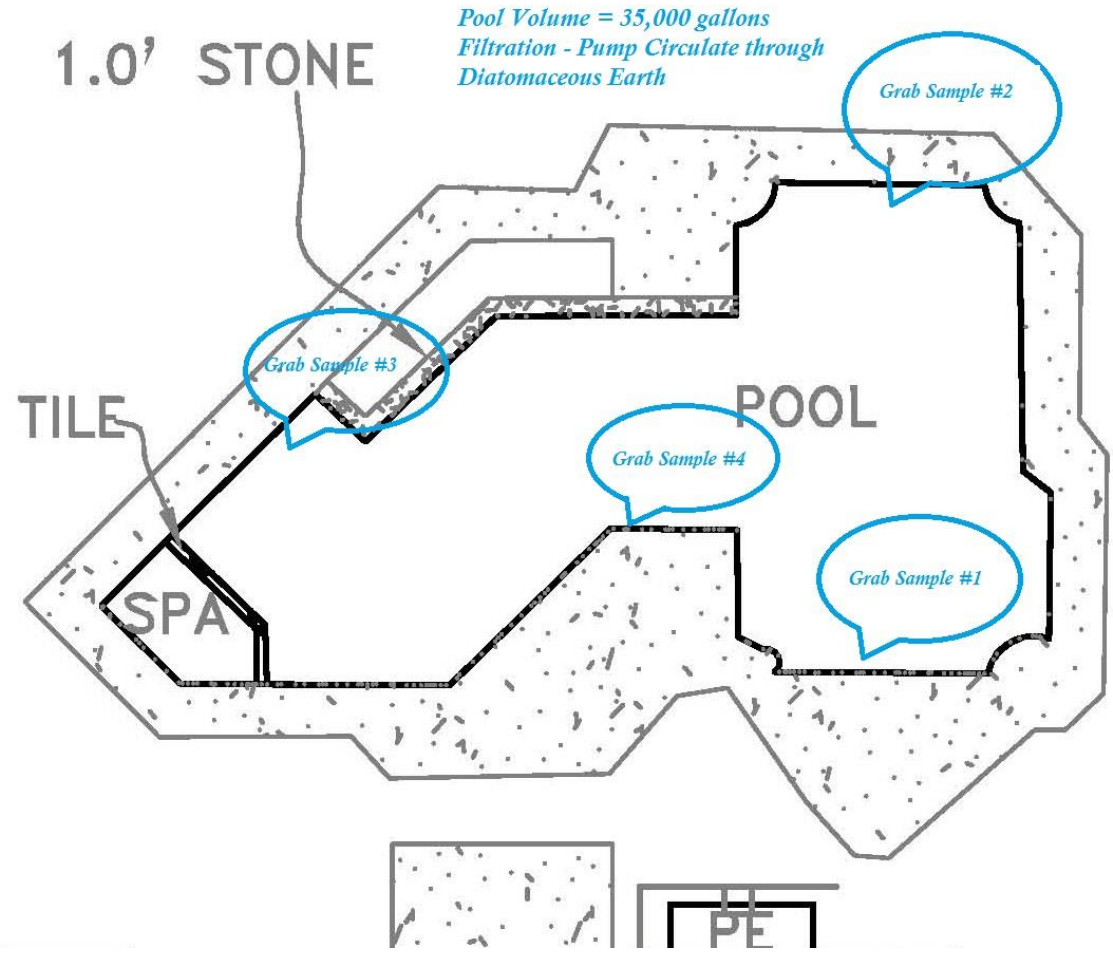
1 liter plastic bottles with caps

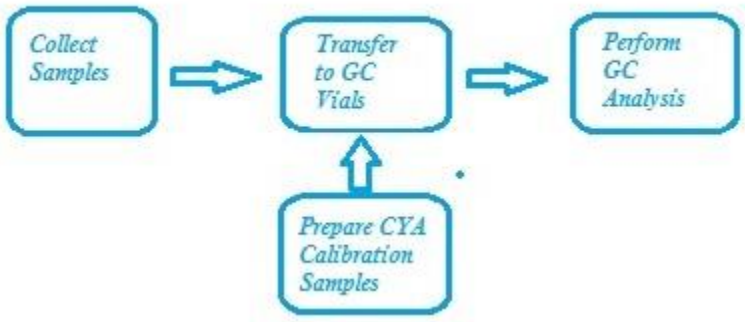
GC vials appropriate for the instrument used

