Aquatrade Water Treatment Chemicals (Pty) Ltd

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1 Identification

GHS Product Identifier

SODIUM TRIPOLYPHOSPHATE

Other means of identification

CAS:	7758-29-4
EC:	231-838-7
RTECS:	YK4570000
ICSC:	1469
IUPAC Name:	pentasodium bis(phosphonooxy)phosphinate
Chemical Family:	Sodium Salt
Synonyms:	pentapotassium triphosphate potassium triphosphate sodium triphosphate sodium tripolyphosphate sodium tripolyphosphate anhydrous STPP
Proper Shipping Name:	NOT REGULATED FOR TRANSPORT
Chemical Formula:	$H_5O_{10}P_{3.5}Na$
Molecular Weight:	367.86 g/mol

Sodium tripolyphosphate is a solid, inorganic compound present in the form of slightly hygroscopic granules or powder. The stable form of STPP is the hexahydrated salt.

Impurities of sodium tripolyphosphate may include sodium pyrophosphate, sodium orthophosphate and sodium metaphosphate. Typical analysis give : STPP 95 % Pyro + Ortho + Metaphosphate 2 %
The impurity profile depends of the production process and the composition of the raw materials.

Recommended use of the chemical and restriction on use

Oxidants and Oxidant Stabilizers. Food Additives: Sequestrant; texturizer; thickener.

Industry Uses
Adhesives and sealant chemicals
Adsorbents and absorbents
Bleaching agents
CBI
Corrosion inhibitors and anti-scaling agents
Dyes
Fillers
Machinery
Plating agents and surface treating agents
Processing aids, not otherwise listed
Processing aids, specific to petroleum production
Solids separation agents
Solvents (for cleaning and degreasing)
Solvents (which become part of product formulation or mixture)
Surface active agents
used as emulsifier, water softener
used in industrial cleaners
from EPA Chemicals under the TSCA

Consumer Uses
Adhesives and sealants
Agricultural products (non-pesticidal)
Automotive care products
Building/construction materials not covered elsewhere
CBI
Cleaning and furnishing care products
Fabric, textile, and leather products not covered elsewhere
Ink, toner, and colorant products
Laundry and dishwashing products
Metal products not covered elsewhere
Non-TSCA use
Photographic supplies, film, and photo chemicals
Water treatment products

Supplier's details

AQUATRADE WATER TREATMENT CHEMICALS (PTY) LTD

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Emergency phone number

E le Sar: +27 82 921 0643 (Available Mon - Fri, GMT 5:00 to 20:00)
Spilltech: +27 861 000 366 (Available 24/7)

2 Hazard(s) identification

Classification of the substance or mixture

Classification according to Regulation (EC) No 1272/2008
Skin Corrosion/Irritation, (Category 2), H315
Serious Eye Damage/Eye Irritation, (Category 2), H319
Specific Target Organ Toxicity - Single Exposure - Respiratory System (Irritation), (Category 3), H335

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

GHS label elements

Warning

Causes skin irritation

Causes serious eye irritation

May cause respiratory irritation

Avoid breathing dust/fume/gas/mist/vapours/spray.

Wash thoroughly after handling.

Use only outdoors or in a well-ventilated area.

Wear protective gloves/protective clothing/eye protection/face protection.

IF ON SKIN: Wash with plenty of soap and water.

IF INHALED: Remove victim to fresh air and Keep at rest in a position comfortable for breathing.

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

Call a POISON CENTER or doctor/physician if you feel unwell.

Specific treatment (see P351+P352 on this label).

If skin irritation occurs: Get medical advice/attention.

IF eye irritation persists: Get medical advice/attention.

Take offcontaminated clothing and wash before reuse.

Store in a well-ventilated place. Keep container tightly closed.

Store locked up.

Dispose of contents and container in accordance with local, regional, national, international regulations.

Other hazards which do not result in classification

STPP is not PBT or vPvB and does not meet the criteria for classification as dangerous and therefore the exposure assessment and risk characterisation sections of the chemical safety report are not required. See section 8 in CSR.

3 Composition/information on ingredients

Description	CAS Number	EINECS Number	%	Note
Sodium triphosphate pentabasic			0 - 95	

4 First-aid measures

Description of necessary first-aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.

If inhaled
Inhalation: remove casualty to fresh air and keep at rest. Seek medical advice.

In case of skin contact
After contact with skin wash immediately with plenty of water.

In case of eye contact
Rinse opened eye for several minutes under running water.

If swallowed
Rinse out mouth and then drink plenty of water.

Most important symptoms/effects, acute and delayed

Eye contact with concentrated alkali causes conjunctival edema & corneal destruction.
A. Alkalies penetrate skin slowly. Extent of damage therefore depends on duration of contact.
B. Chronic poisoning (from skin contact). Chronic dermatitis may follow repeated contact.

Inhalation Symptoms
Cough. Sore throat.

Skin Symptoms
Redness. Pain.

Eye Symptoms
Redness. Pain.

Indication of immediate medical attention and special treatment needed, if necessary

No additional data available.

5 Fire-fighting measures

Suitable extinguishing media

The product itself is not flammable: take extinguishing action appropriate to the fire in the surroundings. Foam, dry

powder, CO2 water spray jet

Unsuitable extinguishing media:
No data available.

Specific hazards arising from the chemical

Behavior in fire: May melt with loss of steam. When heated to decomp, can emit highly toxic fumes of Po(x).

Special protective actions for fire-fighters

Cool containers/tanks with water spray. Minimize exposure. **DO NOT** breathe fumes. Contain run-off.

Special protective equipment for firefighters:
Wear self-contained breathing apparatus and protective suit.

