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GPS SAFETY SUMMARY
ACETALDEHYDE

This Product Safety Summary is intended to provide a general overview of the chemical substance in the context of ICCA Global Product Strategy. The information on the Summary is basic information and is not intended to provide emergency response information, medical information or treatment information. The summary should not be used to provide in-depth safety and health information. In-depth safety and health information can be found on the (extended) Safety Data Sheet for the chemical substance.

1 General Statement

Acetaldehyde is a highly volatile and extremely flammable, colourless organic liquid. It is a naturally occurring substance, which can be found in small amounts in some fruits, *e.g.* in oranges. Acetaldehyde is also a natural metabolite in the human body due to the enzymatic degradation of ethanol, which is present *e.g.* due to alcohol consumption. Also tobacco smoke contains acetaldehyde, which is generated during the burning process.
In the chemical industry the substance is mainly used as an intermediate to synthesize other important chemical substances, such as acetic acid.
Acetaldehyde has been classified as harmful to human health since it may be irritating to the respiratory tract, causes serious eye irritation, and is suspected of causing cancer.
Since it is a natural metabolite in the human body and is a natural ingredient in fruits, it should be noted that especially overexposure to this substance is harmful to human health. Workers should pay special attention during handling and storage of acetaldehyde due to its extreme flammability and the possible hazardous health effects. It is recommended that workers obtain specific instructions before handling this substance and to not exceed existing limit values.

2 Chemical Identity

Name:	Acetaldehyde
CAS number:	75-07-0
EINECS number:	200-836-8
Molecular formula:	C_2H_4O

3 Uses and Applications

Acetaldehyde is primarily used in industrial processes as an intermediate for the manufacture of other substances, such as acetic acid, ethyl acetate, crotonaldehyde, and many others.
Also application as flavouring agent in foodstuff (fruit juices, yoghurts, etc.) due to its aromatic and fruitful taste has been reported. The use as flavouring additive is currently under discussion.

4 Physical / Chemical Properties

Acetaldehyde is a highly volatile and extremely flammable, colourless organic liquid with a pungent odour. It is miscible with water at all ratios and is miscible with many organic solvents. Due to its high flammability it is crucial to remove all sources of ignition during handling and

storage and to take precautionary measures against static discharges. Due to its high volatility and low boiling point vapours can easily be generated. These vapours can build explosive or highly flammable mixtures with air, so adequate ventilation and suction should be provided during handling. The substance should be stored at low temperatures.
During storage the colour of the liquid can change from colourless to yellowish due to its chemical instability, *i.e.* acetaldehyde is converted to paraldehyde; this substance is a cyclic compound build of three molecules acetaldehyde. However, paraldehyde is also not chemically stable, so that various products can be formed during storage.

Appearance	
State of matter:	liquid
Colour:	colourless to yellowish
Odour:	pungent
Odour threshold:	0.5 mg/m^3
Molecular weight:	44.05 g/mol

Safety relevant basis data

Parameter	**Value**	**Unit**	**Remark**
Density:	0.78	g/cm^3	at 18 °C
pH:	5		at 20 °C; 10 g/L H_2O
Melting point / range:	-123.37	°C	at standard temperature and pressure
Boiling temperature / range:	20.1	°C	at 1013 hPa
Flash point:	-39	°C	at 1013 hPa
Explosion hazard:			vapours can build explosive / highly flammable mixtures with air
Lower explosion limit:	4	V-%	
Upper explosion limit:	60	V-%	
Ignition temperature:	175	°C	at 1013 hPa
Decomposition temperature:	420	°C	thermal
Vapour pressure:	1200	hPa	at 25 °C
Solubility in water:			miscible with water
log $P_{O/W}$ (n-octanol / water):	0.45		at 25 °C
Viscosity:	0.25	mPa*s	at 15 °C

5 Health Effects

5.1 Consumer

In the industry acetaldehyde is typically handled under strictly enclosed conditions in manufacturing and processing as intermediate due to its physical properties and its health risks. Acetaldehyde might be present in consumer products only in traces comparable to the level occuring naturally *e.g.* in fruits or tobacco smoke. It should also be noted that acetaldehyde is a natural metabolite of ethanol in the human body.

5.2 Worker

Workers are generally exposed via the same routes as consumers. During work, they will typically not come into contact with the substance as it is manufactured and processed in closed systems in industrial and professional settings under strictly controlled conditions. In case of unintended exposure during synthesis, transfer or other procedures, workers should follow the recommended safety measures in the (extended) Safety Data Sheet. The following table gives an overview on the health effects:

Effect Assessment	Result
Acute Toxicity oral / inhalation / dermal	Acetaldehyde is considered as toxic by inhalation.
Irritation / corrosion skin / eye / respiratory tract	The substance is classified as irritating to eyes and the respiratory tract. (Eye Irrit. 2; H319: Causes serious eye irritation. STOT SE 3; H335: May cause respiratory irritation.) Studies revealed that the substance also has mildly irritating effects on the skin.
Sensitisation	No data is available on sensitisation properties.
Toxicity after repeated exposure oral / inhalation / dermal	Data is lacking for repeated exposure (oral, inhalation and dermal). Since single exposure via inhalation showed that acetaldehyde can be a respiratory irritant and is further considered as toxic by inhalation, it is likely that repeated exposure has adverse effects, too.
Genotoxicity / mutagenicity	Studies revealed that acetaldehyde has mutagenic potential.
Carcinogenicity	The substance is suspected of causing cancer. (Carc. 2; H351: Suspected of causing cancer.)
Toxicity for reproduction	No data is available for substance properties concerning developmental or reproductive toxicity.

6 Environmental Effects

Based on available data for the substance, acetaldehyde is considered as harmful to aquatic organisms. Adverse effects on microorganisms in waste water treatment plants are not expected. However, no detailed information for acetaldehyde amounts released into the aquatic environment is available. It is not expected to bioaccumulate, is readily biodegradable and is therefore not expected to persist in the environment.

Effect Assessment	Result
Aquatic Toxicity	Based on available data acetaldehyde is considered as harmful to fish, aquatic invertebrates and might have also harmful effects on aquatic algae. It is not hazardous for aquatic microorganisms. No data is available for sediment organisms or other aquatic organisms.
Terrestrial Toxicity	No data available.

Fate and behaviour	Result
Biodegradation	Acetaldehyde is readily biodegradable (> 90% in 28 days).
Bioaccumulation potential	Bioaccumulation is not expected (log P_{OW} ≤ 3; BCF ≤ 100).
PBT / vPvB conclusion	This substance is not expected to be a PBT or vPvB substance.

7 Exposure

7.1 Human health

Exposure of workers to acetaldehyde in manufacturing facilities is considered as low because the process, storage and handling operations are in closed systems and are strictly controlled. Workers who might accidentally come into contact with the substance should follow the safety measures recommended in the Extended Safety Data Sheet.
Consumers do get in contact with naturally occuring acetaldehyde. Acetaldehyde is also a natural metabolite in the human body in low concentrations.

7.2 Environment

The manufacture of the substance and on-site uses are proceeded under strictly controlled conditions. It is expected that no relevant releases to the environment occur, but no specific information is available. In general, acetaldehyde should be prevented from entering surface waters, since the substance is harmful to aquatic organisms and to soil.
In the case of accidental release acetaldehyde does not pose a significant risk for the environment as it is readily biodegradable

8 Risk Management Recommendations

When using acetaldehyde, avoid any kind of exposure, if possible. Make sure that there is adequate ventilation and suction at critical points to ensure that occupational exposure limit values are not exceeded. Do not breath vapours and avoid contact with eyes and skin by using appropriate respiratory protection, eye protection, such as tight fitting protective goggles, appropriate chemical resistant gloves and adequate body protection. Do not eat, drink or smoke where chemicals are handled, processed or stored. Wash hands thoroughly after handling. Observe regulations for protection against explosion, since vapours can build explosive and extremely flammable mixtures with air. Eliminate all sources of ignition. Do not release into the aquatic environment or soil. Keep away from incompatible substances such as alkalis, strong acids and oxidising agents. Please refer to the corresponding Safety Data Sheet.

9 First Aid Measures

Guide people to safety. First aid assistants should pay attention to self-protection. After contact with the substance via skin, eyes, ingestion and/or inhalation, a doctor should immediately be consulted. Immediately take off all contaminated clothing and shoes and dispose of safely. In case of contact with the skin, immediately flush affected area with large amounts of water for 10-15 minutes followed by washing with soap and water. Use an emergency shower in case of large amounts. In case of contact with eyes, immediately flush eyes with large amounts of water for 10 -15 minutes while holding eyelids open. After inhalation of the substance, move person to fresh air, keep the affected person warm and at rest. If breathing has stopped, give artificial respiration. Treat the person with cortisone spray as early as possible. If accidentally swallowed, let water be swallowed in little sips, only if the person is conscious, and obtain immediate medical attention. Do not induce vomiting since danger of aspiration exists. Skilled personnel should pump out stomach by intubation.

10 Fire Fighting Measures

In case of fire, use plenty of water, extinguishing powder, sand, (alcohol resistant) foam or carbon dioxide (CO_2). Fight fire from a safe distance. If it can be done without risk, cool endangered product containers, guide personal to safety and keep unprotected people away. Hazardous decomposition products in case of incomplete combustion contain highly toxic pyrolysis products, *e.g.* carbon monoxide (CO). It is absolutely required to wear a self-contained breathing apparatus.

11 Accidental Release Measures

When handling the substance, personal protection equipment must be worn. In case of spills, avoid any contact with the substance as well as inhalation of gases, mists and vapours. Keep unprotected people away and remove all ignition sources since acetaldehyde is extremely flammable. Take precautionary measures against static discharges and consider explosion protection. For small spills dilute with plenty of water. Contain any fluid spilled using suitable material (*e.g.* diatomaceous earth). Dispose of in prescribed marked containers. Contain larger amounts via pumping into suitable containers. Prevent material from entering surface waters, drains or sewers, and soil. Dispose of according to local/state/federal regulations.

12 Disposal Considerations

It is recommended to incinerate acetaldehyde according to official regulations in a special waste incinerator. Local regulations must be observed. Collect contaminated fire extinguishing water separately. Retain contaminated washing water and dispose of according to national, federal and local regulations. Dumping into the environment must be prevented. Contaminated packaging material must be completely emptied and can be reused or recycled following appropriate cleaning. Handle contaminated packaging in the same way as the substance itself. Packaging material which cannot be properly cleaned must be thrown away.

13 Handling and Storage

If handling the substance, keep away from ignition sources, e.g. heat, sparks, open flames, hot surfaces, and do not smoke. Acetaldehyde is extremely flammable. Take precautionary measures against static discharges when filling from one container into another by grounding of metal containers, apparatus, pumps and suction equipment in order to discharge static accumulation to the ground and to prevent formation of sparks. Provide for sufficient ventilation and punctiform suction at critical points. Also consider explosion protection since vapours can form mixtures with air, which can lead to explosions. Observe regulations for protection against explosion. Do not mix with alkalis, strong acids and oxidising agents.
Store only in the original container in a cool, well-ventilated place. Keep the container tightly closed and protect from oxygen admission, *i.e.* air admission. Do not store together with fire-promoting and spontaneously inflammable substances or with highly flammable solids.

14 State Agency Review

Acetaldehyde has been registered under REACH and in many other countries according to national regulations. For this product a chemical safety assessment according to national regulations has been carried out.

15 Classification and Labelling

The substance is classified under the EU Classification Labelling and Packaging (CLP) Regulation EC/1272/2008 as follows:

Hazard Class and Category	H-Phrase	Hazard pictograms	Wording
Flammable liquid 1	H224		Extremely flammable liquid and vapour.
Serious eye irritation 2	H319		Causes serious eye irritation.
Specific target organ toxicity after single exposure 3	H335		May cause respiratory irritation.
Carcinogenicity 2	H351		Suspected of causing cancer.

16 Conclusion

Acetaldehyde is a well characterised substance. It is a natural metabolite of ethanol in the human body, but can have significant hazardous effects on human health upon overexposure, e.g. carcinogenic effects. Likely routes of exposure for consumers to acetaldehyde can arise via consumption of cigarettes, alcoholic beverages and foodstuff containing acetaldehyde as flavouring additive. Except for the exposure routes indicated for consumers, workers are unlikely to be exposed to acetaldehyde in a way leading to hazardous health effects, if safety measures recommended in the Safety Data Sheet are followed, e.g. compliance with exposure limit values, use of protective equipment, technical measures, etc. Hazardous environmental effects are also unlikely due to processing in closed systems and - by accidental release - due to its biodegradability.

17 Contact Information within Company

For further information on this substance or product safety summaries in general, please contact: Dr. Christian Eppelsheim at wlcp-reach@wacker.com or visit our website at www.wacker.com.

18 Date of Issue

19/03/2012

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GPS SAFETY SUMMARY
ACETYLACETONE

This Product Safety Summary is intended to provide a general overview of the chemical substance in the context of ICCA Global Product Strategy. The information on the Summary is basic information and is not intended to provide emergency response information, medical information or treatment information. The summary should not be used to provide in-depth safety and health information. In-depth safety and health information can be found on the (extended) Safety Data Sheet for the chemical substance.

1 General Statement

Acetylacetone is a colourless organic liquid with an ester-like odour. It is manufactured from isopropenyl acetate via thermal rearrangement under acid catalysis and subsequently purified by distillation. It is widely used in industrial and professional processes, e.g. as solvent, as intermediate, for the manufacture of other substances, including bulk, large scale and fine chemicals (including petroleum products), for formulation of preparations, coatings, paints, thinners and paint removers, and as laboratory reagent.
In regard to human health acetylacetone is of acute toxicity by all routes (inhalation, ingestion and skin contact). Further, the substance is harmful to aquatic organisms.
Special attention during handling and storage has to be given to the substance due to its high flammability. It is unlikely that consumers are exposed to relevant amounts of this substance. Workers should refer to the information set out in the Safety Data Sheet.

2 Chemical Identity

Name:	Acetylacetone
Chemical name:	2,4-pentanedione, pentane-2,4-dione
CAS number:	123-54-6
EINECS number:	204-634-0
Molecular formula:	$C_5H_8O_2$

3 Uses and Applications

Acetylacetone is widely used as laboratory reagent in scientific research and development as well as intermediate in industrial processes, e.g. for the manufacture of other substances such as bulk, large scale and fine chemicals (including petroleum products), for formulation of preparations or during plastic production. Very often it is applied as solvent and as formulation component in coatings, paints, thinners and paint removers. It can be used as solvent, stabiliser, processing aid or process regulator during polymerisation processes for the production of resins, rubbers and polymers, as well as a component in organic peroxide formulations. Herein, it builds a functional part which is used to increase the reactivity of a resin cure system.
Professional uses especially include the application as component in coatings, e.g. in paints and thinners in the construction and building sector. Products and articles manufactured from these processes can be e.g. found in the building and construction industry and the offshore- industry. Further, these products find application during manufacture of food products, furniture as well as manufacture of machinery, equipment, vehicles and other transport equipment. However, it is

highly unlikely that consumer articles contain significant amounts of acetylacetone. Workers should observe the information available in the (e)SDS.

4 Physical / Chemical Properties

Acetylacetone is a colourless organic liquid with an ester-like, pleasant odour. Its liquid and vapours are flammable, whereas the vapours can build flammable / explosive vapour-air mixtures; therefore an adequate ventilation should be provided and special attention to this substance should be given during handling and storage.

Appearance

State of matter:	liquid
Colour:	colourless
Odour:	ester-like
Odour threshold:	13 mg/m^3
Molecular weight:	100.1158 g/mol

Safety relevant basis data

Parameter	Value	Unit	Remark
Density:	0.9732	g/cm^3	at 20 °C
pH:	3.2		at 22 °C; 175 g/l H_2O
Melting point / range:	-15	°C	at 1013 hPa
Boiling temperature / range:	139.5	°C	at 1013 hPa
Flash point:	35	°C	at 956
Explosion hazard:			not applicable
Lower explosion limit:	2.4	Vol-%	
Upper explosion limit:	11.4	Vol-%	
Ignition temperature:	390	°C	at 960 hPa
Decomposition temperature:	293 – 389	°C	thermal decomposition
Vapour pressure:	7.9	hPa	at 20 °C
Oxidizing properties:			no
Solubility in water:	154.5	g/l	at 20 °C
log $P_{O/W}$ (n-octanol / water):	0.68		
Viscosity (dynamic):	0.762	mPa s	at 20 °C

5 Health Effects

5.1 Consumer

Consumer exposure is unlikely as the substance is only manufactured and handled in industrial and professional settings.

5.2 Worker

Workers will typically not come into contact with the substance as it is manufactured in closed systems in industrial and professional settings. In case of unintended exposure during synthesis, formulation, transfer or other procedures, workers should follow the recommended safety

measures in the extended Safety Data Sheet. The following table gives an overview on the health effects:

Effect Assessment	Result
Acute Toxicity oral / inhalation / dermal	The investigation performed on the acute toxicity of the substance after administration by the oral, dermal and inhalation route showed that acetylacetone has to be regarded as harmful if swallowed and toxic by inhalation and in contact with skin. (Acute Tox. 3; H331: Toxic if inhaled. Acute Tox. 3; H311: Toxic in contact with skin. Acute Tox. 4; H302: Harmful if swallowed.)
Irritation / corrosion skin / eye / respiratory tract	Studies with single exposure to animals showed no potential of the substance for being either skin or eye irritating. No test has been performed in regard to respiratory tract irritation.
Sensitisation	The substance is not sensitising.
Toxicity after repeated exposure oral / inhalation / dermal	Studies for the dermal and inhalative route revealed that acetylacetone is toxic upon repeated exposure, having neurologic effects on the brain by both, the dermal and inhalative route, cardiovascular / haematological effects on the thymus by dermal exposure and harmful effects on the nose via inhalation. However, effects were not considered as sufficient for classification.
Genotoxicity / mutagenicity	For the inhalation route no genotoxic effects were observed. In contrast, after intraperitoneal administration no consistent genotoxic responses were observed (negative for rats, positive for mice). Due to the ambiguous results, acetylacetone has not been classified as genotoxic / mutagenic.
Carcinogenicity	No data available.
Toxicity for reproduction	Studies revealed no teratogenic effects, although fetotoxic effects such as reduced fetal weights could be observed. However, results were not considered as sufficient for classification.

6 Environmental Effects

Acetylacetone has been identified as harmful to aquatic organisms, such as fish, daphnia and algae. However, the substance is readily biodegradable and does neither bioaccumulate nor persist in the environment.

Effect Assessment	**Result**
Aquatic Toxicity	Studies on fish, aquatic invertebrates, aquatic algae and aquatic microorganisms revealed adverse effects.
Terrestrial Toxicity	No data available.

Fate and behaviour	**Result**
Biodegradation	Acetylacetone is readily biodegradable (>80% in 28 days).
Bioaccumulation potential	Bioaccumulation is not expected to occur. (log K_{ow}: 0.68)
PBT / vPvB conclusion	This product contains no relevant substances considered to be persistent, bioaccumulative and toxic (PBT) or very persistent and very bioaccumulative (vPvB).

7 Exposure

7.1 Human health

Consumer exposure is unlikely as the substance is only manufactured and handled in industrial and professional settings. Workers will typically not come into contact with the substance as it is manufactured in closed systems in industrial and professional settings. In case of unintended exposure during synthesis, formulation, transfer or other procedures, workers should follow the recommended safety measures in the extended Safety Data Sheet.

7.2 Environment

The manufacture of the substance and on-site uses are proceeded under strictly controlled conditions. Expected releases amount to nearly zero, having no adverse effects on the environment.

8 Risk Management Recommendations

When using acetylacetone, standard industrial hygiene practices for the handling of chemical substances should be observed. Do not eat, drink or smoke during handling. Adequate ventilation and suction at critical points should be implemented to ensure that occupational exposure limit values are not exceeded. Do not breathe vapours and avoid any contact with eyes and skin by using appropriate personal protection equipment, such as a gas mask with ABEK filter, protective gloves, e.g. made of butyl rubber (only for short periods, i.e. <10 minutes), tight fitting protective goggles and appropriate protective clothing. In case of long or strong exposure, a positive pressure self contained breathing apparatus must be worn.

9 First Aid Measures

Always seek medical advice in the event of any contact with this substance. Symptoms of poisoning may not become apparent until after many hours - medical monitoring is therefore required for at least 48 hours after any accident. First aider should keep attention to self-protection. After inhalation of the substance, keep the patient calm and warm. If breathing stops, administer artificial respiration. If the person is unconscious, place him in stable sideways position. In case of skin contact, immediately remove contaminated clothes and wash off the affected area with plenty of water or water and soap for 10-15 minutes. In serious cases, an emergency shower should be immediately used. After contact with eyes, rinse immediately with plenty of water for 10-15 minutes. Keep eyelids well open to rinse the whole eye surface and eyelids with water. In case of ingestion, give several small portions of water to drink when the person is conscious. Do not induce vomiting.

10 Fire Fighting Measures

Fire fighters should use respiratory protection independent of re-circulated air. As extinguishing media use water spray, extinguishing powder, alcohol-resistant foam or carbon dioxide (CO_2); do not use a water jet. If it can be done without risk, cool endangered product containers by using water fog, guide personal to safety and keep unprotected people away. Hazardous decomposition products in case of incomplete combustion contain various organic decomposition products.

11 Accidental Release Measures

When handling the substance, personal protection equipment must be worn. Avoid inhaling mists and vapours. Keep unprotected people away and remove all ignition sources. Contain any fluid that runs out using suitable material by absorbing with a liquid binding material such as diatomaceous earth or earth. Contain larger amounts by pumping into suitable containers. Do not empty into drains or the aquatic environment. Dispose off in prescribed marked containers according to local/state/federal regulations.

12 Disposal Considerations

It is recommended to carry out burning of acetylacetone as hazardous waste in a special waste incinerator according to local/state/federal regulations. Collect contaminated fire extinguishing water separately. Retain contaminated washing water and dispose of according to national, federal and local regulations. Dumping into the environment must be prevented. Contaminated packaging material must be completely emptied and can be re-used or recycled following appropriate cleaning. Handle contaminated packaging in the same way as the substance itself. Packaging material which cannot be properly cleaned must be thrown away.

13 Handling and Storage

It is highly recommended to use personal protective equipment when handling the substance. Keep in the original container in a cool well ventilated place and keep the container dry and tightly closed. Since the material is flammable, keep away from sources of ignition, such as heat, sparks and flames, and do not smoke. Ensure adequate ventilation during handling and storage. Flammable vapours may accumulate and form explosive mixtures with air in containers, process vessels, including partial, empty and uncleaned containers and vessels, or other enclosed spaces. During transfusion electrostatic charging is possible; therefore, take precautionary measures against electrostatic charging and do not store in iron containers. Storage together with fire-promoting and spontaneously inflammable substances or with highly inflammable solids should be prevented. Incompatible materials are oxidising agents, strong bases as well as amines.

14 State Agency Review

Acetylacetone has been registered under REACH. For this product chemical safety assessments according to national regulations have been carried out.
The substance is listed in: U.S. Toxic Substances Control Act (TSCA), European Inventory of Existing Commercial Chemical Substances (EINECS), Canadian Domestic Substances List (DSL), Korean Existing Chemicals List (ECL), Philippine Inventory of Chemicals and Chemical Substances (PICCS), Australian Inventory of Chemical Substances (AICS), Japanese Existing and New Chemical Substances Inventory (ENCS), Inventory of Existing Chemical Substances in China (IECSC).

15 Classification and Labelling

The substance is classified under the EU Classification Labelling and Packaging (CLP) Regulation EC/1272/2008 as follows:

Hazard Class and Category	H-Phrase	Hazard pictograms	Wording
Acute toxicity (inhal.) 3	H331		Toxic if inhaled.
Acute toxicity (dermal) 3	H311		Toxic in contact with skin.
Acute toxicity (oral) 4	H302		Harmful if swallowed.
Flammable liquid 3	H226		Flammable liquid and vapour.

16 Conclusion

Acetylacetone is a well characterised substance in regard to its physico-chemical properties. Special attention should be given to the substance during handling and storage, since it is of acute toxicity via all routes (inhalation, ingestion and upon skin contact). Studies on CMR effects (carcinogenicity, mutagenicity and reproductive toxicity) revealed ambiguous results for mutagenicity and reproductive toxicity; data on carcinogenicity is lacking. Acetylacetone is further harmful to aquatic organisms; therefore dumping into the environment must be prevented. Consumers are not likely to get in contact with the substance, while workers should follow the recommended safety measures in the extended Safety Data Sheet.

17 Contact Information within Company

For further information on this substance or product safety summaries in general, please contact: Dr. Christian Eppelsheim at wlcp-reach@wacker.com or visit our website at www.wacker.com.

18 Date of Issue

30/03/2012

WACKER

GPS SAFETY SUMMARY
CHLORINE

This Product Safety Summary is intended to provide a general overview of the chemical substance in the context of ICCA Global Product Strategy. The information on the Summary is basic information and is not intended to provide emergency response information, medical information or treatment information. The summary should not be used to provide in-depth safety and health information. In-depth safety and health information can be found on the (extended) Safety Data Sheet (e)SDS for the chemical substance.

1 General Statement

Chlorine is a greenish-yellow gas at room temperature. It is most commonly generated by electrolysis from sodium chloride (rock salt, table salt), or to a minor extent from potassium chloride or hydrogen chloride. It is hazardous to human health, and is manufactured and used in closed systems and by trained professionals with safety equipment. It is highly recommended that only workers with specific training be allowed to handle this substance.

2 Chemical Identity

Name:	Chlorine
CAS number:	7782-50-5
EINECS number:	231-959-5
Molecular formula:	Cl_2

3 Uses and Applications

Chlorine is a basic inorganic chemical with a wide variety of uses in industry. It is used in the synthesis of many other industrial and fine chemicals due to its high reactivity. It is used in the preparation of many plastics which have a wide variety of uses in construction, automotive and other industries. It is also used in metal refining, manufacture of electronic equipment and textiles. Chlorine is used in the disinfection of drinking water, and is effective against almost all bacteria, viruses and amoeba.
Elemental chlorine is not present in consumer products or provided for consumer use, but it is possible for consumers to be exposed to chlorine gas from improper use of sodium hypochlorite bleach (mixing with acids).

4 Physical / Chemical Properties

Chlorine is a gas at room temperature and pressure, though it is often transported as a liquid at higher pressures and/or lower temperatures. It is a powerful oxidant, which leads to many of its useful applications. At ambient pressure gaseous chlorine forms a liquid at -34 °C and the liquid freezes at -102 °C. The gas is heavier than air, so tends to sink.

Appearance

State of matter:	Gas
Colour:	Green-yellow
Odour:	Characteristic ‘chlorine’ odour
Odour treshold:	0,06 - 1,5 mg/m^3
Molecular weight:	70.9 g/mol

Safety relevant basis data

Parameter	Value	Unit	Remark
Density:	1,409	g/cm^3	at 20°C
pH:	1,8		6,4 g/l H_2O
Melting point / range:	- 102	°C	
Boiling temperature / range:	- 34,1	°C	at 1013 hPa
Flash point:			not applicable
Explosion hazard:			not applicable
Lower explosion limit:			not applicable
Upper explosion limit:			not applicable
Ignition temperature:			not applicable
Decomposition temperature:			no data
Vapour pressure:	6730	hPa	at 20 ° C
Solubility in water:	7,3	g/l	
log $P_{O/W}$ (n-octanol / water):			not applicable

5 Health Effects

5.1 Consumer

Consumer exposure is extremely unlikely as the substance is manufactured and handled in industrial and professional settings in closed systems. Exposure is possible as noted above through the improper use of household bleach, and care must be taken to follow safety instructions found on bleach packaging.

5.2 Worker

Workers will not typically come into contact with the substance as it is manufactured and handled in industrial or professional settings in closed systems. In case of unintended exposure during maintenance, sampling, testing or other procedures workers should follow the recommended safety measures in the extended Safety Data Sheet (eSDS).
Extensive toxicity testing has been done on chlorine. The most relevant route of exposure is inhalation, and exposure to chlorine can be fatal if inhaled. Chlorine exposure leads only to local effects, the seriousness of which is related primarily to concentration of the gas in the air and not to the duration of exposure.
Chlorine is classified as an irritant for skin, eye and may cause respiratory irritation. Chlorine is not a sensitizing agent and does not have genetic effects or cause cancer, and is not toxic to reproduction.

6 Environmental Effects

Chlorine reacts rapidly with water to form hypochlorous acid and degrades rapidly in the environment. This substance is very toxic to aquatic organisms. However, due to the pattern of use, chlorine is not released into the natural aquatic environment, indicating that the risk to the environment is very low. In some applications, chlorine is added deliberately to drinking water supplies for disinfection and destruction of almost all harmful microorganisms. If appropriately managed, the substance can be handled at all stages of manufacture and use with a minimal impact on the aquatic environment. Additionally, the substance is not bioaccumulative, is rapidly degraded and will not persist in the environment.

7 Exposure

7.1 Human health

Consumers will not typically come into contact with chlorine. Exposure to the substance for workers and professional users is avoided as the substance is manufactured and used in closed systems only. Professional and industrial users must follow the directions given in the eSDS document. The uses identified for the substance have been assessed as safe under several regulatory programs.

7.2 Environment

Chlorine is manufactured and used under closed conditions. No aqueous or gaseous effluents are emitted directly into the environment without passing through a treatment step to remove any unreacted chlorine.

8 Risk Management Recommendations

Avoid contact with eyes and skin. Do not breathe vapours. Keep working clothes separately. Do not eat, drink or smoke when handling. Wash hands at the end of work and before eating. Keep away from foodstuff, drink and feeding stuff.
Respiratory protection: gas mask filters B. In case of long or strong exposure: positive pressure self contained breathing apparatus.
Hand protection: protective gloves made of fluorinated rubber. Wear gloves for short periods only < 10 mins.
Eye protection: tight fitting protective goggles. Provide work station with eye bathing equipment.
Skin protection: acid-proof protective clothing. In case of long or strong exposure: full protective suit.
Prevent material from entering surface waters, drains or sewers and soil.

9 First Aid Measures

Observe self-protection for first aid. Remove contaminated clothes at once. Keep warm, in restful position, cover up. Where there is a risk of unconsciousness place and transport on one side in a stable position.
After inhalation: Move to fresh air, keep the victim laying down and restful. If breathing has stopped, give artificial respiration. Seek medical advice and clearly identify substance.
After contact with the skin: Wash immediately with plenty of water. In serious cases, use emergency shower immediately. Seek medical advice and clearly identify the substance.

After contact with the eyes: Rinse immediately with plenty of water for 10-15 minutes. Keep eyelids well open to rinse the whole eye surface and eyelids with water. Seek medical advice and clearly identify the substance. Follow up check by oculist. Continue to bathe eyes during transport to medical practitioner.

Advice for the physician: Allow cortisone spray inhalation at first possible opportunity. Patient must be kept under medical supervision for at least 48 hours because there may be a delay in the onset of pulmonary oedema.

10 Fire Fighting Measures

Chlorine does not burn. Use extinguishing measures appropriate to the source of the fire. Cool endangered containers with water. Do not allow water to reach leak. Special exposure hazards arising from the substance or preparation itself, combustion products, and resulting gases: corrosive substances, toxic gases. Ensure adequate retention potential for extinguishing water.

11 Accidental Release Measures

Personal precautions: Wear personal protection equipment (see section 8). Avoid gas build-up at lower levels. Keep unprotected persons away. Take persons to a safe place. Observe wind direction.
Environmental precautions: Condense gasses/vapours/mists using a directed spray of water. Close leak if possible without risk. Retain contaminated water/extinguishing water. Prevent material from entering surface waters, drains or sewers and soil.
Methods for cleaning up: Exhaust vapours.

12 Disposal Considerations

Containers may be recycled or re-used. Observe local/state/federal regulations.

13 Handling and Storage

Handling:
Avoid exposure by technical measures or personal protective equipment.
Precautions for safe handling: Ensure adequate ventilation. Ventilation recommended under formation of mist. Keep away from incompatible substances in accordance with section 10.2.
Precautions against fire and explosion: Keep away from combustible substances. Keep away from sources of heat. Cool endangered containers with water.

Storage:
Conditions for storage rooms and vessels: Store in pressure containers. Grease equipment solely with special grease. Use only corrosion-free utensils, apparatus and electrical installations. Unsuitable material for storage containers, casks and pipelines: synthetics, titanium.
Pressurized container: protect from sunlight and do not expose to temperatures exceeding 50 °C. Do not pierce or burn, even after use.
Advice for storage of incompatible materials: Do not store together with combustible substances. Keep away from water.

14 State Agency Review

Chlorine has been registered under REACH (Regulation EC 1907/2066). The substance was also reviewed under an OECD program for substances with large production volumes. In both cases the substance was found to be safe for the uses identified. Chlorine is currently under review for the European Biocidal Products Directive for its uses as biocide. Chlorine is listed on or in accordance with the following inventories: IECSC - China; PICCS - Philippines; AICS - Australia; ECL - Korea; DSL - Canada; TSCA - USA; EINECS - Europe; ENCS - Japan.

15 Classification and Labelling

The substance is subject to harmonised classification under the EU Classification Labelling and Packaging (CLP) Regulation EC/1272/2008. Industry has adopted a more stringent self-classification, as follows:

Oxidising gas 1	H270		May cause or intensify fire; oxidiser
Liquefied gas	H280		Contains gas under pressure; may explode if heated
Acute toxicity 2	H330		Fatal if inhaled
Eye irritation 2	H319		Causes serious eye irritation
STOT SE 3	H335		May cause respiratory irritation
Skin irritation 2	H315		Causes skin irritation
Aquatic acute 1	H400		Very toxic to aquatic life

16 Conclusion

Chlorine is a well understood substance. Essential uses of this hazardous substance have been shown to be safe by minimisation of the risks of exposure of the workers, the public and the environment.

17 Contact Information within Company

For further information on this substance or product safety summaries in general, please contact: Dr. Christian Eppelsheim at wlcp-reach@wacker.com or visit our website at www.wacker.com. Euro Chlor (www.eurochlor.org), the European chlor-alkali manufacturers' association is a useful repository of information regarding chlorine and can be contacted at eurochlor@cefic.be.

18 Date of Issue

07/03/2012

WACKER

GPS SAFETY SUMMARY
CHLOROMETHANE

This Product Safety Summary is intended to provide a general overview of the chemical substance in the context of ICCA Global Product Strategy. The information on the Summary is basic information and is not intended to provide emergency response information, medical information or treatment information. The summary should not be used to provide in-depth safety and health information. In-depth safety and health information can be found on the (extended) Safety Data Sheet (e)SDS for the chemical substance.

1 General Statement

Chloromethane is a colourless, extremely flammable organic gas, which is produced naturally in large amounts, e.g. in oceanic organisms and forest fires. In the industry the main synthesis route is the reaction of methanol with hydrogen chloride, mostly in the presence of a catalyst. It is used as chemical intermediate for the manufacture of bulk, large scale, and fine chemicals, as laboratory reagent and manufacture of rubber products.The substance is not considered as hazardous to the environment, since it is a naturally ocurring gas. Natural processes account to approximately 90% of chloromethane released to the environment. In regard to hazardous health effects to humans, chloromethane is suspected to cause cancer when inhaled and further to cause damage to organs, such as the central nervous system, upon repeated or prolonged inhalation. Special attention also has to be given during handling and storage of the gas due to its extreme flammability as well as the possibilty of explosion of containers filled with chloromethane, if exposed to heat. It is recommended that workers obtain specific instructions before handling this substance.