Thermofisher Gas Chromatograph with auto-sampler

Attachment 2 - Drawing of the Experimental Layout including P&ID

Provide a detailed drawing of the experiment including P&ID's showing all inputs and outputs for equipment..





Attachment 3 – Normal Operations, Startup and Shutdown Procedures

*Provide a **step-wise** procedure that describes **in detail** how the work will be performed. The procedure should begin and end with the equipment in the normal idle (inoperative) state.*

*Include a statement of the required PPE **at the beginning** of the procedure, and at every location in the procedure where the PPE requirements change.*

Include details of how you will meet the required elements of your chosen task (e.g. run time, run rate, sample rate etc.)

Indicate where hazardous feedstock chemicals will be stored, how they will be transported to the location of the experimental work, how they will be transferred from storage vial into the experimental apparatus, and how they will be returned to storage.

Fill out the Take into account those items for which you indicate "yes" on the NMSU Lab Hazard Assessment Checklist, which is found at the end of this document..

Safety glasses, long pants and closed toe shoes will be required in the Chemistry lab while preparing samples and running the gas chromatograph

Good non-slip shoes are required while collecting grab samples from the swimming pool. Always sit or kneel down on decking while collecting samples to avoid becoming off-balance and falling into the pool.

The CYA chemical will be stored in the Civil Engineering Lab when not being used to make up the calibration samples.

CYA Calibration Curve – Sample Preparation

Prepare the following samples of Cyanuric Acid in deionized water by weighing the dry CYA powder on an analytical balance on the countertop in the Civil Engineering Lab. Mix the CYA powder in one liter of water and allow to dissolve for 24 hours at room temperature. Label each container with the material name and concentration

Sample #	Cyanuric Acid (CYA) – ppm or mg/liter
1	0.1
2	0.5
3	1.0
4	1.5
5	2.5
6	5.0
7	10.0
8	20.0

Obtain clean vials for the gas chromatograph and transfer solution from each sample bottle to a vial. Label each vial with the material and concentration. Place the vials in a plastic box with a lid to transport them to the chemistry lab for analysis.

Grab Sample Collection and Preparation

Collect the following grab samples from the swimming pool using a 1 liter plastic bottle with a cap. Proceed to the sample collection location as shown on the map in Attachment #1, kneel or sit on the pool

deck. Remove the cap from the bottle. Submerse the bottle to a depth of 12 inches and hold the bottle under water until no more bubbles appear. Carefully remove the bottle from the water, so it remains full, and cap it. Label the bottle with description of material contents, location and date. Repeat this procedure at each collection location for the date and time shown in the matrix.

Date	Sample #1	Sample #2	Sample #3	Sample #4
08/06/06	Deep End	Deep End	Middle	Shallow End
08/16/06	Deep End	Deep End	Middle	Shallow End
08/26/06	Deep End	Deep End	Middle	Shallow End

Transport these samples in a plastic box with a lid to the Civil Engineering lab.

Obtain clean vials for the gas chromatograph and transfer solution from each sample bottle to a vial. Label each vial with the material and concentration. Place the vials in a plastic box with a lid to transport them to the chemistry lab for analysis.

Gas Chromatograph Analysis

Load vials from either CYA calibration or grab samples in the auto-sampler. Turn on the carrier gas and allow the system to come to equilibrium. Select the program for CYA data collection. Run each sample and record the amount of CYA detected in solution.