6 Accidental release measures

Personal precautions, protective equipment and emergency procedures

Avoid causing dust. Wear protective clothing. Particulate filter respirator adapted to the airborne concentration of the substance.

Environmental precautions

Avoid release into the sewage network or the aquatic environment.

Methods and materials for containment and cleaning up

Sweep spilled substance into covered containers. Carefully collect remainder. Rinse away residues with water. Then store and dispose in accordance with the safety regulations.

7 Handling and storage

Precautions for safe handling

Information for safe handling
No special precautions necessary if used correctly. **Avoid** contact with skin and eyes. **Avoid** formation of dust and aerosols. Provide appropriate exhaust ventilation at places where dust is formed. For precautions see section 2.2.

Information about protection against explosions and fire
No special measures required.

Conditions for safe storage, including any incompatibilities

Requirements to be met by storerooms and containers
No special requirements.

Information about storage in one common storage facility
Not required.

Further information about storage conditions
Store in cool, dry conditions in well sealed containers

8 Exposure controls/personal protection

Appropriate engineering controls

Provide emergency on-site eyewash and showers. Provide enough ventilation in the working areas. Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Individual protection measures

The selection of PPE is dependent on a detailed risk assessment. The risk assessment should consider the work situation, the physical form of the chemical, the handling methods, and environmental factors. Recommendations below is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Eye/face protection:
Safety glasses or safety goggles. Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166 (EU). Contact lenses should not be worn as they may contribute to severe eye injury.

Skin protection:
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands. The selected protective gloves have to satisfy the specifications of EU Directive 89/686/EEC and the standard EN 374 derived from it.

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves.

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

Respiratory protection:
For nuisance exposures use (US) type P95 or EN 143 (EU) type P1 particle respirator. Use respirators and components tested and approved under appropriate government standards such as (US) or CEN (EU).

Control of environmental exposure:
No special precautions required.

9 Physical and chemical properties

Physical and chemical properties

Appearance (physical state, colour etc) @ 20°C and 1013 hPa:	White inorganic solid
Odour:	No data
Odour threshold:	No data
pH 1% soln @ 25 deg °C:	9.7 - 9.8
Melting/Freezing Point @ 101 325 Pa:	895.15 K
Initial boiling point and boiling range:	No data
Flash point:	No data
Evaporation rate:	No data
Flammability (solid, gas):	non flammable
Upper/lower flammability or explosive limits:	non explosive
Vapour pressure:	No data
Vapour density:	No data
Relative density @ 21.0 ± 0.5°C:	2.55
Solubility(ies) @ 20 °C:	148 000 mg/L
Partition coefficient: n-octanol/water:	No data
Auto-ignition temperature:	No data
Decomposition temperature:	No data
Viscosity:	No data
Dissociation constant @ 25 °C:	9.52-9.55

NOTE: The physical data presented above are typical values and should not be construed as a specification.

10 Stability and reactivity

Reactivity

The product hydrolyses with water.

Chemical stability

Highly stable product compatible with the materials usually employed in industrial plants.

Possibility of hazardous reactions

None known

Conditions to avoid

None known

Incompatible materials

None.

Hazardous decomposition products

None.

11 Toxicological information

Toxicological (health) effects

Acute toxicity:

Acute toxicity: via oral route

Dose descriptor:	LD_{50}	2 000 mg/kg bw

Acute toxicity: via inhalation route

Dose descriptor:	LC_{50}	390 mg/m³

Acute toxicity: via dermal route

Dose descriptor:	LD_{50}	4 640 mg/kg bw

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

Skin irritation / corrosion

Endpoint conclusion: no adverse effect observed (not irritating)

Several reliable studies are available for skin irritation. The study by Freeman (1989) is considered the key study as it is performed according to OECD guidelines and to GLP. Studies performed according to other guidelines include the use of abraded skin and under these conditions some mild irritation is observed but this method should not be used for classification purposes.

Eye irritation

Endpoint conclusion: no adverse effect observed (not irritating)

In the eye irritation tests ocular effects were limited to conjunctival reactions following exposure to STPP as a powder, and this substance is not classified as an eye irritant

Skin sensitisation

Endpoint conclusion: no adverse effect observed (not sensitising)

Additional information:

Migrated from Short description of key information: One reliable study is available on skin sensitisation for sodium tripolyphosphate (Bradshaw 2008)

Sodium tripolyphosphate is not a skin sensitiser in the Local Lymph Node Assay

Repeated dose toxicity: via oral route - systemic effects

Dose descriptor: NOAEL 225 mg/kg bw/day

Additional information

STPP was administered for 1 month to groups of 5 male weanling (6-week old) rats at doses of 0.2, 2.0 and 10% in the diet (Hodge, 1964). One control group received the basal diet only, one additional control group received the basal diet

supplemented with 10% Sodium chloride, and one control group received 5% orthophosphate. Growth reduction was observed at the high dose of 10%, and in the control group receiving basal diet with 10% sodium chloride. Enough calcium was added to the diet to ensure a "reasonably balanced" ratio of calcium to phosphorus (no further details). Growth was normal in rats receiving 2% sodium tripolyphosphate. No data were available on food consumption, clinical signs, or haematology. An increased relative kidney weight was observed at the highest dose of STPP and in the control group supplemented with NaCl. Histopathological examination showed tubular necrosis in the kidneys of rats treated at 10% sodium tripolyphosphate, and in the control group with 5% orthophosphate. Only inflammatory changes of the renal pelvis were observed at 2%, while normal kidneys were observed at 0.2%. Based on the renal effects, the NOEL was determined to be 0.2%.