2 Chemical Identity

Name:	**chloromethane**
CAS number:	**74-87-3**
EINECS number:	**200-817-4**
Molecular formula:	**CH_3Cl**

3 Uses and Applications

Chloromethane is primarily used in industrial processes as chemical intermediate for the manufacture of other substances, of bulk and large scale chemicals, including petroleum products, and manufacture of fine chemicals as well as rubber products. Further application of chloromethane includes the use as laboratory reagent. As examples its use as chemical intermediate in the production of silicon polymers, butyl rubbers and in petroleum refining processes can be mentioned. Chloromethane is also employed as a methylating and chlorinating agent in organic chemistry. It is also used e.g. as an extractant for greases, oils and resins, as propellant and blowing agent in polystyrene foam production, as an intermediate in drug manufacturing, as a catalyst carrier in low-temperature polymerisation and as a fluid for thermometric and thermostatic equipment. Due to its toxicity and flammability its former wide spread use as refrigerant has been discontinued. It is highly unlikely that consumers are exposed to this substance in any way, whereas workers (industry, laboratory) should follow the safety measures recommended in the extended Safety Data Sheet (eSDS).

4 Physical / Chemical Properties

Chloromethane is an organic, colourless gas with a minorly sweet odour. Vapours of this substance are extremely flammable, so that it is crucial to remove all sources of ignition during handling and storage and to take precautionary measures against static discharges. Vapours can build explosive / highly flammable mixtures with air, so adequate ventilation and suction should be provided.

Appearance

State of matter:	gaseous
Colour:	colourless
Odour:	ethereal odour
Odour treshold:	no data available
Molecular weight:	50.4875 g/mol

Safety relevant basis data

Parameter	Value	Unit	Remark
Density:	0.0021	g/cm^3	20℃, 1013 hPa
pH:			no data available
Melting point / range:	-97,7	℃	
Boiling temperature / range:	-23,76	℃	1013 hPa
Flammability:			extremely flammable
Flash point:			not applicable
Explosion hazard:			not applicable
Lower explosion limit:	7,1	Vol.-%	
Upper explosion limit:	18,5	Vol.-%	
Ignition temperature:	632	℃	
Oxidising properties:			not applicable
Vapour pressure:	4100	hPa	at 20 ℃
Solubility in water:	5.32	g/l	at 25℃
log $P_{O/W}$ (n-octanol / water):	0.91		
Viscosity:			not applicable
Surface tension:	16.2	mN/m	at 20℃

5 Health Effects

5.1 Consumer

Consumer exposure is extremely unlikely as the substance is manufactured and handled in industrial and professional settings. However, possible exposure might result from its former wide spread use as refrigerant.

5.2 Worker

Workers will typically not come into contact with the substance as it is manufactured in closed systems in industrial and professional settings. In case of unintended exposure during synthesis, formulation, transfer or other procedures, workers should follow the recommended safety measures in the extended Safety Data Sheet (eSDS). The following table gives an overview on the health effects:

Effect Assessment	Result
Acute Toxicity oral / inhalation / dermal	Since chloromethane is a gas, oral and dermal exposure are unlikely. Inhalation is the significant route of exposure. Inhalation studies revealed that chloromethane is of acute inhalative toxicity, whereas the most common consequences of single exposure have been functional changes in the central nervous system. However, these changes are assumed to be reversible after a certain recovery period.
Irritation / corrosion skin / eye / respiratory tract	Chloromethane is considered as not irritating to the respiratory tract based on inhalative toxicity tests in rats. Standard studies for skin and eye irritation are not applicable as chloromethane is a gas.
Sensitisation	Standard sensitation testing is not feasible for chloromethane since it is a gas.
Toxicity after repeated exposure oral / inhalation / dermal	Due to its gaseous state, repeated dose studies for oral and dermal toxicity have not been conducted. Inhalation is the significant route of exposure. Subacute, subchronic and chronic chloromethane inhalation exposure studies revealed that the urogenital tract, the central nervous system and the liver are the most affected organs, whereas differences could be observed among testing animals in regard to species and gender. (STOT RE 2; H373: May cause damage to organs through prolonged or repeated exposure.)
Genotoxicity / mutagenicity	In regard to mutagenicity, conducted in vitro tests with chloromethane were positive, whereas in vivo tests were negative, leading to an overall classification as not genotoxic.
Carcinogenicity	Regarding carcinogenicity, the liver, kidney and the nervous system could be identified as target organs in conducted long term studies with chloromethane, leading to tumours, adenoma and cysts in testing animals. (Carc. 2; H351: Suspected of causing cancer.)
Toxicity for reproduction	Based on available data developmental and reproductive toxicity were revealed for testing animals. This includes reduced fertility to incomplete fertility, hazardous effects on fetuses and pregnant species. Chloromethane is not officially classified, but special attention has to be given to the substance since it is suspected of damaging fertility and/or the unborn child.

6 Environmental Effects

Based on available data for chloromethane, this substance is not considered as harmful to aquatic organisms, such as fish and invertebrates, and aquatic plants, neither on a short term or long term basis, due to its tendency to evaporate from water bodies. Chloromethane is gaseous and the primary environmental compartment which is affected is air. Plants show slightly toxic

effect with chloromethane far in excess of natural occuring concentrations. However, chloromethane is mainly released to the environment by natural processes. Releases due to anthropogenic sources, as industrial processes, are negligible. It does not bioaccumulate, is readily biodegradable and will not persist in the environment.

Effect Assessment	Result
Aquatic Toxicity	Based on available data chloromethane is not considered as harmful to fish, aquatic invertebrates and aquatic algae on a short term basis. Also long term effects on above mentioned species are not expected. It is not hazardous to aquatic microorganisms.
Terrestrial Toxicity	Since exposure to soil and sediment is unlikely due to the substances´ solubilty and volatility, hazardous effects are not expected. However, plants show a slightly toxic effect of chloromethane when exposed far in excess of natural occurring concentrations.

Fate and behaviour	Result
Biodegradation	Chloromethane can be regarded as readily biodegradable. (calculated half-life in water < 15 days, in soil ~ 30 days)
Bioaccumulation potential	No potential for bioaccumulation. (log K_{OW}: 0.91).
PBT / vPvB conclusion	This substance is not a PBT or vPvB substance.

7 Exposure

7.1 Human health

The only possible route of exposure to consumers may result from its former wide spread use as refrigerant. However, this exposure is extremely unlikely due to legal restrictions long time ago. Other routes of consumer exposure do not exist since manufacture and handling takes place in industrial and professional settings only. Exposure to chloromethane of personnel in manufacturing facilities is also considered as low because the process, storage and handling operations are strictly controlled. Workers who might accidentally come into contact with the gaseous product should follow the safety measures recommended in the Extended Safety Data Sheet (eSDS), as the gas is absolutely hazardous to human health upon repeated inhalation.

7.2 Environment

The manufacture of the substance and on-site uses are proceeded under strictly controlled conditions with minimal emissions. The estimation of the share of industrial releases compared with global natural releases is not of significance. The contribution of natural sources has been estimated to account to more than 90% of the total releases, whereas the anthropogenic entrance amounts to 10% or less.

8 Risk Management Recommendations

When using chloromethane make sure that there is adequate ventilation and suction at critical points to ensure that occupational exposure limit values are not exceeded. (Limit value: 100 mg/m^3 (50 ppm) in DE, AT and CH). Do not breath vapours and avoid contact with eyes and skin by using appropriate respiratory protection (in case of low concentrations or short term exposure respirator with gas filter for organic vapours with boiling point < 65°C, e.g. EN 14387, type AX; in

case of long or strong exposure use a self-contained breathing apparatus), eye protection, such as chemical goggles with side shields (e.g. EN 166), appropriate chemical resistant gloves, e.g. for long-term use (> 480 minutes) gloves made of nitrile rubber, and body protection. Do not eat, drink or smoke where chemicals are handled, processed or stored. Wash hands thoroughly after handling. Do not release into the aquatic environment or soil. Keep chloromethane away from all kinds of ignition sources.

9 First Aid Measures

Guide people to safety. First aid assistants should pay attention to self-protection. In case of contact with the skin, immediately flush affected area with large amounts of water and soap. Take off immediately all contaminated clothing. After inhalation of the substance, move to fresh air, keep the affected person warm and at rest. In case of respiratory arrest, provide artificial respiration. In case of ingestion, rinse mouth immediately and drink large quantities of water (200-300 mL). After contact with the substance via skin, ingestion and/or inhalation, a medicine should be consulted, if problems persist. In case of contact with eyes, immediately flush eyes with large amounts of water for 10-15 minutes while holding eyelids open and consult an ophthalmologist.

10 Fire Fighting Measures

In case of fire use water fog / spray, exstinguishing powder, alcohol resistant foam or carbon dioxide (CO_2) as exstinguishing media. Do not use a high power water jet. Hazardous decomposition products in case of incomplete combustion contain chlorinated hydrocarbons and carbon oxides, such as carbonmonoxide (CO) and carbondioxide (CO_2). It is absolutely required to wear a self-contained breathing apparatus. If it can be done without risk, guide personal to safety and keep unprotected people away. Collect contaminated fire extinguishing water separately and dispose of according to official state regulations. Do not allow entering soil, drains or surface water.

11 Accidental Release Measures

When handling the substance, personal protection equipment must be worn. Avoid contact with skin, eye and clothing. Do not breathe gas/fumes/vapour/spray. Keep unprotected people away and remove all ignition sources since chloromethane is extremely flammable. Do not empty into drains or the aquatic environment. Collect contaminated water separately. Ensure that gas/fumes/vapour/spray are extracted by suction. Provide adequate ventilation. In case of large spills prevent spreading, e.g. by damming, and cover with alcohol resistant foam followed by removal into appropriate containers by skimming. In case of small spills absorb with appropriate liquid-binding material (e.g. sand, diatomaceous earth, acid- or universal binding agents). Dispose of according to official state regulations.

12 Disposal Considerations

It is required to carry out burning of chloromethane as harzardous waste according to official regulations. Local regulations must be observed. Collect contaminated fire extinguishing water separately. Retain contaminated washing water and dispose of according to national, federal

and local regulations. Dumping into the environment must be prevented. Contaminated packaging material must be completely emptied and has to be handled in the same way as the substance itself. Non-contaminated packing can be recycled, reused or disposed of.

13 Handling and Storage

If handling the substance, keep away from ignition sources, e.g. heat, sparks, open flames, hot surfaces, and do not smoke. Chloromethane is extremely flammable. Take precautionary measures against static discharges when filling from one container into another by grounding of metal containers, apparatus, pumps and suction equipment in order to discharge static accumulation to the ground and to prevent formation of sparks. Provide for sufficient ventilation and punctiform suction at critical points. Vapours in closed rooms as well as in emptied, but contaminated containers may form explosive mixtures with air, which can lead to explosions in presence of ignition sources.
Store only in the original container in a cool, well-ventilated place. Keep the packing dry and well sealed to prevent contamination and absorbtion of dampness. Do not store together with oxidising and self-igniting substances as well as with highly flammable substances. The maximum storage temperature should not exceed 45°C. The storage class according to VCI (Verband der Chemischen Industrie, Germany) is 2A (gases).

14 State Agency Review

Chloromethane has been registered under REACH. This substance is listed and is in compliance with the requirements of the TSCA Chemical Substance Inventory, the Canadian Domestic Substances List (DSL), IECSC (China), PICCS (Philippines), AICS (Australia), ENCS (Japan), ECL (Korea) and EINECS (Europe).

15 Classification and Labelling

The substance is classified under the EU Classification Labelling and Packaging (CLP) Regulation EC/1272/2008 as follows:

Hazard Class and Category	H-Phrase	Hazard pictograms	Wording
Flammable gas 1	H220		Extremely flammable gas.
Gases under pressure	H280		Contains gas under pressure; may explode if heated.
Carcinogenicity 2	H351		Suspected of causing cancer.
Specific target organ toxicity after repeated exposure 2	H373		May cause damage to organs through prolonged or repeated exposure.

16 Conclusion

Chloromethane is a well characterised substance. The substance is not considered as hazardous to the environment, since it is a naturally ocurring gas. In regard to hazardous health effects to humans as well as its physico-chemical properties (extremely high flammability), workers must obtain specific instructions before handling this substance (personal protection equipment, handling and storage conditions). Chloromethane is suspected to cause cancer and further to cause damage to organs, such as the central nervous system, upon repeated or prolonged inhalation. Dermal and oral studies are not available due to the substances´ gaseous state of matter. Consumers are unlikely to get in contact with this substance, since use of this substance takes place in industrial and professional settings only. Workers should follow the safety measures recommended in the Extended Safety Data Sheet (eSDS).

17 Contact Information within Company

For further information on this substance or product safety summaries in general, please contact: Dr. Christian Eppelsheim at wlcp-reach@wacker.com or visit our website at www.wacker.com.

18 Date of Issue

05/03/2012

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GPS SAFETY SUMMARY
CYCLOHEPTAPENTYLOSE

This Product Safety Summary is intended to provide a general overview of the chemical substance in the context of ICCA Global Product Strategy. The information on the Summary is basic information and is not intended to provide emergency response information, medical information or treatment information. The summary should not be used to provide in-depth safety and health information. In-depth safety and health information can be found on the (extended) Safety Data Sheet for the chemical substance.

1 General Statement

Cycloheptapentylose is an organic white, odourless powder made out of starch by an enzymatic process. It is isolated by complexing with an organic solvent and purified in a subsequent step. The most common technical functions of the substance cover the use as a complexing agent, as intermediates for further processing, as a pharmaceutical substance, as a process regulator or aid and as stabilizer. Cycloheptapentylose can be found in consumer articles, such as cosmetics, personal care products, perfumes, fragrances or cleaning agents.
The substance is not classified as hazardous to human health; neither acute nor chronic toxic effects were identified. In the course of the assessment no carcinogenic or genotoxic effects have been observed. The substance has no irritating, corrosive or sensitising effects. In regard to the aquatic environment, cycloheptapentylose is considered as not hazardous. Workers should pay special attention during handling and storage due to the possibility to induce dust explosions.

2 Chemical Identity

Name:	Cycloheptapentylose
CAS number:	7585-39-9
EINECS number:	231-493-2
Molecular formula:	$C_{42}H_{70}O_{35}$

3 Uses and Applications

Cycloheptapentylose is primarily used in industrial processes as an intermediate for the manufacture of fine chemicals. Additionally, the substance is used in the textile manufacturing process, in which textiles, leather or fur undergo a dipping or pouring treatment. For the manufacture of paper articles the substance is used for mixing or blending in batch processes. During the manufacture of basic pharmaceutical products or fine chemicals cycloheptapentylose is used as a process aid in order to regulate the pH level, to flocculate or precipitate the desired product. Further applications include the use as additive in paints, as laboratory chemical or as a cleaning agent. Cycloheptapentylose can also be found in consumer articles, such as cosmetics, personal care products, perfumes, fragrances or cleaning agents.

4 Physical / Chemical Properties

Cycloheptapentylose is a white, odourless powder. The substance exhibits no specific hazardous physico-chemical properties. Appropriate measures should be taken to prevent dust explosions, e.g. take precautionary measures against electrostatic charging. Furthermore, oxidizing agents should be kept away from the substance.

Appearance

State of matter:	solid
Colour:	white
Odour:	odourless
Odour threshold:	not applicable
Molecular weight:	1134.9842 g/mol

Safety relevant basis data

Parameter	Value	Unit	Remark
Density:	1.44	g/cm^3	at 20°C
pH:	5 – 8		10 g/l H_2O
Melting point / range:			not applicable; substance decomposes at ~ 290°C
Boiling temperature / range:			not applicable; substance decomposes upon heating
Flash point:			not applicable
Explosion hazard:			not explosive
Lower explosion limit:			not determined
Upper explosion limit:			not determined
Ignition temperature:			not applicable
Decomposition temperature:	290	°C	
Vapour pressure:			not applicable
Solubility in water:	14.3	g/l	at 20°C
log $P_{O/W}$ (n-octanol / water):	-9.06		
Viscosity (dynamic):			not applicable

5 Health Effects

5.1 Consumer

Due to the widespread use of cycloheptapentylose, consumers are likely to get in contact with the substance via various consumer products, such as cosmetics, personal care products, perfumes, fragrances or cleaning agents. No hazardous health effects for consumers using indicated products are expected.

5.2 Worker

Workers can be exposed to the substance, since the production process and the industrial use involve steps which are not carried out in closed systems. Nevertheless, precautionary measures have been implemented in order to minimize the risk during daily handling. The following table gives an overview on the health effects:

Effect Assessment	Result
Acute Toxicity oral / inhalation / dermal	The substance is harmlessness after oral, dermal or inhalative administration.
Irritation / corrosion skin / eye / respiratory tract	The substance showed no adverse effects on skin and only slightly irritating effects on the eye. Data is lacking for irritating effects on the respiratory tract.
Sensitisation	After dermal application the substance did not exhibit any signs of allergic skin reactions. No data is available for potential sensitising effects on the respiratory tract.
Toxicity after repeated exposure oral / inhalation / dermal	Repeated exposure via oral application showed that cycloheptapentylose is slightly toxic with the target organs being kidneys and liver. Nevertheless, the detected effects were not sufficient for a classification. Data is lacking for repeated inhalative and dermal exposure.
Genotoxicity / mutagenicity	No genotoxic and no mutagenic properties have been observed.
Carcinogenicity	The substance did not show any signs of carcinogenic activity.
Toxicity for reproduction	Medium to high dosages led to slight effects on body weight gain of the offspring of testing animals. Also minor developmental effects have been observed for high dosages. However, results are not sufficient for classification.

6 Environmental Effects

Cycloheptapentylose has a low toxicological profile in regard to environmental effects. The substance is readily biodegradable and does neither bioaccumulate nor persist.

Effect Assessment	Result
Aquatic Toxicity	Testings on fish, aquatic invertebrates, aquatic algae and aquatic microorganisms revealed no adverse effects.
Terrestrial Toxicity	No data available.

Fate and behaviour	Result
Biodegradation	Cycloheptapentylose is readily biodegradable (75% in 28 days).
Bioaccumulation potential	No potential for bioaccumulation (log K_{OW}: -9.06).
PBT / vPvB conclusion	This substance is neither a PBT nor a vPvB substance.

7 Exposure

7.1 Human health

Consumers can come in contact with cycloheptapentylose as it can be found in various consumer articles, such as cosmetics, personal care products, perfumes, fragrances or cleaning agents. During daily handling workers might be exposed to the substance via dermal contact and/or inhalation. Appropriate risk management measures have been established in order to guarantee the safe use of the substance and to minimize exposure of workers.

7.2 Environment

The manufacture of the substance and on-site uses are not proceeded under strictly controlled conditions, but appropriate measures have been commonly established to guarantee that the substance does not reach the environment.

8 Risk Management Recommendations

When using cycloheptapentylose, standard industrial hygiene practices for the handling of chemical substances should be observed. Do not eat or drink while handling the substance. Avoid generation and inhalation of dust as well as contact with eyes and skin. When using the substance, adequate ventilation and suction at critical points should be implemented to ensure that occupational exposure limit values are not exceeded. The use of personal protection, such as antistatic protective gloves, chemical safety goggles and a fine dust mask, is recommended.

9 First Aid Measures

In case of inhalation, provide fresh air and get medical attention if symptoms such as breathing difficulties occur. After skin contact, wash affected area with plenty of water or with water and soap. If skin changes or other complaints are observed, seek medical advice. In case of contact with eyes, immediately flush eyes with plenty of water and seek medical advice if a continuous irritation occurs. If accidentally swallowed, give several small portions of water to drink and do not induce vomiting. A physician should be contacted in any case of irritation and if problems persist.

10 Fire Fighting Measures

In case of large fires, use water spray, extinguishing powder or alcohol-resistant foam. For small fires carbon dioxide (CO_2) can be used. If it can be done without risk, cool endangered product containers by using water fog, guide personal to safety and keep unprotected people away. Hazardous decomposition products in case of incomplete combustion contain carbon dioxide, carbon monoxide and incompletely burnt hydrocarbons. It is absolutely required to wear a self-contained breathing apparatus.

11 Accidental Release Measures

When handling the substance, personal protection equipment must be worn. Avoid formation and inhalation of dust. Keep unprotected people away and remove all ignition sources. Take precautionary measures against static discharges. Cover any spilled material in accordance with regulations to prevent dispersal by wind. Spilled substances should be taken up mechanically and disposed of according to local state regulations. After cleaning the contaminated area with water, the cleansing water should be disposed off in accordance to local state regulations. Do not empty into drains or the aquatic environment.

12 Disposal Considerations

It is recommended to carry out burning of cycloheptapentylose as hazardous waste according to official regulations. Local regulations must be observed. Collect contaminated fire extinguishing water separately. Retain contaminated washing water and dispose of according to national, federal and local regulations. Dumping into the environment must be prevented. Contaminated packaging material must be completely emptied and can be re-used or recycled following appropriate cleaning. Handle contaminated packaging in the same way as the substance itself. Packaging material which cannot be properly cleaned must be thrown away.

13 Handling and Storage

In order to prevent dust explosion keep away from ignition sources, e.g. heat, sparks, open flames. Take precautionary measures against static discharges when handling the container by grounding of metal containers, apparatus, pumps and suction equipment in order to discharge static accumulation to the ground and to prevent formation of sparks. Store only in the original container and keep container tightly closed. Keep the substance away from oxidizing agents.

14 State Agency Review

Cycloheptapentylose has been registered under REACH. For this product chemical safety assessments according to national regulations have been carried out.
National regulations, under which the substance is listed, are: U.S. Toxic Substances Control Act (TSCA), U.S. Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), U.S. Superfund Amendments and Reauthorization Act (SARA), U.S. Hazardous Air Pollutants (HAPS), California Proposition 65 on Carcinogens and Reproductive Toxins, Massachusetts Substance List, New Jersey Right-to-Know Hazardous Substance List, Pennsylvania Right-to-Know Hazardous Substance List.
Furthermore, the substance has been assessed according to following international inventories: European Inventory of Existing Commercial Chemical Substances (EINECS), Australian Inventory of Chemical Substances (AICS), Inventory of Existing Chemical Substances in China (IECSC), Philippine Inventory of Chemicals and Chemical Substances (PICCS), Korean Existing Chemicals List (ECL), Canadian Domestic Substances List (DSL).

15 Classification and Labelling

Based on available data cycloheptapentylose is not hazardous to human health or the environment. There are no classification and labelling obligations for this substance according to the EU Classification Labelling and Packaging (CLP) Regulation (EC) 1272/2008.

16 Conclusion

Cycloheptapentylose is a well characterised substance and is not classified as hazardous to human health and the environment. Due to its harmlessness, cycloheptapentylose can be found in various applications, such as pharmaceuticals, cosmetics, personal care products, perfumes, fragrances or cleaning agents.

17 Contact Information within Company

For further information on this substance or product safety summaries in general, please contact: Dr. Christian Eppelsheim at wlcp-reach@wacker.com or visit our website at www.wacker.com.

18 Date of Issue

30/03/2012

WACKER

GPS SAFETY SUMMARY
DICHLORO(METHYL)(VINYL)SILANE

This Product Safety Summary is intended to provide a general overview of the chemical substance in the context of ICCA Global Product Strategy. The information on the Summary is basic information and is not intended to provide emergency response information, medical information or treatment information. The summary should not be used to provide in-depth safety and health information. In-depth safety and health information can be found on the (extended) Safety Data Sheet for the chemical substance.

1 General Statement

Dichloro(methyl)(vinyl)silane is a highly flammable and corrosive organic liquid with a pungent odour similar to hydrochloric acid. Dichloro(methyl)(vinyl)silane is not directly accessible via direct synthesis. It is commercially prepared by the so called hydrosilylation process reacting acetylene with dichloro(methyl)silane in the presence of a catalyst, whereas the whole production process is performed under moisture free conditions. Where the process and end applications require removal of other silane or organic by-products and/or to increase the purity of dichloro(methyl)(vinyl)silane, subsequent steps as filtration and distillation are performed, again under moisture-free conditions.
Dichloro(methyl)(vinyl)silane is primarily used as intermediate for the production of other silicon based substances, such as alkoxysilanes, as monomer in the production of silicone polymers and as laboratory reagent in research and development activities. The substance is very corrosive and can cause severe damages to skin, eyes and other human tissue due to the generation of hydrochloric acid upon contact with water or moisture. Further, it is of acute toxicity upon ingestion and inhalation. In regard to hazardous effects on the environment, dichloro(methyl)(vinyl)silane is considered of low toxicity to aquatic organisms, since the substance hydrolyses rapidly upon contact with water to silanol- or siloxanol-compounds and hydrochloric acid. Exposure to consumers is absolutely unlikely since it is handled under strict conditions in industrial and professional settings only. It is absolutely required that workers and professional users obtain specific instructions before handling this substance.

2 Chemical Identity

Name:	dichloro(methyl)(vinyl)silane
CAS number:	124-70-9
EINECS number:	204-710-3
Molecular formula:	$C_3H_6Cl_2Si$

3 Uses and Applications

Dichloro(methyl)(vinyl)silane is mainly applied as chemical intermediate in industrial processes for the production of other organosilicon substances, as monomer in the production of silicone polymers and as laboratory reagent. The major use (95% globally) of organochlorosilanes is in the manufacture of silicone polymers. When used as intermediate in industrial processes, dichloro(methyl)(vinyl)silane is applied during synthesis of other organofunctional silanes. These substances are then used for the manufacture of silicones, either as monomers or as cross-linking agents. Organochlorosilanes are also used as reagents in both industrial and academic

laboratories. Alternatively, organochlorosilanes play also a facilitating role, e.g. use as a "blocking agent" in organic synthesis or as a surface modifying agent. In end products available on the market no unreacted residues of dichloro(methyl)(vinyl)silane are present; therefore, consumer exposure will not occur. Workers (industry, laboratory) should follow the safety measures recommended in the Safety Data Sheet.

4 Physical / Chemical Properties

Dichloro(methyl)(vinyl)silane is an organic colourless liquid with a pungent odour similar to hydrochloric acid. Liquid and vapours are highly flammable, so it is crucial to remove all ignition sources and to take precautionary measures against electrostatic charging during handling and storage. Flammable vapours may accumulate and form explosive mixtures with air. Violent reactions under generation of heat and hydrogen chloride are possible with various chemicals, such as proton-active substances, e.g. acids, basic substances, alcohols and ketones/aldehydes and water. Contact with such materials should be avoided; the hydrolysis of dichloro(methyl)(vinyl)silane leads to rapid and violent decomposition into silanol- or siloxanol-compounds and hydrochloric acid, which is extremely corrosive.

Appearance

State of matter:	liquid
Colour:	colourless
Odour:	pungent, similar to hydrochloric acid
Odour threshold:	no data available
Molecular weight:	141.1 g/mol

Safety relevant basis data

Parameter	Value	Unit	Remark
Density:	1.09	g/cm^3	at 25 °C
pH:			not applicable; displays extremely acidic reaction with water
Melting point / range:	> -78		
Boiling temperature / range:	93	°C	at 1013 hPa
Flash point:	9	°C	
Explosion hazard:			no data available
Lower explosion limit:	1.5	Vol-%	
Upper explosion limit:	42	Vol-%	
Ignition temperature:	320	°C	
Vapour pressure:	51 210	hPa hPa	at 20 ° at 50 °C
Solubility in water:			virtually insoluble; hydrolytic decomposition occurs
log $P_{O/W}$ (n-octanol / water):			not applicable
Viscosity (dynamic):	0.55	mPa.s	at 25 °C

5 Health Effects

5.1 Consumer

Consumer exposure is absolutely unlikely since the substance is handled under strictly controlled conditions in industrial and professional settings only.

5.2 Worker

Workers will typically not come into contact with the substance as it is manufactured in closed systems under protective atmosphere. In case of unintended exposure during synthesis, formulation, transfer or other procedures, workers should follow the recommended safety measures in the Data Sheet. The following table gives an overview on the health effects:

Effect Assessment	Result
Acute Toxicity oral / inhalation / dermal	Based on the corrosiveness, dichloro(methyl)(vinyl)silane is classified as substance of acute toxicity via ingestion and inhalation; Studies on skin were not required since the substance meets the criteria for classification as corrosive to skin. (Acute Tox. 4; H302: Harmful if swallowed.; Acute Tox. 3; H331: Toxic if inhaled.)
Irritation / corrosion skin / eye / respiratory tract	Dichloro(methyl)(vinyl)silane is meets the criteria for classification as corrosive to skin and eyes and based on studies it is expected to be corrosive to the respiratory tract as well. (Skin Corr. 1A; H314: Causes severe skin burns and eye damage.)
Sensitisation	There are no data to suggest that dichloro(methyl)(vinyl)silane should be classified for skin or respiratory sensitisation.
Toxicity after repeated exposure oral / inhalation / dermal	Based on a study conducted with a related substance trimethoxy(vinyl)silane, indications exist that urinary bladder is a potential target organ following oral exposure. However, at the dose levels tested, corrosive effects of dichloro(methyl)(vinyl)silane would outweigh any potential systemic effects. Therefore, the substance is not considered as appropriate to be classified for repeated dose toxicity.
Genotoxicity / mutagenicity	Based on tests it is concluded that for dichloro(methyl)(vinyl)silane classification for genotoxicity / mutagenicity is not required.
Carcinogenicity	There is no evidence that the substance should be classified for carcinogenicity.
Toxicity for reproduction	The available data on the structural analogue trimethoxyvinylsilane do not suggest that dichloro(methyl)(vinyl)silane should be classified for effects on reproduction or development

6 Environmental Effects

Due to the hydrolysis characteristics of dichloro(methyl)(vinyl)silane the ecotoxicological assessment has been based on its hydrolysis products. No harmful effects are expected for aquatic organisms after neutralisation or if the buffer capacity of the sewage treatment plant or the water compartment is not exceeded. Dichloro(methyl)(vinyl)silane does not bioaccumulate and will not persist in the environment. No environmental problems are expected if the substance is handled and treated in accordance with standard industrial practices and local regulations, where applicable.

Effect Assessment	Result
Aquatic Toxicity	On the basis of data available for the hydrolysis products silanol- and/or siloxanol-compounds and hydrochloric acid, no harmful effects are expected for aquatic organisms. However, large

	amounts should not be introduced into purification plants before a neutralisation step has been carried out.
Terrestrial Toxicity	Tests regarding toxicity to sediment organisms are considered as not necessary due to the rapid hydrolysis of the substance. No chronic toxicity data for sediment and the terrestrial compartment is available.

Fate and behaviour	Result
Biodegradation	Dichloro(methyl)(vinyl)silane is not readily biodegradable (0% in 28 days), but hydrolyses rapidly upon contact with water.
Bioaccumulation potential	Bioaccumulation is not expected to occur.
PBT / vPvB conclusion	This substance is not a PBT or vPvB substance.

7 Exposure

7.1 Human health

Consumers will typically not come into contact with dichloro(methyl)(vinyl)silane as it is manufactured in industrial and professional settings in closed processes only. Exposure to dichloro(methyl)(vinyl)silane of personnel in manufacturing facilities is also considered as low because the process, storage and handling operations are generally carried out under strictly controlled conditions. Workers who might accidentally come into contact with the substance should follow the safety measures recommended in the Safety Data Sheet.

7.2 Environment

Exposure of the environment to dichloro(methyl)(vinyl)silane is very low but can generally take place by releases to air and waste water resulting from distillation, from tank loading and cleaning operations, from storage tanks and minor spillages during routine activities. Based on the rapid hydrolysis of the substance upon contact with moisture/water as well as commonly applied industrial risk management measures releases to the environment are considered as very low having no adverse effects on aquatic or terrestrial organisms.

8 Risk Management Recommendations

When using dichloro(methyl)(vinyl)silane it must be ensured that there is adequate ventilation and suction at critical points in order to not exceed occupational exposure limit values. Observe standard hygiene measures, i.e. do not eat, drink or smoke at the workplace and wash hands at the end of work and before eating. Do not breath gases, vapours or aerosols and avoid any contact with eyes and skin by using appropriate respiratory protection (gas mask with ABEK filter; in case of long or strong exposure a positive pressure self contained breathing apparatus), eye protection, such as tight fitting protective goggles or when risk of splashing exists a protective face shield, appropriate chemical resistant gloves, e.g. made of fluorinated rubber, and appropriate body protection, such as an acid-proof protective clothing and neck protection, when necessary. Provide work station with eye bathing equipment and do not wear contact lenses. Only wear gloves for short periods (<10 minutes) and replace them immediately in case there are any signs of decay or chemical permeability. Do not release the substance into the aquatic environment or soil. Observe existing regulations for protection against explosion.

8.1.1 First Aid Measures

First aid assistants should pay attention to self-protection. Always seek medical advice in the event of contact with this substance. In case of inhalation take affected person to a safe place, keep warm and at rest. If unconscious, place in a stable sideways position and protect against loss of body heat. If breathing stops, administer artificial respiration. Upon contact with skin remove contaminated or soaked clothing at once and rinse the affected area with plenty of soap and water for minimum 15 minutes. In serious cases, use emergency shower immediately and consult a physician. In case of contact with eyes, rinse immediately with plenty of water for minimum 15 minutes. Keep eyelids well opened to rinse the whole eye surface and eyelids with water. Seek medical advice and continue to bathe eyes during the transport. In case the substance is accidentally swallowed, give several small portions of water to drink, if the person is conscious, and do not induce vomiting. Physicians should treat the victim as early as possible with cortisone spray in case of inhalation. Medical checks are necessary up to a latency period of at least 24 hours. In the event of first degree burns use corticoid-externa. In the case of second degree burns, treat the affected area symptomatically. Take into account that in case of swallowing a risk of intra-abdominal gas development as well as risk of perforation of the stomach exists.

9 Fire Fighting Measures

In case of fire it is recommended to use carbon dioxide (CO_2), dry sand or alcohol-resistant foam. It should be considered that application of foam will release significant amounts of flammable and corrosive vapours at the beginning, which could be trapped under the foam blanket. Do not use water, extinguishing powder or halones. If it can be done without risk, cool endangered product containers, guide personal to safety and keep unprotected people away. Keep upwind since hazardous combustion products includes corrosive hydrogen chloride among other toxic pyrolysis products. It is absolutely required to wear a self-contained breathing apparatus and a tight fitting chemical protection suit.

10 Accidental Release Measures

Personal protection equipment must be worn. In case of spills, eliminate all sources of ignition and indicate that there is a risk of slippery. Avoid any contact with the substance, e.g. do not walk through spilled material, as well as inhalation of mists, gases and vapours. Keep unprotected people away and ensure adequate ventilation. Task forces have to wear a tightly fitting chemical protection suit. Regarding methods for cleaning do not flush spills away with water. Absorb small leaks immediately with an appropriate, liquid-binding material (mainly acid-binding material) and place in appropriate containers for disposal according to official and local state regulations. In case of large amounts cover large spills with nearly waterless foam and take up in container. Condense gases/vapours/mists using a directed spray of water, let remaining vapours evaporate and provide adequate ventilation. Clean area with plenty of water. Contaminated water and extinguishing water should be disposed of in prescribed marked containers. Prevent material from entering surface waters, drains or sewers and soil.