Attachment 4 -. Emergency Shutdown Procedure

*Provide a **step-wise** procedure that describes how the equipment will be brought to a safe state in the event of an emergency. The description should include a detailed explanation of how to attend to potential medical emergencies that may result.*

Do not work alone in the laboratory. The act of collecting grab samples should be performed with someone else around or having a means of communication in case of emergency such as a cell phone.

If an emergency happens in the Civil Engineering Lab: Close any open chemicals. Turn off hot plate stirrer. Evacuate the area per established protocol.

If an emergency happens in the Chemistry Lab: Close the carrier gas cylinder valve. Turn the power off to the gas chromatograph. Ensure any chemical containers are closed. Evacuate the are per established protocol.

In case of spill: Don't use your hands to clean up broken glass, use a broom and dust pan. Put the broken glass into a glass box not the trash. Use paper towels to clean up any water spill and put the wet towels into the normal trash since this is not a hazardous waste. In case of spill of CYA powder, clean up with wet paper towels and put into the trash.

Attachment 5 - Waste Management Procedure

Prepare a Waste Management Procedure that provides the exact nature and estimated volumes of all wastes to be generated in performing these experiments. NMSU will provide containers and forms to be filled out by the researcher for proper disposal of materials. An example Waste tracking form is attached for reference.

Cyanuric acid is not a hazardous material when mixed with water. However, for this experiment all samples will be combined into plastic carboys which will be collected by EHS. An NMSU waste tracking form will be attached to the waste container with necessary information completed (see Attachment 8).

Attachment 6 – Hazard Identification and Mitigation

Identify ALL HIGH hazards associated with the experiment. The analysis must consider

- *all sources of energy (electric, chemical, hydraulics, mechanical, compressed gases),*
- *extreme conditions of pressure or temperature (from flame or steam to cryogenics),*
- *chemical storage,*
- *housekeeping,*
- *fire, and/or*
- *biological hazards.*

Examples of HIGH hazards to include (list not exhaustive):

- *substances that are highly reactive, radioactive, highly flammable, pyrophoric, highly toxic, mutagenic, teratogenic, carcinogenic, or have very low exposure limits,*
- *high voltage, high RF, x-ray, laser (class 3b or 4),*
- *high temperatures, and*
- *high pressure or pressurizing vessels.*

When in doubt about whether a substance represents a HIGH HAZARD, ask for assistance.

For each HIGH hazard (use the checklist as a guide to identifying these hazards, chme.nmsu.edu/files/2013/11/Lab-PPE-selection1.pdf), provide the following information:

1. *description of the HIGH hazard;*
2. *operational and engineering controls that will be used (based on identified industry best-practices used in addressing this safety hazard);*
3. *required PPE (beyond minimum) when this HIGH hazard is present; and*
4. *special training (beyond minimum) that is necessary.*

Basic hazards include slip/trip/fall around the swimming pool during collection of grab samples. Be sure to wear good non-slip shoes and skit or kneel while collecting the samples.

Otherwise were safety glasses, long pants and close toe shoes when working in either the Civil Engineering Lab or the Chemistry Lab.

Items identified in NMSU JSA Checklist include:

Gas under pressure – Be sure to turn the cylinder valve slowly on the carrier gas cylinder when starting the gas chromatograph. Listen for any leaks from the piping. Turn the gas off if hissing is heard and contact the lab manager for assistance. Turn the carrier gas cylinder off after sample runs are completed and ready to shut down the instrument.

Spill cleanup - Don't use your hands to clean up broken glass, use a broom and dust pan. Put the broken glass into a glass box not the trash. Use paper towels to clean up any water spill and put the wet towels into the normal trash since this is not a hazardous waste. In case of spill of CYA powder, clean up with wet paper towels and put into the trash.

Glassware washing – Be sure to use non-slip rubber gloves while washing glassware. Place wet glassware on a drying rack. Don't use your hands to clean up broken glass, use a broom and dust pan. Put the broken glass into a glass box not the trash.