Assuming a 0.4 kg rat eats about 18 g of food per day, the NOEL for the 1-month diet study is therefore estimated to be 90 mg/kg/day for STPP. Furthermore, in this study, other groups of rats received similar doses of other inorganic condensed phosphates (sodium hexametaphosphate, sodium trimetaphosphate and sodium tetrametaphosphate), which produced similar effects, especially at 10%.

Sodium tripolyposphate was further assessed in a 104-week oral repeated dose study in rats (Hodge, 1964). A preliminary assay was conducted with groups of 14 male rats, at doses of 0.2%, 2% and 10% STPP for 1 month. The effects described above for the previous study (growth retardation, increase in kidney weights, and tubular degeneration and necrosis of the kidneys) were again observed at the highest dose. In the main 2-year study, males and females rats (50 animals per dose group and per sex) received 0.05, 0.5 and 5.0% of STPP in the diet. Mortality, food consumption, body weights were monitored. At the end of the treatment period, organ weights, haematology, urine analysis, bone analysis and histopathology were evaluated. Growth retardation was observed in the high dose group in males (throughout the study period) and females (slight during the first year, then more obvious during the second year). High mortality was reported in males and females due to several epidemics during the study. The high dose group was more affected (up to 80% in females of the 5% dose during the second year of the study). Concerns about potential altered calcium to phosphorus balance were addressed by conducting bone analysis. Femur analysis of the high dose group (5%) showed a slight increase in water content and slight decrease in organic matter as compared to the control group. No anomalies were observed at the bone radiography. The ash contents and ratios calcium to phosphorus were normal in both sexes of the high dose group. The effects observed after repeated oral ingestion of high doses of STPP were anaemia observed after 1 year of treatment at 5% (decrease in red blood cells counts, haemoglobin values and haematocrits), and mainly renal effects. In the high dose group (5%), kidney weights were increased in males, and relative liver and kidney weights were found increased in females. Histopathological examination showed enlargement of the kidney associated with tissue changes such as dilated convoluted tubules, hyaline casts, interstitial fibrosis between the dilated tubules, fibrotic glomeruli and intertubular calcification also in the group receiving the 5 % dose.

Based on the renal effects (nephrocalcinosis), the NOEL was estimated to be 0.5% for the 2-year repeated dose study in rats. Assuming a 0.4 kg rat eats about 18 g of food per day, the NOEL is estimated to be 225 mg/kg/day.

The most applicable NOEL is therefore 225 mg/kg/day as this is the highest NOEL bellow the lowest LOAEL.

Genetic Toxicity

Pentasodium triphosphate (90% purity) was assessed in a modified Ames test at concentrations between 5 and up to 5000 µg/plate, with and without metabolic activation (Shimizu et al., 1985). The preincubation method was used in the presence of metabolic activation. The bacterial strains used were Salmonella typhimurium strains TA98, TA100, TA1535, TA1537 and TA1538, and Escherichia coli WP2uvrA. The test was performed in duplicate, and appropriate positive and negative controls were used. No cytotoxic effects were observed. No increase in the number of revertants was observed, with or without S-9 mix. No mutagenic activity was found in a reverse mutation assay performed in Salmonella typhimurium strains TA92, TA94, TA98, TA100, TA1535, and TA1537 with STPP (84.1% purity) at concentrations up to 10 mg/plate (Ishidate et al. 1984). Limited documentation was available on methodology and test results (no positive controls, no details on doses tested, no indication of cytotoxicity). However, test results support the absence of mutagenic activity of sodium tripolyphosphate STPP (84.1% purity) was assessed for chromosomal aberrations in Chinese Hamster fibroblasts cell line (CHL) (Ishidate et al. 1984). Cells were treated at 3 different doses for 24 or 48 hours, without metabolic activation. The maximum dose tested was determined in a preliminary assay not reported in the publication. The value of the maximum concentration tested (determined in a preliminary assay) was 84.1 mg/plate. One hundred well-spread metaphases were analysed for incidence of polyploid cells, structural aberrations (chromatid or chromosome gaps, breaks, exchanges, ring formations, fragmentations and others). No significant effects were observed. Reporting of the methodology and results was rather limited. No metabolic activation was used. There was no information on cytotoxicity, and whether the test concentrations were optimal. No positive controls were included. These negative results were further supported by another publication reporting the results of a chromosomal aberration assay in Chinese

Hamster fibroblasts cell line (CHL) (Ishidate et al. 1988). STPP was tested at a maximum concentration of 500 µg/ml (1.4 mM) for a treatment time of 48 hours. No other doses were mentioned. The vehicle was not indicated. No metabolic activation was used. No structural aberrations were reported. Limited documentation was available on test conditions and results.

Although limited documentation was generally available on these assays reported in the literature, altogether the negative results obtained in various assays support the lack of evidence for genetic toxicity for STPP in vitro and in vivo

Short description of key information:
The available in vitro genotoxicity studies were not performed according to current guidelines and GLP. However, STPP was found not mutagenic in several reliable in vitro and in vivo studies, including Ames tests in S. typhimurium and E. coli, chromosomal aberration test in CHL cells (Shimizu et al., 1985; Ishidate et al., 1984, 1988) and dominant lethal assay and gene mutation assay (Weir, 1975).

Endpoint Conclusion: No adverse effect observed (negative)

Toxicity to reproduction
Effects on fertility
Effect on fertility: via oral route
Dose descriptor: NOAEL 141 mg/kg bw/day

Additional information
In the prenatal developmental toxicity studies, pregnant females received STPP (anhydrous) during gestation period by oral intubation. Control groups received the vehicle only (water). At the end of gestation period, all dams were subjected to caesarean section and the number of implantation sites, resorption sites, as well as live and dead foetuses were recorded. The body weights of the live pups were taken. The urogenital tract level of dams was examined for abdominal abnormalities. All foetuses were examined for the presence of external congenital abnormalities. One-third of the foetuses were examined for visceral abnormalities and the remaining two-third were examined for skeletal abnormalities. No maternal toxicity or teratogenic effects were observed at up to the maximum dose levels tested in each species. The NOEL for maternal and foetal toxicity corresponded to the maximum dose tested.