11 Disposal Considerations

It is recommended to incinerate dichloro(methyl)(vinyl)silane as hazardous waste in a special waste incinerator, but ensure that a special chemical / physical treatment is applied. Discuss with the supplier in case of uncertainties and observe local, federal and national regulations. Collect contaminated fire extinguishing water separately. Retain contaminated washing water and dispose of in accordance with national, federal and local regulations. Dumping into the environment must be prevented. Contaminated packaging material should be completely emptied and can be re-used or recycled after appropriate cleaning. Handle uncleaned packaging in the same way as the substance itself.

12 Handling and Storage

Avoid formation and inhalation of gases, vapours or aerosols. Use special protective equipment and ensure adequate ventilation during handling and storage. Product must be siphoned off in situ. Keep away from incompatible substances, i.e. proton-active substances, such as basic substances, acids, alcohols and ketones / aldehydes and water, since the silane reacts violently with them under formation of hydrogen chloride and heat. Further, it should be taken into account that the substance reacts strongly with oxidising agents. Spills must be immediately eliminated since it poses an increased risk of slipping. Further, keep away from ignition sources, e.g. heat, sparks, open flames, hot surfaces, and do not smoke. Flammable vapours may accumulate and form explosive mixtures with air in containers, process vessels, including partial, empty and uncleaned containers and vessels, or other enclosed spaces. Vapours are heavier than air; therefore inflammable gas mixtures may form mainly near floor. Take precautionary measures against electrostatic charging. In regard to storage, dichloro(methyl)(vinyl)silane should be stored under protective gas in order to avoid any contact with moisture. The packaging should be kept dry and well sealed to prevent any contamination and absorption of dampness. Store the product only in its original container and keep the container tightly closed in a cool, well ventilated place.

13 State Agency Review

Dichloro(methyl)(vinyl)silane has been registered under REACH. Chemical safety assessments have been carried out according to several regulations.
National regulations listing dichloro(methyl)(vinyl)silane are: European Inventory of Existing Commercial Chemical Substances (EINECS), Australian Inventory of Chemical Substances (AICS), Japanese Existing Notified Chemical Substances (ENCS), Philippine Inventory of Chemicals and Chemical Substances (PICCS), U.S. Toxic Substances Control Act (TSCA), Inventory of Existing Chemical Substances in China (IECSC), Canadian Domestic Substances List (DSL).

14 Classification and Labelling

The substance is classified under the EU Classification Labelling and Packaging (CLP) Regulation EC/1272/2008 as follows:

Hazard Class and Category	H-Phrase	Hazard pictograms	Wording
Flammable liquid, 2	H225		Highly flammable liquid and vapour.

Acute toxicity, 4 (oral)	H302	-	Harmful if swallowed.
Acute toxicity, 3 (inhalation)	H331		Toxic if inhaled.
Skin corrosion / irritation, 1A (Serious eye damage / eye irritation, 1)	H314		Causes severe skin burns and eye damage.

15 Conclusion

Dichloro(methyl)(vinyl)silane is a well characterised substance, which is processed in industrial and professional settings only under strictly performed conditions, due to its strong corrosive property, its high flammability as well as its sensitivity to water / moisture leading to rapid hydrolysis upon contact. Consumers will not be exposed to this substance under any circumstances. However, workers must follow existing risk management measures since dichloro(methyl)(vinyl)silane. In regard to hazardous effects on the environment it can be concluded that the substance does not bear a risk to aquatic organisms since it rapidly hydrolyses to silanoles and hydrochloric acid upon contact with water.

16 Contact Information within Company

For further information on this substance or product safety summaries in general, please contact: Dr. Christian Eppelsheim at wlcp-reach@wacker.com or visit our website at www.wacker.com.

17 Date of Issue

23/03/2012

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GPS SAFETY SUMMARY
HYDROGEN CHLORIDE

This Product Safety Summary is intended to provide a general overview of the chemical substance in the context of ICCA Global Product Strategy. The information in the Summary is basic information and is not intended to provide emergency response, medical or treatment information. In-depth safety and health information can be found in the (extended) Safety Data Sheet (e)SDS for the chemical substance.

1 General Statement

Hydrogen chloride is a colourless, non-flammable but toxic and corrosive gas. It is most commonly found as solution in water known as hydrochloric acid, which is highly acidic (it lowers the pH of water it is released into) which is also corrosive. The typical concentrated aqueous solution is in the range of 30 % HCl by weight, but higher and lower concentrations are also available.
It is primarily manufactured from the reaction of chlorine and hydrogen, both of which are prepared by the electrolysis of salt solutions, or isolated as a by-product of many organic or inorganic reactions. It is a strong acid and is used in a wide variety of industries for many uses. The substance exists also naturally as a major component of gastric acid, maintaining the pH of 1-2 in the stomach of humans.

2 Chemical Identity

Name:	hydrogen chloride
CAS number:	7647-01-0
EINECS number:	231-595-7
Molecular formula:	HCl

3 Uses and Applications

Hydrogen chloride is a commodity inorganic chemical with an wide variety of uses, mainly by industry but also by professionals and consumers. It is used primarily within industry as a pH regulator in water and waste-water treatment, food production, in the manufacture of other organic and inorganic chemicals. It is also used to regenerate ion-exchange resins and to pickle steel (remove rust and impurities from steel before processing or shaping). The substance is used professionally as a cleaning agent to remove lime scale and for water treatment. The most common public use is as a component of cleaning products to remove lime scale (sanitary cleaners for households). Hydrochloric acid has been assessed by the European Food Safety Authority as being safe for use in food product preparation, carrying the E number, E 507.

4 Physical / Chemical Properties

Hydrogen chloride can be found as a gas or, more commonly, as a solution of hydrochloric acid in water. Hydrogen chloride is a colourless gas that forms a white mist upon exposure to humid air. It is a strong acid, and it is corrosive to many metals in the presence of moisture (water). Fully dry (anhydrous) hydrogen chloride gas does not corrode common construction materials like steel or aluminium, thus it can be stored and transported as a compressed gas in steel cylinders. The gas is extremely soluble in water (up to 700 litres gaseous HCl per litre of water at

ambient conditions) giving an aqueous solution known as hydrochloric acid. It is also readily soluble in polar organic solvents like methanol, ethanol or acetic acid.
Hydrochloric acid is a corrosive, non-flammable liquid; the typical concentration is in the range of 30 % HCl by weight (so-called concentrated hydrochloric acid), but solutions of up to 38 % (so-called fuming hydrochloric acid) are used in industry, as well as lower concentrations. If concentrated hydrochloric acid is heated to boiling it will release HCl gas and form an azeotrope which boils at 110 °C at 1013 mbar and contains 20.2 % HCl. The corrosivity against common metals, lime stone etc. depends strongly on the concentration of the hydrochloric acid.
Consumer products typically contain only small amounts of HCl (1-2 %), which are further diluted for use in households.

Appearance	**Gas**
State of matter:	gaseous
Colour:	colourless to slightly yellow
Odour:	pungent irritating
Odour threshold:	1.5 mg/m^3
Molecular weight:	36.46 g/mol

Safety relevant basis data

Parameter	**Value Gas**	**Value Hydrochl. Acid 30%**	**Unit**	**Remark**
Density:	0.0016	1.149	g/cm^3	at 20 °C, 1013 hPa
pH:				not applicable
Melting point:	ca. -114	ca. -50	°C	
Boiling temperature:	-85	ca. 110	°C	at 1013 hPa
Flash point:				not applicable
Explosion hazard:				not explosive
Ignition temperature:				not applicable
Decomposition temperature:	> 2000		°C	thermal decomposition
Oxidizing properties				no
Vapour pressure:	~42000		hPa	at 20 °C
	53200		hPa	at 30 °C
	80600		hPa	at 50 °C
Solubility in water:	719.8		g/l	at 20 °C
log $P_{O/W}$ (n-octanol / water):				not applicable
Viscosity (dynamic):				not applicable

5 Health Effects

5.1 Consumer

Due to the wide spread use of hydrochloric acid, consumers can easily get in contact with aqueous solutions of hydrogen chloride via various products, e.g. washing and cleaning products or articles used for removal of cement rests from bricks. From these solutions gaseous hydrogen chloride can be released. Consumers should pay attention during handling due to the corrosive nature of the substance and its liquid by avoiding inhalation as well as any direct contact with eyes or skin.

5.2 Worker

Due to its highly corrosive character the substance is produced under closed systems and under strictly controlled conditions. Workers will typically not come into contact with the substance. In case of unintended exposure during manufacture, use, formulation and (re)packaging workers should follow the recommended safety measures in the extended Safety Data Sheet. The following table gives an overview on the most important health effects:

Effect Assessment	Result
Acute Toxicity oral / inhalation / dermal	Oral or dermal exposure is very unlikely due to its gaseous state of matter. The most likely route of exposure is inhalation, for which several tests have been carried out, resulting in a classification as acute toxic via inhalation. (H331: Toxic if inhaled.)
Irritation / corrosion skin / eye / respiratory tract	Studies revealed that aqueous hydrogen chloride is strongly corrosive to skin and eyes causing severe damage upon contact. (H314: Causes severe skin burns and eye damage.)
Sensitisation	The substance is not sensitising.
Toxicity after repeated exposure oral / inhalation / dermal	Due to the gaseous form of the substance oral or dermal exposure is very unlikely. The most likely route of exposure is inhalation, for which several tests have been carried out, resulting in adverse effects after prolonged exposure. The maximum workplace concentration established should be observed.
Genotoxicity / mutagenicity	No genotoxic or mutagenic properties.
Carcinogenicity	Not carcinogenic.
Toxicity for reproduction	No data are available in regard to reproductive toxicity. Nevertheless, it is expected that hydrogen chloride has no adverse fertility or developmental effects.

6 Environmental Effects

Hydrochloric acid lowers the pH of any water that it is released into. Small amounts are diluted and neutralised by reaction with the basic substances present in natural waters and soil. If a large amount is released or if other acids are present, the pH could be lowered until it is harmful for aquatic animals and plants (at pH 3 to 5). As this is a generic pH effect and is not due to the specific substance, hydrogen chloride is not classified as toxic to the aquatic environment. Additionally, the substance is not bioaccumulative, is rapidly removed (neutralised to water and chloride ions, which are both harmless) and will not persist in the environment.

Effect Assessment	Result
Aquatic Toxicity	Except for sediment organisms, several tests have been carried out on fish, aquatic invertebrates and algae. Depending on the amount of the diluted hydrogen chloride and the resulting pH level adverse effects have been detected on these organisms.
Terrestrial Toxicity	No data available. Nevertheless, it is anticipated that hydrogen chloride will not have any adverse effects to the terrestrial compartment due to the immediate dissociation in water.
Fate and behaviour	**Result**
Biodegradation	Not biologically degradable (inorganic substance).
Bioaccumulation potential	No potential for bioaccumulation.
PBT / vPvB conclusion	HCl is not classified as a PBT or vPvB substance.

7 Exposure

7.1 Human health

The different uses of the substance have been assessed as safe under several regulatory programmes, provided the necessary control measures are put in place. Consumers can come into contact with the substance through its use as a component of some household cleaners. This use has been assessed as safe, provided that the product is used as directed on the label. The substance has been assessed as safe for professional and industrial use, when the provisions laid down in the Safety Data Sheet are followed carefully. Uses advised against are those that may lead to aerosol formation (mists), which could be harmful for the eyes, skin and respiratory system.

7.2 Environment

Hydrogen chloride release into the environment does not normally occur, as the gas is used only by industry within closed systems under controlled conditions. Industrial waste-water containing hydrochloric acid is neutralised by the addition of a basic substance to give a neutral solution, which can be safely disposed of. Small-scale release into drains from household cleaning products poses no risk to the environment due to the large dilution of the acid and neutralisation by the buffering capacity of the system or natural waters.

8 Risk Management Recommendations

Because hydrogen chloride is toxic upon inhalation and strongly corrosive, risk management measures regarding human health should focus on the prevention of any direct contact with the substance. For this reason automated and closed systems should preferably be used for any industrial and professional uses of the substance. Respiratory protection is needed when exposure to gaseous hydrogen chloride is possible. Due to the corrosive properties appropriate skin and eye protection is required.

9 First Aid Measures

After contact with the substance via skin, eyes and/or inhalation, a physician should immediately be consulted in serious cases. Upon contact with the skin take off immediately all contaminated clothing and shoes and wash the affected body area with plenty of water and soap for minimum 15 minutes; use an emergency shower in serious cases and consult a medicine as soon as possible. Dispose off contaminated clothing. In case of contact with the eyes, immediately flush eyes with large amounts of water for at least 15 minutes holding eyelids open. Continue to bathe eyes during transport to the medical practitioner. After inhalation of the substance move the affected person to fresh air and keep the person laying down and restful. Give artificial respiration if breathing has stopped. Place the person in a stable sideways position if the person is unconscious. Treat the person with cortisone spray as early as possible. Contact a physician as soon as possible! Guide unprotected people to safety. First aid assistants should pay attention to self-protection.

10 Fire Fighting Measures

The substance is not flammable. Therefore, extinguishing measures should be adjusted to the source of fire. If it can be done without risk, cool endangered product containers by using water fog. Guide personal to safety and keep unprotected people away. Since hydrochloric acid will be

generated upon contact with water, ensure adequate retention possibilities for extinguishing water. Due to its corrosive character extinguishing water should not be allowed to enter sewerage, soil or inshore waters. Instead, contaminated extinguishing water and soil must be disposed off in accordance with local, state or federal regulations. It is absolutely required to wear a self-contained breathing apparatus and a tightly fitting chemical protection suit.

11 Accidental Release Measures

In case of unintentional releases wear personal protection equipment. The task force should wear a tightly fitting chemical protection suit. In case of spills avoid any contact with the substance as well as inhalation of mists and vapours. Keep unprotected persons away and ensure adequate ventilation. Leaks should be eliminated, if it can be done without risk. Directed water spray should be used for condensation of gasses, vapours or mists. In order to clean up the contaminated area vapours should be exhausted and the area afterwards treated with plenty of water. Contaminated water must be retained and afterwards disposed off in prescribed marked containers according to official and local state regulations. Do not empty into drains or the aquatic environment.

12 Disposal Considerations

Collect contaminated fire extinguishing water separately. Retain contaminated washing water and dispose off according to national, federal and local regulations. Dumping into the environment must be prevented. Contaminated packaging material must be completely emptied and can be re-used or recycled following appropriate cleaning. Handle contaminated packaging in the same way as the substance itself. Packaging material which cannot be properly cleaned must be thrown away. Consult the supplier for information on special chemical/physical treatment procedures.

13 Handling and Storage

If handling the substance provide for sufficient ventilation and punctiform suction at critical points. The substance should be siphoned off in situ. In order to prevent the occurrence of violent chemical reactions, basic substances, such as ammonia, amines or alkalis, should be kept away from hydrogen chloride. Contact with metals should be avoided, since it might lead to the generation of hydrogen (highly flammable gas). Store only in the original container in a cool, well-ventilated place. Keep the packaging dry and well sealed. The substance should be stored in unbreakable containers and should be kept away from open flames, heat and sparks. In case of fire remove the container out of the endangered area and cool the area with water.

14 State Agency Review

Hydrogen chloride has been registered under REACH. The substance was reviewed in 2002 under the OECD HPV program (assessment of chemicals produced in high volumes). In 2010 it was reviewed and registered under the European REACH Regulation (EC) No. 1907/2006 and the substance was found to be safe for the uses identified. Currently it is under review for the European Biocidal Products Directive 98/8/EC.

15 Classification and Labelling

The substance is classified under the EU Classification Labelling and Packaging (CLP) Regulation EC/1272/2008 as follows:

Hazard Class and Category	H-Phrase	Wording	Hazard pictograms
Hydrogen Chloride Gas			
Acute toxicity (inhal.) 3	H331	Toxic if inhaled.	
Skin corrosion/irritation 1A	H314	Causes severe skin burns and eye damage.	
Gases under pressure: Compressed gas	H280	Contains gas under pressure; may explode if heated.	
Hydrochloric Acid with ≥25 % HCl			
Metal Corrosion 1	H290	May be corrosive to metals	
Skin Corrosion 1B	H314	Causes severe skin burns and eye damage	
Specific target organ toxicity - single exposure 3A	H335	May cause respiratory irritation	
Hydrochloric Acid with ≥10-25 % HCl			
Metal Corrosion 1	H290	May be corrosive to metals	
Eye Irritation 2	H319	Causes serious eye irritation	
Skin Irritation 2	H315	Causes skin irritation	
Specific target organ toxicity - single exposure 3A	H335	May cause respiratory irritation	
Hydrochloric Acid with ≥0.1-10 % HCl			
Metal Corrosion 1	H290	May be corrosive to metals	

15.1.1 Conclusion

Hydrogen chloride is a well-understood substance that is useful for numerous practical applications, stretching from industry to consumer products. Use of this hazardous substance has been shown to be safe when care is taken during its use and instructions provided are followed.

16 Contact Information within Company

For further information on this substance or product safety summaries in general, please contact: Dr. Christian Eppelsheim at wlcp-reach@wacker.com or visit our website at www.wacker.com.

Euro Chlor (www.eurochlor.org), the European chlor-alkali manufacturers association is a useful repository of information regarding chlorine and can be contacted at eurochlor@cefic.be. Additional information on the ICCA global product strategy can be found here: http://www.icca-chem.org/en/Home/ICCA-initiatives/global-product-strategy/

17 Date of Issue

23/03/2012

WACKER

GPS SAFETY SUMMARY
HEXAMETHYLDISILAZANE

This Product Safety Summary is intended to provide a general overview of the chemical substance in the context of ICCA Global Product Strategy. The information on the Summary is basic information and is not intended to provide emergency response information, medical information or treatment information. The summary should not be used to provide in-depth safety and health information. In-depth safety and health information can be found on the (extended) Safety Data Sheet (e)SDS for the chemical substance.

1 General Statement

Hexamethyldisilazane is an organic liquid, which is manufactured by reaction of chlorotrimethylsilane and anhydrous ammonia, followed by several purification steps. The substance is widely used as intermediate for the production of other organic chemicals. Further applications of this substance include the use as non-metal surface treatment agent, as reagent in analytical laboratories as well as the manufacture of semiconductors in the electronic industry. The substance is hazardous to human health in many ways. It is extremely harmful upon inhalation of vapours as well as ingestion, which can lead e.g. to paralysis. Further, it has been classified as toxic upon contact with skin and can additionally cause severe skin burns due to its corrosive properties; also contact with the eyes leads to serious eye damage due to its corrosive effects.
It is very unlikely that consumers get in contact with this substance. Workers have to pay special attention during handling and storage of this substance, not only in regard to its hazardous effects on health, but also due to the high flammability of the liquid and arising vapours. Also contact with water should be avoided, since arising decomposition products of hexamethyldisilazane, e.g. ammonia, are toxic and corrosive. Regarding hazardous effects to the environment, the substance has been identified as toxic to specific aquatic organisms. It is recommended to obtain specific instructions before handling this substance.

2 Chemical Identity

Name:	**hexamethyldisilazane**
CAS number:	**999-97-3**
EINECS number:	**213-668-5**
Molecular formula:	**$C_6H_{19}NSi_2$**

3 Uses and Applications

Hexamethyldisilazane is used as intermediate in various industrial processes. It can be applied as silylating agent for the synthesis of fine chemicals, e.g. pharmaceutical intermediates, and as chemical reagent for modification of many starting materials, such as alcohols, carboxylic acids, amines, amides and mercaptanes. The substance is widely used as a surface treatment agent for non-metal surfaces, e.g. glass surfaces (hydrophobicity). Hexamethyldisilazane is also applied as a primer and adhesion promoter in the production of spin-on dielectrics and photoresists in the electronic industry. Further, the substance is used as laboratory reagent in analytical laboratories, e.g. for the preparation of test samples applied in gas chromatography

measurements and various chemical reactions where protective group chemistry has to be implemented.

4 Physical / Chemical Properties

Hexamethyldisilazane is a colourless organic liquid with a strong odour. The substance is characterised by its high volatility and its reactivity with water, which leads to the formation of trimethylsilanol and ammonia. Gaseous ammonia, as well its aqueous solutions, is regarded as hazardous and corrosive. Therefore, it is highly recommended to handle the substance under adequate ventilation, to use personnel protective equipment and to avoid any contact with moisture. Taking into account the high flammability of the substance, it is crucial to remove all sources of ignition during handling and storage and to take precautionary measures against static discharges. Vapours can build explosive / highly flammable mixtures with air, so adequate ventilation and suction should be provided.

Appearance

State of matter:	liquid
Colour:	colourless
Odour:	strong
Odour threshold:	no data available
Molecular weight:	161.4 g/mol

Safety relevant basis data

Parameter	Value	Unit	Remark
Density (relative):	0.77	g/cm^3	at 20 °C
pH:	> 7		
Melting point / range:	-76.2	°C	at 1013 hPa
Boiling temperature / range:	125	°C	at 1013 hPa
Flash point:	11	°C	at 101.3 kPa
Explosion hazard:			vapours can build explosive / highly flammable mixtures with air
Lower explosion limit:	0.3	Vol.-%	
Upper explosion limit:	41	Vol.-%	
Ignition temperature:	331	°C	at 101.3 kPa
Decomposition temperature:			no data available
Vapour pressure:	10.1	kPa	at 20 °C
Solubility in water:	18	mg/L	at 20 °C; virtually insoluble; upon contact with water decomposition to trimethylsilanol and ammonia occurs. Solubility of decomposition products: Trimethylsilanol: 920 mg/L (at 25 °C); Ammonia: 510-530 g/L (at 20 °C)
log $P_{O/W}$ (n-octanol / water):	1.19		at 20 °C
Viscosity (dynamic):	0.9	mPa·s	at 25 °C
Viscosity (static):	0.9	mm^2/s	at 20 °C

5 Health Effects

5.1 Consumer

The substance is only handled during industrial processes. Exposure of consumers to this substance will not happen at any time.

5.2 Worker

Workers will typically not come into contact with the substance as it is manufactured in closed systems in industrial and professional settings. In case of unintended exposure during synthesis, formulation, transfer or other procedures, workers should follow the recommended safety measures in the extended Safety Data Sheet (eSDS). The following table gives an overview on the health effects:

Effect Assessment	Result
Acute Toxicity oral / inhalation / dermal	Analysed data revealed acute hazardous effects upon exposure via all three routes. The substance is therefore classified as toxic via oral, inhalative and dermal exposure. (Acute Tox. 4; H302: Harmful if swallowed. Acute Tox. 3; H311: Toxic in contact with skin. Acute Tox. 4; H332: Harmful if inhaled.)
Irritation / corrosion skin / eye / respiratory tract	Hexamethyldisilazane is corrosive to skin and can also seriously damage the eyes upon contact. The corrosive property can be ascribed to its hydrolysis product ammonia, which is generated upon contact of the substance with water contained in skin and eyes. (Skin Corr. 1B; H314: Causes severe skin burns and eye damage.)
Sensitisation	No data available since the corrosive properties do not allow any tests in regard to sensitisation.
Toxicity after repeated exposure oral / inhalation / dermal	Data is lacking for repeated oral and dermal exposure. Testing results revealed minor adverse effects via inhalation dependent on the inhaled concentration.
Genotoxicity / mutagenicity	*In vitro* and *in vivo* tests revealed neither genotoxic nor mutagenic properties.
Carcinogenicity	No detailed data available. The substance is regarded as not carcinogenic due to the absence of mutagenic effects as well as abnormal cell effects upon prolonged exposure.
Toxicity for reproduction	Based on available data a classification as toxic to reproduction (fertility and development) can be excluded.

6 Environmental Effects

Based on available data for the pure substance, hexamethyldisilazane is considered as toxic to aquatic organisms. The substance hydrolyses very rapidly (half-life at pH 7 and 1.5 °C: ≤ 0.5 min) to trimethylsilanol and ammonia. Therefore, the impact on aquatic organisms will be dominated by the effects of the hydrolysis products, rather than the substance itself.
No reliable data are available for the toxicity of hexamethyldisilazane and ammonia to microorganisms.
Due to its rapid decomposition after dissolution in water the substance is regarded as not bioaccumulative and not persistent in the environment. The decomposition products are also regarded as not bioaccumulative. Trimethylsilanol is considered as not readily biodegradable, while ammonia is rapidly incorporated into the nitrogen cycle.

Effect Assessment	Result
Aquatic Toxicity	On the basis of conducted studies, it is expected that aquatic species are exposed to the hydrolysis products of the substance, trimethylsilanol and ammonia. Based on available data and taking into account chronic data of ammonia, hexamethyldisilazane is considered as harmful to aquatic organisms, resulting in classification as toxic to the aquatic environment. (Aquatic Chronic 3; H412: Harmful to aquatic life with long lasting effects.)
Terrestrial Toxicity	No data available.

Fate and behaviour	Result
Biodegradation	Hexamethyldisilazane is considered to be not readily biodegradable (15% in 28 days). The hydrolysis product trimethylsilanol is not readily biodegradable, too.
Bioaccumulation potential	The substance hydrolyses very rapidly to ammonia and trimethylsilanol. Trimethylsilanol has a low log K_{OW} value (1.19) and thus has low potential for bioaccumulation. Ammonia enters the natural nitrogen cycle and is not expected to bioaccumulate.
PBT / vPvB conclusion	Hexamethyldisilazane and its hydrolysis products are not classified as PBT or vPvB substances.

7 Exposure

7.1 Human health

Consumers will not come into contact with hexamethyldisilazane in any way, as the substance is manufactured and processed under strictly controlled conditions in the industry. During industrial processes workers might be exposed to the substance via dermal contact and/or inhalation. Risk management measures have been established in order to guarantee the safe use of the substance.

7.2 Environment

Industrial use of reactive organosilicon substances, such as hexamethyldisilazane, is strictly regulated and controlled and designed in such ways to ensure process containment under normal operating conditions. Appropriate technical measures, such as use of air emission abatement equipment and treatment of effluents, are used to minimize the exposure to the environment.

8 Risk Management Recommendations

Strict containment measures are required for hexamethyldisilazane due to the rapid hydrolysis of the substance upon contact with air and water. In addition, due to the corrosive nature of the substance, and the release of ammonia as hydrolysis product, personal protective equipment (fluorinated or nitrile rubber gloves/ gauntlets) and respiratory protective equipment (full-face respirator with ABEK-filter; goggles or face shield and self-contained, positive pressure breathing apparatus) are mandatory for all personnel involved in the production process.

Due to the high volatility of the substance it is crucial that there is adequate ventilation and suction at critical points to ensure that occupational exposure limit values are not exceeded. In order to prevent pollution and contamination of the environment, use of air emission abatement equipment, such as incinerators and scrubbers, is highly recommended. Effluents should be treated in wastewater treatment plants.

9 First Aid Measures

Get immediately medical attention. First aid assistants should pay attention to self-protection. After contact with the substance via skin, eyes, ingestion and/or inhalation, a medicine should be consulted. Immediately take off all contaminated clothing and shoes and dispose of safely. If the substance has been inhaled, remove the affected person to fresh air and provide artificial respiration or oxygen in case the person is not breathing. In case of contact with the skin, immediately flush affected area with large amounts of water for 10-15 minutes followed by washing with soap and water. Use an emergency shower in case of large amounts. In case of contact with eyes, immediately flush eyes with large amounts of water for 10-15 minutes while holding eyelids open. If accidentally ingested, let water be swallowed in little sips, if the person is conscious, and obtain immediate medical attention. Do not induce vomiting.

10 Fire Fighting Measures

Liquids and vapour of the substance are highly flammable – in case of fire use water mist, extinguishing powder, alcohol-resistant foam, carbon dioxide or sand as extinguishing agents. Do not use water spray or water jet, dry chemicals or halones! Cool endangered containers with water. Consider the formation of ammonia after contact with water (corrosive!).
Hazardous decomposition products in case of incomplete combustion contain carbon dioxide, carbon monoxide, formaldehyde, silicon dioxide, nitrogen oxides, ammonia and various hydrocarbons.
It is absolutely required to wear full protective clothing including a self-contained breathing apparatus.

11 Accidental Release Measures

When handling the substance, personal protection equipment must be worn. In case of spills, avoid any contact with the substance via eyes or skin as well as inhalation of gases and mists. Keep unprotected people away and remove all ignition sources since hexamethyldisilazane is highly flammable. Take precautionary measures against static discharges. Absorb spills with a liquid binding material such as diatomaceous earth and place in appropriate containers for disposal according to official and local state regulations. Do not flush away the spills with water! In case of large spills, cover the contaminated area with near waterless foam and transfer the contaminant in appropriate containers. The contaminated water should be retained and disposed of in prescribed marked containers. Prevent material from entering surface waters, drains or sewers, and soil.

12 Disposal Considerations

It is recommended to carry out burning of hexamethyldisilazane as hazardous waste according to official regulations. Local regulations must be observed. Collect contaminated fire extinguishing water separately. Retain contaminated washing water and dispose of according to national, federal and local regulations. Contaminated packaging material must be completely emptied and can be re-used or recycled following appropriate cleaning. Handle contaminated packaging in the same way as the substance itself.

13 Handling and Storage

As flammable vapours may accumulate and form explosive mixtures with air in containers, process vessels, including partial, empty and uncleaned containers and vessels or other enclosed spaces, keep away from ignition sources and do not smoke. Take precautionary measures against static discharges. Provide for sufficient ventilation and punctiform suction at critical points.
Store only in the original container in a cool, well-ventilated place. Keep the packaging dry and well sealed to prevent contamination and absorption of dampness. Hexamethyldisilazane must be protected from dampness, otherwise hydrolysis can take place leading to trimethylsilanol and ammonia.

14 State Agency Review

Hexamethyldisilazane has been registered under REACH. This substance is listed on or is in compliance with the requirements laid out in the Philippine Inventory of Chemicals and Chemical Substances (PICCS), the Existing Notified Chemical Substances (ENCS), Existing Chemicals List (ECL), the Domestic Substances List (DSL), the Toxic Substances Control Act (TSCA), the European Inventory of Existing Commercial Chemical Substances (EINECS), the Australian Inventory of Chemical Substances (AICS) and the Inventory of Existing Chemical Substances in China (IECSC).

15 Classification and Labelling

The substance is classified under the EU Classification Labelling and Packaging (CLP) Regulation EC/1272/2008 as follows:

Hazard Class and Category	H-Phrase	Hazard pictograms	Wording
Flammable liquid 2	H225		Highly flammable liquid and vapour.
Skin corrosion 1B	H314		Causes severe skin burns and eye damage.

Acute toxicity 3	H311		Toxic in contact with skin.
Acute toxicity 4	H302 H332		Harmful if swallowed Harmful if inhaled
Hazardous to the aquatic environment — Chronic Hazard 3	H412	-	Harmful to aquatic life with long lasting effects.

16 Conclusion

Hexamethyldisilazane is a well characterised substance, although detailed data is lacking with regard to health effects for sensitisation, repeated oral and dermal exposure as well as carcinogenicity. However, consumers are unlikely to get in contact with this substance, since use of this substance takes place in industrial and professional settings only. Workers should follow the safety measures recommended in the Extended Safety Data Sheet (eSDS). With regard to environmental effects, hexamethyldisilazane is considered as hazardous to aquatic organisms.

17 Contact Information within Company

For further information on this substance or product safety summaries in general, please contact: Dr. Christian Eppelsheim at wlcp-reach@wacker.com or visit our website at www.wacker.com.

18 Date of Issue

05/03/2012

WACKER

GPS SAFETY SUMMARY
ISOPROPENYL ACETATE

This Product Safety Summary is intended to provide a general overview of the chemical substance in the context of ICCA Global Product Strategy. The information on the Summary is basic information and is not intended to provide emergency response information, medical information or treatment information. The summary should not be used to provide in-depth safety and health information. In-depth safety and health information can be found on the (extended) Safety Data Sheet (e)SDS for the chemical substance.

1 General Statement

Isopropenyl acetate is an organic liquid, which is manufactured by reaction of acetone with ketene in the presence of an acidic catalyst and subsequent purification by fractional distillation. It is used as chemical intermediate for the manufacture of bulk, large scale, and fine chemicals, as laboratory reagent and as monomer for the production of plastics. Upon repeated or prolonged inhalation isopropenyl acetate may cause respiratory irritation. The substance is toxic to specific aquatic organisms. Otherwise no hazardous environmental or human health effects have been observed. Special attention during handling and storage has to be given to the substance due to its high flammability. It is recommended that workers obtain specific instructions before handling this substance.

2 Chemical Identity

Name:	**isopropenyl acetate**
CAS number:	**108-22-5**
EINECS number:	**203-562-7**
Molecular formula:	**$C_5H_8O_2$**

3 Uses and Applications

Isopropenyl acetate is primarily used in industrial processes as intermediate for the manufacture of other substances, of bulk and large scale chemicals, including petroleum products, and manufacture of fine chemicals. As examples its use as mild acetylating agent for pharmaceutical ingredients (steroids), fragrances and flavour chemicals can be mentioned, or its application in the synthesis of enol acetates. Due to its chemical structure it is often applied as (co-)monomer in polymerisation processes for the production of plastic products, e.g. thermoplastics. Further application of isopropenyl acetate includes the use as laboratory reagent. It is highly unlikely that consumers are exposed to this substance in any way, whereas workers (industry, laboratory) should follow the safety measures recommended in the extended Safety Data Sheet (eSDS).

4 Physical / Chemical Properties

Isopropenyl acetate is a clear, colourless organic liquid with a pleasant, ester-like odour. Liquid and vapour of this substance are highly flammable, so that it is crucial to remove all sources of

ignition during handling and storage and to take precautionary measures against static discharges. Vapours can build explosive / highly flammable mixtures with air, so adequate ventilation and suction should be provided. Upon reaction with water, hydrolysis will take place leading to decomposition of isopropenyl acetate to acetone and acetic acid. Peroxides, light, heat and heavy metal compounds have to be avoided as they can act as radical initiatores and lead to polymerisation of isopropenyl acetate.

Appearance

State of matter:	**liquid**
Colour:	**colourless**
Odour:	**pleasant**
Odour treshold:	**40 mg/m^3**
Molecular weight:	**100.117 g/mol**

Safety relevant basis data

Parameter	Value	Unit	Remark
Density:	0.9212	g/cm^3	at 20°C
pH:	3		34 g/l H_2O
Melting point / range:	< -50	°C	
Boiling temperature / range:	96.8	°C	
Flash point:	8	°C	
Explosion hazard:			not applicable
Lower explosion limit:	1.8	V-%	
Upper explosion limit:			not determined
Ignition temperature:	411	°C	
Decomposition temperature:	250	°C	thermal
Vapour pressure:	101	hPa	at 20°
	202	hPa	at 38°
	307	hPa	at 50°
Solubility in water:	29.7	g/l	at 20°C
log P O/W (n-octanol / water):	1.41		at 40°C
Viscosity (dynamic):			not determined

5 Health Effects

5.1 Consumer

Consumer exposure is extremely unlikely as the substance is manufactured and handled in industrial and professional settings.