JHA Lab Hazard Checklist

Lab Hazard Assessment			
Activity	Yes	No	Comments
Working with gas under pressure, in gas cylinders or as part of experimental conditions	X		
Working with water volume in excess of 1 gallon	X		
Working with corrosive Liquids	X		
Working with organic solvents or flammable chemicals		X	
Working with acutely toxic , carcinogenic or highly hazardous chemicals		X	
Working with air or water reactive chemicals		X	
Working with engineered nanomaterials such as carbon nanotubes, silver wire, carbon fiber etc. or other dusts with particle sizes <10 um		X	
Working with potentially explosive chemicals		X	
Working with temperaturs <0C or >100C		X	
Working with radioactive compounds		X	
Working with Class 3 or Class 4 Lasers		X	
Working with cryogenic materials including dry ice		X	
Working with liquids >100C including from sources such as oil bath, water bath, pressure vessel, autoclave etc.)		X	
Working with open flames		X	
Working with loud equipment (>85 db)		X	
Working with a centrifuge		X	
Working with a sonicator		X	
Working with sharp objects such as needles, knives, razor blades etc.		X	
Working with machine hazards such as pinch points, caught by or stuck by dangers etc.		X	
Working with electrical hazards such as un-insulated wiring, exposed control panels, wet conditions, etc.		X	
Working with electrical voltage in excess of 110V		X	
Working with batteries, all types such as lead-acid, nickel-cadmium, lithium etc.		X	
Working with high center of gravity hazards such as tall apparatus that requires extra support etc.		X	

SIGMA-ALDRICH sigma-aldrich.com

SAFETY DATA SHEET

Version 4.5
Revision Date 02/27/2015
Print Date 12/11/2017

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Cyanuric acid

Product Number : 185809
Brand : Aldrich

CAS-No. : 108-80-5

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : +1-703-527-3887 (CHEMTREC)

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

Not a hazardous substance or mixture.

2.2 GHS Label elements, including precautionary statements

Not a hazardous substance or mixture.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Synonyms : 2,4,6-Trihydroxy-1,3,5-triazine
1,3,5-Triazine-2,4,6-triol

Formula : $C_3H_3N_3O_3$
Molecular weight : 129.07 g/mol
CAS-No. : 108-80-5
EC-No. : 203-618-0

Hazardous components

Component	Classification	Concentration
Cyanuric acid		
		<= 100 %

4. FIRST AID MEASURES

4.1 Description of first aid measures

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration.

In case of skin contact
Wash off with soap and plenty of water.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Carbon oxides, Nitrogen oxides (NOx)

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Avoid dust formation. Avoid breathing vapours, mist or gas.
For personal protection see section 8.

6.2 Environmental precautions
No special environmental precautions required.

6.3 Methods and materials for containment and cleaning up
Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.
Provide appropriate exhaust ventilation at places where dust is formed.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place.

Keep in a dry place.
Storage class (TRGS 510): Non Combustible Solids

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Cyanuric acid	108-80-5	TWA	10.000000 mg/m3	USA. Workplace Environmental Exposure Levels (WEEL)
		TWA	5.000000 mg/m3	USA. Workplace Environmental Exposure Levels (WEEL)

8.2 Exposure controls

Appropriate engineering controls
General industrial hygiene practice.

Personal protective equipment

Eye/face protection
Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Choose body protection in relation to its type, to the concentration and amount of dangerous substances, and to the specific work-place., The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Respiratory protection is not required. Where protection from nuisance levels of dusts are desired, use type N95 (US) or type P1 (EN 143) dust masks. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
No special environmental precautions required.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a) Appearance — Form: powder
Colour: white

b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/range: > 360 °C (> 680 °F) - lit.
f)	Initial boiling point and boiling range	No data available
g)	Flash point	No data available
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	No data available
l)	Vapour density	No data available
m)	Relative density	No data available
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	log Pow: -1.31 at 25 °C (77 °F)
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
Strong oxidizing agents