Summary of teratogenicity studies with sodium tripolyphosphate

-	animal / group	Dose (mg/kg bw)	Treatment period (gestation day)	End of gestation	Result (NOEL)
Mouse	24	2.4, 11, 52, 238	6-16	Day 17	238 mg/kg
Rat	24	1.7, 8, 37, 170	6-15	Day 20	170 mg/kg
Hamster	22-25	1.41, 6.5, 30, 141	6-10	Day 14	141 mg/kg
rabbit	20-22	2.5, 11.6, 54, 250	6-18	Day 29	250 mg/kg

Short description of key information:
A series of four prenatal developmental toxicity studies were performed by the US food and drug administration (rabbit, mouse, rat and hamster). Sodium tripolyphosphate was not found to be a teratogen at any of the dose levels tested.

A 3-generation study in rats is available (Hodge et al., 1959). At a dose of 0.5% in the food, STPP showed no evidence of significant alteration of fertility, nor on the litter size, nor on growth and survival of offspring. A slight increase in kidney weights was observed, but was not statistically significant. The macroscopic and microscopic appearances of major organs in the 3rd generation were reported to be comparable in control and treated groups. These results were presented as a summary of unpublished reports from a detergent company, and limited documentation was available. However, any significant effects seem to have been reported by the author. The results provided support the assumption that there is no concern with regard to effects of STPP on reproduction.

Effects on developmental toxicity
Description of key information

Based on the three-generation reproduction study on STPP (Hodge, 1959), no effects on reproductive performance or fertility were found when STPP was administered to rats for three generations at a dose of 0.5% in the diet with at least two litters per generation

Additional information
The Hodge reproduction study (1959) was conducted prior to the institution of good laboratory practice guidelines and to the current OECD Guideline 416. Therefore, the study has deficiencies when examined according to today's standards. The study is considered a Klimisch Code 2, reliable with restrictions. The conclusions regarding the hazard identification of STPP are supported by data on sodium hexametaphosphate (SHMP) and sodium trimetaphosphate (STMP), both of which are structurally similar to STPP. All three inorganic phosphate salts had no adverse effects on reproductive toxicity and fertility when tested in rats over three generations (Hodge 1959, 1960).

In theManual for Investigation of HPV Chemicals, Chapter 3: Data Evaluation (2005), Section 3.1.6 Weight-of-the-Evidence Analysis, requires the use of a weight-of-the-evidence analysis during the assessment of data quality and adequacy. The guidance permits the pooling of several studies, one or more of which may be inadequate, to satisfy a specific SIDS element. In the current case, available data exist on two other sodium inorganic phosphate salts which are similar in structure to STPP. Three generation reproduction studies have been conducted on SHMP and STMP which are similar to the one on STPP in that they were conducted prior to good laboratory practice guidelines and the existence of OECD Guideline 416; nevertheless, they provide additional supplemental support for the hazard assessment of STPP (IUCLID Robust Study Summary included as supplemental information). Because all three sodium phosphates showed no effects on reproductive performance, these data show similar responses which allows a more robust conclusion for the individual salts. STPP and SHMP were both tested at a dose level of 0.5% in the diet. STMP was tested at a dose of 0.05% in the diet. These dose levels were viewed as appropriate levels based on the results of the chronic toxicity/carcinogenicity studies for each salt.

Additional Information:
RTECS: YK4570000.

Information on the likely routes of exposure

Data for WORKERS

INHALATION Exposure	***Threshold***	***Most sensitive study***
Systemic Effects		
Long-term:	(DNEL) 661 µg/m³	repeated dose toxicity
Acute /short term:	(DNEL) 661 µg/m³	repeated dose toxicity
Local Effects		
Long-term:	-	-
Acute /short term:	-	-
DERMAL Exposure	***Threshold***	***Most sensitive study***
Systemic Effects		
Long-term:	(DNEL) 375 µg/kg bw/day	repeated dose toxicity
Acute /short term:	(DNEL) 375 µg/kg bw/day	repeated dose toxicity
Local Effects		
Long-term:	-	-
Acute /short term:	-	-
EYE Exposure	**-**	**-**

Additional information - workers
Acute, subchronic and chronic studies are available for the oral route of exposure, the most relevant NOAEC is from the chronic study (Hodge 1964) which has the highest NOAEC below the lowest LOAEC.

Only one dermal toxicity study is available (Bullock CH 1971), the study only provides an LD_{50} and lacks data required to derive a meaningful NOAEL. The dermal DNEL will therefore be derived by route to route extrapolation from the chronic oral study (Hodge 1964).

One acute inhalation toxicity study is available (Jackson GC 1988), the study only provides an LD_{50} and lacks data required to derive a meaningful NOAEL. The inhalation DNEL will therefore be derived by route to route extrapolation from the chronic oral study (Hodge 1964).