5.2 Worker

Workers will typically not come into contact with the substance as it is manufactured in closed systems in industrial and professional settings. In case of unintended exposure during synthesis, formulation, transfer or other procedures, workers should follow the recommended safety measures in the extended Safety Data Sheet (eSDS). The following table gives an overview on the health effects:

Effect Assessment	Result
Acute Toxicity oral / inhalation / dermal	Studies did not reveal any evidence that isopropenyl acetate is of acute oral, dermal or inhalative toxicity.
Irritation / corrosion skin / eye / respiratory tract	Isopropenyl acetate is considered as relatively harmless to skin or eyes. Repeated exposure via inhalation showed that isopropenyl acetate is a respiratory irritant.
Sensitisation	This substance is not sensitising.
Toxicity after repeated exposure oral / inhalation / dermal	Data is lacking for repeated oral and dermal exposure. Repeated exposure via inhalation showed that isopropenyl acetate is a respiratory irritant. (STOT SE 3; H335: May cause respiratory irritation. Target organ in animal tests: nasal mucous membrane)
Genotoxicity / mutagenicity	No genotoxic and no mutagenic properties.
Carcinogenicity	No data available.
Toxicity for reproduction	Based on available data no developmental or reproductive toxicity has to be anticipated.

6 Environmental Effects

Based on available data for the pure substance, isopropenyl acetate is considered as toxic to aquatic organisms. However, the substance amount released into the aquatic environment is low indicating no risk for the aquatic environment. It does not bioaccumulate, is readily biodegradable and will not persist in the environment.

Effect Assessment	Result
Aquatic Toxicity	Based on available data isopropenyl acetate is considered as harmful to fish, aquatic invertebrates and might have also harmful effects on aquatic algae. It is not hazardous for aquatic microorganisms. No data is available for sediment organisms or other aquatic organisms.
Terrestrial Toxicity	No data available.

Fate and behaviour	Result
Biodegradation	Isopropenyl acetate is readily biodegradable (77% in 28 days).
Bioaccumulation potential	No potential for bioaccumulation (log K_{OW}: 1.41).
PBT / vPvB conclusion	This substance is not a PBT or vPvB substance.

7 Exposure

7.1 Human health

Consumers will not come into contact with isopropenyl acetate as it is manufactured in industrial and professional settings in closed processes. Exposure to isopropenyl acetate of personnel in manufacturing facilities is also considered as low because the process, storage and handling operations are strictly controlled. Workers who might accidentally come into contact with the non-formulated, undiluted substance should follow the safety measures recommended in the Extended Safety Data Sheet (eSDS), as the non formulated, undiluted substance may cause respiratory irritation.

7.2 Environment

The manufacture of the substance and on-site uses are proceeded under strictly controlled conditions with no releases to air and soil and nearly no releases to water. Sludge generated from municipal sewage treatment plants is completely incinerated. Also during the industrial use of the substance there are only very minor releases to air, water and soil. The substance amount released into the aquatic environment is low, hence, indicating no risk for the aquatic environment.

8 Risk Management Recommendations

When using isopropenyl acetate make sure that there is adequate ventilation and suction at critical points to ensure that occupational exposure limit values are not exceeded. Do not breath vapours and avoid contact with eyes and skin by using appropriate respiratory protection (respirator with ABEK filter; in case of long or strong exposure use a self-contained breathing apparatus), eye protection, such as splash-proof chemical goggles, appropriate chemical resistant gloves, e.g. for short-term use (< 10 minutes) gloves made of butyl rubber, and body protection. Do not eat, drink or smoke where chemicals are handled, processed or stored. Wash hands thoroughly after handling. Do not release into the aquatic environment or soil.

9 First Aid Measures

Guide people to safety. First aid assistants should pay attention to self-protection. After contact with the substance via skin, eyes, ingestion and/or inhalation, a medicine should be consulted. Immediately take off all contaminated clothing and shoes and dispose of safely. In case of contact with the skin, immediately flush affected area with large amounts of water for 10-15 minutes followed by washing with soap and water, if available. Use an emergency shower in case of large amounts. In case of contact with eyes, immediately flush eyes with large amounts of water for 10-15 minutes while holding eyelids open. After inhalation of the substance, move to fresh air, keep the affected person warm and at rest. Treat the person with cortisone spray as early as possible. If accidentally swallowed, let water be swallowed in little sips, only if the person is conscious, and obtain immediate medical attention. Do not induce vomiting.

10 Fire Fighting Measures

In case of large fires, use water fog, exstinguishing powder or alcohol resistant foam as exstinguishing media. For small fires carbon dioxide (CO_2) can be used. Do not use a high power water jet. If it can be done without risk, cool endangered product containers by using water fog, guide personal to safety and keep unprotected people away. Hazardous decomposition products in case of incomplete combustion contain corrosive substances among other toxic pyrolysis products as carbonmonoxide (CO), carbondioxide (CO_2). It is absolutely required to wear a self-contained breathing apparatus.

11 Accidental Release Measures

When handling the substance, personal protection equipment must be worn. In case of spills, avoid any contact with the substance as well as inhalation of gases and vapours. Keep unprotected people away and remove all ignition sources since isopropenyl acetate is highly flammable. Take precautionary measures against static discharges. Absorb spills with an appropriate, liquid-binding material (e.g. earth, diatomaceous earth) and place in appropriate containers for disposal according to official and local state regulations. In case of large spills, prevent spreading by dyking and remove into appropriate containers by skimming. Provide adequate ventilation. Do not empty into drains or the aquatic environment.

12 Disposal Considerations

It is recommended to carry out burning of isopropenyl acetate as harzardous waste according to official regulations. Local regulations must be observed. Collect contaminated fire extinguishing water separately. Retain contaminated washing water and dispose of according to national, federal and local regulations. Dumping into the environment must be prevented. Contaminated packaging material must be completely emptied and can be re-used or re-cycled following appropriate cleaning. Handle contaminated packaging in the same way as the substance itself. Packaging material which cannot be properly cleaned must be thrown away.

13 Handling and Storage

If handling the substance, keep away from ignition sources, e.g. heat, sparks, open flames, hot surfaces, and do not smoke. Isopropenyl acetate is highly flammable. Take precautionary measures against static discharges when filling from one container into another by grounding of metal containers, apparatus, pumps and suction equipment in order to discharge static accumulation to the ground and to prevent formation of sparks. Provide for sufficient ventilation and punctiform suction at critical points. Vapours in closed rooms as well as in emptied, but contaminated containers may form explosive mixtures with air, which can lead to explosions in presence of ignition sources.
Store only in the original container in a cool, well-ventilated place. Keep the packing dry and well sealed to prevent contamination and absorbtion of dampness. Isopropenyl acetate must be protected from dampness, otherwise hydrolysis can take place leading to acetone and acetic acid. Do not store together with oxidising and self-igniting substances as well as with highly flammable solids. The maximum storage life of isopropenyl acetate is 12 months. Storage of isopropenyl acetate exceeding this recommended time span does not imply a loss of the substance quality. However, for quality reasons it is crucial to check the relevant substance properties before using it for specific applications. The maximum storage and transport temperature should not exceed 30 °C. The storage class according to VCI (Verband der Chemischen Industrie, Germany) is 3A (flammable liquid).

14 State Agency Review

Isopropenyl acetate has been registered under REACH. This substance is listed and is in compliance with the requirements of the TSCA Chemical Substance Inventory and the Canadian Domestic Substances List.
Isopropenyl acetate is listed on or in accordance with the following inventories:

PICCS - Philippines; ECL - Korea; EINECS - Europe; C&L-Inventory - EU; ENCS - Japan; AICS - Australia; IECSC - China

15 Classification and Labelling

The substance is classified under the EU Classification Labelling and Packaging (CLP) Regulation EC/1272/2008 as follows:

Hazard Class and Category	H-Phrase	Hazard pictograms	Wording
Flammable liquid 2	H225		Highly flammable liquid and vapour.
Specific target organ toxicity after single exposure 3	H335		May cause respiratory irritation.

16 Conclusion

Isopropenyl acetate is a well characterised substance, although detailled data is lacking in regard to health effects for repeated oral and dermal exposure as well as carcinogenicity. However, consumers are unlikely to get in contact with this substance, since use of this substance takes place in industrial and professional settings only. Workers should follow the safety measures recommended in the Extended Safety Data Sheet (eSDS).

17 Contact Information within Company

For further information on this substance or product safety summaries in general, please contact: Dr. Christian Eppelsheim at wlcp-reach@wacker.com or visit our website at www.wacker.com.

18 Date of Issue

05/03/2012

WACKER

GPS SAFETY SUMMARY
METHYL ACETATE

This Product Safety Summary is intended to provide a general overview of the chemical substance in the context of ICCA Global Product Strategy. The information on the Summary is basic information and is not intended to provide emergency response information, medical information or treatment information. The summary should not be used to provide in-depth safety and health information. In-depth safety and health information can be found on the (extended) Safety Data Sheet for the chemical substance.

1 General Statement

Methyl acetate is a highly flammable, colourless organic liquid with a pleasant odour. It is produced as a by-product in an industrial manufacturing process together with methanol and water and purified by subsequent distillation and extraction. Methyl acetate is widely used as solvent, laboratory reagent, as intermediate in the manufacture of other substances *e.g.* of fine chemicals and for the formulation of preparations. It can also be found in different consumer products, such as adhesives, nail varnish removers and brush cleaners. No hazardous effects for the environment arise from this substance. Regarding human health, methyl acetate has irritating effects on the eyes and may irritate the respiratory tract upon inhalation as well as the skin due to its degreasing effects. Further, it has narcotic properties and may cause dizziness and drowsiness upon inhalation. It is recommended that workers observe the safety measures listed in the (extended) Safety Data Sheet.

2 Chemical Identity

Name:	methyl acetate
Synonyms:	acetic acid methyl ester; methyl ethanoate
CAS number:	79-20-9
EINECS number:	201-185-2
Molecular formula:	$C_3H_6O_2$

3 Uses and Applications

Methyl acetate is commonly used as a solvent and in various industrial processes and can be also found in many consumer products.
In the industry the substance itself is applied as solvent and laboratory reagent, as intermediate in the manufacture of other substances *e.g.* of fine chemicals and for the formulation of preparations . Industrial and professional uses include the application in coatings, cleaning agents, metal working fluids and rolling oils, blowing agents, binders and release reagents as well as manufacture and processing of polymers. In consumer products methyl acetate is present in various indoor and outdoor articles with adhesive purposes, in nail varnish removers and brush cleaners.

4 Physical / Chemical Properties

Methyl acetate is a colourless, organic liquid with a pleasant odour. Materials to avoid include oxidising agents and alkalis since reaction with these leads to formation of heat. Due to the high flammability of liquid and vapours, special attention should be given during handling and storage. Flammable vapours may accumulate and form explosive mixtures with air. Therefore, adequate ventilation should be ensured and measures taken against electrostatic discharges.

Appearance				
State of matter:	liquid			
Colour:	colourless			
Odour:	pleasant			
Odour threshold:	no data available			
Molecular weight:	74.08 g/mol			
Safety relevant basis data				
Parameter		**Value**	**Unit**	**Remark**
Density:		0.93	g/cm³	at 20 °C
pH:		3.9		at 20 °C; 295 g/L H_2O
Melting point:		-98	°C	1013 hPa
Boiling temperature:		57	°C	1013 hPa
Flash point:		-13	°C	1013 hPa
Explosion hazard:				
Lower explosion limit:		3.1	Vol-%	
Upper explosion limit:		16	Vol-%	
Ignition temperature:		454	°C	1013 hPa
Decomposition temperature:				no data available
Vapour pressure:		228 787	hPa hPa	at 20 °C at 50 °C
Solubility in water:		243.5	g/L	at 20 °C
log $P_{O/W}$ (n-octanol / water):		0.18		
Viscosity (dynamic):		0.364	mPa*s	at 25 °C

5 Health Effects

5.1 Consumer

Due to the use of methyl acetate as component in different consumer products, such as adhesives in indoor and outdoor articles, nail varnish removers and brush cleaners, consumers might get in contact with the substance. However, hazardous health effects for consumers using indicated products can be excluded.

5.2 Worker

Workers might be exposed to the substance, since the production process and the industrial use involve steps which are not carried out in closed systems. Nevertheless, precautionary measures have been implemented in order to minimize the risk during daily handling. The following table gives an overview on possible health effects:

Effect Assessment	Result
Acute Toxicity oral / inhalation / dermal	Methyl acetate is of very low acute toxicity via the oral, dermal and inhalative route. Inhalation of vapours may be narcotising and can cause headache and somnolence. (STOT SE 3; H336: May cause drowsiness or dizziness.)
Irritation / corrosion skin / eye / respiratory tract	Studies revealed that methyl acetate can have degreasing and weak irritating effects on skin and on the upper respiratory tract. The substance is definitely irritating to eyes. (Eye Irrit. 2; H319: Causes serious eye irritation.)
Sensitisation	No indications for skin sensitisation have been observed.
Toxicity after repeated exposure oral / inhalation / dermal	Inhalation tests on animals revealed changes in the olfactory membrane of the nose, while repeated exposure to skin may cause skin dryness or cracking. However, methyl acetate did not show systemic effects of toxicological relevance and therefore has not been classified as toxic after repeated exposure.
Genotoxicity / mutagenicity	No genotoxic and no mutagenic properties have been observed.
Carcinogenicity	The substance did not show any signs of carcinogenic activity.
Toxicity for reproduction	No reproductive hazards are expected for methyl acetate.

6 Environmental Effects

Based on studies no hazardous environmental effects are expected for aquatic organisms as well as water purification plants. Methyl acetate has a low toxicological profile. It is readily biodegradable, does not bioaccumulate and is not considered as persistent in the environment.

Effect Assessment	Result
Aquatic Toxicity	Studies revealed that methyl acetate is of very low toxicity to aquatic organisms, such as fish, daphnia, and algae, and consequently has no expected damaging effects to the aquatic environment or bacteria in water purification plants.
Terrestrial Toxicity	No data available.

Fate and behaviour	Result
Biodegradation	Methyl acetate is readily biodegradable (70% in 28 days).
Bioaccumulation potential	No potential for bioaccumulation (log $P_{OW} \leq 3$).
PBT / vPvB conclusion	This substance is neither a PBT nor a vPvB substance.

7 Exposure

7.1 Human health

Consumers can come in contact with methyl acetate as it can be found in different consumer articles, such as adhesives for indoor and outdoor uses, nail varnish removers and brush cleaners. During daily handling workers might be exposed to the substance via dermal contact and/or inhalation. Workers should follow the safety measures listed in the (extended) Safety Data Sheet.

7.2 Environment

No environmental hazards were identified and all uses of the substance identified under REACH are assessed as safe for the environment.

8 Risk Management Recommendations

When using methyl acetate, standard industrial hygiene practices for the handling of chemical substances should be observed. Do not eat, drink or smoke while handling the substance. Avoid contact with eyes and skin and do not breathe vapours. It is strongly recommended to use personal protective equipment, such as protective gloves made of butyl rubber as hand protection, protective goggles for protection of the eyes as well as suitable respiratory protection in cases of long or strong exposure or when technical measures, such as adequate ventilation and suction at critical points, are insufficient, *i.e.* occupational exposure limit values might be exceeded.

9 First Aid Measures

In case of accident or if you feel unwell seek medical advice (show label or Safety Data Sheet where possible). If inhaled, move person to fresh air, keep the victim laying down and restful. In case of breathing difficulties or breathing has stopped, give artificial respiration. After contact with the skin remove contaminated or soaked clothing and wash the affected area with plenty of water or water and soap. Effects on the skin may cause degreasing and skin irritations. Seek medical advice in case of continuous irritation. In case of contact with the eyes, rinse immediately with plenty of water while holding eye lids apart and contact an oculist. After ingestion, do not induce vomiting since a danger of aspiration exists. Immediately seek medical advice and clearly identify substance.

10 Fire Fighting Measures

In case of fire it is recommended to use water spray, extinguishing powder, foam or carbon dioxide (CO_2) as extinguishing media, while the use of a water jet should be avoided. If it can be done without risk, endangered product containers should be cooled by using water spray, personal should be guided to a safe place and unprotected people kept away. Hazardous decomposition products in case of incomplete combustion contain, among other substances, acetic acid, which is corrosive. It is absolutely required that fire fighters wear a self-contained breathing apparatus as well as a full protective suit.

11 Accidental Release Measures

Wear personal protection equipment and avoid inhalation of mists and vapours. Eliminate all sources of ignition and absorb spills with an appropriate liquid binding material, such as diatomaceous earth. For larger amounts it is recommended to pump up spills into suitable containers. Dispose of in prescribed marked containers. Observe local/state/federal regulations. Prevent material from entering sewers or surface waters. Keep unprotected people away and guide people to safety.

12 Disposal Considerations

It is recommended to dispose of according to national regulations by incineration in a special waste incinerator. Small quantities may be disposed of by incineration in an approved facility. In regard to packaging material, it is recommended to completely empty the containers and to re-use or recycle them after appropriate cleaning. Containers which cannot be properly cleaned must be thrown away.

13 Handling and Storage

When handling methyl acetate adequate ventilation has to be ensured. Since the substance is highly flammable, sources of ignition must be kept away, *e.g.* heat, sparks, open flames. Do not smoke. Take precautionary measures against static discharges when handling the container by grounding of metal containers, apparatus, pumps and suction equipment. Flammable vapours may accumulate and form explosive mixtures with air in containers, process vessels, including partial, empty and uncleaned containers and vessels, or other enclosed spaces. Do not store together with fire-promoting and spontaneously inflammable substances or with highly inflammable solids. Keep container tightly closed and store in a cool, well ventilated place.

14 State Agency Review

Methyl acetate has been registered under REACH and in many other countries according to national regulations. For this product a chemical safety assessment according to national regulations has been carried out.

15 Classification and Labelling

The substance is classified under the EU Classification Labelling and Packaging (CLP) Regulation EC/1272/2008 as follows:

Hazard Class and Category	H-Phrase	Hazard pictograms	Wording
Flammable liquids, category 2	H225		Highly flammable liquid and vapour.
Serious eye damage / eye irritation, category 2	H319		Causes serious eye irritation.
Specific target organ toxicity (single exposure), category 3	H336	-	May cause drowsiness and dizziness.

16 Conclusion

Methyl acetate is a well characterised substance in regard to its physico-chemical as well as (eco)toxicological properties. It is considered as not hazardous to the environment. In regard to human health effects, it is irritating to eyes upon contact and further may be irritating to the respiratory tract and skin due to its degreasing effect. Inhalation of vapours has a narcotic effect and can cause drowsiness and dizziness. Consumers may be exposed to methyl acetate via different products, although serious hazardous effects can be excluded. Workers should follow the safety measures listed in the (extended) Safety Data Sheet.

17 Contact Information within Company

For further information on this substance or product safety summaries in general, please contact: Dr. Christian Eppelsheim at wlcp-reach@wacker.com or visit our website at www.wacker.com.

18 Date of Issue

19/03/2012

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GPS SAFETY SUMMARY
MONOCHLOROACETONE

This Product Safety Summary is intended to provide a general overview of the chemical substance in the context of ICCA Global Product Strategy. The information on the Summary is basic information and is not intended to provide emergency response information, medical information or treatment information. The summary should not be used to provide in-depth safety and health information. In-depth safety and health information can be found on the (extended) Safety Data Sheet (e)SDS for the chemical substance.

1 General Statement

Monochloroacetone is a clear, dark-coloured organic liquid with pungent odour. It was used as a tear gas in World War I due to its adverse effects on human health. At present, it is only used as intermediate in industrial processes for the manufacture of other substances under strictly controlled conditions. Due to its properties, it is classified as absolutely hazardous to human health by all exposure routes. Also in regard to effects on the environment, this substance exhibits a high toxicity and must not be released into the environment. Consumers will not get into contact with this substance in any way. Workers (industry, laboratory) should follow the safety measures recommended in the extended Safety Data Sheet (eSDS) and also observe all official regulations.

2 Chemical Identity

Name:	**Monochloroacetone**
Synonyms:	**Chloroacetone, chloropropanone, acetonyl chloride**
CAS number:	**78-95-5**
EINECS number:	**201-161-1**
Molecular formula:	**C_3H_5ClO**

3 Uses and Applications

Monochloroacetone is primarily used in industrial processes for synthesis of many substances, such as heterocycles (e.g. imidazoles, thiazoles, pyrroles, thiophenes, thiazines), pharmaceuticals (e.g. Benzarone, Benziodarone, Bometolol, Denbufyllin, etc.), pesticides (Fumecylox, Thiabendazole, herbicide-safeners, insecticides) and dyes. Further application of monochloroacetone includes the use as laboratory reagent. It is absolutely unlikely that consumers are exposed to this substance in any way, whereas workers (industry, laboratory) should follow the safety measures recommended in the extended Safety Data Sheet (eSDS).

4 Physical / Chemical Properties

Monochloroacetone is a colourless liquid with a pungent odour. Upon exposure to light, it turns to a dark yellow-amber colour via oxidation. The liquid is mobile and has a strong lachrymatory effect. Liquid and vapour of this substance are flammable, so that it is crucial to remove all

sources of ignition during handling and storage and to take precautionary measures against static discharges. Vapours can build explosive / highly flammable mixtures with air, so adequate ventilation and suction should be provided.

Appearance

State of matter:	liquid
Colour:	dark
Odour:	pungent
Odour threshold:	10 mg/m^3
Molecular weight:	92.52 g/mol

Safety relevant basis data

Parameter	Value	Unit	Remark
Density:	1.1519	g/cm^3	at 20°C
pH:	4.8		at 21°C, 10g/l H_2O
Melting point / range:			not applicable
Boiling temperature / range:	115	°C	at 1013 hPa
Flash point:	38	°C	
Explosion hazard:			not applicable
Lower explosion limit:	3.4	V-%	
Upper explosion limit:			no data available
Ignition temperature:	600	°C	
Auto-ignition temperature:			not applicable
Oxidizing properties			no
Decomposition temperature:	178 – 318	°C	thermal
Vapour pressure:	7.9	hPa	at 20°
	28	hPa	at 38°
	59	hPa	at 50°
Solubility in water:	148.8	g/l	at 20°C
log P O/W (n-octanol / water):			no data available
Viscosity (dynamic):	1.11	mPa.a	at 25°C

5 Health Effects

5.1 Consumer

Consumer exposure is extremely unlikely as the substance is manufactured and handled in industrial and professional settings only.

5.2 Worker

Workers will typically not come into contact with the substance as it is manufactured in closed systems in industrial and professional settings. In case of unintended exposure during synthesis, formulation, transfer or other procedures, workers should follow the recommended safety measures in the extended Safety Data Sheet (eSDS). The following table gives an overview on the health effects:

Effect Assessment	Result
Acute Toxicity oral / inhalation / dermal	Studies revealed that monochloroacetone is toxic upon inhalation, ingestion and upon contact with skin. (Acute Tox. 3; H301: Toxic if swallowed. Acute Tox. 2; H310: Fatal in contact with skin. Acute Tox. 2; H330: Fatal if inhaled.)
Irritation / corrosion skin / eye / respiratory tract	Monochloroacetone is strongly irritating to the eyes, the respiratory system and to skin (Skin Irrit. 2; H315: Causes skin irritation. Eye Irrit. 2A; H319: Causes serious eye irritation.)
Sensitisation	No data available.
Toxicity after repeated exposure oral / inhalation / dermal	Data is lacking for repeated oral and dermal exposure. Repeated exposure via inhalation showed that monochloroacetone is a respiratory irritant. (STOT SE 3; H335: May cause respiratory irritation.)
Genotoxicity / mutagenicity	No genotoxic and no mutagenic properties known.
Carcinogenicity	No data available.
Toxicity for reproduction	Based on available data no developmental or reproductive toxicity has to be anticipated.

6 Environmental Effects

Based on available data for the substance, monochloroacetone is considered as very toxic to aquatic organisms and can even have long-term adverse effects. It is not expected to bioaccumulate, but based on tests biodegradation occurs slowly and in this way can have adverse effects on aquatic organisms on a long-term perspective. Therefore, dumping into the environment should be prevented in any way.

Effect Assessment	Result
Aquatic Toxicity	Based on available data, monochloroacetone is very toxic to aquatic organisms and may also cause long-term adverse effects in the aquatic environment. Also in regard to the degradation activity of activated sludge, the substance may have disturbing effects.
Terrestrial Toxicity	No data available.

Fate and behaviour	Result
Biodegradation	Monochloroacetone is not readily biodegradable. (59% in 28 days)
Bioaccumulation potential	Bioaccumulation is not expected to occur.
PBT / vPvB conclusion	No data available.

7 Exposure

7.1 Human health

Consumers will not come into contact with monochloroacetone as it is manufactured in industrial and professional settings in closed processes. Exposure to monochloroacetone of personnel in manufacturing facilities is also considered as low because the process, storage and handling operations are strictly controlled. Workers who might accidentally come into contact with the

substance should absolutely follow the safety measures recommended in the Extended Safety Data Sheet (eSDS), since the substance is highly toxic to human health.

7.2 Environment

The manufacture of the substance and on-site uses are proceeded under strictly controlled conditions with no releases to air, soil and water (expected). Also during the industrial use of the substance there are no releases to air, water and soil, since the substance is classified as very toxic to the aquatic environment and is considered to have also significant adverse effects to aquatic organisms on a long-term perspective. Dumping into the environment must be prevented in any way.

8 Risk Management Recommendations

When using monochloroacetone, make sure that there is adequate ventilation and suction at critical points to ensure that occupational exposure limit values are not exceeded. Do not breath vapours and avoid contact with eyes and skin by using appropriate respiratory protection (gas mask with filter type A; in case of long or strong exposure use a self-contained breathing apparatus), eye protection, such as tight fitting protective goggles, appropriate chemical resistant gloves, e.g. for short-term use (< 10 minutes) gloves coated with neoprene, and a full protective suit as body protection. Emergency showers and eye-bath possibilities must be provided. Do not eat, drink or smoke where chemicals are handled, processed or stored. Keep away from foodstuff, drink and feeding stuff. Wash hands thoroughly after handling. Keep working clothes separately. Do not release into the aquatic environment, i.e. surface waters, drains or sewers, or soil. If large amounts are introduced into sewerage inform responsible authorities immediately.

9 First Aid Measures

First aid assistants should pay attention to self-protection. In any cases of accident or unwell feeling a medicine should be immediately be consulted; the label should be shown, if possible. After inhalation of vapours the victim should be moved to fresh air. Lay victim down and keep calm and at rest. In case breathing has stopped, artificial respiration should be provided. If breathing is difficult, give oxygen. Immediately consult a doctor. In case of contact with skin, rinse the affected area with plenty of water and soap for at least 15 minutes. Remove all contaminated clothes and shoes at once. In serious cases use an emergency shower. After contact with the eyes, rinse with plenty of water for at least 15 minutes and seek immediately medical advice. Continue to bathe eyes during transport to a medicine. Protect the unharmed eye. While rinsing eyes with water, keep eyelids well open to rinse the whole eye surface and eyelids with water. If accidentally swallowed, rinse mouth with plenty of water but do not induce vomiting since a risk of aspiration exists. Seek immediately medical advice and show the label or packaging.

10 Fire Fighting Measures

In case of fire, use water spray, extinguishing powder, foam or carbon dioxide (CO_2) as extinguishing media. Do not use a high power water jet or plenty of water. If it can be done without risk, cool endangered product containers by using water fog. Guide personal to safety and keep unprotected people away. Hazardous decomposition products contain corrosive substances such as hydrogen chloride among other toxic pyrolysis products as carbon

monoxide (CO) and carbon dioxide (CO_2). It is absolutely required to wear a self-contained breathing apparatus.

11 Accidental Release Measures

When handling the substance, personal protection equipment must absolutely be worn. In special cases (task force) a tightly fitting chemical protection suit must be worn. Avoid any contact with the substance as well as inhalation of mists, gases and vapours. Take persons to a safe place and keep unprotected people away. Observe wind direction and keep upwind. It should also be ensured that all ignition sources are removed since monochloroacetone is flammable. Take precautionary measures against static discharges. Dumping in the environment must be prevented, e.g. prevent material from entering sewers or surface waters. For absorption of spills use an appropriate, liquid-binding material (e.g. earth, diatomaceous earth) and place in appropriate containers for disposal according to official and local state regulations. For large amounts pump up into suitable, prescribed marked containers. In case of small spills, cover the area with calcium oxide (CaO) and dispose of safely. Do not flush spills away by using water.

12 Disposal Considerations

It is recommended to carry out burning of monochloroacetone as hazardous waste in a special waste incinerator according to official regulations. Local regulations must be observed. Collect contaminated fire extinguishing water separately. Retain contaminated washing water and dispose of according to national, federal and local regulations. Dumping into the environment must be prevented. Contaminated packaging material must be completely emptied and can be re-used or re-cycled following appropriate cleaning. Handle contaminated packaging in the same way as the substance itself. Packaging material which cannot be properly cleaned must be thrown away.

13 Handling and Storage

If handling the substance, exposure must be avoided by using appropriate technical measures and personal protective equipment. Ensure an adequate ventilation and punctiform suction at critical points. Must be siphoned off in situ. Open and handle container with care. Keep away from ignition sources, e.g. heat, sparks, open flames, hot surfaces, and do not smoke since monochloroacetone is a flammable substance. Take precautionary measures against static discharges. Flammable vapours may accumulate and form explosive mixtures with air in containers, process vessels, including partial, empty and uncleaned containers and vessels, or other enclosed spaces. Be aware that the substance reacts violently with basic substances under formation of heat, so avoid such materials.
This substance should only be stored under protective gas. Keep the storage container dry and in a cool, well-ventilated place and tightly closed. Do not use containers, casks and pipelines made of light metals or their alloys, e.g. aluminum, as well as iron, steel or zinc.

14 State Agency Review

Monochloroacetone has been registered under REACH. This substance is listed on the TSCA Chemical Substance Inventory (USA) and the Canadian Domestic Substances List (DSL), as

well as PICCS (Philippines), ENCS (Japan), ECL (Korea), EINECS (Europe), AICS (Australia) and IECSC (China).

15 Classification and Labelling

The substance is classified under the EU Classification Labelling and Packaging (CLP) Regulation EC/1272/2008 as follows:

Hazard Class and Category	H-Phrase	Hazard pictograms	Wording
Flammable liquids 3	H226		Flammable liquid and vapour.
Acute Toxicity 3 (oral)	H301		Toxic if swallowed.
Acute Toxicity 2 (dermal)	H310		Fatal in contact with skin.
Acute Toxicity 2 (inhalation)	H330		Fatal if inhaled.
Skin irritation 2	H315	(GHS 07)	Causes skin irritation.
Serious eye irritation 2A	H319		Causes serious eye irritation.
Specific target organ toxicity after single exposure 3	H335		May cause respiratory irritation.
Acute aquatic toxicity 1	H400		Very toxic to aquatic life.
Chronic aquatic toxicity 1	H410		Very toxic to aquatic life with long lasting effects.

16 Conclusion

Monochloroacetone is a well characterised substance. Consumers will not get in contact with this substance, since use of this substance takes place in industrial and professional settings only. Workers should follow the safety measures recommended in the Extended Safety Data Sheet (eSDS) and also observe all official regulations (local/national) since the substance has acute hazardous effects on human health by all ways of exposure. With regard to the environment monochloroacetone is regarded as very toxic, also on a long-term perspective. Therefore, dumping into the environment must be prevented.

17 Contact Information within Company

For further information on this substance or product safety summaries in general, please contact:Dr. Christian Eppelsheim at wlcp-reach@wacker.com or visit our website at www.wacker.com.

18 Date of Issue

05/03/2012

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GPS SAFETY SUMMARY
POTASSIUM METHYLSILANETRIOLATE

This Product Safety Summary is intended to provide a general overview of the chemical substance in the context of ICCA Global Product Strategy. The information on the Summary is basic information and is not intended to provide emergency response information, medical information or treatment information. The summary should not be used to provide in-depth safety and health information. In-depth safety and health information can be found on the (extended) Safety Data Sheet for the chemical substance.

1 General Statement

Potassium methlysilanetriolate is a colourless to yellowish aqueous solution. The substance is industrially produced by reaction of trimethoxymethylsilane with an aqueous potassium hydroxide solution (batch process or continuous process). The application of the substance covers a broad range. Potassium methlysilanetriolate is used as a chemical intermediate in various industrial processes, as a non-metal surface treatment agent, as agent for hydrophobation processes as well as laboratory reagent. It is also used as component in coatings, paints and in masonry products through which consumers can get in contact with the substance.
The aqueous solution is very corrosive and can cause severe damage to eyes, skin and the mucous membranes, such as mouth and throat, upon contact. From the ecotoxicological point of view the substance poses no risk to the environment. Potassium methlysilanetriolate reacts violently with acids under formation of heat. Upon contact with various light metals highly flammable hydrogen gas is generated, which should also be taken into account during handling and storage. Workers (industry, laboratory) should follow the safety measures recommended in the Safety Data Sheet.

2 Chemical Identity

Name:	Potassium methylsilanetriolate
CAS number:	31795-24-1
EINECS number:	250-807-9
Molecular formula:	$CH_6O_3Si.xK$

3 Uses and Applications

The uses of potassium methylsilanetriolate cover a broad range. These include the use as intermediate in the production of other chemicals as well as application in coatings and paints in the building and construction sector due to its hydrophobic property. In the building and construction industry the substance is used as an active ingredient in formulations for water-repellent purposes, e.g. treatment of external masonry surfaces of new buildings, restoration and preservation of historical buildings as well as infrastructural constructions, e.g. bridges. Also various substrates are treated with potassium methylsilanetriolate containing preparations by dipping or spraying. These substrates include fired clay products, such as bricks and roof tiles, and (aerated) plaster and gypsum products. The substance is also often used for the production of mineral/silicate-based paints, in which it is combined e.g. with water glass (potassium silicate),

minerals and fillers. Besides these uses, potassium methylsilanetriolate is also used as laboratory reagent in research and development.

4 Physical / Chemical Properties

Potassium methylsilanetriolate is a multi-constituent substance containing methylsilanetriolate, dimers and trimers of methylsilanetriolate and potassium hydroxide. The organic substance is only stable in aqueous solutions at high pH values. When the pH is reduced, polymerisation occurs. The solution is colourless to yellowish, is strongly corrosive and has a slight odour. Upon contact with light metals, such as aluminum, flammable hydrogen gas is generated. Further, the solution reacts strongly upon contact with acids leading to formation of heat. Special attention has to be given during handling and storage.

Appearance

State of matter:	liquid
Colour:	colourless to yellowish
Odour:	slight
Odour threshold:	no data
Molecular weight:	132.23 g/mol for $CH_3Si(OH)_2OK$

Safety relevant basis data

Parameter	Value	Unit	Remark
Density:	1.3 – 1.4	g/cm^3	at 25°C
pH:	13 -14		at 20°C
Melting point / range:			not applicable
Boiling temperature / range:			not applicable
Flash point:			not applicable
Explosion hazard:			not explosive
Lower explosion limit:			not applicable
Upper explosion limit:			not applicable
Ignition temperature:	> 600	°C	at 101.3 kPa
Decomposition temperature:			no data
Vapour pressure:			not applicable
Solubility in water:			completely miscible
log $P_{O/W}$ (n-octanol / water):	<< 0		at 20°C (values for methyl-silanetriol, and dimer and trimer of methylsilanetriol)
Viscosity (dynamic):	10 - 25	mPa.s	at 25 °C

5 Health Effects

5.1 Consumer

A few consumer products, such as masonry treatment products, can contain potassium trimethylsilane-triolate. Therefore, consumers might get in contact with the substance. Due to the corrosive nature of the solution direct contact with skin, eyes or respiratory tract should be avoided. The instructions for use available for consumer articles should be observed.