10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - male and female - > 5,000 mg/kg
(Fixed Dose Method)

Inhalation: No data available

LD50 Dermal - Rabbit - male and female - > 5,000 mg/kg
(OECD Test Guideline 402)

No data available

Skin corrosion/irritation
Skin - Rabbit
Result: No skin irritation
(OECD Test Guideline 404)

Serious eye damage/eye irritation
Eyes - Rabbit
Result: No eye irritation
(OECD Test Guideline 405)

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
in vitro assay
S. typhimurium
Result: negative

Carcinogenicity

Carcinogenicity - Mouse - Skin
Liver:Tumors.

Carcinogenicity - Rat - Oral
Tumorigenic:Equivocal tumorigenic agent by RTECS criteria. Liver:Tumors. Skin and Appendages: Other: Tumors.

Carcinogenicity - Rat - Subcutaneous
Tumorigenic:Equivocal tumorigenic agent by RTECS criteria. Lungs, Thorax, or Respiration:Tumors.
Blood:Lymphomas including Hodgkin's disease.

Carcinogenicity - Mouse - Oral
Tumorigenic:Equivocal tumorigenic agent by RTECS criteria. Blood:Lymphomas including Hodgkin's disease.

IARC:	No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
ACGIH:	No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.
NTP:	No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
OSHA:	No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available

No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information

Repeated dose toxicity - Rat - male - Oral - No observed adverse effect level - 154 mg/kg - Lowest observed adverse effect level - 371 mg/kg
RTECS: XZ1800000

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	static test LC50 - Pimephales promelas (fathead minnow) - > 2,100 mg/l - 96 h
Toxicity to daphnia and other aquatic invertebrates	static test LC50 - Daphnia magna (Water flea) - > 1,000 mg/l - 48 h

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
Not dangerous goods

IMDG
Not dangerous goods

IATA
Not dangerous goods

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards

No SARA Hazards

Massachusetts Right To Know Components
No components are subject to the Massachusetts Right to Know Act.

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Cyanuric acid	108-80-5	

New Jersey Right To Know Components

	CAS-No.	Revision Date
Cyanuric acid	108-80-5	

California Prop. 65 Components
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

HMIS Rating

Health hazard:	0
Chronic Health Hazard:	
Flammability:	0
Physical Hazard	0

NFPA Rating

Health hazard:	0
Fire Hazard:	0
Reactivity Hazard:	0

Further information

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information
Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 4.5 Revision Date: 02/27/2015 Print Date: 12/11/2017

SAFETY DATA SHEET

Version 5.13
Revision Date 11/06/2017
Print Date 01/01/2018

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Sodium hypochlorite solution

Product Number : 425044
Brand : Sigma-Aldrich

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : +1-703-527-3887 (CHEMTREC)

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Skin corrosion (Category 1B), H314
Serious eye damage (Category 1), H318
Acute aquatic toxicity (Category 1), H400

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word Danger

Hazard statement(s)

H314	Causes severe skin burns and eye damage.
H400	Very toxic to aquatic life.

Precautionary statement(s)

P264	Wash skin thoroughly after handling.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P330 + P331	IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
P303 + P361 + P353	IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304 + P340 + P310	IF INHALED: Remove person to fresh air and keep comfortable for breathing. Immediately call a POISON CENTER/doctor.
P305 + P351 + P338 + P310	IF IN EYES: Rinse cautiously with water for several minutes. Remove

	contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER/doctor.
P363	Wash contaminated clothing before reuse.
P391	Collect spillage.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.2 Mixtures

Formula : ClNaO
Molecular weight : 74.44 g/mol

Hazardous components

Component		Classification	Concentration
Sodium hypochlorite solution			
CAS-No. EC-No. Index-No.	7681-52-9 231-668-3 017-011-00-1	Skin Corr. 1B; Eye Dam. 1; Aquatic Acute 1; H314, H400	10 - 20 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Take off contaminated clothing and shoes immediately. Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.Continue rinsing eyes during transport to hospital.