Data for the GENERAL POPULATION

INHALATION Exposure	*Threshold*	*Most sensitive study*
Systemic Effects		
Long-term:	(DNEL) 661 µg/m³	repeated dose toxicity
Acute /short term:	(DNEL) 660 µg/m³	repeated dose toxicity
Local Effects		
Long-term:	-	-
Acute /short term:	-	-
DERMAL Exposure	*Threshold*	*Most sensitive study*
Systemic Effects		
Long-term:	(DNEL) 375 µg/kg bw/day	repeated dose toxicity
Acute /short term:	(DNEL) 375 µg/kg bw/day	repeated dose toxicity
Local Effects		
Long-term:	-	-
Acute /short term:	-	-
ORAL Exposure	*Threshold*	*Most sensitive study*
Systemic Effects		
Long-term:	(DNEL) 750 µg/kg bw/day	repeated dose toxicity
Acute /short term:	(DNEL) 750 µg/kg bw/day	repeated dose toxicity
EYE Exposure	*-*	

Additional information - General Population

Oral exposure:

Assessment factors for inter and intra species, duration, dose response and quality of data are applied to the chronic toxicity data. An assessment factor of 4 is used to correct for differences in metabolic rate per body weight and an assessment factor of 2.5 (default) for remaining interspecies differences. A default assessment factor of 10 is applied for intra species differences. An assessment factor of 1 is applied for exposure duration as no exposure extrapolation is required. An assessment factor of 3 is applied for the dose response to account for the poor quality of the study from which the NOAEL is derived. The total assessment factor applied is obtained by multiplication of all the assessment factors giving an overall assessment factor of 300.

Dermal exposure:

The dermal DNEL is derived from the chronic oral study and therefore the same assessment factors apply with an additional factor of 2 to account for route to route extrapolation. The total assessment factor applied is therefore 600.

Inhalation exposure:

The inhalation DNEL is derived from the chronic oral study and therefore the same assessment factors apply with an additional factor of 2 to account for route to route extrapolation. The total assessment factor applied is therefore 600.

Toxicokinetics, metabolism and distribution

Studies tend to indicate that polyphosphates are not absorbed as such in the intestinal tract, but they can be hydrolysed in vivo by enzymes with the formation of monophosphates, mainly orthophosphate and possibly pyrophosphate, which are then absorbed (Gosselin et al., 1952; Ebel, 1958). This is further supported by the fact that systemic effects of polyphosphates are very similar to those of orthophosphates. It was estimated that approximately two-thirds of ingested phosphates is absorbed from the gastro-intestinal tract.

No data have been identified with regard to dermal absorption properties. It is generally considered that the percutaneous absorption of salts or ionic substances is limited

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact with concentrated alkali causes conjunctival edema & corneal destruction.
A. Alkalies penetrate skin slowly. Extent of damage therefore depends on duration of contact.
B. Chronic poisoning (from skin contact). Chronic dermatitis may follow repeated contact.

Inhalation:

Cough. Sore throat.

Skin:

Redness. Pain.

Eyes:
Redness. Pain.

HUMAN EXPOSURE AND TOXICITY:
If ingested in large amounts this chemical can cause nausea, vomiting, and diarrhea. It has produced vesiculation when applied to intact and abraded skin of humans. Sodium and potassium hexametaphosphates, polyphosphates, tripolyphosphates, pyrophosphates, and other phosphates used as water softeners form complexes with calcium and, after ingestion, are capable of seriously reducing the serum level of ionic calcium. They have less corrosive effect on mucous membranes than sodium or potassium hydroxide. Eye contact with concentrated material can cause conjunctival edema and corneal destruction. Chronic dermatitis may follow repeated contact of the chemical that migrates to food from packaging materials. Occupational exposure involves acetyl cellulose makers, bronze alloy makers, munitions workers, smoke bomb and incendiary makers, pesticide rat poison worker, fertilizer makers, electroluminescent-coating makers, and semiconductor workers.

ANIMAL STUDIES:
This chemical induced emesis in dogs. Dietary administration in animals has caused decrease iron content in bone, liver, and spleen, and bone depletion of calcium.
from HSDB

Human Toxicity Excerpts
If ingested in large amt nausea, vomiting, & diarrhea are probable. If appreciable amount of intact polymer are absorbed from alimentary tract, hypocalcemic tetany may be a danger due to binding (chelation) of ionized calcium. Hypocalcemic tetany also occurred in one ingestion episode.
Gosselin, R.E., R.P. Smith, H.C. Hodge. Clinical Toxicology of Commercial Products. 5th ed. Baltimore: Williams and Wilkins, 1984., p. II-121
from HSDB

Cmpd applied to intact & abraded skin of humans for 4 hr: skin responses graded 4, 24 & 48 hr after. Sodium tripolyphosphate produced vesiculation @ abraded sites of 1 of 6 humans.
Abstract: PubMed
NIXON ET AL; TOXICOL APPL PHARMACOL 31 (MAR): 481 (1975)
from HSDB

A 1% aq soln has a ph of 9.8, & ph of concentrated soln (slurries) is about 10.5, so that there is no significant danger of corrosive injuries to the eyes or esophagus as in lye poisoning with ph's above 11 or even 12.
Gosselin, R.E., R.P. Smith, H.C. Hodge. Clinical Toxicology of Commercial Products. 5th ed. Baltimore: Williams and Wilkins, 1984., p. II-121
from HSDB

Acute poisoning by injestion: Even though patients recover from immediate damage, esophageal stricture can occur wk, mo, or yr later to make swallowing difficult. Ingestion of tripolyphosphate in detergents or laxatives cause shock-like state, fall of blood pressure, slow pulse, cyanosis coma & sometimes tetany as result of redn in ionic calcium.
Dreisbach, R.H. Handbook of Poisoning. 12th ed. Norwalk, CT: Appleton and Lange, 1987., p. 211
from HSDB