5.2 Worker

During the manufacturing process workers can get in contact with the substance for limited periods or occasionally via skin or inhalation. Appropriate risk management measures have been established in order to minimise the risk to workers. Workers should follow the recommended safety measures in the Safety Data Sheet. The following table gives an overview on the health effects:

Effect Assessment	Result
Acute Toxicity oral / inhalation / dermal	Due to the corrosiveness of potassium trimethylsilanetriolate, no data is available for acute dermal and inhalation toxicity. Studies regarding oral toxicity demonstrated that the substance is not toxic via the oral route.
Irritation / corrosion skin / eye / respiratory tract	The substance is only stable in strongly alkaline solutions, which leads to the classification as a strong corrosive. (Skin Corr. 1A; H314: Causes severe skin burns and eye damage, Eye Dam. 1; H318: Causes serious eye damage.)
Sensitisation	No data is available due to the corrosive character of the solution.
Toxicity after repeated exposure oral / inhalation / dermal	For the assessment of toxicity after repeated inhalative and oral exposure a structural analogue of potassium trimethylsilane-triolate has been used (trimethoxymethylsilane). The results led to the conclusion that potassium methylsilanetriolate is not toxic for the indicated exposure routes. Due to its corrosive property, the dermal route is irrelevant.
Genotoxicity / mutagenicity	No potential for genotoxicity or mutagenicity has been observed.
Carcinogenicity	There is no evidence that the substance is carcinogenic.
Toxicity for reproduction	No data is available for the substance itself. Studies based on the structural analogue trimethoxy(methyl)silane revealed that no adverse reproductive or developmental effects have to be expected.

6 Environmental Effects

Based on available data potassium methylsilanetriolate as substance itself as well as in form of its alkaline solution (pH 13-14) is not considered as toxic to the environment, since the substance condenses and forms polymeric species when lowering the pH value. However, in order to assess possible adverse effects on aquatic organisms, tests have been carried out with structural analogues of the substance, namely triethoxy- and trimethoxy(methyl)silane. The substance is regarded as not significantly biodegradable, to have a low bioaccumulation potential and to be not persistent in the environment.

Effect Assessment	Result
Aquatic Toxicity	Studies for the substance and its structural demonstrate that potassium methylsilanetriolate has no adverse effects on various aquatic organisms.
Terrestrial Toxicity	Although no data is available, it is expected that the substance poses a low risk to terrestrial organisms.

Fate and behaviour	Result
Biodegradation	No significant biodegradation is expected.
Bioaccumulation potential	Low potential for bioaccumulation (predicted log K_{ow} value <<0)
PBT / vPvB conclusion	The substance does not meet the criteria for PBT or vPvB.

7 Exposure

7.1 Human health

Consumers can come in contact with potassium methylsilanetriolate as it can be found in some consumer products, such as masonry treatment products. During use of such articles dermal and inhalative exposure may occur to some extent. Instructions available for products should be followed. In regard to industrial and professional handling of potassium methylsilanetriolate limited exposure to workers via skin contact or inhalation can occur during production, formulation, filling and use. Workers and professional users should follow the risk management measures, which have been implemented, in order to guarantee the safe use and to minimise risks. It is recommended to observe the safety measures recommended in the Safety Data Sheet.

7.2 Environment

Due to the corrosive property of the highly alkaline aqueous solution, strict containment measures and highly controlled conditions have been established for the production process and on-site uses. Based on the very low volatility of the pure substance and the solution, exposure to air can be excluded. Also releases to waste water from cleaning processes or minor spillages during routine activities at the production and formulation stages are low. Waste waters are directed to waste water treatment plants, which may be contaminated with the substance itself or its hydrolysis products. Therefore, secondary biological treatment, on-site waste water as well as municipal or external waste water treatment plants have been implemented to minimise releases via water.

8 Risk Management Recommendations

Due to the corrosive nature of the aqueous solution of potassium methylsilanetriolate, personal protective equipment is crucial in order to avoid any direct exposure. Workers are required to wear suitable respiratory protection, such as a gas mask with ABEK filter in case of long or strong exposure, protective gauntlets or gloves made of e.g. five layer laminate polyethylene (PE), nitrile rubber, fluorinated rubber or gloves coated with neoprene (suitable for 480 minutes), protective and tight fitting goggles/face protection and chemically resistant clothing to minimise any risks. If splashing is possible, complete head, face and neck protection has to be used. For serious cases work stations should be provided with eye bathing equipment and showers. Contact lenses should not be used; eating, drinking and/or smoking are not allowed during handling of the substance. Contaminated clothing has to be immediately removed. In regard to environmental exposure controls, any releases to the environment must be prevented; large waste water amounts should not be introduced into purification plants before a neutralisation step has been carried out.

9 First Aid Measures

Guide people to safety. First aid assistants should pay attention to self-protection. After contact with the substance via skin, eyes, ingestion and/or inhalation, a physician must immediately be consulted. In case of contact with the skin, contaminated clothes should be removed at once and the affected area immediately flushed with large amounts of water for minimum 15 minutes followed by washing with soap and water, if available. In case of large amounts an emergency shower should be used. In case of contact with eyes, eyes must be immediately flushed with large amounts of water for at least 15 minutes while holding eyelids apart. After inhalation of the substance, the affected person has to be kept warm and at rest; in case of breathing difficulties or breathing has stopped artificial respiration has to be provided. If accidentally swallowed, let water be swallowed in little sips (only if the person is conscious), and obtain immediate medical attention. Do not induce vomiting. Let physician allow inhalation of cortisone spray at the first possible opportunity. Medical checks are necessary up to a latency period of at least 24 hours. In the event of first degree burns corticoid treatment is necessary. For second degree burns, burns should be treated symptomatically.

10 Fire Fighting Measures

The substance is not flammable. In case of fire use extinguishing measures appropriate to the source of fire and according to the surrounding area. It is absolutely required to wear a full protective suit and a self-contained breathing apparatus.

11 Accidental Release Measures

When handling the substance, personal protection equipment must be worn. In case of spills, avoid any contact with the substance via eye and skin as well as inhalation of mists and vapours. Keep unprotected people away. Absorb spills with an appropriate, liquid-binding material (e.g. earth, diatomaceous earth) and place in appropriate containers for disposal according to official and local state regulations. Larger quantities of the spilled substance should be pumped up in suitable containers. Prevent material from entering sewers or surface waters.

12 Disposal Considerations

It is recommended to incinerate potassium methylsilanetriolate as hazardous waste according to official regulations in a special incineration plant. Local regulations must be observed. Dumping into the environment must be prevented. Contaminated packaging material must be completely emptied and can be re-used or recycled following appropriate cleaning. Handle contaminated packaging in the same way as the substance itself. Packaging material which cannot be properly cleaned must be thrown away.

13 Handling and Storage

If handling the substance, avoid any contact with skin and eyes as well as inhalation of vapours, mists and aerosols. It is crucial that personal protective equipment is used. Keep away from incompatible substances, such as acids, since acids react violently with the basic solution under formation of heat. Store only in the original container and keep the container tightly closed. The

container material must not consist of light metal material, such as aluminum, since corrosion under formation of flammable hydrogen gas will occur.

14 State Agency Review

Potassium methylsilanetriolate has been registered under REACH. For this product chemical safety assessments have been carried out. National regulations listing potassium methylsilanetriolate are the following: European Inventory of Existing Commercial Chemical Substances (EINECS), Australian Inventory of Chemical Substances (AICS), Korean Existing Chemicals List (ECL), Japanese Existing Notified Chemical Substances (ENCS), Philippine Inventory of Chemicals and Chemical Substances (PICCS), U.S. Toxic Substances Control Act (TSCA), Inventory of Existing Chemical Substances in China (IECSC).

15 Classification and Labelling

The substance is classified under the EU Classification Labelling and Packaging (CLP) Regulation EC/1272/2008 as follows:

Hazard Class and Category	H-Phrase	Hazard pictogram	Wording
Skin corrosion 1A	H314		Causes severe skin burns and eye damage.
Eye Damage 1	H318		Causes serious eye damage.

16 Conclusion

Potassium methylsilanetriolate is a well characterised substance, which is available in form of an alkaline solution. The most significant property is its strong corrosiveness due to its high pH value. Consumers might get in contact with potassium methylsilantriolate via available consumer products, e.g. for masonry treatment. It is absolutely required that consumers handle such products with caution. Workers (industry, laboratory) should follow the safety measures recommended in the Safety Data Sheet.

17 Contact Information within Company

For further information on this substance or product safety summaries in general, please contact: Dr. Christian Eppelsheim at wlcp-reach@wacker.com or visit our website at www.wacker.com.

18 Date of Issue

27/03/2012

WACKER

GPS SAFETY SUMMARY
SILICON TETRACHLORIDE

This Product Safety Summary is intended to provide a general overview of the chemical substance in the context of ICCA Global Product Strategy. The information on the Summary is basic information and is not intended to provide emergency response information, medical information or treatment information. The summary should not be used to provide in-depth safety and health information. In-depth safety and health information can be found on the (extended) Safety Data Sheet (e)SDS for the chemical substance.

1 General Statement

Silicon tetrachloride is an inorganic, colourless liquid. For its synthesis various manufacturing methods have been established. The main route of production uses silicon and either hydrogen chloride or methylchloride as reactants and results in high yields of silicon tetrachloride. Other major sources for silicon tetrachloride production are based on industrial processes for the manufacture of silicon products. In these processes silicon tetrachloride is generated as by-product. Silicon tetrachloride is used as an intermediate in the production of other silicon-based substances, as a monomer in the production of silicon polymers and resins, in the semiconductor industry including photovoltaics and in the production of optical fibres. Further application includes its use as laboratory reagent in research and development activities. In regard to hazardous health effects, silicon tetrachloride causes severe burns upon contact with eyes and skin; inhalation of vapours is highly irritating to the respiratory tract, possibly leading to severe lung damage. Specific attention also has to be given during handling of silicon tetrachloride, since contact with water or other proton-active substances (e.g. alcohols) releases gaseous hydrogen chloride (HCl), which is highly irritating and corrosive. It is highly recommended that workers obtain specific instructions before handling this substance. Due to possible releases of hydrogen chloride upon hydrolisation, hazardous ecotoxicological effects to the aquatic environment may arise from the shift to low pH values.

2 Chemical Identity

Name:	**silicon tetrachloride**
CAS number:	**10026-04-7**
EINECS number:	**233-054-0**
Molecular formula:	**Cl_4Si**

3 Uses and Applications

The application of silicon tetrachloride covers a broad range of uses. Silicon tetrachloride is used as a laboratory reagent in industrial and academic settings and as an intermediate in industrial processes especially including the synthesis of other silicon-based materials, e.g. for the production of alkoxysilanes, trichlorosilane and synthetic amorphous silica. Silicon tetrachloride is occassionally used as a monomer in the production of silicone resins together with other organochloro- and/or organoalkoxysilanes. Silicon tetrachloride is further used in the electronics industry for the production of silicon and silicon wafers of very high purity, and in the manufacture of semiconductors and photovoltaics via the chemical vapour deposition process (CVD). Additionally, its application as starting material in the production of optical fibres by conversion of silicon tetrachloride to silicon and subsequent agglomeration of silicon on a

substrate can be mentioned. It is highly unlikely that consumers are exposed to this substance in any way, whereas workers (industry, laboratory) should follow the safety measures recommended in the extended Safety Data Sheet (eSDS).

4 Physical / Chemical Properties

Silicon tetrachloride is a clear, colourless inorganic liquid with a pungent odour. The substance is characterised by its high volatility and its reactivity with water, which leads to the release of hydrogen chloride (HCl), which is highly toxic and corrosive. Therefore, it is highly recommended to handle the substance under adequate ventilation, to use personel protective equipment and to keep it away from substances such as water, basic substances, acids, alcohols, ketones and aldehydes.

Appearance

State of matter:	liquid
Colour:	colourless
Odour:	pungent
Odour treshold:	no data
Molecular weight:	169.90 g/mol

Safety relevant basis data

Parameter	Value	Unit	Remark
Density:	1.48	g/cm^3	at 20°C
pH:	< 1		5 g/l H_2O
Melting point / range:	- 68.9	°C	
Boiling temperature / range:	57	°C	at 1013 hPa
Flash point:			not applicable
Explosion hazard:			not applicable
Lower explosion limit:			not applicable
Upper explosion limit:			not applicable
Ignition temperature:			not applicable
Decomposition temperature:			no data
Vapour pressure:	260	hPa	at 20 ° C
Solubility in water:			not applicable, since substance reacts violently with water
log $P_{O/W}$ (n-octanol / water):			not applicable, since substance reacts violently with water
Viscosity (static):	0.35	mm^2/s	at 25 °C
Viscosity (dynamic):	0.48	mPa·s	at 20 °C

5 Health Effects

5.1 Consumer

Consumer exposure is extremely unlikely as the substance is manufactured and handled in industrial and professional settings and is not recommended for consumer use.

5.2 Worker

Workers will typically not come into contact with the substance as it is manufactured in closed systems in industrial and professional settings. In case of unintended exposure during synthesis, formulation, transfer or other procedures, workers should follow the recommended safety measures in the extended Safety Data Sheet (eSDS). The following table gives an overview on the health effects:

Effect Assessment	Result
Acute Toxicity oral / inhalation / dermal	Studies revealed clear hazardous effects upon oral or inhalative exposure. Based on the testing results silicon tetrachloride is classified oral toxic (Acute Tox. 3; H301: Toxic if swallowed) and inhalative toxic (Acute Tox. 3 H331: Toxic if inhaled). Single dermal exposure led to minor effects.
Irritation / corrosion skin / eye / respiratory tract	Testing showed clear evidence of skin and eye corrosiveness. Based on data from testings and a poisoing incident the substance has been classified skin corrosive (Skin Corr. 1A; H314: Causes severe skin burns and eye damage.) and eye damaging (Eye Damage 1 H318: Causes serious eye damage).
Sensitisation	No data available since the effects, caused by the corrosive nature of the substance, would camouflage possible sensitizing effects.
Toxicity after repeated exposure oral / inhalation / dermal	Due to the high reactivity towards water no data are available for the repeated dose toxicity. Instead testing results of similar substances – tetramethylorthosilicate and tetraethylorthosilicate – have been used. No suitable dermal data are available. Testing results revealed adverse inhalative effects which were dependent on the inhaled concentration.
Genotoxicity / mutagenicity	*In vitro* testing results indicate an absence for a mutagenic potential.
Carcinogenicity	No carcinogenic potential, since silicon tetrachloride does not exhibit mutagenic properties.
Toxicity for reproduction	There are no data indicating that silicon tetrachloride should be classified as toxic to reproduction or development.

6 Environmental Effects

Based on available data silicon tetrachloride is regarded as not hazardous to the environment. Silicon tetrachloride hydrolyses (half-life < 1 minute) to silicic acid and hydrogen chloride. Effects on aquatic organisms arising from exposure to hydrogen chloride are indicated to be based on the pH reduction in the ambient environment to a level below their tolerable limit. The hazardous effects arising from hydrogen chloride are regarded to be not clearly a result of chemical toxicity, but will be a function of and dependent on the buffering capacity of the environment. In order to assess the environmental effects of silicon tetrachloride toxicological data of a similar compound – tetraethylorthosilicate – have been used. Due to its high reactivity with water the substance does not bioaccumulate and will not persist in the environment. The hydrolysis product (silicic acid) is a naturally occurring substance, which is not harmful to aquatic organisms.

Effect Assessment	Result
Aquatic Toxicity	No data are available for silicon tetrachloride. Therefore, data of a similar compound – tetraethylorthosilicate – have been used. All data indicate that the similar compound poses no toxicological hazard to the aquatic environment. Due to the similarity of the decomposition products (silicic acid) of silicon

	tetrachloride and tetraethylorthosilicate, it can be argued that silicon tetrachloride has no toxic potential to aquatic organisms, too.
Terrestrial Toxicity	No data available.

Fate and behaviour	Result
Biodegradation	Contact with water liberates hydrochloric acid and silicic acid (half-life < 1 minute), i.e. silicon tetrachloride is highly biodegradable.
Bioaccumulation potential	No potential for bioaccumulation due to hydrolisation to hydrogen chloride and silicic acid.
PBT / vPvB conclusion	This substance is not a PBT or vPvB substance.

7 Exposure

7.1 Human health

Consumers will not come into contact with silicon tetrachloride as it is manufactured in industrial and professional settings in closed processes. Exposure to silicon tetrachloride of personnel in manufacturing facilities is also considered as low because the process, storage and handling operations are strictly controlled. Workers who might accidentally come into contact with the substance should follow the safety measures recommended in the Extended Safety Data Sheet (eSDS).

7.2 Environment

Silicon tetrachloride hydrolyses rapidly to silicic acid and hydrogen chloride. These substances are regarded to have no significant environmental effect.

8 Risk Management Recommendations

Due to the corrosive and reactive nature of the substance, all aspects of silicon tetrachloride handling, including on-site storage and transfer, are subject to highly controlled conditions. The Centre Européen des Silicones (CES) manual on Safe Handling of Chlorosilanes recommends that on-site storage vessels are located outside, remote from other buildings, overhead utilities or piping. Equipment such as transfer lines, pumps, valves and vessels must be thoroughly dried, and should be fully enclosed to prevent contact with atmospheric moisture. Carbon steel vessels and piping are suitable in the absence of water, and leak tight systems are employed. In addition, due to the corrosive nature of the substance and the possible release of hydrogen chloride, personal protective equipment and respiratory protective equipment are mandatory for all personnel involved in processes using silicon tetrachloride.

9 First Aid Measures

Guide people to safety. First aid assistants should pay attention to self-protection. After contact with the substance via skin, eyes, ingestion and/or inhalation, a physician must immediately be consulted. Immediately take off all contaminated clothing and shoes and dispose of safely. In case of contact with skin, immediately flush affected area with large amounts of water for minimum 10-15 minutes followed by washing with soap and water, if available. Use an

emergency shower in case of large amounts. In case of contact with eyes, immediately flush eyes with large amounts of water for minimum 10-15 minutes while holding eyelids open. After inhalation of the substance, move to fresh air, keep the affected person warm and at rest. If accidentally swallowed, let several glasses of water be swallowed, only if the person is conscious, and obtain immediate medical attention. Do not induce vomiting.

10 Fire Fighting Measures

The substance itself is not flammable but reacts with water under formation of hydrogen chloride. In case of fire do not use water as an extinguising agent! Use other appropriate extinguishing media and apply measures appropriate to the source of fire. Hazardous decomposition products contain hydrogen chloride. It is absolutely required to wear full protective clothing including a self-contained breating apparatus.

11 Accidental Release Measures

When handling the substance, personal protection equipment must be worn. In case of spills, avoid any contact with the substance as well as inhalation of mists and vapours. Keep unprotected persons away and ensure adequate ventilation. Prevent material from entering surface waters, drains or sewers and soil. Any fluid that runs out should be contained by using a suitable material (e.g. earth). Directed spray of water should be used for condensation of gasses, vapours or mists. The contaminated water should be retained and afterwards disposed of in prescribed marked containers. If large amounts have leaked out, try to close the leak without any personal risk. In case small amounts have been spilled, absorb the liquid by acid binding material and dispose of the collected fluid according to official and local state regulations. Larger quantities of the spilled substance should be covered by nearly waterless foam and should be taken up in containers. After removing the spilled substance, the area should by cleaned up with plenty of water.

12 Disposal Considerations

It is recommended to carry out the disposal of silicon tetrachloride as hazardous waste according to official regulations. Local regulations must be observed. Collect contaminated fire extinguishing water separately. Retain contaminated washing water and dispose of according to national, federal and local regulations. Dumping into the environment must be prevented. Contaminated packaging material must be completely emptied and can be re-used or recycled following appropriate cleaning. Handle contaminated packaging in the same way as the substance itself. Packaging material which cannot be properly cleaned must be thrown away.

13 Handling and Storage

If handling the substance, provide sufficient ventilation and punctiform suction at critical points. Substance should be stored under protective, inert gas. Keep away from incompatible substances, such as water, basic substances, acids, alcohols, ketones and aldehydes. Keep the container tightly closed and keep it in a cool, well ventilated place. Keep the packaging dry and well sealed to prevent contamination and absorbtion of dampness. Store in original container only.

14 State Agency Review

Silicon tetrachloride has been registered under REACH. This substance is listed on the Philippine Inventory of Chemicals and Chemical Substances (PICCS), the Existing Notified Chemical Substances (ENCS), Existing Chemicals List (ECS), the Domestic Substances List (DSL), the Toxic Substances Control Act (TSCA), the European Inventory of Existing Commercial Chemical Substances (EINECS), the Australian Inventory of Chemical Substances (AICS) and the Inventory of Existing Chemical Substances in China (IECSC).

15 Classification and Labelling

The substance is classified under the EU Classification Labelling and Packaging (CLP) Regulation EC/1272/2008 as follows:

Hazard Class and Category	H-Phrase	Hazard pictograms	Wording
Acute toxicity 3	H301		Toxic if swallowed.
Acute toxicity 3	H331		Toxic if inhaled.
Skin corrosion 1A	H314		Causes severe skin burns and eye damage.
Serious eye damage 1	H318		Causes serious eye damage.
	EUH014		Reacts violently with water.
	EUH071		Corrosive to the respiratory tract.

16 Conclusion

Silicon tetrachloride is a well characterised substance, although detailed data is lacking in regard to health effects to repeated dermal exposure. For the assessment, information of a similar compound – tetramethylorthosilicate – has been used for studies on repeated oral and inhalative exposure. However, it is highly unlikely that consumers get in contact with this substance, since its use takes place in industrial and professional settings only. Workers should follow the safety measures recommended in the Extended Safety Data Sheet (eSDS).

17 Contact Information within Company

For further information on this substance or product safety summaries in general, please contact: Dr. Christian Eppelsheim at wlcp-reach@wacker.com or visit our website at www.wacker.com.

18 Date of Issue

06/03/2012

WACKER

GPS SAFETY SUMMARY
SODIUM HYDROXIDE (AQUEOUS SOLUTION 50%)

This Product Safety Summary is intended to provide a general overview of the chemical substance in the context of ICCA Global Product Strategy. The information on the Summary is basic information and is not intended to provide emergency response information, medical information or treatment information. The summary should not be used to provide in-depth safety and health information. In-depth safety and health information can be found on the (extended) Safety Data Sheet (e)SDS for the chemical substance.

1 General Statement

Pure sodium hydroxide (NaOH) is a white, inorganic solid. Its aqueous solution is a colourless, strong corrosive liquid. Sodium hydroxide is industrially produced from a sodium chloride solution via electrolysis using different processes (membrane process, mercury process, or diaphragm process).
The uses of sodium hydroxide and its aqueous solution cover a broad range of applications. In the industry sodium hydroxide is e.g. used for the production of other organic and inorganic chemicals, in the pulp and paper industry as well as metal industry. Consumers can get in contact with sodium hydroxide due to its use in paint stripping and pipe cleaning agents.
The sodium hydroxide solution is very corrosive and causes severe damage upon contact with eyes, skin and mucous membranes such as mouth and throat. Sodium hydroxide also may have adverse environmental effects, which result from changes of the pH value of natural waters upon entry of sodium hydroxide, which in return has adverse effects on aquatic organisms.
Workers (industry, laboratory) should follow the safety measures recommended in the extended Safety Data Sheet (eSDS).

2 Chemical Identity

Name:	**sodium hydroxide**
CAS number:	**1310-73-2**
EINECS number:	**215-185-5**
Molecular formula:	**NaOH**

3 Uses and Applications

Sodium hydroxide is applied in many different industry sectors, such as the food industry, in the pulp and paper industry, in the metal industry and in the textile and leather industry. In the food industry it is e.g. used to clean bottles and to peel vegetables. In the pulp and paper industry sodium hydroxide is applied to de-ink water; in the textile and leather industry it is a useful agent to mercerize cotton, i.e. to refine cotton, and to peel leather. In the metal industry, e.g. aluminum industry it is used for the extraction of alumina, and more generally, the manufacture of various chemicals due to its use as intermediate.
Further uses of sodium hydroxide include its application during the production of biodiesel from vegetable oils, regeneration of resins, water softening, air drying procedures and various processes for adjustment of the pH value.

Sodium hydroxide can be found in various consumer products. The substance is often a component in batteries. It is applied to drain and clean pipes, to strip off paints and old floor layers, and to treat wood. Another application of sodium hydroxide solutions includes its use as hair straighteners.

4 Physical / Chemical Properties

Sodium hydroxide solutions are inorganic liquids, which are colour- and odourless. They are strongly corrosive and can lead to formation and releases of flammable hydrogen gas upon contact with metals, such as aluminum, zinc, tin and their alloys. Hydrogen gas can build explosive oxy-hydrogen gases with atmospheric hydrogen. The solution reacts strongly upon contact with acids leading to heat release.

Appearance	
State of matter:	liquid
Colour:	colourless
Odour:	odourless
Odour threshold:	no data
Molecular weight:	40.0 g/mol (for solid NaOH)

Safety relevant basis data

Parameter	Value	Unit	Remark
Density:	1.525	g/cm^3	at 20 °C
pH:	> 14		no data
Melting point / range:	12	°C	
Boiling temperature / range:	143	°C	at 1013 hPa
Flash point:			not applicable
Explosion hazard:			not explosive
Lower explosion limit:			not applicable
Upper explosion limit:			not applicable
Ignition temperature:			not applicable
Decomposition temperature:			no data
Vapour pressure:	~ 18.7	hPa	at 60 °C
	13.33	hPa	at 50 °C
	1.19	hPa	at 20 °C
Solubility in water:			completely miscible
log $P_{O/W}$ (n-octanol / water):			not applicable
Viscosity (dynamic):	85	mPa.s	at 20 °C

5 Health Effects

Consumer

Due to the widespread uses of sodium hydroxide solutions, consumers can easily get in contact with the substance via various consumer products, e.g. pipe cleaning agents. Consumers should pay attention during handling due to the corrosive nature of the substance and its liquid by strictly avoiding any direct contact with eyes and skin.

Worker

Workers will typically not come into direct contact with the substance as it is manufactured in closed systems in industrial and professional settings. In case of unintended exposure during synthesis, formulation, transfer or other procedures workers should follow the recommended safety measures in the Safety Data Sheet (SDS). The following table gives an overview on the health effects:

Effect Assessment	Result
Acute Toxicity oral / inhalation / dermal	No data is available for oral, inhalative and dermal toxicity due to the corrosive character of the solution.
Irritation / corrosion skin / eye / respiratory tract	Based on various studies, it can be stated that even very diluted solutions of sodium hydroxide have irritating effects to skin and eyes.
Sensitisation	Existing data do not demonstrate that NaOH is a skin sensitizer. No data are available for respiratory sensitization.
Toxicity after repeated exposure oral / inhalation / dermal	Due to the corrosive properties, data is not available.
Genotoxicity / mutagenicity	No genotoxic and no mutagenic properties known.
Carcinogenicity	No carcinogenic properties known.
Toxicity for reproduction	Sodium hydroxide is expected to have no adverse effects on reproductive organs.

6 Environmental Effects

Based on available data, aqueous sodium hydroxide solutions are considered as toxic to aquatic organisms due to possible changes of the natural pH value in waters. However, the substance amount released into the aquatic environment is considered as low with no hazardous effects for the aquatic environment. Sodium hydroxide does not bioaccumulate (no accumulation in the food chain) and will not persist in the environment. Since sodium hydroxide is an inorganic substance, no biodegradation will occur.

Effect Assessment	Result
Aquatic Toxicity	The toxicity of NaOH can be ascribed to the pH increase upon entry into the aquatic environment, which in return has hazardous consequences for aquatic organisms.
Terrestrial Toxicity	No data available.

Fate and behaviour	Result
Biodegradation	Due to the inorganic character sodium hydroxide will not undergo biodegradation.
Bioaccumulation potential	Considering the high water solubility sodium hydroxide does not bioconcentrate in organisms.
PBT / vPvB conclusion	NaOH does not fulfil the criteria for persistency, bioaccumulation and toxicity. Therefore, NaOH is not considered a PBT or vPvB substance.

7 Exposure

Human health

Consumers can come in contact with sodium hydroxide as it can be found in various consumer products, such as neutralisation agents, cleaning products, cosmetics and personal care products (in very small concentrations). Further sources of sodium hydroxide are drain and pipe cleaning products, wood treatment agents and oven cleaner pads. During industrial processes workers might be exposed to the substance via dermal contact and/or inhalation. Risk management measures have been established in order to guarantee the safe use of the substance.

Environment

The manufacture of the substance and on-site uses are proceeded under strictly controlled conditions with no releases to soil and water. In this context, sewage treatment plants and surface waters are sufficiently protected in regard to pH changes. Furthermore, neutralisation of NaOH containing waste waters and effluents is a common practice based on legislation (legislation for surface waters) as well as on practical background for maintenance of the functioning of biological sewage treatment plants (STPs) and waste water treatment plants (WWTPs).

8 Risk Management Recommendations

Because sodium hydroxide is corrosive, the risk management measures for human health should focus on the prevention of any direct contact with the substance. For this reason automated and closed systems should preferably be used for industrial and professional uses of sodium hydroxide. Breathing protection is needed when aerosols of sodium hydroxide can be formed. Due to the corrosive properties appropriate skin and eye protection is absolutely required. In regard to environmental risk management measures it is important to assure that effluents are neutralized before discharging into the aquatic environment. A pH increase of environmental waters due to sodium hydroxide emissions must be prevented.

9 First Aid Measures

Guide people to safety and remove contaminated clothes at once, since the substance is strongly corrosive. After contact with the substance via skin, eyes, ingestion or inhalation, a physician should be consulted. In case of contact with the skin, immediately flush affected area with large amounts of water. In case of contact with eyes, immediately flush eyes with large amounts of water for at least 15 minutes while holding eyelids open. If accidentally swallowed, let water be swallowed in little sips (only if the person is conscious), and obtain immediate medical attention. Do not induce vomiting. Allow cortisone spray inhalation at the first possible opportunity.

10 Fire Fighting Measures

The product is not flammable. In case of fire use extinguishing measures appropriate to the source of fire and according to the surrounding area. Hazardous decomposition products contain corrosive substances. Hazardous fumes may be generated at ambient temperatures. It is absolutely required to wear a full protective suit and a self-contained breathing apparatus.

11 Accidental Release Measures

When handling the substance, personal protection equipment must be worn. In case of spills, avoid any contact with the substance via eye and skin as well as inhalation of mists and vapours. Keep unprotected people away. Absorb spills with an appropriate, liquid-binding material (e.g. earth) and dilute remaining spills with plenty of water. Place in appropriate containers for disposal according to official and local state regulations. Prevent material from entering sewers or surface waters.

12 Disposal Considerations

Collect contaminated fire extinguishing water separately. Retain contaminated washing water and dispose of according to national, federal and local regulations. Dumping into the environment must be prevented. Contaminated packaging material must be completely emptied and can be re-used or recycled following appropriate cleaning. Handle contaminated packaging in the same way as the substance itself. Packaging material which cannot be properly cleaned must be thrown away. Use water as a cleaning agent.

13 Handling and Storage

If handling the substance, keep away from incompatible substances, such as acids. Acids react strongly with this basic substance and its solution under formation of heat. Further, keep in mind that the solution reacts with light metals, such as aluminum, light metal alloys, and the metals zinc and tin under formation of hydrogen. Hydrogen is an extremely flammable gas and can form explosive oxy-hydrogen gas upon contact with atmospheric oxygen. Eliminate spills immediately as they pose a risk of slipping.
Store only in the original container and keep the container tightly closed. The container material should not consist of aluminium, any other light metals or zinc since reaction under formation of hydrogen is likely. The temperature for storage and transport should not be below 20°C. The storage group is 8B.

14 State Agency Review

Sodium hydroxide has been registered under REACH. For this product a chemical safety assessment according to the following national regulations has been carried out: CHIP (Hazard Information and Packaging for Supply) Regulations 2002, COSHH (Control of Substances Hazardous to Health) Regulations 2002, Management of Health & Safety at Work Regulations 1999, Health & Safety at Work Act 1974, Environmental Protection Act 1993 & Subsidiary Regulations.

Other national regulations listing sodium hydroxide are the following:
Australian Inventory of Chemical Substances (AICS), European Inventory of Existing Commercial Chemical Substances (EINECS), Inventory of Existing Chemical Substances in China (IECSC), Canadian Domestic Substances List (DSL), Korean Existing Chemicals List (ECL), Japanese Existing Notified Chemical Substances (ENCS), Philippine Inventory of Chemicals and Chemical Substances (PICCS),Toxic Substances Control Act (TSCA) in USA.

15 Classification and Labelling

The substance is classified under the EU Classification Labelling and Packaging (CLP) Regulation (EC) No. 1272/2008 as follows:

Hazard Class and Category	H-Phrase	Hazard pictograms	Wording
Skin corrosion 1A	H314		Causes severe skin burns and eye damage.

16 Conclusion

Sodium hydroxide and its aqueous solution are very well characterised. The most significant property is its strong corrosiveness due to its high pH value, although the ions of sodium hydroxide (Na^+ and OH^-) are naturally occurring and ubiquitous ions present in the human body and the environment. Consumers might get in contact with sodium hydroxide solutions due to its wide spread use in various consumer products. It is absolutely required that consumers handle these products with caution. Workers (industry, laboratory) should follow the safety measures recommended in the Safety Data Sheet.

17 Contact Information within Company

For further information on this substance or product safety summaries in general, please contact: Dr. Christian Eppelsheim at wlcp-reach@wacker.com or visit our website at www.wacker.com.

18 Date of Issue

29.02.2012

WACKER

GPS SAFETY SUMMARY
TETRAETHYL SILICATE

This Product Safety Summary is intended to provide a general overview of the chemical substance in the context of ICCA Global Product Strategy. The information on the Summary is basic information and is not intended to provide emergency response information, medical information or treatment information. The summary should not be used to provide in-depth safety and health information. In-depth safety and health information can be found on the (extended) Safety Data Sheet for the chemical substance.

1 General Statement

Tetraethyl silicate is a flammable organic liquid with weak odour. It is prepared by direct reaction of silicon tetrachloride and ethanol, and simultaneous removal of the by-product hydrogen chloride. The substance can also be manufactured by reaction of tetramethylorthosilicate (TMOS) with ethanol, which results in a technical grade product with a slightly lower purity. Subsequent purification steps can be performed depending on the end application of tetraethyl silicate. The substance is mainly applied as chemical intermediate in the industry, where it is used in coatings and sealants, as non-metal and metal pigment surface treatment agent, in the manufacture of semiconductors, masonry applications and in the production of plastic products. In regard to hazardous effects on the environment, tetraethyl silicate is considered of very low toxicity to aquatic organisms, since the substance hydrolyses rapidly upon contact with water to silicic acid and ethanol. Besides irritating effects upon contact with eyes, serious hazardous effects on human health have been especially observed in case of inhalation. Exposure of consumers to significant amounts of this substance is negligible, but possible due to its use in sealants, paints and coatings. However, it is highly recommended that workers and professional users obtain specific instructions before handling this substance, e.g. due to its toxicity via inhalation as well as its flammability.