If swallowed
Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Dry powder

5.2 Special hazards arising from the substance or mixture
No data available

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Wear respiratory protection. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Soak up with inert absorbent material and dispose of as hazardous waste. Do not flush with water. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid inhalation of vapour or mist.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.
Never allow product to get in contact with water during storage. Do not store near acids.

Recommended storage temperature 2 - 8 °C
Storage class (TRGS 510): 8B: Non-combustible, corrosive hazardous materials

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Sodium hypochlorite solution	7681-52-9	STEL	2.000000 mg/m3	USA. Workplace Environmental Exposure Levels (WEEL)

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Tightly fitting safety goggles. Faceshield (8-inch minimum). Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min

Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: liquid
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	-28.9 °C (-20.0 °F)
f)	Initial boiling point and boiling range	111 °C (232 °F)
g)	Flash point	Not applicable
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	23.3 hPa (17.5 mmHg) at 20 °C (68 °F)
l)	Vapour density	No data available
m)	Relative density	1.206 g/mL at 25 °C (77 °F)
n)	Water solubility	completely miscible
o)	Partition coefficient: n-octanol/water	No data available
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available

r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
Strong acids, Organic materials, Powdered metals, Forms shock-sensitive mixtures with certain other materials., Amines, Reacts violently with ammonium salts, aziridine, methanol, and phenylaceto primary aliphatic or aromatic amines to form explosively unstable n-chlor 55°C.

10.6 Hazardous decomposition products
Hazardous decomposition products formed under fire conditions. - Hydrogen chloride gas, Sodium oxides
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
No data available

Inhalation: No data available

Dermal: No data available

No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity

No data available

Carcinogenicity

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available
No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: Not available

burning sensation, Cough, wheezing, laryngitis, Shortness of breath, spasm, inflammation and edema of the larynx, spasm, inflammation and edema of the bronchi, pneumonitis, pulmonary edema, Material is extremely destructive to tissue of the mucous membranes and upper respiratory tract, eyes, and skin., To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

12. ECOLOGICAL INFORMATION

12.1 Toxicity
No data available

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Very toxic to aquatic life.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 1791 Class: 8 Packing group: III
Proper shipping name: Hypochlorite solutions
Reportable Quantity (RQ): 667 lbs
Poison Inhalation Hazard: No

IMDG
UN number: 1791 Class: 8 Packing group: III EMS-No: F-A, S-B
Proper shipping name: HYPOCHLORITE SOLUTION
Marine pollutant:yes

IATA

UN number: 1791 Class: 8 Packing group: III
Proper shipping name: Hypochlorite solution

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
Acute Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Sodium hypochlorite solution	7681-52-9	2007-03-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Water	7732-18-5	
Sodium hypochlorite solution	7681-52-9	2007-03-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
Water	7732-18-5	
Sodium hypochlorite solution	7681-52-9	2007-03-01

California Prop. 65 Components
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Aquatic Acute	Acute aquatic toxicity
Eye Dam.	Serious eye damage
H314	Causes severe skin burns and eye damage.
H318	Causes serious eye damage.
H400	Very toxic to aquatic life.
Skin Corr.	Skin corrosion

HMIS Rating

Health hazard:	3
Chronic Health Hazard:	
Flammability:	0
Physical Hazard	0

NFPA Rating

Health hazard:	3
Fire Hazard:	0
Reactivity Hazard:	0

Further information

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

SAFETY DATA SHEET

Version 5.2
Revision Date 02/24/2014
Print Date 01/01/2018

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Water

Product Number : W4502
Brand : Sigma
REACH No. : A registration number is not available for this substance as the substance or its uses are exempted from registration, the annual tonnage does not require a registration or the registration is envisaged for a later registration deadline.
CAS-No. : 7732-18-5

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : +1-703-527-3887 (CHEMTREC)

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

Not a hazardous substance or mixture.