Irritating because of its alkalinity and hypertoxicity. If ingested in large amounts nausea, vomiting and diarrhea are probable. Thought to be hydrolyzed to (ortho) phosphates before absorption, which may induce a metabolic acidosis. If appreciable amounts of the intact polymer are absorbed from the alimentary tract, hypocalcemic tetany may be a danger due to the binding (chelation) of ionized calcium. Hypocalcemic tetany apparently occurred in a single case of water softener poisoning.
Gosselin, R.E., R.P. Smith, H.C. Hodge. Clinical Toxicology of Commercial Products. 5th ed. Baltimore: Williams and Wilkins, 1984., p. II-121
from HSDB

Sodium and potassium hexametaphosphates, polyphosphates, tripolyphosphates, pyrophosphates, and other phosphates used as water softeners form complexes with calcium and, after ingestion, are capable of seriously reducing the serum level of ionic calcium. They have less corrosive effect on mucous membranes than sodium or potassium hydroxide. Hydrolysis of the polymeric phosphates can also produce acidosis.
Dreisbach, R.H. Handbook of Poisoning. 12th ed. Norwalk, CT: Appleton and Lange, 1987., p. 211
from HSDB

The estimated fatal dose of sodium phosphates is 50 g. The corrosive effect is strong irritation & erythema, blistering.
Dreisbach, R.H. Handbook of Poisoning. 12th ed. Norwalk, CT: Appleton and Lange, 1987., p. 212
from HSDB

Non-Human Toxicity Excerpts
In beagle dogs, sodium tripolyphosphate induced emesis. Emesis probably results from a direct action upon the gi mucosa.
Abstract: PubMed
WEAVER JE, GRIFFITH JF; TOXICOL APPL PHARMACOL 14 (2): 214 (1969)
from HSDB

Dietary admin of tripolyphosphate decrease bone, liver & spleen contents of iron & incr the bone deposition of calcium.
OSHIBA ET AL; SEIKATSU EISEI 23 (6): 209 (1979)
from HSDB

Gastrointestinal absorption, transport, tissue deposition, and excretion of cadmium were investigated in mice after single or repeated exposure with or without chelating agents. Male CBA-mice received a single oral 69 mg/kg dose of cadmium-109 in combination with a single 600 mg/kg dose of nitrilotriacetic acid, sodium tripolyphosphate, or 60 or 600 mg/kg ethylenediaminetetraacetic acid. Animals were observed, and blood cadmium concentrations followed, from 5 minutes to 21 days before dissection and tissue analysis. Female CBA-mice received a single oral 15 ug/kg dose of radioactive cadmium in combination with cadmium and 50 or 500 ppm of these chelating agents in their drinking water and were observed for 18 months. Acute cadmium toxicity was reduced in mice given cadmium in combination with ethylenediaminetetraacetic acid. At all times from 5 minutes to 5 hours after dosing blood cadmium concentrations were lowest in mice exposed to cadmium plus sodium tripolyphosphate. Almost all cadmium in kidneys of mice exposed to cadmium and ethylenediaminetetraacetic acid at the higher doses was bound in the cadmium ethylenediaminetetraacetic acid complex, while at the lower dose of ethylenediaminetetraacetic acid part of the cadmium was bound to high molecular weight proteins. Cadmium 24 hour elimination was increased from 20% with cadmium alone to 45% with the higher and 35% with the lower dose of ethylenediaminetetraacetic acid. Whole body retention at 21 days was 4.4% with cadmium alone, 2% with nitrilotriacetic acid and 5.5% with sodium tripolyphosphate. With repeated exposure no substantial differences in whole body or organ retention of cadmium were seen after treatment with different chelating agents. Chelating agents did not affect mortality over 18 months. /It was concluded/ that the effects of different chelating agents on acute cadmium toxicity and metabolism are produced by change in the stability of the chelate complexes and the availability of metal binding ligands in-vivo.
Engstrom B; Environ Health Persp 54: 219-32 (1984)
from HSDB

Delayed and immediate effects and also chronic effects from short and long term exposure

The aerosol is mildly irritating to the eyes, skin and respiratory tract. No additional data available.

Numerical measures of toxicity (such as acute toxicity estimates)

Refer section 11.1 and 11.2 for values.

Interactive effects

The mechanism by which sodium tripolyphosphate increases cadmium toxicity after sc administration was investigated in mice after a dose of cadmium (30 umol/kg), alone or with sodium tripolyphosphate (90 umol/kg). ... Histological ... changes in the liver were not observed during the first 12 hr after injection of cadmium, but already 6-8 hr after injection of cadmium plus sodium tripolyphosphate early centrilobular necroses and blood stasis appeared. At 12 hr more advanced necroses were present. Sodium tripolyphosphate administered alone was nontoxic and did not change the liver morphology, when compared to animals killed immediately after injection. During the first 12 hr after cadmium administration with sodium tripolyphosphate, there was a much faster transport of cadmium, giving rise to higher liver and kidney concn of cadmium and partial inhibition of cadmium-metallothionein binding, as compared with animals receiving the same dose of cadmium without sodium tripolyphosphate.
Abstract: PubMed
Andersen O et al; Environ Res 29 (1): 54-61 (1982) from HSDB

The adjuvant effect of di-sodium DL-alpha-glycerophosphate on the rectal absorption of cefoxitin (as the sodium salt) was greatly augmented by the presence of ... sodium tripolyphosphate. ... Coadjuvants only slightly enhanced cefoxitin rectal absorption when administered alone.
Abstract: PubMed
Nishihata T et al; J Pharm Sci 73 (11): 1523-5 (1984) from HSDB

Where specific chemical data are not available

No additional data.

Mixtures

No additional data.

Mixture versus ingredient information

No additional data.

Other information

None.