2 Chemical Identity

Name:	tetraethyl silicate
Other names:	tetraethyl orthosilicate (TEOS), ethyl silicate
CAS number:	78-10-4
EINECS number:	201-083-8
Molecular formula:	$C_8H_{20}O_4Si$

3 Uses and Applications

Tetraethyl silicate is mainly applied as chemical intermediate in industrial processes, *e.g.* manufacture of semiconductors and plastics. During production and processing of plastics it is applied as monomer and as component in non-aqueous polymer preparations, but also finds application during the production of mould-making elastomers. Further, tetraethyl silicate can be found in coatings and sealants, *e.g.* for masonry applications, and is also used as non-metal and metal pigment surface treatment agent. Besides this uses, it is used as chemical substance on a laboratory scale. It is unlikely that consumers are exposed to this substance in considerable amounts, for instance via coatings, paints and sealants, whereas workers (industry, laboratory) should follow the safety measures recommended in the extended Safety Data Sheet.

4 Physical / Chemical Properties

Tetraethyl silicate is an organic colourless liquid with a slight odour. Liquid and vapour of this substance are flammable, so that it is crucial to remove all sources of ignition during handling and storage and to take precautionary measures against static discharges. Vapours can generate explosive / flammable mixtures with air, so adequate ventilation and suction should be provided. Especially in the presence of acids or bases reaction with water, *i.e.* hydrolysis, will take place leading to decomposition of the substance under formation of ethanol.

Appearance

State of matter:	liquid
Colour:	colourless
Odour:	slight
Odour threshold:	85 mg/m^3
Molecular weight:	208.33 g/mol

Safety relevant basis data

Parameter	Value	Unit	Remark
Density:	0.94	g/cm^3	at 20 °C
pH:			not applicable
Melting point:	-82.5	°C	at 1013 hPa
Boiling temperature:	165 - 166	°C	at 1013 hPa
Flash point:	45	°C	at 1013 hPa
Explosion hazard:			
Lower explosion limit:	1.3	Vol-%	
Upper explosion limit:	23	Vol-%	
Ignition temperature:	222	°C	at 962 hPa
Decomposition temperature:			no data available
Vapour pressure:	110	Pa	at 20 °
Solubility in water:			virtually insoluble; hydrolytic decomposition occurs
log $P_{O/W}$ (n-octanol / water):	3.18		at 40 °C
Viscosity (dynamic):	0.6	mPa.s	at 20 °C

5 Health Effects

5.1 Consumer

Consumer exposure to considerable amounts of tetraethyl silicate is unlikely as the substance is only manufactured and handled in industrial and professional settings. However, possible exposure may result from products containing tetraethyl as component in coatings, paints and sealants.

5.2 Worker

Workers will typically not come into contact with the substance as it is manufactured in closed systems in industrial and professional settings. In case of unintended exposure during synthesis, formulation, transfer or other procedures, workers should follow the recommended safety

measures in the extended Safety Data Sheet. The following table gives an overview on the health effects:

Effect Assessment	Result
Acute Toxicity oral / inhalation / dermal	Based on studies with testing animals tetraethyl silicate is of acute toxicity via exposure through inhalation. (Acute Tox. 4; H332: Harmful if inhaled.)
Irritation / corrosion skin / eye / respiratory tract	Since effects on the respiratory tract were observed in acute toxicity studies as well as from practical experiences from human exposure tetraethyl silicate is classified as irritating to the respiratory tract upon single exposure. Studies also revealed that the substance is irritating to the eyes. (STOT SE 3 (respiratory tract); H335: May cause respiratory irritation. Eye Irrit. 2; H319: Causes serious eye irritation.)
Sensitisation	This substance is not sensitising.
Toxicity after repeated exposure oral / inhalation / dermal	Studies revealed that tetraethyl silicate had adverse effects on kidneys, lungs, liver and mucous membranes of testing animals upon repeated exposure via inhalation. Further the substance has been considered to have narcotic effects and to cause dermatitis. However, results were not sufficient for classification as toxicant after repeated exposure.
Genotoxicity / mutagenicity	Based on tests tetraethyl silicate does not induce mutations in bacterial or mammalian cells, or chromosome aberrations in mammalian cells. Although there was some evidence of damage to the DNA, there is no sufficient justification for classification as mutagenic substance.
Carcinogenicity	There is no data suggesting that tetraethyl silicate has carcinogenic properties.
Toxicity for reproduction	Based on available data no hazardous developmental or reproductive effects have to be anticipated.

6 Environmental Effects

Based on available data for the pure substance, tetraethyl silicate is not considered as toxic to aquatic organisms, since contact with water leads to rapid hydrolysis to silicic acid and ethanol. The hydrolysis product silicic acid is not expected to be harmful to the environment nor the organisms exposed; however, ethanol has some potential to cause harm. Therefore, dumping into the environment should be prevented. Since tetraethyl silicate rapidly hydrolyses it does not bioaccumulate and will not persist in the environment.

Effect Assessment	Result
Aquatic Toxicity	Based on available data tetraethyl silicate is considered as having a low acute toxicity to fish, aquatic invertebrates and algae, since contact with water leads to a rapid hydrolysis into silicic acid and ethanol. No chronic aquatic toxicity data is available.
Terrestrial Toxicity	Tests regarding toxicity to sediment organisms are considered as not necessary due to the rapid hydrolysis of the substance. No chronic toxicity data for sediment and the terrestrial compartment is available.

Fate and behaviour	Result
Biodegradation	Tetraethyl silicate is hydrolysed upon contact with water forming silicic acid and ethanol. Silicic acid is a naturally occurring

	mineral, while ethanol is readily biodegradable.
Bioaccumulation potential	Bioaccumulation is not expected to occur.
PBT / vPvB conclusion	This substance is not a PBT or vPvB substance.

7 Exposure

7.1 Human health

Consumers will typically not come into contact with considerable amounts of tetraethyl silicate as it is manufactured in industrial and professional settings in closed processes only. However, exposure to small amounts may result due to its use *e.g.* in products for masonry applications or in sealants, coatings or paints. Exposure to tetraethyl silicate of personnel in manufacturing facilities is also considered as low because the process, storage, and handling operations are generally carried out under strictly controlled conditions. Workers who might accidentally come into contact with the substance should follow the safety measures recommended in the Safety Data Sheet.

7.2 Environment

Exposure of the environment to tetraethyl silicate is absolutely unlikely, on the one hand side based on the rapid hydrolysis of the substance upon contact with water on the other hand side due to commonly applied industrial risk management measures. Risk management measures related to environmental emissions from industrial sites include air emission abatement techniques, onsite waste treatment processes, *e.g.* secondary biological treatment as well as external waste water treatment at specific treatment plants. Therefore, even for a worst case scenario releases to the environment are considered as negligible with having no adverse effects on aquatic or terrestrial organisms.

8 Risk Management Recommendations

When using tetraethyl silicate it must be ensured that there is adequate ventilation and suction at critical points in order not to exceed occupational exposure limit values. Do not breath gases, vapours or aerosols and avoid contact with eyes and skin by using appropriate respiratory protection (gas mask with ABEK filter in case of long or strong exposure), eye protection, such as tight fitting protective goggles, appropriate chemical resistant gloves, e.g. for uses up to 60 minutes gloves made of butyl rubber, and appropriate body protection. Do not eat, drink or smoke where chemicals are handled, processed, or stored. Wash hands thoroughly after handling. Do not release the substance into the aquatic environment or soil.

9 First Aid Measures

First aid assistants should pay attention to self-protection. In case of inhalation take affected person to a safe place, keep warm and at rest. If unconscious, place in a stable sideways position and protect against loss of body heat. Seek medical advice and clearly identify the substance. Upon contact with skin remove contaminated or soaked clothing immediately and rinse the affected area with plenty of soap and water. In the event of visible skin changes or other complaints arise, consult a physician. In case of contact with eyes rinse immediately with plenty of water for minimum 15 minutes. Keep eyelids well opened to rinse the whole eye surface and eyelids with water. Seek medical advice in case irritations persist. After accidentally swallowed, give several small portions of water to drink, if the person is conscious, and do not induce vomiting. Seek immediately medical advice and clearly identify substance.

10 Fire Fighting Measures

In case of fire it is recommended to use water mist, extinguishing powder, alcohol resistant foam, carbon dioxide (CO_2) or sand. Do not use a high power water jet or water spray. If it can be done without risk, cool endangered product containers, guide personal to safety and keep unprotected people away. Keep upwind since hazardous decomposition products include nitrous gases among other toxic pyrolysis products. It is absolutely required to wear a self-contained breathing apparatus.

11 Accidental Release Measures

When handling the substance, personal protection equipment must be worn. In case of spills, avoid any contact with the substance as well as inhalation of mists, gases and vapours. Keep unprotected people away and remove all ignition sources since tetraethyl silicate is flammable. Take precautionary measures against static discharges. Do not flush spills away with water. Absorb small leaks immediately with an appropriate, liquid-binding material (e.g. diatomaceous earth) and place in appropriate containers for disposal according to official and local state regulations. Also contaminated water and extinguishing water should be disposed off in prescribed marked containers. In case of large spills pump up into appropriate containers. Clean any slippery coating that remains using a detergent / soap solution or another biodegradable cleaner. Exhaust vapours and provide adequate ventilation. Prevent material from entering surface waters, drains, or sewers and soil.

12 Disposal Considerations

It is recommended to incinerate tetraethyl silicate as hazardous waste in a special waste incinerator. Local, federal and national regulations must be observed. Collect contaminated fire extinguishing water separately. Retain contaminated washing water and dispose of in accordance with national, federal and local regulations. Dumping into the environment must be prevented. Contaminated packaging material should be completely emptied and can be re-used or recycled after appropriate cleaning. Handle contaminated packaging in the same way as the substance itself. Packaging material which cannot be properly cleaned must be thrown away.

13 Handling and Storage

Avoid formation and inhalation of gases, vapours or aerosols. Use special protective equipment and provide for sufficient ventilation and local suction at critical points. Keep away from incompatible substances *e.g.* water, since in the presence of basic and acidic substances hydrolysis occurs, leading to decomposition under formation of ethanol. Further, keep away from ignition sources, *e.g.* heat, sparks, open flames, hot surfaces, and do not smoke. Tetraethyl silicate is flammable. Flammable vapours may accumulate and form explosive mixtures with air in containers, process vessels, including partial, empty and uncleaned containers and vessels, or other enclosed spaces. Take precautionary measures against static discharges, e.g. when filling from one container into another. In case of fire cool endangered containers with water. Spilled material should be immediately eliminated since risk of slipping exists. In regard to storage conditions packaging should be kept dry and well sealed to prevent contamination and absorption of dampness. Tetraethyl silicate must be protected from dampness, otherwise hydrolysis could take place leading to formation of ethanol. Keep container tightly closed and store in a cool, well ventilated place.

14 State Agency Review

Tetraethyl silicate has been registered under REACH. Chemical safety assessments have been carried out according to several regulations.
Regulations listing tetraethyl silicate are: European Inventory of Existing Commercial Chemical Substances (EINECS), Australian Inventory of Chemical Substances (AICS), Korean Existing Chemicals List (ECL), Japanese Existing Notified Chemical Substances (ENCS), Philippine Inventory of Chemicals and Chemical Substances (PICCS), U.S. Toxic Substances Control Act (TSCA), Inventory of Existing Chemical Substances in China (IECSC), Canadian Domestic Substances List (DSL).

15 Classification and Labelling

The substance is classified under the EU Classification Labelling and Packaging (CLP) Regulation EC/1272/2008 as follows:

Hazard Class and Category	H-Phrase	Hazard pictograms	Wording
Flammable liquid, 3	H226		Flammable liquid and vapour.
Serious eye damage / eye irritation 2	H319		Causes serious eye irritation.
Acute toxicity (inhalation), 4	H332		Harmful if inhaled.
Specific target organ toxicity after single exposure, 3 (respiratory tract irritation)	H335		May cause respiratory irritation.

16 Conclusion

Tetraethyl silicate is a well characterised substance, which is mainly processed in industrial and professional settings. Due to its use as component in sealants, paints, coatings or masonry, consumers might be exposed to this substance in negligible amounts not bearing any hazardous health effects at all. However, workers must follow existing risk management measures since tetraethyl silicate is of acute toxicity via inhalation and irritating upon contact with eyes. In regard to hazardous effects on the environment it can be concluded that the substance does not bear a risk to aquatic organisms since it rapidly hydrolyses to silicic acid and ethanol upon contact with water.

17 Contact Information within Company

For further information on this substance or product safety summaries in general, please contact: Dr. Christian Eppelsheim at wlcp-reach@wacker.com or visit our website at www.wacker.com.

18 Date of Issue

21/03/2012

WACKER

GPS SAFETY SUMMARY
TRIACETOXYETHYLSILANE

This Product Safety Summary is intended to provide a general overview of the chemical substance in the context of ICCA Global Product Strategy. The information on the Summary is basic information and is not intended to provide emergency response information, medical information or treatment information. The summary should not be used to provide in-depth safety and health information. In-depth safety and health information can be found on the Safety Data Sheet for the chemical substance.

1 General Statement

Triacetoxyethylsilane is a colourless organic liquid with a characteristic, acetic acid-like odour. The substance is manufactured by a continuous counterflow reaction of trichloroethylsilane and acetic acid at boiling point in a special reaction system. The product is continuously extracted from the system, while by-products, such as hydrochloric acid, can be removed for recycling. The use of triacetoxyethylsilane is limited to specific applications, i.e. its use as specific component in silicone sealants in the industry and professional sector. Furthermore, the substance is used as laboratory chemical for research and development purposes.
In regard to hazardous health effects, triacetoxyethylsilane has adverse effects upon contact with eyes and skin due to its corrosive effects and acute toxic effects after ingestion. The substance is very sensitive to water and hydrolyses easily to ethylsilanetriol and acetic acid. In case of large releases to the aquatic environment, acetic acid may have adverse effects on aquatic organisms due to considerable pH changes. Workers (industry, laboratory) should follow the safety measures recommended in the Safety Data Sheet.

2 2. Chemical Identity

Name:	Triacetoxyethylsilane
CAS number:	17689-77-9
EINECS number:	241-677-4
Molecular formula:	$C_8H_{14}O_6Si$

3 Uses and Applications

Triacetoxyethylsilane is mainly applied as as cross-linking agent and adhesion promoter in silicone-based sealant products. These sealants are used for a wide range of industrial and professional applications and can be found in various consumer products. For instance, silicon-based sealant products are used in electronic devices, for automotive, computer, telecommunication and health-care articles, where they have a protective function against moisture, dust, chemicals and temperature extremes. In the automotive industry the sealants are used in the engine compartment. In the building and construction sector triacetoxyethylsilane is applied as component in sealants for Structural Glazing (SG) and Insulating Glass (IG), which is used for weather sealing, sealing of windows and doors and sealing of sanitary facilities. Besides its main application as sealant, triacetoxyethylsilane is also used as laboratory reagent for research and development purposes.

4 Physical / Chemical Properties

Triacetoxyethylsilane is a clear, colourless organic liquid with an acetic acid like odour. The substance is very sensitive to water and moisture. Contact leads to the release of acetic acid, which is a flammable and corrosive substance. Therefore, it is highly recommended to handle the substance under adequate ventilation, to use personel protective equipment and to keep it away from substances such as water, alcohols or basic substances.

Appearance

State of matter:	liquid
Colour:	colourless
Odour:	similar to acetic acid
Odour threshold:	no data
Molecular weight:	234.28 g/mol

Safety relevant basis data

Parameter	Value	Unit	Remark
Density:	1.14	g/cm^3	at 25 °C
pH:	2		at 25 °C (50 g/l H_2O)
Melting point / range:	-2.9 to 8.4	°C	
Boiling temperature:	~ 220	°C	at 1013 hPa
Flash point:	104	°C	at 1013 hPa
Explosion hazard:			not explosive
Lower explosion limit:			not determined
Upper explosion limit:			not determined
Ignition temperature:	382	°C	
Decomposition temperature:	> 130	°C	
Vapour pressure:	5.1	Pa	at 20 °C
Solubility in water:			completely miscible
log $P_{O/W}$ (n-octanol / water):			not applicable
Viscosity (dynamic):	5 to 6	mPa s	at 25 °C

5 Health Effects

5.1 Consumer

Consumers might get in contact with the substance during the use of products, in which the substance is a component in sealants. During the use of such products exposure via inhalation or dermal contact can occur, but is unlikely. Although the substance is classified as corrosive, a risk from the substance released from consumer articles can be excluded due to the low concentrations in these articles (range: 1-5 %) and the rare frequency of use.

5.2 Worker

Workers can come in contact with the substance via inhalation or by skin during processes which are not carried out under strictly controlled conditions. Due to the corrosive nature of the substance, adequate measures have been implemented in order to minimise the risk to workers. Workers should follow these safety measures in the Safety Data Sheet. The following table gives an overview on the health effects:

Effect Assessment	Result
Acute Toxicity oral / inhalation / dermal	Due to the corrosive nature of the substance dermal and inhalative testings have been omitted. Tests based on oral application revealed adverse effects, leading to classification. (Acute Tox. 4 (oral); H302: Harmful if swallowed.)
Irritation / corrosion skin / eye / respiratory tract	The substance is corrosive and is expected to be highly irritating to the respiratory tract (Skin Corr. 1B; H314: Causes severe skin burns and eye damage.) and eye damaging (Eye Dam. 1; H318: Causes serious eye damage.). No specific data is available for respiratory irritation.
Sensitisation	No skin sensitiser.
Toxicity after repeated exposure oral / inhalation / dermal	Triacetoxyethylsilane is not classified as toxic after repeated exposure by any route.
Genotoxicity / mutagenicity	Triacetoxethylsilane is neither genotoxic nor mutagenic.
Carcinogenicity	No data for carcinogenicity is available. Due to the absence of genotoxic or mutagenic properties it is expected that triacetoxyethylsilane exhibits no carcinogenic properties.
Toxicity for reproduction	There are no data indicating that triacetoxethylsilane is toxic to reproduction or has hazardous developmental effects.

6 Environmental Effects

Based on available data triacetoxyethylsilane is regarded as not hazardous to the environment. The substance hydrolyses very rapidly (half-life <13 s), leading to acetic acid and ethylsilanetriol. Ethylsilanetriol is not toxic to the aquatic environment, whereas acetic acid is considered as hazardous to aquatic organisms based on the possibility of pH reduction. The hazardous effects arising from acetic acid are not clearly a result of chemical toxicity, but a function of and dependent on the buffering capacity of the environment. For the assessment of triacetoxyethylsilane toxicological data of similar compounds – trimethoxy(vinyl)silane and trichloro(ethyl)silane – have been used. Due to its high reactivity with water the substance does not bioaccumulate and will not persist in the environment.

Effect Assessment	Result
Aquatic Toxicity	Studies carried out with triacetoxyethylsilane and its structurally analogous substances revealed no adverse effects on aquatic organisms.
Terrestrial Toxicity	No data is available for plants, soil microorganisms or other organisms. Testings with earthworms revealed that the substance has no adverse effects.

Fate and behaviour	Result
Biodegradation	Ready biodegradable (74 % in 21 days)
Bioaccumulation potential	The substance hydrolyses very rapidly to substances which have low log K_{ow} values (< 3), and thus have low potential for bioaccumulation.
PBT / vPvB conclusion	The substance does not meet the criteria for PBT or vPvB.

7 Exposure

7.1 Human health

Consumers may be exposed to very low amounts of triacetoxyethylsilane due to its potential presence in consumer articles, such as joint and/or assembly sealants, via exposure by inhalation or skin. Workers can come in contact with the substance via the same exposure routes during processes, which are not carried out under strictly controlled conditions. Due to the corrosive nature of the substance adequate risk management measures have been implemented in order to minimise the risk to workers, which should be strictly followed.

7.2 Environment

Releases to air during production are negligible due to the low vapour pressure and strictly controlled manufacturing conditions. The production of triacetoxyethylsilane is a moisture free process. Minor releases to waste water may result from cleaning processes and minor spillages during handling, e.g. formulation. These waste waters are directed to waste water treatment plants, which may be contaminated with the substance or its hydrolysis products.

8 Risk Management Recommendations

When using triacetoxyethylsilane make sure that there is adequate ventilation and suction at critical points to ensure that occupational exposure limit values are not exceeded (limit value: 25 mg/m^3 (10 ppm); valid for acetic acid). Do not breath vapours and avoid contact with eyes and skin by using appropriate respiratory protection (gas mask with filter type ABEK; in case of long or strong exposure use a self-contained breathing apparatus), eye protection, such as tight fitting protective goggles, appropriate chemical resistant gloves, e.g. gloves made of fluorinated rubber, suitable for up to 60 minutes use. Use protective clothing. Do not eat, drink or smoke where chemicals are handled, processed or stored. Do not release into the aquatic environment, i.e. surface waters, drains, sewers or soil.

9 First Aid Measures

Guide people to safety. First aid assistants should pay attention to self-protection. After contact with the substance via skin, eyes, ingestion and/or inhalation, a physician must immediately be consulted. Immediately take off all contaminated clothing and shoes and dispose off safely. In case of contact with skin, immediately flush affected area with large amounts of water for minimum 15 minutes followed by washing with soap and water, if available. Use an emergency shower in case of large amounts. In case of contact with eyes, immediately flush eyes with large amounts of water for minimum 15 minutes while holding eyelids open. After inhalation of the substance, move the victim to fresh air, keep the affected person warm and at rest. Administer artificial respiration if breathing stops. If accidentally swallowed, let several glasses of water be swallowed, only if the person is conscious, and obtain immediate medical attention. Do not induce vomiting. Treat the affected person with a cortisone spray in case of inhalation. Medical checks should be carried out up to a latency period of at least 24 hours. In the event of first degree burns, use corticoid-externa, whereas in the case of second degree burns symptomatic treatment should be applied.

10 Fire Fighting Measures

In case of fire use extinguishing powder, alcohol-resistant foam, carbon dioxide or sand as extinguishing media. Triacetoxyethylsilane hydrolyses rapidly under formation of ethylsilanetriol and acetic acid. Since acetic acid is a flammable and corrosive substance, use of water jets or

spray should be avoided. Hazardous decomposition products contain corrosive substances, i.e. acetic acid. It is absolutely required to wear a full protective suit and a self-contained breathing apparatus.

11 Accidental Release Measures

When handling the substance, personal protection equipment must be worn. Keep unprotected people away and remove all sources of ignition. In case of spills, avoid any contact with the substance via eyes and skin and avoid inhalation of mists and vapours. Prevent material from entering surface waters, drains or sewers and soil. Any fluid that runs out should be absorbed by using a suitable liquid or acid-binding material. Place in appropriate containers for disposal according to official and local state regulations. Larger quantities of the spilled substance should be taken up in containers by pumping. Remaining vapours can be evaporated.

12 Disposal Considerations

It is recommended to incinerate triacetoxytriethylsilane as hazardous waste according to official regulations in a special waste incinerator. Local regulations must be observed. Collect contaminated fire extinguishing water separately. Retain contaminated washing water and dispose of according to national, federal and local regulations. Dumping into the environment must be prevented. Contaminated packaging material must be completely emptied and can be re-used or recycled following appropriate cleaning. Handle contaminated packaging in the same way as the substance itself. Packaging material which cannot be properly cleaned must be thrown away.

13 Handling and Storage

If handling the substance, provide sufficient ventilation and punctiform suction at critical points. Keep away from incompatible materials, such as basic substances, water or alcohols since contact with these substances leads to the formation of acetic acid. Eliminate spills immediately as they pose a risk of slipping. Keep the container tightly closed and in a cool, well ventilated place. Flammable vapours may accumulate and form explosive mixtures with air in containers, process vessels, including partial, empty and uncleaned containers and vessels, or other enclosed spaces. Therefore, keep away from ignition sources, e.g. heat, sparks, open flames, hot surfaces, and do not smoke. Take precautionary measures against static discharges. The minimum temperature for storage and transport should be 0°C.

14 State Agency Review

Triacetoxyethylsilane has been registered under REACH. For this product chemical safety assessments have been carried out. National regulations listing triacetoxyethylsilane are the following: European Inventory of Existing Commercial Chemical Substances (EINECS), Korean Existing Chemicals List (ECL), Japanese Existing Notified Chemical Substances (ENCS), Australian Inventory of Chemical Substances (AICS), Inventory of Existing Chemical Substances in China (IECSC), Canadian Domestic Substances List (DSL), Philippine Inventory of Chemicals and Chemical Substances (PICCS), U.S. Toxic Substances Control Act (TSCA).

15 Classification and Labelling

The substance is classified under the EU Classification Labelling and Packaging (CLP) Regulation EC/1272/2008 as follows:

Hazard Class and Category	H-Phrase	Hazard pictograms	Wording
Acute Toxicity 4	H302		Harmful if swallowed.
Skin Corrosion 1B	H314		Causes severe skin burns and eye damage.
Serious eye damage/eye irritation 1	H318		Causes serious eye damage.

16 Conclusion

Triacetoxyethylsilane is a well characterised substance, although some information is lacking in regard to toxicological effects on human health, e.g. carcinogenicity. The substance is sensitive to water and hydrolyses violently to ethylsilanetriol and acetic acid, bearing no risk to the aquatic environment. Workers should obtain specific instructions before handling this substance (personal protection equipment, handling and storage conditions). Consumers might get in contact with triacetoxyethylsilane through products used for sealing purposes, in which the substance is present as component, although concentrations within these products are negligible, bearing no risk.

17 Contact Information within Company

For further information on this substance or product safety summaries in general, please contact: Dr. Christian Eppelsheim at wlcp-reach@wacker.com or visit our website at www.wacker.com.

18 Date of Issue

26/03/2012

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GPS SAFETY SUMMARY
TRICHLORO(2,4,4-TRIMETHYLPENTYL)SILANE

This Product Safety Summary is intended to provide a general overview of the chemical substance in the context of ICCA Global Product Strategy. The information on the Summary is basic information and is not intended to provide emergency response information, medical information or treatment information. The summary should not be used to provide in-depth safety and health information. In-depth safety and health information can be found on the (extended) Safety Data Sheet for the chemical substance.

1 General Statement

Trichloro(2,4,4-trimethylpentyl)silane is a colourless to yellowish organic liquid. The substance is manufactured industrially by the addition of trichlorosilane to iso-octene. The reaction is carried out in the presence of a catalyst and is characterised by its good yields and only few by-products. Due to the sensitivity to water the reaction is carried out under strictly controlled conditions and under an inert atmosphere, followed by purification. The use of trichloro(2,4,4-trimethylpentyl)silane is quite limited, consisting of its application as intermediate for the manufacture of other organosilicon compounds. Furthermore, the substance is used as a laboratory reagent for research and development purposes.
In regard to hazardous health effects, trichloro(2,4,4-trimethylpentyl)silane has adverse effects upon contact with eyes and skin due to its corrosiveness and acute toxic effects after ingestion. Upon contact with water the substance hydrolyses rapidly and violently to the corresponding silanetriol and hydrogen chloride. Hydrogen chloride and its aqueous solution are corrosive substances. In case of large releases to the aquatic environment, hydrochloric acid may have adverse effects on aquatic organisms due to considerable changes of the pH value. Besides the moisture sensitiveness, special attention also has to be given during handling of the substance, since flammable vapours may accumulate and form explosive mixtues with air in containers or process vessels. Since vapours are heavier than air, inflammable gas mixtures may form mainly near the floor. Workers (industry, laboratory) should follow the safety measures recommended in the Safety Data Sheet.

2 Chemical Identity

Name:	Trichloro(2,4,4-trimethylpentyl)silane
CAS number:	18379-25-4
EINECS number:	242-262-0
Molecular formula:	$C_8H_{17}Cl_3Si$

3 Uses and Applications

Trichloro(2,4,4-trimethylpentyl)silane is used as a chemical intermediate for the manufacture of silanes, such as alkoxysilanes, acyloxysilanes, oximinosilanes or aminosilanes. For instance, alkoxysilanes, which have been generated from trichloro(2,4,4-trimethylpentyl)silane, are used as hydrophobing agents on substrates to prevent water ingress. Trichloro(2,4,4-trimethylpentyl)silane is also used as a laboratory reagent. In most cases, trichloro(2,4,4-trimethylpentyl)silane is used in the synthesis of silicon-based chemicals. Alternatively, the substance may be used as a “blocking agent” in organic synthesis or as a surface modifying agent.

4 Physical / Chemical Properties

Trichloro(2,4,4-trimethylpentyl)silane is an organic colourless to yellowish liquid with a pungent odour. The substance is highly reactive with water. Contact leads to the formation of hydrogen chloride, which is a strong corrosive substance and causes severe damage to skin and eyes upon contact. It reacts violently with water, basic substances, acids, alcohols and ketones/aldehydes. Vapours can build explosive / highly flammable mixtures with air, so adequate ventilation and suction should be provided and ignition sources should be removed.

Appearance

State of matter:	liquid
Colour:	colourless to yellowish
Odour:	pungent
Odour threshold:	no data
Molecular weight:	247.67 g/mol

Safety relevant basis data

Parameter	Value	Unit	Remark
Density:	1.07	g/cm^3	at 25 °C
pH:			not applicable
Melting point:	> - 30	°C	
Boiling temperature / range:	202	°C	at 1013 hPa
Flash point:	84.5	°C	
Explosion hazard:			not explosive
Lower explosion limit:			not determined
Upper explosion limit:			not determined
Ignition temperature:	390	°C	at 1013 hPa
Decomposition temperature:			no data
Vapour pressure:	45	Pa	at 20 °C
Solubility in water:			virtually insoluble
log $P_{O/W}$ (n-octanol / water):			not applicable
Viscosity (dynamic):	2	mPa.s	at 25 °C

5 Health Effects

5.1 Consumer

Consumers will not come into contact with trichloro(2,4,4-trimethylpentyl)silane as it is manufactured in industrial and professional settings in closed processes only. In consumer products no unreacted residues of the substance will be present as the substance is extremely reactive. Therefore, consumers will not be exposed to the substance.

5.2 Worker

Due to the reactivity of the product and the starting materials, the manufacturing process is proceeded under strictly controlled conditions. Nevertheless, workers can come in contact with the substance via inhalation or by skin during processes which are not carried out under strictly controlled conditions. Due to the corrosive nature of the substance, adequate measures have

been implemented in order to minimise the risk to workers. Workers should follow these safety measures in the Safety Data Sheet. The following table gives an overview on the health effects:

Effect Assessment	Result
Acute Toxicity oral / inhalation / dermal	A study revealed adverse effects after oral application, leading to a classification (Acute Tox. 3; H301: Toxic if swallowed.). No data are available for inhalation and dermal toxicity due to the corrosive character of the substance.
Irritation / corrosion skin / eye / respiratory tract	The substance is corrosive to skin and can also seriously damage the eyes upon contact. The substance is therefore classified as corrosive (Skin Corr. 1A; H314: Causes severe skin burns and eye damage.) and eye damaging (Eye Damage 1; H318: Causes serious eye damage.).
Sensitisation	No skin sensitiser.
Toxicity after repeated exposure oral / inhalation / dermal	No data are available for the substance. Studies, carried out with structural analogues, revealed minor adverse effects after oral applications (target organs: urinary bladder, liver) but no adverse effects after prolonged inhalation. No data for repeated dermal toxicity are available.
Genotoxicity / mutagenicity	No genotoxic and no mutagenic properties known.
Carcinogenicity	No carcinogenic potential, since trichloro(2,4,4-trimethylpentyl)silane does not exhibit mutagenic properties.
Toxicity for reproduction	Based on available data a classification as toxic to reproduction (fertility and development) can be excluded.

6 Environmental Effects

Based on available data trichloro(2,4,4-trimethylpentyl)silane is regarded as not hazardous to the environment. The substance hydrolyses quite rapidly (half life < 1 minute), leading to (2,4,4-trimethylpentyl)silanetriol and hydrochloric acid. Effects on aquatic organisms arising from exposure to hydrogen chloride are indicated to be based on the pH reduction in the ambient environment to a level below their tolerable limit. The hazardous effects arising from hydrogen chloride are regarded to be not clearly a result of chemical toxicity, but as a function of and dependent on the buffering capacity of the environment. Due to its high reactivity with water the substance does not bioaccumulate and will not persist in the environment.

Effect Assessment	Result
Aquatic Toxicity	Studies, carried out with the substance and its structural analogues, revealed no adverse effects on aquatic organisms.
Terrestrial Toxicity	No data available.

Fate and behaviour	Result
Biodegradation	No data available. Biodegradation rate (13 % in 28 days) of a structural analogue demonstrates that the substance is not readily biodegradable.
Bioaccumulation potential	No data available. The substance hydrolyses rapidly to substances which have a low K_{ow} and thus a low bioaccumulation potential.
PBT / vPvB conclusion	The substance hydrolyses rapidly in the presence of water; neither the substance nor its hydrolysis products meet the criteria for PBT or vPvB.

7 Exposure

7.1 Human health

Consumers will not come into contact with trichloro(2,4,4-trimethylpentyl)silane as it is manufactured in industrial and professional settings in closed processes only. The substance is extremely reactive and no residual unreacted starting material is present in consumer products. Therefore, consumers will not be exposed to the substance. Workers can come in contact with the substance via exposure by inhalation or skin during processes, which are not carried out under strictly controlled conditions, such as transfer from/to large vessels or transfer of the substance or the preparation into small containers. Due to the corrosive nature and the acute toxicity of the substance adequate risk management measures have been implemented in order to minimise the risk to workers.

7.2 Environment

Due to the water sensitive properties, the manufacturing process of the substance is carried out under strictly moisture free conditions. Minor releases to waste water originate from washing of waste gases in scrubbers, from cleaning equipment, from cooling equipment and spillages during handling, e.g. formulation. These wastewaters are directed to waste water treatment plants, which may be contaminated with the hydrolysis products of the substance. Other waste/residue resulting from the direct synthesis and eventually containing the hydrolysis products or other contaminants is incinerated or recycled.

8 Risk Management Recommendations

When using trichloro(2,4,4-trimethylpentyl)silane make sure that there is adequate ventilation and suction at critical points to ensure that occupational exposure limit values are not exceeded (limit value (OEL): 2 mg/m^3 (1 ppm); limit value (EU): 8 mg/m^3 (5 ppm); valid for hydrogen chloride). Inhalative limit values for workers for the substance itself have also been established: 18.1 mg/m^3 (valid for local acute and long term exposure) and 83.7 mg/m^3 (valid for systemic long term exposure). Avoid any exposure, such as contact with skin and eyes, and do not breathe vapours. Avoid any contact or exposure by using appropriate respiratory protection (gas mask with ABEK filter; in case of long or strong exposure use a positive pressure self-contained breathing apparatus), eye protection (tight fitting protective goggles or protective shield where splashing is expected). Furthermore, protective gloves made of fluorinated rubber (e.g. for short term use < 10 minutes) and a full protective suit for protection of the body should be worn. Emergency showers and eye-bath possibilities must be provided. Do not eat, drink or smoke where chemicals are handled, processed or stored. Keep away from foodstuff, drink and feeding stuff. Wash hands thoroughly after handling and keep working clothes separately. Do not release into the aquatic environment, i.e. surface waters, drains or sewers, or soil. Regulations for protection against explosion should be observed.