2.2 GHS Label elements, including precautionary statements

Not a hazardous substance or mixture.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula : H_2O
Molecular Weight : 18.02 g/mol
CAS-No. : 7732-18-5
EC-No. : 231-791-2

No ingredients are hazardous according to OSHA criteria.
No components need to be disclosed according to the applicable regulations.

4. FIRST AID MEASURES

4.1 Description of first aid measures

If inhaled
If not breathing give artificial respiration

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
no data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

5.2 Special hazards arising from the substance or mixture
no data available

5.3 Advice for firefighters
no data available

5.4 Further information
The product itself does not burn.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
For personal protection see section 8.

6.2 Environmental precautions
no data available

6.3 Methods and materials for containment and cleaning up
Wipe up with absorbent material (e.g. cloth, fleece).

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
No special storage conditions required.

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters
Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice.

Personal protective equipment

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min

Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Respiratory protection
No special protective equipment required.

Control of environmental exposure
Prevent product from entering drains.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: liquid Colour: colourless
b)	Odour	no data available
c)	Odour Threshold	no data available
d)	pH	6.0 - 8.0 at 25 °C (77 °F)
e)	Melting point/freezing point	0.0 °C (32.0 °F)
f)	Initial boiling point and boiling range	100 °C (212 °F) - lit.
g)	Flash point	not applicable
h)	Evapouration rate	no data available
i)	Flammability (solid, gas)	no data available
j)	Upper/lower flammability or explosive limits	no data available
k)	Vapour pressure	no data available
l)	Vapour density	no data available
m)	Relative density	1.000 g/cm3 at 3.98 °C (39.16 °F)
n)	Water solubility	completely miscible
o)	Partition coefficient: n-octanol/water	no data available
p)	Auto-ignition temperature	no data available
q)	Decomposition temperature	no data available
r)	Viscosity	no data available
s)	Explosive properties	no data available
t)	Oxidizing properties	no data available

9.2 Other safety information
no data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
no data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
no data available

10.4 Conditions to avoid
no data available

10.5 Incompatible materials
no data available

10.6 Hazardous decomposition products
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
no data available

Inhalation: no data available

Dermal: no data available

no data available

Skin corrosion/irritation
no data available

Serious eye damage/eye irritation
no data available

Respiratory or skin sensitisation
no data available

Germ cell mutagenicity
no data available

Carcinogenicity

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
no data available

no data available

Specific target organ toxicity - single exposure
no data available

Specific target organ toxicity - repeated exposure
no data available

Aspiration hazard
no data available

Additional Information
RTECS: ZC0110000

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

12. ECOLOGICAL INFORMATION

12.1 Toxicity
no data available

12.2 Persistence and degradability
not applicable

12.3 Bioaccumulative potential
no data available

12.4 Mobility in soil
no data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

no data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Taking into account local regulations the product may be disposed of as waste water after neutralisation.

14. TRANSPORT INFORMATION

DOT (US)
Not dangerous goods

IMDG
Not dangerous goods

IATA
Not dangerous goods

15. REGULATORY INFORMATION

REACH No. : A registration number is not available for this substance as the substance or its uses are exempted from registration, the annual tonnage does not require a registration or the registration is envisaged for a later registration deadline.

SARA 302 Components
SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
SARA 313: This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
No SARA Hazards

Massachusetts Right To Know Components
No components are subject to the Massachusetts Right to Know Act.

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Water	7732-18-5	

New Jersey Right To Know Components

	CAS-No.	Revision Date
Water	7732-18-5	

California Prop. 65 Components

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

HMIS Rating

Health hazard:	0
Chronic Health Hazard:	
Flammability:	0
Physical Hazard	0

NFPA Rating

Health hazard:	0
Fire Hazard:	0
Reactivity Hazard:	0

Further information

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 5.2 Revision Date: 02/24/2014 Print Date: 01/01/2018