12 Ecological information

Toxicity

Hazard for aquatic organisms

Freshwater

Hazard assessment conclusion:	PNEC aqua (freshwater)
PNEC value:	0.005 mg/L
Assessment factor:	1 000
Extrapolation method:	assessment factor
PNEC freshwater (intermittent releases):	0.05 mg/L

Marine water

Hazard assessment conclusion:	PNEC aqua (marine water)
PNEC value:	0.005 mg/L
Assessment factor:	1 000
Extrapolation method:	assessment factor

Sediment (freshwater)

Hazard assessment conclusion:	PNEC sediment (freshwater)
PNEC value:	0.19 mg/kg sediment dw
Extrapolation method:	equilibrium partitioning method

Hazard for air

No data

Hazard for terrestrial organisms

Soil

Hazard assessment conclusion:	PNEC soil
PNEC value:	0.14 mg/kg soil dw
Extrapolation method:	equilibrium partitioning method

Hazard for predators

No data

Short-term toxicity to fish

Three studies are available for the short-term toxicity to fish. The study conducted by Dion M (1985) is considered the key study as, although it has not been conducted to OECD guidelines, it is well documented and in accordance with national standard methods (AFNOR T 90 303). Results from this study must be treated with some caution as testing was only performed for 24h. The second study only provided a value of CL0 (highest tested concentration without effects).

A study performed following similar methods to OECD guideline 212 (short term toxicity test on embryo and sac-fry) has also been submitted (LOEC = 5 mg/L).

STPP is not classified as toxic to fish. The acute fish toxicity of the test material was 1850 mg/l.

Key value for chemical safety assessment

LC_{50} for freshwater fish: 1 850 mg/L

Long-term toxicity to fish
Fish embryos treated with sodium tripolyphosphate from just after fertilisation to 96h with concentrations ranging from 5 - 40 mg/l STPP.
Abnormal body structure was observed in embryos treated with 20 and 40 mg/l.

All treated embryos exhibited early hatching, late pigmentation, curvature in the body axis and reduces activity.
A NOEC could not be established.

LOEC = 5 mg/L STPP

Short-term toxicity to aquatic invertebrates
Six studies on aquatic invertebrates are available of which three are considered reliable. Although the study by Vaishnav et al (1991) only used one test concentration, results from this study gave the most conservative result and this is therefore considered the key study.
Statistical analysis (t-test) of data indicated there was no significant (alpha = 0.05) difference between the number of daphnids immobilized in control and treatment exposures.

EC_{50}>100 mg/L

Key value for chemical safety assessment
EC_{50}/LC_{50} for freshwater invertebrates: 100 mg/L

Long-term toxicity to aquatic invertebrates
No data.

Toxicity to aquatic algae and cyanobacteria
The algae growth was very low in the controls (less than a factor 16 in 144 hours) and the addition of sodium tripolyphosphate at 10 and 32 mg/l led to a steady increase of the algae growth indicating that the test medium is deficient in phosphates. With 100 mg/l and 320 mg/l the growth decreased regularly but at the end of the test it was still higher than in the controls. It is suspected that the positive effect on the algae growth due to the o-phosphate formed by hydrolysis of sodium tripolyphosphate was counterbalanced by the complexation of metals like Mg++, Cu++, Zn++, B3+ … which are essential to the algae growth. Due to the low growth of controls and the opposite direct and indirect effect of sodium tripolyphosphate on the algae medium, this study cannot be used for derivation of a PNEC in the risk assessment.

Toxicity to microorganisms
No data.

Toxicity to other aquatic organisms
The toxicity of different phosphates to the freshwater gastropod, Helisoma duryi, was studied by Bernhardt et al. (1985). The mortality of neonates and sublethal effects were reported for 3 nominal concentrations of phosphates (15, 150 and 1500 mg/l) and an exposure period of 4 weeks. 100% mortality of the neonates was obtained with 1500 mg/l after 7 days of exposure to pentasodium tripolyphosphate and tetrasodium pyrophosphate, and after 21 days of exposure to sodium orthophosphate.

Conclusion on classification
Sodium tripolyphosphate is not classified for the environment.

Persistence and degradability

Pentasodium triphosphate is an inorganic substance, biodegradation studies are not applicable. There are a number of studies indicating that under natural conditions hydrolysis to pyrophosphate and then to orthophosphate is the primary route of degradation (see IUCLID section 5.1.2).

Bioaccumulative potential

STPP is hydrolysed to orthophosphate in aqueous and biological systems. The degradation products of sodium tripolyphosphate are essential nutrients (food element) for plants, and stimulate the growth of water plants (macrophytes) and/or algae (phytoplankton). The potential for bioaccumulation is therefore considered to be minimal.

Mobility in soil

The vapour pressure of STPP is negligible, the IUCLID chemical data sheet from the EINECS register indicates a vapour pressure of 0.1 hPa (10Pa). The Henrys law constant is calculated to be 0.03 Pa•m3•mol-1. Atmospheric exposure is not therefore anticipated.

STPP and its soluble complex salts are not expected to adsorb highly onto the solid particles of the aquatic environment, due to their solubility.

In soils, it is expected that STPP will hydrolyse and be bio-assimilated via the same mechanisms in the aquatic environment.

The formation of complex insoluble species is likely to occur in soils. Thus it is expected that STPP may also be transformed in soils to insoluble forms which will remain trapped in soils.

Other adverse effects

Stability

As an ingredient of household cleaning products, STPP present in domestic waste waters is mainly discharged to the aquatic compartment , directly, via waste water treatment plants, via septic tanks, infiltration or other autonomous waste water systems. As STPP is an inorganic substance, biodegradation studies are not applicable. However, STPP can be hydrolysed in water to pyrophosphate and then to orthophosphate which can be assimilated by algae and/or by micro-organisms. STPP thus ends up in a form which is assimilated into the natural phosphorus cycle.