9 First Aid Measures

Guide people to safety. First aid assistants should pay attention to self-protection. After contact with the substance via skin, eyes, ingestion and/or inhalation, a physician must immediately be consulted. Immediately take off all contaminated clothing and shoes and dispose off safely. In case of contact with skin, immediately flush affected area with large amounts of water for minimum 15 minutes followed by washing with soap and water, if available. Use an emergency shower in case of large amounts. In case of contact with eyes, immediately flush eyes with large amounts of water for minimum 15 minutes while holding eyelids open. After inhalation of the substance, move to fresh air, keep the affected person warm and at rest. Administer artificial

respiration if breathing stops. If accidentally swallowed, let several small portions of water be swallowed, only if the person is conscious, and obtain immediate medical attention. Do not induce vomiting. Let physician allow cortisone spray inhalation at the first possible opportunity. Observe the affected person up to a latency period of at least 24 hours. Apply corticoid-externa in case of first degree burns and apply symptomatic treatment in case of second degree burns.

10 Fire Fighting Measures

In case of fires use alcohol-resistant foam, carbon dioxide or dry sand. Please consider that the application of foam will initially release significant amounts of flammable and corrosive vapours which could be trapped under the foam blanket. Do not use water, extinguishing powder or halones as extinguishing agents. Hazardous combustion products contain hydrogen chloride, which is corrosive. It is absolutely required to wear full protective clothing including a self-contained breating apparatus.

11 Accidental Release Measures

When handling the substance, personal protection equipment must be worn. In case of spills, avoid any contact with the substance via eye and skin as well as inhalation of mists and vapours. Keep unprotected people away and ensure adequate ventilation. Do not walk through spilled material and indicate risk of slipping. Prevent material from entering surface waters, drains or sewers and soil. Any fluid that runs out should be contained by using a suitable material (e.g. earth). Directed spray of water should be used for condensation of gasses, vapours or mists. The contaminated water should be retained and afterwards disposed of in prescribed marked containers. If large amounts have leaked out, try to close the leak without any personal risk. In case small amounts have been spilled, absorb the liquid by acid binding material and dispose of the collected fluid according to official and local state regulations. Larger quantities of the spilled substance should be covered by nearly waterless foam and should be taken up in containers by pumping. After removing the spilled substance, the area should by cleaned up with plenty of water. Eliminate all sources of ignition.

12 Disposal Considerations

It is recommended to incinerate trichloro(2,4,4-trimethylpentyl)silane as hazardous waste according to official regulations in a special waste incinerator. Local regulations must be observed. Collect contaminated fire extinguishing water separately. Retain contaminated washing water and dispose of according to national, federal and local regulations. Dumping into the environment must be prevented. Contaminated packaging material must be completely emptied and can be re-used or recycled following appropriate cleaning. Handle contaminated packaging in the same way as the substance itself. Packaging material which cannot be properly cleaned must be thrown away.

13 Handling and Storage

If handling the substance, provide sufficient ventilation and punctiform suction at critical points. Trichloro(2,4,4-trimethylpentyl)silane should be stored under protective, inert gas. Keep away from incompatible substances, such as water, basic substances, acids, alcohols, ketones and aldehydes. Flammable vapours may accumulate and form explosive mixtues with air in containers, process vessels, including partial, empty and uncleaned containers and vessels or other enclosed spaces. Vapours are heavier than air, therefore inflammable gas mixture may form mainly near the floor. Take precautionary measures against electrostatic charging. Keep

away from sources of ignition and do not smoke and keep the container tightly closed in a cool, well ventilated place. The packaging should be kept dry and well sealed to prevent contamination and absorbtion of dampness. Store in original container only.

14 State Agency Review

Trichloro(2,4,4-trimethylpentyl)silane has been registered under REACH. For this product chemical safety assessments have been carried out.
National regulations listing trichloro(2,4,4-trimethylpentyl)silane are the following:
Toxic Substances Control Act (TSCA) in USA, European Inventory of Existing Commercial Chemical Substances (EINECS), Australian Inventory of Chemical Substances (AICS).

15 Classification and Labelling

The substance is classified under the EU Classification Labelling and Packaging (CLP) Regulation EC/1272/2008 as follows:

Hazard Class and Category	H-Phrase	Hazard pictograms	Wording
Acute toxicity 3	H301		Toxic if swallowed.
Skin corrosion 1A	H314		Causes severe skin burns and eye damage.
Eye Damage 1	H318		Causes serious eye damage

16 Conclusion

Trichloro(2,4,4-trimethylpentyl)silane is a well characterised substance, although some information is lacking in regard to toxicological effects on human health, e.g. inhalation or dermal toxicity. The substance is very corrosive and further sensitive to water. Upon contact with water it hydrolyses violently to (2,4,4-trimethylpentyl)silanetriol and hydrogen chloride. Consumers will not come into contact with trichloro(2,4,4-trimethylpentyl)silane as it is manufactured in industrial and professional settings in closed processes only. Workers should obtain specific instructions before handling this substance (personal protection equipment, handling and storage conditions) and follow the safety measures recommended in the Safety Data Sheet.

17 Contact Information within Company

For further information on this substance or product safety summaries in general, please contact: Dr. Christian Eppelsheim at wlcp-reach@wacker.com or visit our website at www.wacker.com.

18 Date of Issue

27/03/2012

WACKER

GPS SAFETY SUMMARY
TRICHLOROACETONE

This Product Safety Summary is intended to provide a general overview of the chemical substance in the context of ICCA Global Product Strategy. The information on the Summary is basic information and is not intended to provide emergency response information, medical information or treatment information. The summary should not be used to provide in-depth safety and health information. In-depth safety and health information can be found on the (extended) Safety Data Sheet (e)SDS for the chemical substance.

1 General Statement

Trichloroacetone is a colourless to reddish organic liquid with a pungent odour. It is only used in industrial settings under strictly controlled conditions as intermediate for the production of other chemicals as well as reagent on a laboratory scale. Due to its toxic and corrosive properties, it is classified as hazardous to human health by all routes of exposure (oral, dermal and by inhalation). Also in regard to its effects on the environment, this substance is very toxic to the aquatic environment and must not be released into the environment under any circumstances. Consumers will not get into contact with this substance in any way. Workers (industry, laboratory) should follow the safety measures recommended in the extended Safety Data Sheet (eSDS) and also observe all official regulations.

2 Chemical Identity

Name:	**Trichloroacetone**
Synonyms:	**1,1,3-Trichloroacetone**
CAS number:	**921-03-9**
EINECS number:	**213-063-6**
Molecular formula:	**$C_3H_3Cl_3O$**

3 Uses and Applications

Trichloroacetone is primarily used as intermediate in industrial processes, e.g. the manufacture of folic acid. A further use of trichloroacetone includes its application as laboratory reagent for various reactions. It is absolutely unlikely that consumers are exposed to this substance in any way, whereas workers (industry, laboratory) should follow the safety measures recommended in the extended Safety Data Sheet (eSDS).

4 Physical / Chemical Properties

Trichloroacetone is a colourless to reddish organic liquid with a pungent odour, which has a strong lachrymatory effect. Due to its low pH value, it has corrosive properties and can cause severe damage to skin and eyes upon contact. Vapours can build explosive / highly flammable mixtures with air, so adequate ventilation and suction should be provided. Due to its chlorination degree, it is not as easily flammable as its mono-chlorinated relative, monochloroacetone, but however, sources of ignition should be removed when handling trichloroacetone.

Appearance

State of matter:	liquid
Colour:	colourless to reddish
Odour:	pungent
Odour threshold:	1 mg/m^3
Molecular weight:	161.41 g/mol

Safety relevant basis data

Parameter	Value	Unit	Remark
Density:	1.5334	g/cm^3	at 20°C
pH:	3.7		at 21°C, 10g/l H_2O
Melting point / range:	~ 10	°C	
Boiling temperature / range:	172 111 – 112	°C °C	at 1013 hPa at 100 hPa
Solidification point / range:	6 - 13	°C	
Flash point:	63	°C	
Explosion hazard:			not applicable
Lower explosion limit:	6.3	V-%	
Upper explosion limit:			no data available
Ignition temperature:	540	°C	
Auto-ignition temperature:			no data available
Oxidizing properties			no data available
Decomposition temperature:	begins at ~ 100 146 – 246 246 - 333	°C °C °C	thermal
Vapour pressure:	0.3	hPa	at 20°
	1.4	hPa	at 38°
	3.5	hPa	at 50°
Solubility in water:			not applicable
log P O/W (n-octanol / water):	0.45		calculated
Viscosity (dynamic):			not determined

5 Health Effects

5.1 Consumer

Consumer exposure is extremely unlikely as the substance is manufactured and handled in industrial and professional settings only.

5.2 Worker

Workers will typically not come into contact with the substance as it is manufactured in closed systems in industrial and professional settings. In case of unintended exposure during synthesis, formulation, transfer or other procedures, workers should follow the recommended safety measures in the extended Safety Data Sheet (eSDS). The following table gives an overview on the health effects:

Effect Assessment	Result
Acute Toxicity oral / inhalation / dermal	Studies revealed that trichloroacetone is very toxic upon inhalation, toxic upon ingestion as well as harmful in contact with skin. (Acute Tox. 3; H301: Toxic if swallowed. Acute Tox. 2; H310: Fatal in contact with skin. Acute Tox. 2; H330: Fatal if inhaled.)
Irritation / corrosion skin / eye / respiratory tract	Trichloroacetone has corrosive properties due to its low pH value and causes severe burns upon contact with skin and eyes. (Skin Corr. 1C; H314: Causes severe skin burns and eye damage.)
Sensitisation	Due to the substances corrosive properties, no tests on skin sensitisation are applicable.
Toxicity after repeated exposure oral / inhalation / dermal	Data is not required for repeated exposure for all routes, since the substance has significant acute toxic effects.
Genotoxicity / mutagenicity	Based on two different tests, one test revealed that trichloroacetone has mutagenic effects (bacterial reverse mutation test).
Carcinogenicity	No data available.
Toxicity for reproduction	No data available.

6 Environmental Effects

Based on available data for the substance, trichloroacetone is considered as very toxic to aquatic organisms and can even have long-term adverse effects. It is not expected to bioaccumulate, but based on tests biodegradation occurs very slowly and in this way can have adverse effects on aquatic organisms on a long-term perspective. Therefore, dumping into the environment should be prevented in any way.

Effect Assessment	Result
Aquatic Toxicity	Based on available data, trichloroacetone is very toxic to aquatic organisms and may also cause long-term adverse effects in the aquatic environment.
Terrestrial Toxicity	No data available.

Fate and behaviour	Result
Biodegradation	Trichloroacetone is not readily biodegradable. (5% in 28 days)
Bioaccumulation potential	Bioaccumulation is not expected to occur. (log $P_{ow} \leq 3.0$)
PBT / vPvB conclusion	No data available.

7 Exposure

7.1 Human health

Consumers will not come into contact with trichloroacetone as it is manufactured in industrial and professional settings in closed processes only. Exposure to trichloroacetone of workers in manufacturing facilities is also considered as low because the process, storage and handling operations are strictly controlled. Workers who might accidentally come into contact with the

substance should absolutely follow the safety measures recommended in the Extended Safety Data Sheet (eSDS), since the substance is highly toxic to human health.

7.2 Environment

The manufacture of the substance and on-site uses are proceeded under strictly controlled conditions with no releases to air, soil and water (expected). Also during the industrial use of the substance there are no releases to air, water and soil, since the substance is classified as very toxic to the aquatic environment and is considered to have also significant adverse effects to aquatic organisms on a long-term perspective. Dumping into the environment must be prevented in any way.

8 Risk Management Recommendations

When using trichloroacetone, make sure that there is adequate ventilation and suction at critical points. Avoid any exposure, such as contact with skin and eyes, and do not breathe vapours. Contaminated clothing or soaked clothing must be immediately removed. Avoid any contact or exposure by using appropriate respiratory protection (gas mask with ABEK filter; in case of long or strong exposure use a positive pressure self-contained breathing apparatus), eye protection (tight fitting protective goggles), appropriate chemical resistant gloves (e.g. for short-term use (< 10 minutes) gloves coated with neoprene) and a full protective suit for protection of the body. Emergency showers and eye-bath possibilities must be provided. Do not eat, drink or smoke where chemicals are handled, processed or stored. Keep away from foodstuff, drink and feeding stuff. Wash hands thoroughly after handling and keep working clothes separately. Do not release into the aquatic environment, i.e. surface waters, drains or sewers, or soil. If large amounts are introduced into sewerage, inform responsible authorities immediately.

9 First Aid Measures

First aid assistants should pay attention to self-protection. In any cases of accident or unwell feeling a medicine should be immediately be consulted; the label should be shown, if possible. In case of risk of unconsciousness, place the victim on one side in a stable position and also transport in this position. After inhalation of vapours, the victim should be moved to fresh air. Lay victim down and keep calm and at rest. In case breathing has stopped, artificial respiration should be provided. If breathing is difficult, give oxygen. Immediately consult a doctor. In case of contact with skin, rinse the affected area with plenty of water and soap for at least 15 minutes. Remove all contaminated clothes and shoes at once. In serious cases immediately use an emergency shower. After contact with the eyes, rinse with plenty of water for at least 15 minutes and seek immediately medical advice. Continue to bathe eyes during transport to a medicine. Protect the unharmed eye. While rinsing eyes with water, keep eyelids well open to rinse the whole eye surface and eyelids with water. If accidentally swallowed, rinse mouth with plenty of water, give several small portions of water to drink, but do not induce vomiting since a risk of aspiration exists. Seek immediately medical advice and show the label or packaging.

10 Fire Fighting Measures

In case of fire, fight the fire from a safe distance, keep upwind and wear appropriate protective equipment such as full protective suit and a self-contained breathing apparatus. As extinguishing media use water spray, extinguishing powder, foam or carbon dioxide (CO_2). Do not use a high

power water jet. If it can be done without risk, cool endangered product containers by using water fog. Guide personal to safety and keep unprotected people away. Hazardous decomposition products contain corrosive substances such as hydrogen chloride among other toxic pyrolysis products as carbon monoxide (CO) and carbon dioxide (CO_2).

11 Accidental Release Measures

When handling the substance, personal protection equipment must be worn. In special cases (task force) a tightly fitting chemical protection suit must be worn. Avoid any contact with the substance as well as inhalation of mists, gases and vapours. Take persons to a safe place and keep unprotected people away. Observe wind direction and keep upwind. Eliminate all sources of ignition. Dumping in the environment must be prevented, e.g. prevent material from entering sewers or surface waters. For absorption of spills use an appropriate, liquid-binding material (e.g. earth, diatomaceous earth) and place in appropriate containers for disposal according to official and local state regulations. For large amounts pump up into suitable, prescribed marked containers. In case of small spills, cover the area with calcium oxide (CaO) and dispose of safely.

12 Disposal Considerations

It is strongly recommended to carry out burning of trichloroacetone as hazardous waste in a special waste incinerator according to official regulations. Local regulations must be observed. Collect contaminated fire extinguishing water separately. Retain contaminated washing water and dispose of according to national, federal and local regulations. Dumping into the environment must be prevented. Contaminated packaging material must be completely emptied and can be re-used or recycled following appropriate cleaning. Handle contaminated packaging in the same way as the substance itself. Packaging material which cannot be properly cleaned must be thrown away.

13 Handling and Storage

If handling the substance, exposure must be avoided by using appropriate technical measures and personal protective equipment. Ensure an adequate ventilation and punctiform suction at critical points. Must be siphoned off in situ. Keep away from incompatible materials, such as basic substances, since trichloro-acetone reacts violently with such substances under formation of heat. Open and handle container with care. Keep away from ignition sources, e.g. heat, sparks, open flames, hot surfaces, and do not smoke. Take precautionary measures against static discharges. Flammable vapours may accumulate and form explosive mixtures with air in containers, process vessels, including partial, empty and uncleaned containers and vessels, or other enclosed spaces. Regarding storage, only store in the original container and keep the container dry and tightly closed, when not in use. Keep storage containers in a cool, well-ventilated place and ensure that during storage, and also during transport, the temperature does not fall below 10 °C. Protect containers against frost. Do not use containers, casks and pipelines made of light metals or their alloys, e.g. aluminum, as well as iron, steel, or zinc.

14 State Agency Review

Trichloroacetone has been registered under REACH. This substance is listed on PICCS (Philippines), EINECS and C&L-Inventory (Europe) and AICS (Australia).

15 Classification and Labelling

The substance is classified under the EU Classification Labelling and Packaging (CLP) Regulation EC/1272/2008 as follows:

Hazard Class and Category	H-Phrase	Hazard pictograms	Wording
Acute Toxicity 3 (oral)	H301		Toxic if swallowed.
Acute Toxicity 2 (dermal)	H310		Fatal in contact with skin.
Acute Toxicity 1 (inhalation)	H330		Fatal if inhaled.
Skin corrosion 1C	H314		Causes severe skin burns and eye damage.
Acute aquatic toxicity 1	H400		Very toxic to aquatic life.
Chronic aquatic toxicity 1	H410		Very toxic to aquatic life with long lasting effects.

16 Conclusion

Trichloroacetone is of acute toxicity by all routes of exposure (oral, dermal and inhalation) and further has corrosive properties due to its low pH value. In regard to mutagenicity, conducted tests revealed both, positive and negative results. No data on carcinogenicity and developmental / reproductive effects are available. Consumers will not get in contact with this substance, since use of this substance takes place in industrial and professional settings only. Workers should follow the safety measures recommended in the Extended Safety Data Sheet (eSDS) and also observe all official regulations (local/national) since the substance has acute hazardous effects on human health. Trichloroacetone is regarded as very toxic to the environment, also on a long-term perspective. Therefore, dumping into the environment must be prevented.

17 Contact Information within Company

For further information on this substance or product safety summaries in general, please contact: Dr. Christian Eppelsheim at wlcp-reach@wacker.com or visit our website at www.wacker.com.

18 Date of Issue

05/03/2012

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GPS SAFETY SUMMARY
TRICHLORO(ETHYL)SILANE

This Product Safety Summary is intended to provide a general overview of the chemical substance in the context of ICCA Global Product Strategy. The information on the Summary is basic information and is not intended to provide emergency response information, medical information or treatment information. The summary should not be used to provide in-depth safety and health information. In-depth safety and health information can be found on the (extended) Safety Data Sheet for the chemical substance.

1 General Statement

Trichloro(ethyl)silane is a very corrosive, colourless organic liquid with a pungent odour similar to hydrochloric acid. The main commercial method for production of the substance is the hydrosilylation of ethylene with trichlorosilane, either initiated by peroxides, UV light or gamma radiation or using a metal catalyst. Other synthesis routes include the direct synthesis from reaction of chloroethane or chloromethane with silicon – known as Müller-Rochow synthesis when using chloromethane. The direct synthesis results in a mixture of mono-, di- and trimethylchlorosilanes, as well as other minor products, from which trichloro(ethyl)silane can be isolated in a subsequent distillation step. However, the direct reaction route is currently not conducted in the EU. Uses of trichloro(ethyl)silane of commercial significance is the use as intermediate in the production of other organosilicon substances, such as triacetoxy(ethyl)silane, and the use as laboratory chemical in research and development activities. The substance is very corrosive and can cause severe damages to skin, eyes and other human tissue due to the generation of hydrochloric acid upon contact with water / moisture. Further, it is of acute toxicity upon inhalation and ingestion and highly flammable. In regard to hazardous effects on the environment, trichloro(ethyl)silane is considered of low toxicity to aquatic organisms, since the substance hydrolyses rapidly upon contact with water to silanol- and/or siloxanol-compounds and hydrochloric acid. Exposure to consumers is absolutely unlikely since it is handled under strict conditions in industrial and professional settings only. It is absolutely required that workers and professional users obtain specific instructions before handling this substance.

2 Chemical Identity

Name:	trichloro(ethyl)silane
CAS number:	115-21-9
EINECS number:	204-072-6
Molecular formula:	$C_2H_5Cl_3Si$

3 Uses and Applications

Trichloro(ethyl)silane is mainly applied as chemical intermediate in industrial processes and as laboratory chemical. Trichloro(ethyl)silane, in common with many other organochlorosilanes, is primarily used as a chemical intermediate in the synthesis of other organofunctional silanes. These derivatives (alkoxysilanes, acyloxysilanes, oximinosilanes, aminoxysilanes, aminosilanes and amidosilanes) are then used in the manufacture or end-use of silicones, either as monomers or as cross-linking agents. Trichloro(ethyl)silane, like other organochlorosilanes, is further applied as reagent in industrial and academic laboratories, for research and development or quality assurance. In most instances, organochlorosilanes are used as intermediates in the synthesis of other silicon-based chemicals. Alternatively, organochlorosilanes may play a

facilitating role, e.g. use as a “blocking agent” in organic synthesis or as a surface modifying agent.
In end products available on the market no unreacted residues of trichloro(ethyl)silane are present; therefore, consumer exposure will not occur. Workers (industry, laboratory) should follow the safety measures recommended in the extended Safety Data Sheet.

4 Physical / Chemical Properties

Trichloro(ethyl)silane is an organic colourless liquid with a pungent odour similar to hydrochloric acid. The substance is very sensitive to hydrolysis, which takes place in the presence of proton-active substances such as acids, bases and water. Hydrolysis of trichloro(ethyl)silane leads to decomposition into silanol- and/or siloxanol-compounds and hydrogen chloride, which is extremely corrosive. The substance is highly flammable; flammable vapours may accumulate and form explosive mixtures with air in containers, process vessels, including partial, empty and uncleaned containers and vessels, or other enclosed spaces. Vapours are heavier than air; therefore inflammable gas mixture may form mainly near floor. It is absolutely required to keep the substance away from sources of ignition - do not smoke – and to take precautionary measures against electrostatic charging.

Appearance

State of matter:	liquid
Colour:	colourless
Odour:	pungent, similar to hydrochloric acid
Odour threshold:	no data available
Molecular weight:	163.51 g/mol

Safety relevant basis data

Parameter	Value	Unit	Remark
Density:	1.24	g/cm^3	at 20°C
pH:			not applicable; displays extremely acidic reaction with water
Melting point:	-106		
Boiling temperature / range:	98	°C	at 1013 hPa
Flash point:	14.6	°C	at 1013 hPa
Explosion hazard:			
Lower explosion limit:	2.86	Vol.-%	
Upper explosion limit:			not determined
Ignition temperature:	405	°C	at 1013 hPa
Vapour pressure:	48 190	hPa hPa	at 20 ° at 50°C
Solubility in water:			hydrolytic decomposition
log $P_{O/W}$ (n-octanol / water):			no data available
Viscosity (dynamic):	0.8	mPa.s	at 20°C

5 Health Effects

5.1 Consumer

Consumer exposure is absolutely unlikely since the substance is handled under strictly controlled conditions in industrial and professional settings only.

5.2 Worker

Workers will typically not come into contact with the substance as it is manufactured in closed systems in industrial and professional settings under protective atmosphere, since contact with moisture leads to hydrolysis. In case of unintended exposure during synthesis, formulation, transfer or other procedures, workers should follow the recommended safety measures in the Safety Data Sheet. The following table gives an overview on the health effects:

Effect Assessment	Result
Acute Toxicity oral / inhalation / dermal	Trichloro(ethyl)silane is classified as substance of acute toxicity via ingestion and inhalation. Based on the corrosiveness of the substance, no further studies were required. (Acute Tox. 4; H302: Harmful if swallowed.; Acute Tox. 3; H331: Toxic if inhaled)
Irritation / corrosion skin / eye / respiratory tract	Trichloro(ethyl)silane is corrosive to skin and eyes and further is irritating to the respiratory tract based on conducted studies. (Skin Corr. 1A; H314: Causes severe skin burns and eye damage.)
Sensitisation	There are no data to suggest that trichloro(ethyl)silane should be classified for skin sensitisation.
Toxicity after repeated exposure oral / inhalation / dermal	Based on a study conducted with a related substance (methyltrimethoxysilane), no indications exist that there is a need to classify trichloro(ethyl)silane for adverse effects following repeated exposure.
Genotoxicity / mutagenicity	Based on tests it is concluded that for trichloro(ethyl)silane classification for genotoxicity / mutagenicity is not required.
Carcinogenicity	There is no evidence to suggest that the substance should be classified for carcinogenicity.
Toxicity for reproduction	There are no data to suggest that trichloro(ethyl)silane should be classified for reproductive or developmental toxicity.

6 Environmental Effects

Due to the hydrolysis characteristics of trichloro(ethyl)silane the ecotoxicological assessment has been based on its hydrolysis products silanol- and/or siloxanol-compounds and hydrogen chloride. For the silanols/siloxanols a conclusion was made by analogy (read-across) to structurally similar alkoxy silanes. Despite its pH effects hydrogen chloride does not show any acute or chronic toxicity to aquatic organisms. On the basis of these data no harmful effects are expected for aquatic organisms after neutralization or if the buffer capacity of the sewage treatment plant or the water compartment is not exceeded. Trichloro(ethyl)silane does not bioaccumulate, hydrolyses easily and will not persist in the environment. No environmental problems are expected if the substance is handled and treated in accordance with standard industrial practices and local regulations, where applicable.

Effect Assessment	Result
Aquatic Toxicity	On the basis of data available for the hydrolysis products silanol and hydrochloric acid, no harmful effects are expected for aquatic organisms. However, large amounts should not be introduced into purification plants before a neutralisation has been carried out.
Terrestrial Toxicity	Tests regarding toxicity to sediment organisms are considered as not necessary due to the rapid hydrolysis of the substance. No chronic toxicity data for sediment and the terrestrial compartment is available.

Fate and behaviour	Result
Biodegradation	Trichloro(ethyl)silane is not readily biodegradable (0% in 28 days), but hydrolyses rapidly upon contact with water. Its decomposition products are silanol- and/or siloxanol-compounds as well as hydrochloric acid.
Bioaccumulation potential	Bioaccumulation is not expected to occur.
PBT / vPvB conclusion	This substance is not a PBT or vPvB substance.

7 Exposure

7.1 Human health

Consumers will typically not come into contact with trichloro(ethyl)silane as it is manufactured in industrial and professional settings in closed processes only. Exposure to trichloro(ethyl)silane of personnel in manufacturing facilities is also considered as low because the process, storage and handling operations are generally carried out under strictly controlled conditions. Workers who might accidentally come into contact with the substance should follow the safety measures recommended in the Safety Data Sheet.

7.2 Environment

Exposure of the environment to trichloro(ethyl)silane is absolutely unlikely, on the one hand side based on the rapid hydrolysis of the substance upon contact with water, on the other hand side due to commonly applied industrial risk management measures. Risk management measures related to environmental emissions from industrial sites include air emission abatement techniques, onsite waste treatment processes as well as external waste water treatment at specific treatment plants. Therefore releases to the environment are considered as nearly zero having no adverse effects on aquatic or terrestrial organisms. However, large amounts should not be introduced into purification plants before a neutralisation step of waste water has been carried out.

8 Risk Management Recommendations

When using trichloro(ethyl)silane it must be ensured that there is adequate ventilation and suction at critical points in order to not exceed occupational exposure limit values. Observe standard hygiene measures, i.e. do not eat, drink or smoke at the workplace and wash hands at the end of work and before eating. Do not breath gases, vapours or aerosols and avoid any contact with eyes and skin by using appropriate respiratory protection (gas mask with ABEK filter; in case of long or strong exposure a positive pressure self contained breathing apparatus), eye protection, such as tight fitting protective goggles or when risk of splashing exists a protective face shield, appropriate chemical resistant gloves, e.g. made of fluorinated rubber, and appropriate body protection, such as an acid-proof protective clothing and neck protection,

when necessary. Provide work station with eye bathing equipment and do not wear contact lenses. Only wear gloves for short periods (<10 minutes) and replace them immediately in case there are any signs of decay or chemical permeability. Do not release the substance into the aquatic environment or soil. Observe existing regulations for protection against explosion.

9 First Aid Measures

First aid assistants should pay attention to self-protection. Always seek medical advice in the event of contact with this substance. In case of inhalation take affected person to a safe place, keep warm and at rest. If unconscious, place in a stable sideways position and protect against loss of body heat. If breathing stops, administer artificial respiration. Upon contact with skin remove contaminated or soaked clothing at once and rinse the affected area with plenty of soap and water for minimum 15 minutes. In serious cases, use emergency shower immediately and consult a physician. In case of contact with eyes, rinse immediately with plenty of water for minimum 15 minutes. Keep eyelids well opened to rinse the whole eye surface and eyelids with water. Seek medical advice and continue to bathe eyes during the transport. In case the substance is accidentally swallowed, give several small portions of water to drink, if the person is conscious, and do not induce vomiting. Physicians should treat the victim as early as possible with cortisone spray in case of inhalation. Medical checks are necessary up to a latency period of at least 24 hours. In the event of first degree burns use corticoid-externa. In the case of second degree burns, treat the affected area symptomatically. Take into account that in case of swallowing a risk of intra-abdominal gas development as well as risk of perforation of the stomach exists.

10 Fire Fighting Measures

In case of fire it is recommended to use alcohol-resistant foam, carbon dioxide (CO_2) or dry sand. Application of foam will release significant amounts of flammable and corrosive vapours at the beginning, which, however, could be trapped under the foam blanket. Do not use water, extinguishing powder or halones. If it can be done without risk, cool endangered product containers, guide personal to safety and keep unprotected people away. Keep upwind since hazardous combustion products includes corrosive hydrogen chloride among other toxic pyrolysis products. It is absolutely required to wear a self-contained breathing apparatus and a tight fitting chemical protection suit.

11 Accidental Release Measures

Personal protection equipment must be worn. In case of spills, eliminate all sources of ignition and indicate that there is a risk of slippery. Close leaks if possible without risk. Avoid any contact with the substance, e.g. do not walk through spilled material, as well as inhalation of mists, gases and vapours. Keep unprotected people away and ensure adequate ventilation. Task forces have to wear a tightly fitting chemical protection suite. Regarding methods for cleaning do not flush spills away with water. Absorb small leaks immediately with an appropriate, liquid-binding material (mainly acid binding material) and place in appropriate containers for disposal according to official and local state regulations. In case of large amounts cover large spills with nearly waterless foam and take up in container. Condense gases/vapours/mists using a directed spray of water, let remaining vapours evaporate and provide adequate ventilation. Clean area with plenty of water and let remaining vapours evaporate. Contaminated water and extinguishing water should be disposed off in prescribed marked containers. Prevent material from entering surface waters, drains or sewers and soil.

12 Disposal Considerations

It is recommended to incinerate trichloro(ethyl)silane as hazardous waste in a special waste incinerator, but ensure that a special chemical / physical treatment is applied. Discuss with the supplier in case of uncertainties and observe local, federal and national regulations. Collect contaminated fire extinguishing water separately. Retain contaminated washing water and dispose off in accordance with national, federal and local regulations. Dumping into the environment must be prevented. Contaminated packaging material should be completely emptied and can be re-used or recycled after appropriate cleaning. Handle uncleaned packaging in the same way as the substance itself.

13 Handling and Storage

Avoid formation and inhalation of gases, vapours or aerosols. Use special protective equipment and ensure adequate ventilation during handling and storage. Product must be siphoned off in situ. Keep away from incompatible substances, i.e. proton-active substances, such as basic substances, acids, alcohols and ketones / aldehydes and water, since trichloro(ethyl)silane reacts violently with them under formation of hydrogen chloride and heat. Spills must be immediately eliminated since it poses an increased risk of slipping. Further, keep away from ignition sources, e.g. heat, sparks, open flames, hot surfaces, and do not smoke. Flammable vapours may accumulate and form explosive mixtures with air in containers, process vessels, including partial, empty and uncleaned containers and vessels, or other enclosed spaces. Vapours are heavier than air; therefore inflammable gas mixtures may form mainly near floor. Take precautionary measures against electrostatic charging. In regard to storage, trichloro(ethyl)silane should be stored under protective gas in order to avoid any contact with moisture. The packaging should be kept dry and well sealed to prevent any contamination and absorption of dampness. Store the product only in its original container and keep the container tightly closed in a cool, well ventilated place.

14 State Agency Review

Trichloro(ethyl)silane has been registered under REACH. Chemical safety assessments have been carried out according to several regulations.
National regulations listing trichloro(ethyl)silane are: European Inventory of Existing Commercial Chemical Substances (EINECS), Australian Inventory of Chemical Substances (AICS), Japanese Existing Notified Chemical Substances (ENCS), Philippine Inventory of Chemicals and Chemical Substances (PICCS), U.S. Toxic Substances Control Act (TSCA), Inventory of Existing Chemical Substances in China (IECSC).

15 Classification and Labelling

The substance is classified under the EU Classification Labelling and Packaging (CLP) Regulation EC/1272/2008 as follows:

Hazard Class and Category	H-Phrase	Hazard pictograms	Wording
Flammable Liquid, 2	H225		Highly flammable liquid and vapour.

Skin corrosion / irritation, 1A (Serious eye damage / eye irritation, 1)	H314		Causes severe skin burns and eye damage.
Acute toxicity, 4 (oral)	H302		Harmful if swallowed.
Acute toxicity, 3 (inhalation)	H331		Toxic if inhaled.

16 Conclusion

Trichloro(ethyl)silane is a well characterised substance, which is processed in industrial and professional settings only under strictly performed conditions, due to its strong corrosive property, its high flammability as well as its sensitivity to water / moisture leading to rapid hydrolysis upon contact. Consumers will not be exposed to this substance under any circumstances. However, workers must follow existing risk management measures since trichloro(ethyl)silane. In regard to hazardous effects on the environment it can be concluded that the substance does not bear a risk to aquatic organisms since it rapidly hydrolyses to silanoles and hydrochloric acid upon contact with water.

17 Contact Information within Company

For further information on this substance or product safety summaries in general, please contact: Dr. Christian Eppelsheim at wlcp-reach@wacker.com or visit our website at www.wacker.com.

18 Date of Issue

23/03/2012

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GPS SAFETY SUMMARY
TRICHLORO(PHENYL)SILANE

This Product Safety Summary is intended to provide a general overview of the chemical substance in the context of ICCA Global Product Strategy. The information on the Summary is basic information and is not intended to provide emergency response information, medical information or treatment information. The summary should not be used to provide in-depth safety and health information. In-depth safety and health information can be found on the (extended) Safety Data Sheet.

1 General Statement

Trichloro(phenyl)silane is a very corrosive, colourless organic liquid with a pungent odour similar to hydrochloric acid. The main commercial method for production of the substance is the direct synthesis from chlorobenzene and silicon in the presence of a catalyst or the reaction of trichlorosilane and chlorobenzene at elevated temperatures in the gas phase and presence of a catalyst or radical initiator. The reactions are carried out under strict exclusion of water in an inert atmosphere since all chlorosilanes are highly sensitive to moisture. In order to remove by-products and to increase the purity of trichloro(phenyl)silane, a purifying distillation step is performed. Phenylchlorosilanes are primarily used as intermediates for the production of other Si-based substances, such as alkoxysilanes, as monomers in the production of silicone fluids and resins and as laboratory reagent in research and development activities. The substance is very corrosive and can cause severe damages to skin, eyes and other human tissue due to the generation of hydrochloric acid upon contact with water / moisture. In regard to hazardous effects on the environment, trichloro(phenyl)silane is considered of low toxicity to aquatic organisms, since the substance hydrolyses rapidly upon contact with water to silanol and hydrochloric acid. Exposure to consumers is absolutely unlikely since it is handled under strict conditions in industrial and professional settings only. It is absolutely required that workers and professional users obtain specific instructions before handling this substance.

2 Chemical Identity

Name:	trichloro(phenyl)silane
Other names:	phenyltrichlorosilane
CAS number:	98-13-5
EINECS number:	202-640-8
Molecular formula:	$C_6H_5Cl_3Si$

3 Uses and Applications

Trichloro(phenyl)silane is mainly applied as chemical intermediate in industrial processes, as monomer and as laboratory chemical. The major use (95% globally) of organochlorosilanes is in the manufacture of silicone polymers. When used as intermediate in industrial processes, trichloro(phenyl)silane is applied during synthesis of other organofunctional silanes. These substances are then used for the manufacture of silicones, either as monomers or as cross-linking agents. Of the derivatives of trichloro(phenyl)silane, the commercially most important ones are triethoxy- and trimethoxy(phenyl)silane. Organochlorosilanes are used as reagents in both industrial and academic laboratories. Alternatively, organochlorosilanes play also a facilitating role, *e.g.* use as a “blocking agent” in organic synthesis or as a surface modifying agent. In end products available on the market no unreacted residues of trichloro(phenyl)silane

are present; therefore, consumer exposure will not occur. Workers (industry, laboratory) should follow the safety measures recommended in the Safety Data Sheet.

4 Physical / Chemical Properties

Trichloro(phenyl)silane is an organic colourless liquid with a pungent odour similar to hydrochloric acid. The substance is very sensitive to hydrolysis in the presence of acids, bases and water. Hydrolysis of trichloro(phenyl)silane leads to decomposition into silanol and hydrochloric acid, which is extremely corrosive.

Appearance

State of matter:	liquid
Colour:	colourless
Odour:	pungent, similar to hydrochloric acid
Odour threshold:	no data available
Molecular weight:	211.55 g/mol

Safety relevant basis data

Parameter	Value	Unit	Remark
Density:	1.25	g/cm^3	at 20 °C
pH:			not applicable; extremely acidic reaction with water
Melting point:	-40		
Boiling temperature:	201.8	°C	at 1013 hPa
Flash point:	91.6	°C	
Explosion hazard:			no data available
Lower explosion limit:	1.5	Vol-%	
Upper explosion limit:	9.2	Vol-%	
Ignition temperature:	544	°C	at 1013 hPa
Decomposition temperature:			no data available
Oxidising properties:			no
Vapour pressure:	44	Pa	at 20 °
Solubility in water:			hydrolytic decomposition
log $P_{O/W}$ (n-octanol / water):			not applicable
Viscosity (dynamic):	3.3	mPa.s	at 20 °C

5 Health Effects

5.1 Consumer

Consumer exposure is absolutely unlikely since the substance is handled in industrial and professional settings only.

5.2 Worker

Workers will typically not come into contact with the substance as it is manufactured in closed systems in industrial and professional settings under protective atmosphere, since contact with moisture leads to hydrolysis. In case of unintended exposure during synthesis, formulation,

transfer or other procedures, workers should follow the recommended safety measures in the Safety Data Sheet. The following table gives an overview on the health effects:

Effect Assessment	Result
Acute Toxicity oral / inhalation / dermal	Based on the corrosiveness of the substance, trichloro(phenyl)silane is classified as substance of acute toxicity via the dermal route; no further studies were required. (Acute Tox. 4; H312: Harmful in contact with skin.)
Irritation / corrosion skin / eye / respiratory tract	Due to the corrosiveness of the substance, trichloro(phenyl)silane is expected to cause severe skin, eye and respiratory damage due to release of hydrogen chloride when in contact with water / moisture, *e.g.* in air. (Skin Corr. 1A; H314: Causes severe skin burns and eye damage.)
Sensitisation	There is no direct information about skin or respiratory sensitisation in humans due to the strong corrosiveness of the substance.
Toxicity after repeated exposure oral / inhalation / dermal	Based on a study conducted with a related substance (trimethoxy(phenyl)silane), indications exist that kidney and urinary bladder are potential target organs following oral exposure. However, at the dose levels tested, corrosive effects of trichloro(phenyl)silane would outweigh any potential systemic effects. Therefore, the substance is not considered as appropriate to be classified for repeated dose toxicity.
Genotoxicity / mutagenicity	Based on tests it is concluded that for trichloro(phenyl)silane classification for genotoxicity / mutagenicity is not required.
Carcinogenicity	There is no evidence to suggest that the substance should be classified for carcinogenicity.
Toxicity for reproduction	There are no data to suggest that trichloro(phenyl)silane should be classified for reproductive or developmental toxicity.

6 Environmental Effects

Due to the hydrolysis characteristics of trichloro(phenyl)silane the ecotoxicological assessment has been based on its hydrolysis products silanol and hydrogen chloride. For silanol no damaging effects to aquatic organisms are expected. For hydrogen chloride, despite its pH effects, no acute or chronic toxicity effects to aquatic organisms have been observed. Therefore, no harmful effects are expected for aquatic organisms after neutralisation or if the buffer capacity of the sewage treatment plant or the water compartment is not exceeded.
Trichloro(phenyl)silane does not bioaccumulate and will not persist in the environment. No environmental problems are expected if the substance is handled and treated in accordance with standard industrial practices and local regulations, where applicable.

Effect Assessment	Result
Aquatic Toxicity	On the basis of data available for the hydrolysis products silanol and hydrochloric acid, no harmful effects are expected for aquatic organisms. However, large amounts should not be introduced into purification plants before a neutralisation has been carried out.
Terrestrial Toxicity	Tests regarding toxicity to sediment organisms are considered as not necessary due to the rapid hydrolysis of the substance. No chronic toxicity data for sediment and the terrestrial compartment is available.

Fate and behaviour	Result
Biodegradation	Trichloro(phenyl)silane is not readily biodegradable (1% in 28 days), but hydrolyses rapidly upon contact with water. Its decomposition products are silanol- and/or siloxanol-compounds as well as hydrochloric acid.
Bioaccumulation potential	Bioaccumulation is not expected to occur.
PBT / vPvB conclusion	This substance is not a PBT or vPvB substance.

7 Exposure

7.1 Human health

Consumers will typically not come into contact with trichloro(phenyl)silane as it is manufactured in industrial and professional settings in closed processes only. Exposure to trichloro(phenyl)-silane of personnel in manufacturing facilities is also considered as low because the process, storage and handling operations are generally carried out under strictly controlled conditions. Workers who might accidentally come into contact with the substance should follow the safety measures recommended in the Safety Data Sheet.

7.2 Environment

Exposure of the environment to trichloro(phenyl)silane is absolutely unlikely, on the one hand side based on the rapid hydrolysis of the substance upon contact with water, on the other hand side due to commonly applied industrial risk management measures. Risk management measures related to environmental emissions from industrial sites include air emission abatement techniques, onsite waste treatment processes as well as external waste water treatment at specific treatment plants. Therefore releases to the environment are considered as nearly zero having no adverse effects on aquatic or terrestrial organisms. However, large amounts should not be introduced into purification plants before a neutralisation step of waste water has been carried out.

8 Risk Management Recommendations

When using trichloro(phenyl)silane it must be ensured that there is adequate ventilation and suction at critical points in order to not exceed occupational exposure limit values. Observe standard hygiene measures, *i.e.* do not eat, drink or smoke at the workplace and wash hands at the end of work and before eating. Do not breath gases, vapours or aerosols and avoid any contact with eyes and skin by using appropriate respiratory protection (gas mask with ABEK filter; in case of long or strong exposure a positive pressure self contained breathing apparatus), eye protection, such as tight fitting protective goggles or when risk of splashing exists a protective face shield, appropriate chemical resistant gloves, e.g. made of fluorinated rubber, and appropriate body protection, such as an acid-proof protective clothing and neck protection, when necessary. Provide work station with eye bathing equipment and do not wear contact lenses. Only wear gloves for short periods (<10 minutes) and replace them immediately in case there are any signs of decay or chemical permeability. Do not release the substance into the aquatic environment or soil. Observe existing regulations for protection against explosion.

9 First Aid Measures

First aid assistants should pay attention to self-protection. Always seek medical advice in the event of contact with this substance. In case of inhalation take affected person to a safe place,

keep warm and at rest. If unconscious, place in a stable sideways position and protect against loss of body heat. If breathing stops, administer artificial respiration. Upon contact with skin remove contaminated or soaked clothing at once and rinse the affected area with plenty of soap and water. In serious cases, use emergency shower immediately and consult a physician. In case of contact with eyes, rinse immediately with plenty of water for minimum 15 minutes. Keep eyelids well opened to rinse the whole eye surface and eyelids with water. Seek medical advice and continue to bathe eyes during the transport. In case the substance is accidentally swallowed, give several small portions of water to drink, if the person is conscious, and do not induce vomiting. Physicians should treat the victim as early as possible with cortisone spray in case of inhalation. Medical checks are necessary up to a latency period of at least 24 hours. In the event of first degree burns use corticoid-externa. In the case of second degree burns, treat the affected area symptomatically. Take into account that in case of swallowing a risk of intra-abdominal gas development as well as risk of perforation of the stomach exists.

10 Fire Fighting Measures

In case of fire it is recommended to use carbon dioxide (CO_2) or dry sand. In special cases also alcohol-resistant foam can be used. Application of foam will release significant amounts of flammable and corrosive vapours at the beginning, which, however, will be trapped under the foam blanket. Do not use water, extinguishing powder or halones. If it can be done without risk, cool endangered product containers, guide personal to safety and keep unprotected people away. Keep upwind since hazardous combustion products includes corrosive hydrogen chloride among other toxic pyrolysis products. It is absolutely required to wear a self-contained breathing apparatus and a tight fitting chemical protection suit.

11 Accidental Release Measures

Personal protection equipment must be worn. In case of spills, eliminate all sources of ignition and indicate that there is a risk of slippery. Avoid any contact with the substance, *e.g.* do not walk through spilled material, as well as inhalation of mists, gases and vapours. Keep unprotected people away and ensure adequate ventilation. Task forces have to wear a tightly fitting chemical protection suite. Regarding methods for cleaning do not flush spills away with water. Absorb small leaks immediately with an appropriate, liquid-binding material (e.g. diatomaceous earth, earth) and place in appropriate containers for disposal according to official and local state regulations. In case of large amounts cover large spills with nearly waterless foam and take up in container. Condense gases/vapours/mists using a directed spray of water, let remaining vapours evaporate and provide adequate ventilation. Clean area with plenty of water. Contaminated water and extinguishing water should be disposed of in prescribed marked containers. Prevent material from entering surface waters, drains or sewers and soil.

12 Disposal Considerations

It is recommended to incinerate trichloro(phenyl)silane as hazardous waste in a special waste incinerator, but ensure that a special chemical / physical treatment is applied. Discuss with the supplier in case of uncertainties and observe local, federal and national regulations. Collect contaminated fire extinguishing water separately. Retain contaminated washing water and dispose off in accordance with national, federal and local regulations. Dumping into the environment must be prevented. Contaminated packaging material should be completely emptied and can be re-used or recycled after appropriate cleaning. Handle uncleaned packaging in the same way as the substance itself.

13 Handling and Storage

Avoid formation and inhalation of gases, vapours or aerosols. Use special protective equipment and ensure adequate ventilation during handling and storage. Product must be siphoned off in situ. Keep away from incompatible substances, i.e. proton-active substances, such as basic substances, acids, alcohols and ketones / aldehydes and water, since trichloro(phenyl)silane reacts violently with them under formation of hydrogen chloride and heat. Spills must be immediately eliminated since it poses an increases risk of slipping. Further, keep away from ignition sources, e.g. heat, sparks, open flames, hot surfaces, and do not smoke. Flammable vapours may accumulate and form explosive mixtures with air in containers, process vessels, including partial, empty and uncleaned containers and vessels, or other enclosed spaces. Vapours are heavier than air; therefore inflammable gas mixtures may form mainly near floor. Take precautionary measures against electrostatic charging. In regard to storage, trichloro(phenyl)silane should be stored under protective gas in order to avoid any contact with moisture. The packaging should be kept dry and well sealed to prevent any contamination and absorption of dampness. Store the product only in its original container and keep the container tightly closed in a cool, well ventilated place.

14 State Agency Review

Trichloro(phenyl)silane has been registered under REACH. Chemical safety assessments have been carried out according to several regulations. National regulations listing trichloro(phenyl)silane are: European Inventory of Existing Commercial Chemical Substances (EINECS), Australian Inventory of Chemical Substances (AICS), Korean Existing Chemicals List (ECL), Japanese Existing Notified Chemical Substances (ENCS), Philippine Inventory of Chemicals and Chemical Substances (PICCS), U.S. Toxic Substances Control Act (TSCA), Inventory of Existing Chemical Substances in China (IECSC), Canadian Domestic Substances List (DSL).

15 Classification and Labelling

The substance is classified under the EU Classification Labelling and Packaging (CLP) Regulation EC/1272/2008 as follows:

Hazard Class and Category	H-Phrase	Hazard pictograms	Wording
Acute toxicity, 4 (dermal)	H312		Harmful in contact with skin.
Skin corrosion / irritation, 1A (Serious eye damage / eye irritation, 1)	H314		Causes severe skin burns and eye damage.

16 Conclusion

Trichloro(phenyl)silane is a well characterised substance, which is processed in industrial and professional settings only under strictly performed conditions, on the one hand side due to its strong corrosive property, on the other hand side based on its sensitivity to water / moisture leading to rapid hydrolysis upon contact. Consumers will not be exposed to this substance under any circumstances. However, workers must follow existing risk management measures. In regard to hazardous effects on the environment it can be concluded that the substance does not

bear a risk to aquatic organisms since it rapidly hydrolyses to silanoles and hydrochloric acid upon contact with water.

17 Contact Information within Company

For further information on this substance or product safety summaries in general, please contact: Dr. Christian Eppelsheim at wlcp-reach@wacker.com or visit our website at www.wacker.com.

18 Date of Issue

23/03/2012

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GPS SAFETY SUMMARY
TRIETHOXY(2,4,4-TRIMETHYLPENTYL)SILANE

This Product Safety Summary is intended to provide a general overview of the chemical substance in the context of ICCA Global Product Strategy. The information on the Summary is basic information and is not intended to provide emergency response information, medical information or treatment information. The summary should not be used to provide in-depth safety and health information. In-depth safety and health information can be found on the (extended) Safety Data Sheet.

1 General Statement

Triethoxy(2,4,4-trimethylpentyl)silane is an organic, colourless liquid with a slight odour. The substance is industrially manufactured by a continuous counterflow reaction of ethanol and trichloro(2,4,4-trimethylpentyl)silane at boiling point in a specific reaction system. The product is continuously drained from the reaction system, whereas by-products, such as hydrogen chloride, are removed for recycling.
The substance is used for the manufacture of silicone-modified coatings and plasters, masonry treatment, mass hydrophobation and as a laboratory chemical. The substance is not classified as hazardous to human health; neither acute nor chronic toxic effects were identified. The substance has no irritating, corrosive or sensitising effects. In regard to the aquatic environment, triethoxy(2,4,4-trimethylpentyl)silane is considered as not hazardous. Special attention during handling and storage has to be paid to the flammability of the substance. Workers should refer to the information set out in the Safety Data Sheet.

2 Chemical Identity

Name:	Triethoxy(2,4,4-trimethylpentyl)silane
CAS number:	35435-21-3
EINECS number:	252-558-1
Molecular formula:	$C_{14}H_{32}O_3Si$

3 Uses and Applications

Triethoxy(2,4,4-trimethylpentyl)silane is often used as a component in coatings. These coatings are applied on surfaces to protect from corrosion and other environmental effects, to provide decorative effects and to improve inherent performance properties. Such coatings are used by professionals as well as consumers for applying decorative coatings on interior walls and ceilings. Furthermore, the substance can be found in interior/exterior wood/metal primers, undercoats and finish paints and plasters and as a component in masonry treatment products. They are applied for water repellent treatment purposes, damp-proofing treatment or for mass hydrophobation of minerals. Triethoxy(2,4,4-trimethylpentyl)silane may be used as a reagent in industrial and academic laboratories.

4 Physical / Chemical Properties

Triethoxy(2,4,4-trimethylpentyl)silane is an organic, colourless liquid with a slight odour. The substance is flammable and therefore sources of ignition should be kept away. Furthermore, the substance reacts with water, basic substances and acids under the formation of ethanol, which is also easily flammable. Vapours can build explosive / highly flammable mixtures with air, so adequate ventilation and suction should be provided.

Appearance

State of matter:	liquid
Colour:	colourless
Odour:	slight
Odour threshold:	no data
Molecular weight:	276.5 g/mol

Safety relevant basis data

Parameter	Value	Unit	Remark
Density:	0.886	g/cm^3	at 20 °C
pH:			not applicable
Melting point:	< -50	°C	at 1013 hPa
Boiling temperature / range:	247	°C	at 1013 hPa
Flash point:	46	°C	at 1013 hPa
Explosion hazard:			not explosive
Lower explosion limit:			not determined
Upper explosion limit:			not determined
Ignition temperature:	250	°C	
Decomposition temperature:	> 150	°C	
Vapour pressure:	0.14	Pa	at 20 °C
Solubility in water:	< 0.00025	g/l	virtually insoluble
log $P_{O/W}$ (n-octanol / water):	> 6.5		
Viscosity (dynamic):	1.9	mPa.s	at 25 °C

5 Health Effects

5.1 Consumer

Due to the use of triethoxy(2,4,4-trimethylpentyl)silane in plaster products or wall paints, consumers can easily get in contact with the substance. However, hazardous health effects for consumers using the indicated products can be excluded.

5.2 Worker

Workers might be exposed to the substance, since the production process and the industrial use involve steps which are not carried out in closed systems. Nevertheless, precautionary measures have been implemented in order to minimise the risk during daily handling. The following table gives an overview on possible health effects:

Effect Assessment	Result
Acute Toxicity oral / inhalation / dermal	Studies carried out with triethoxy(2,4,4-trimethylpentyl)silane and its structural analogue showed no adverse acute oral, dermal or inhalative effects.
Irritation / corrosion skin / eye / respiratory tract	Testing revealed that triethoxy(2,4,4-trimethylpentyl)silane is neither irritant to skin nor to the eyes. No data are available for respiratory irritation.
Sensitisation	The substance is not sensitising.
Toxicity after repeated exposure oral / inhalation / dermal	Studies carried out with the substance and its structural analogues showed no adverse effects after repeated oral or inhalative exposure. No data are available for repeated dermal exposure.
Genotoxicity / mutagenicity	No genotoxic and no mutagenic properties are known.
Carcinogenicity	No data for carcinogenicity available.
Toxicity for reproduction	Studies carried out with the substance and its structural analogue revealed neither adverse effects on reproduction nor development.

6 Environmental Effects

A broad range of tests on various aquatic organisms has been carried out with the pure substance and its structural analogues, resulting in no detection of adverse effects. Triethoxy(2,4,4-trimethylpentyl)silane decomposes in water (hydrolysis half life: ~22 hours) and is therefore not bioaccumulative. The substance does not persist in the environment.

Effect Assessment	Result
Aquatic Toxicity	Studies carried out with the substance and its structural analogues revealed no hazardous effects on various aquatic organisms.
Terrestrial Toxicity	No data available.

Fate and behaviour	Result
Biodegradation	Triethoxy(2,4,4-trimethylpentyl)silane is not readily biodegradable (13 % after 28 days).
Bioaccumulation potential	The substance hydrolyses in water; the hydrolysis products have low log K_{ow} values and thus have low potential for bioaccumulation.
PBT / vPvB conclusion	The substance does not meet the criteria for PBT or vPvB.

7 Exposure

7.1 Human health

Consumers may be exposed to low amounts of triethoxy(2,4,4-trimethylpentyl)silane due to its presence in consumer articles (concentration range: 0.5 – 4 % w/w), such as plaster products or wall paints, via exposure by inhalation or skin. Workers can come in contact with the substance via the same exposure routes during processes, which are not carried out under strictly controlled conditions. Risk management measures have been implemented in order to minimise the risk to workers, which should be followed.

7.2 Environment

Releases to air during production or from storing in tanks are negligible due to the low vapour pressure and strictly controlled manufacturing conditions. The production of triethoxy(2,4,4-trimethylpentyl)silane is a moisture free process. Minor releases to waste water may result from cleaning processes and minor spillages during handling, e.g. formulation. These waste waters are directed to waste water treatment plants, which may be contaminated with the substance or its hydrolysis products.

8 Risk Management Recommendations

When using triethoxy(2,4,4-trimethylpentyl)silane make sure that there is adequate ventilation and suction at critical points. Do not breathe vapours, gases or aerosols and avoid contact with eyes and skin by using appropriate respiratory protection (gas mask with filter type ABEK; in case of long or strong exposure use a self-contained breathing apparatus), eye protection, such as tight fitting protective goggles, appropriate chemical resistant gloves, e.g. gloves made of butyl rubber, suitable for up to 60 minutes use. Use protective clothing. Do not eat, drink or smoke where chemicals are handled, processed or stored. Do not release into the aquatic environment, i.e. surface waters, drains, sewers or soil.

9 First Aid Measures

Get medical attention if an accident occurs or if the affected person feels unwell. If the substance has been inhaled, provide the affected person with fresh air. In the case of skin contact, wash the affected area with plenty of water and soap. Seek medical advice if visible skin changes or other complaints occur. In case of contact with eyes, immediately flush eyes with large amounts of water. If accidentally swallowed, let water be swallowed in little sips and do not induce vomiting.

10 Fire Fighting Measures

In the case of fire, use water mist, extinguishing powder, alcohol-resistant foam, carbon dioxide or sand as extinguishing media. Do not use a high power water jet. Hazardous decomposition products in case of incomplete combustion contain alcohols. Collect contaminated fire extinguishing water separately and dispose of according to official state regulations. If it can be done without risk, guide personal to safety and keep unprotected people away. Do not allow entering soil, drains or surface water. It is absolutely required to wear a self-contained breathing apparatus.

11 Accidental Release Measures

When handling the substance, personal protection equipment must be worn. In case of spills, avoid any contact with the substance via eye and skin as well as inhalation of mists and vapours. Keep unprotected people away and remove all ignition sources since triethoxy(2,4,4-trimethylpentyl)silane is flammable. Do not empty into drains or the aquatic environment. Collect contaminated water separately. In case of small spills absorb with appropriate liquid-binding material (e.g. diatomaceous earth). Dispose off according to official state regulations. For large amounts pump up into suitable, prescribed marked containers. Do not flush spills away by using

water. Clean any slippery coating that remains by using a detergent or soap solution or another biodegradable cleaner. Allow vapours to evaporate.

12 Disposal Considerations

It is recommended to carry out burning of triethoxy(2,4,4-trimethylpentyl)silane as hazardous waste in a special waste incinerator according to official regulations. Local regulations must be observed. Collect contaminated fire extinguishing water separately. Retain contaminated washing water and dispose of according to national, federal and local regulations. Dumping into the environment must be prevented. Contaminated packaging material must be completely emptied and can be re-used or recycled following appropriate cleaning. Handle contaminated packaging in the same way as the substance itself. Packaging material which cannot be properly cleaned must be thrown away.

13 Handling and Storage

If handling the substance ensure adequate ventilation and keep away from incompatible substances, such as water, basic substances and acids. Eliminate spills immediately as they pose a risk of slipping. Flammable vapours may accumulate and form explosive mixtures with air in containers, process vessels or other enclosed spaces. Therefore, keep away from ignition sources, e.g. heat, sparks, open flames, hot surfaces, and do not smoke. Take precautionary measures against static discharges. Regarding storage, only store in the original container and keep the container dry and tightly closed, when not in use. Keep storage containers in a cool, well-ventilated place. Triethoxy(2,4,4-trimethylpentyl)silane must be protected from dampness, otherwise hydrolysis can take place leading to 2,4,4-trimethylpentyl)silanetriol and ethanol.

14 State Agency Review

Triethoxy(2,4,4-trimethylpentyl)silane has been registered under REACH. For this product chemical safety assessments have been carried out. National regulations listing triethoxy(2,4,4-trimethylpentyl)silane are the following: Toxic Substances Control Act (TSCA) in USA, Korean Existing Chemicals List (ECL), Australian Inventory of Chemical Substances (AICS), Canadian Domestic Substances List (DSL), European Inventory of Existing Commercial Chemical Substances (EINECS), Japanese Existing Notified Chemical Substances (ENCS), Philippine Inventory of Chemicals and Chemical Substances (PICCS), Inventory of Existing Chemical Substances in China (IECSC).

15 Classification and Labelling

The substance is classified under the EU Classification Labelling and Packaging (CLP) Regulation EC/1272/2008 as follows:

Hazard Class and Category	H-Phrase	Hazard pictograms	Wording
Flammable liquid 3	H226		Flammable liquid and vapour.

16 Conclusion

Triethoxy(2,4,4-trimethylpentyl)silane is a well characterised substance in regard to physico-chemical, ecotoxicological, and toxicological properties. It is not considered as hazardous to human health and the environment and is therefore not classified as hazardous substance. Consumers can get in contact with the substance due to its use as a component in wall and ceiling paints or in interior/exterior wood/metal primers, undercoats and finish paints, and plasters. Due to the flammability of the substance workers should obtain specific instructions before handling this substance (personal protection equipment, handling and storage conditions) and follow the safety measures recommended in the Extended Safety Data Sheet.

17 Contact Information within Company

For further information on this substance or product safety summaries in general, please contact: Dr. Christian Eppelsheim at wlcp-reach@wacker.com or visit our website at www.wacker.com.

18 Date of Issue

26/03/2012

WACKER

GPS SAFETY SUMMARY
VINYL LAURATE

This Product Safety Summary is intended to provide a general overview of the chemical substance in the context of ICCA Global Product Strategy. The information on the Summary is basic information and is not intended to provide emergency response information, medical information or treatment information. The summary should not be used to provide in-depth safety and health information. In-depth safety and health information can be found on the (extended) Safety Data Sheet (e)SDS for the chemical substance.

1 General Statement

Vinyl laurate is an organic liquid, which is purified by distillation in vacuum. Vinyl laurate is used as a monomer in polymerisation reactions to produce copolymers of high molecular weight. Due to its useage it is handled in closed chemical processes (batch or continuous processes) under strictly controlled conditions.
Vinyl laurate is not classified as hazardous to human health. In regard to the aquatic environment, vinyl laurate is considered as not hazardous. There are no supported useages of vinyl laurate in direct consumer products.

2 Chemical Identity

Name:	vinyl laurate
CAS number:	2146-71-6
EINECS number:	218-414-7
Molecular formula:	$C_{14}H_{26}O_2$

3 Uses and Applications

As already indicated, vinyl laurate is solely used as a monomer in polymerisation reactions. These copolymers, delivered as dispersible polymer powders, dispersions, solid resins or as resin solution are used as binders or additives eg in construction chemicals, paints, adhesives and in food industry. Vinyl laurate is not used in widespread or dispersive manner.

4 4. Physical / Chemical Properties

Vinyl laurate is a clear, colourless liquid with a slight odour. The substance has a low vapour pressure and a high boiling point (288 °C). No special precautions against fire and explosion are required. The substance should be kept away from bases and peroxides, since contact can lead to exothermic reactions. Generally, peroxides, light and heat should be avoided as they can act as initiators and lead to undesired, spontaneous polymerisation. Upon contact with water, hydrolysis will take place leading to lauric acid and acetaldehyde.

Appearance	
State of matter:	liquid
Colour:	colourless
Odour:	slight
Odour threshold:	no data
Molecular weight:	226.355 g/mol

Safety relevant basis data

Parameter	Value	Unit	Remark
Relative density:	872.17	kg/m^3	at 20°C
pH:	~ 7		
Melting point / range:	3.8	°C	at 1013 hPa
Boiling temperature / range:	279	°C	at 1013 hPa
Flash point:	125	°C	at 1013 hPa
Explosion hazard:			substance itself is not explosive and does not build explosive mixtures with air
Lower explosion limit:			not applicable
Upper explosion limit:			not applicable
Ignition temperature:	228	°C	at 1013 hPa
Decomposition temperature:			no data
Vapour pressure:	2	Pa	at 50 ° C
Solubility in water:	< 1	mg/l	at 20°C
log P O/W (n-octanol / water):	5.92		at 20°C
Viscosity (dynamic):	3.074	mPas	at 20 °C

5 Health Effects

5.1 Consumer

Due to the processing to copolymers and the properties of vinyl laurate monomer there are no or only traces of residual vinyl laurate monomer present in the copolymer products. Therefore it is highly unlikely that the consumer comes in contact with vinyl laurate.

5.2 Worker

Workers will typically not come into contact with the substance as it is manufactured and processed in closed systems in industrial and professional settings. In case of unintended exposure during synthesis, transfer or processing, workers should follow the recommended safety measures in the Safety Data Sheet (SDS). The following table gives an overview on the health effects:

Effect Assessment	Result
Acute Toxicity oral / inhalation / dermal	No toxic effects were observed after oral and dermal exposure to vinyl laurate. Minor reversible effects after dermal application occurred. No data is available for acute inhalative toxicity. Due to low vapor pressure risk of inhalation is very low.
Irritation / corrosion skin / eye / respiratory tract	Testing revealed that vinyl laurate exhibits neither irritating nor corrosive properties to skin or eyes. No data is available for effects on the respiratory tract.
Sensitisation	Testing revealed that vinyl laurate is not sensitising.
Toxicity after repeated exposure oral / inhalation / dermal	Data is lacking for repeated dermal and inhalative exposure. Repeated oral exposure studies revealed that the substance can be considered as not toxic.
Genotoxicity / mutagenicity	No genotoxic and no mutagenic properties in vivo.
Carcinogenicity	No data available.

Toxicity for reproduction	Based on available data no developmental or reproductive toxicity has to be anticipated.

6 Environmental Effects

A broad range of tests on various aquatic organisms has been carried out, resulting in no detection of any hazardous effects. Vinyl laurate does not bioaccumulate, is readily biodegradable and will not persist in the environment.

Effect Assessment	Result
Aquatic Toxicity	Based on testing studies with fish, invertebrates and algae, it can be concluded that vinyl laurate poses no risks to the aquatic environment. No data is available regarding effects on sediment organisms or other aquatic organisms.
Terrestrial Toxicity	No data available.

Fate and behaviour	Result
Biodegradation	Vinyl laurate is readily biodegradable showing a degradation rate of 98 % after 28 days.
Bioaccumulation potential	Vinyl laurate is regarded as not bioaccumulative due to the sensitiveness towards water and moisture. The hydrolysis products – acetaldehyde and lauric acid – are well known metabolites during digestion and degradation.
PBT / vPvB conclusion	This substance is not a PBT or vPvB substance.

7 Exposure

7.1 Human health

Typically, consumer exposure to this substance is very low to unlikely. Consumers might come into contact only with traces of residual vinyl laurate in the products based on copolymers. Exposure to vinyl laurate of personnel in manufacturing and processing chemical facilities is also considered as low because the process, storage and handling operations are strictly controlled. Workers who might accidentally come into contact with the substance should follow the safety measures recommended in the Safety Data Sheet (SDS).

7.2 Environment

The manufacture of the substance and on-site uses are proceeded under strictly controlled conditions with no releases to air and soil and nearly no releases to water. Also during the industrial use (polymerization) of the substance there are only very minor releases to air, water and soil.
Even in the case of accidental release vinyl laurate does not pose a significant risk for the environment as it is readily biodegradable

8 Risk Management Recommendations

When using vinyl laurate, observe standard industrial hygiene practices for the handling of chemical substances. Do not eat or drink while handling the substance. Avoid contact with eyes and skin. Measures to prevent exposure comprise the use of adequate personal protection

equipment, such as protective gloves made of butyl rubber. Wear gloves for short periods only (< 10 minutes), tight fitting protective goggles, protective clothing and protective goggles/face protection. Further measures to avoid exposure cover the use of local exhaustive ventilation, proper decontamination procedures of equipment after handling, wide use of automatic systems for sampling and information dissemination to workers who might be exposed. In order to avoid environmental pollution, prevent material from entering surface waters and soil. Any potential releases to air or water should be avoided. Waste water should be directed to a water treatment plant.

9 First Aid Measures

Get medical attention, if irritation or other symptoms occur. Immediately take off all contaminated clothing and shoes and dispose of safely. If the substance has been inhaled, provide the affected person fresh air. In the case of skin contact, wipe away excess material immediately by using a waterless hand cleaner. Wash the affected area with plenty of water and soap or use an emergency shower in serious cases. In case of contact with eyes, immediately flush eyes with large amounts of water for at least 15 minutes while holding eyelids open. If accidentally swallowed, drink plenty of water and induce vomiting. Get immediately medical attention.

10 Fire Fighting Measures

This substance does not present any unusual fire or explosion hazards. In case of fire, use water spray, extinguishing powder, foam or carbon dioxide. Do not use a high power water jet. If it can be done without risk, cool endangered product containers by using water fog, guide personal to safety and keep unprotected people away. Hazardous decomposition products in case of incomplete combustion contain organic decomposition products. It is absolutely required to wear a full protective clothing including a self-contained breathing apparatus.

11 Accidental Release Measures

When handling the substance, personal protection equipment must be worn.Sources of ignition should be avoided. Absorb spills with an appropriate, liquid-binding material (e.g. earth) and place in appropriate containers for disposal according to official and local state regulations. In case of large spills, pump up the spills and contain the material in suitable containers. Take appropriate measures to prevent material from entering sewers or surface waters.

12 Disposal Considerations

It is recommended to carry out burning of vinyl laurate as harzardous waste according to official regulations.
Local regulations must be observed. Collect contaminated fire extinguishing water separately. Retain contaminated washing water and dispose of according to national, federal and local regulations. Dumping into the environment must be prevented. Contaminated packaging material must be completely emptied and can be re-used or recycled after appropriate cleaning. Handle contaminated packaging in the same way as the substance itself.

13 Handling and Storage

No special precautions against fire and explosion are required. Provide for sufficient ventilation and punctiform suction at critical points. Store only in the original container in a cool, well-

ventilated place. Keep the packaging dry and well sealed to prevent contamination and absorbtion of dampness, as contact with dampness will induce hydrolysis to acetaldehyde and lauric acid. Do not store together with bases or oxidizing agents, such as peroxides, since contact may lead to exothermic reactions. Protect the material from light and heat.
The minimum storage and transport temperature should not be below 10 °C, whereas the maximum temperature should not exceed 40 °C. Ensure adequate stabilisation of the material, i.e. avoid contact with radicals, e.g. peroxides, and exposure to elevated temperatures. The substance may polymerise spontaneously.

14 State Agency Review

Vinyl laurate has been registered under REACH and in many other countries according to national regulations. For this product a chemical safety assessment according to national regulations has been carried out.

15 Classification and Labelling

Based on available data vinyl laurate is not hazardous to human health or the environment. There are no classification and labelling obligations for this substance according to the EU Classification Labelling and Packaging (CLP) Regulation EC/1272/2008.

16 Conclusion

Vinyl laurate is a well characterised substance in regards to physico-chemical and (eco)toxicological properties. It is not classified as hazardous substance and therefore can be considered as not hazardous to human health and the environment.
Vinyl laurate is solely used as a monomer for industrial purposes. Workers should follow the safety measures recommended in the Safety Data Sheet (SDS).
There is no supported use in direct consumer products. Exposure to human health and environment is considered very low as the manufacturing and processing is done in closed systems.

17 Contact Information within Company

For further information on this substance or product safety summaries in general, please contact: Dr. Christian Eppelsheim at wlcp-reach@wacker.com or visit our website at www.wacker.com.

18 Date of Issue

16/03/2012