Hydrolysis

The hydrolysis of sodium tripolyphosphate was investigated in sterile aqueous buffers at pH 3, 4, 5 and 7 by Zidner et al (1984) and gave a pseudo first order reaction law. At pH 7 and 40°C the rate constant for hydrolysis of sodium tripolyphosphate to pyrophosphate is 4.81E-4 h-1
The kinetics of hydrolysis was also studied in sterile and algal culture media (clesceri and Lee, 1965). STPP hydrolysed much quicker in sterile lake water than in distilled water and about 5-10 times slower in sterile algal media than in sterile lake water. STPP half lives in sterile lake water and algal medium ranged between 83 and 608 h at 23ºC.

From these data on hydrolysis, the rate constant in natural surface water has been calculated at 25ºC by linear regression analysis of the logarithm of the concentrations versus time:
KSTPP/water/25ºC = 0.2369 d-1
DT50 STPP/water/25ºC =70.2h

An hydrolysis rate constant at 12ºC (default average value for EU surface waters) can be extrapolated using the Arrhenius law:
KSTPP/water/12ºC = 0.0837 d-1
DT50 STPP/water/12ºC =198.7h

Davis and Wilcomb (1967) studied the rate of hydrolysis of condensed phosphates STPP and TKPP (tetrapotassium pyrophosphate) in raw domestic sewage from a municipal treatment plant at 28ºC. Rapid hydrolysis were observed in the first 48 h. 80% and 86% of all the condensed forms present (condensed phosphate originally present in the sewage plus STPP or TKPP respectively) were hydrolysed in the first 48 h, while only 35.6% of the condensed forms in the control were hydrolysed in the same length of time. The degradation of sodium tripolyphosphate exhibited pseudo first order reaction kinetics with a rate constant of KSTPP/sewage/15ºC=0.093 h-1 corresponding to a half life of 7.42h at 15ºC. An additional study by Halliwell et al (2001) performed on a small, predominantly domestic waste water treatment facility measured the half life of detergent phosphates (triphosphate) in waste waters as 7.3 hours at 15°C and 3.0 h at 20°C.

13 Disposal considerations

Disposal methods

Waste disposal recommendations

Offer surplus and non-recyclable solutions to a licensed disposal company. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber. Dispose of waste and container in accordance with local and/or national regulations. Hazardous waste shall not be mixed together with other waste. Different types of hazardous waste shall not be mixed together if this may entail a risk of pollution or create problems for the further management of the waste. Hazardous waste shall be managed responsibly. All entities that store, transport or handle hazardous waste shall take the necessary measures to prevent risks of pollution or damage to people or animals.

Recycle/reuse. Remove for physico-chemical/biological treatment. **Avoid** discharge into drains or the environment.

Ecology - waste materials
Avoid release to the environment.

Empty Container
Avoid reuse of packaging.

14 Transport information

UN Number

TRANSPORTATION CLASSIFICATION	DOT	TDG	IMDG	IATA
Identification Number	N/A	N/A	N/A	N/A
Proper Shipping Name	N/A	N/A	N/A	N/A
Transport Hazard Class(es)	N/A	N/A	N/A	N/A
Packing Group	N/A	N/A	N/A	N/A
Environmental Hazards	N/A	N/A	N/A	N/A
Emergency Response	N/A	N/A	N/A	N/A
Additional Information	None	None	None	None

UN Proper Shipping Name

NOT REGULATED FOR TRANSPORT

Transport hazard class(es)

NOT REGULATED FOR TRANSPORT

Packing group, if applicable

NOT REGULATED FOR TRANSPORT

Environmental hazards

No environmental hazard known for the product. **Avoid** discharge into the environment, open water sources or municipal sewer.

Special precautions for user

None exept those in sections 4 to 8.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Not applicable.

15 Regulatory information

Safety, health and environmental regulations specific for the product in question

SA NATIONAL LEGISLATION
Hazardous Substances Act 15 of 1973 and Regulations.
Occupational Health and Safety Act 85 of 1993 and Regulations.

SA NATIONAL STANDARDS
SANS 10228 : 2006 : Identification and Classification of Dangerous Goods for Transport by Road and Rail.
SANS 10231 : 2018 : Transport of dangerous goods - Operational requirements for road vehicles.
SANS 10234 : 2008 : Globally Harmonized System of classification and labelling of chemicals (GHS).
SANS 11014 : 2010 : Safety Data Sheets for chemical Products.

REACH Regulation (EC) No 1907/2006
This product contains only components that have been either pre-registered, registered, are exempt from registration, are regarded as registered or are not subject to registration according to Regulation (EC) No. 1907/2006 (REACH)., The

aforementioned indications of the REACH registration status are provided in good faith and believed to be accurate as of the effective date shown above. However, no warranty, express or implied, is given. It is the buyer´s/user´s responsibility to ensure that his/her understanding of the regulatory status of this product is correct.

Seveso III: Directive 2012/18/EU
Listed in Regulation: Not applicable

CERCLA Reportable Quantities
Persons in charge of vessels or facilities are required to notify the National Response Center (NRC) immediately, when there is a release of this designated hazardous substance, in an amount equal to or greater than its reportable quantity of 5000 lb or 2270 kg. The toll free number of the NRC is (800) 424-8802; In the Washington D.C. metropolitan area (202) 426-2675. The rule for determining when notification is required is stated in 40 CFR 302.4 (section IV. D.3.b).

FIFRA Requirements
Residues of sodium tripolyphosphate are exempted from the requirement of a tolerance when used as a buffer, surfactant, suspending agent, dispersing agent, anticaking agent or conditioning agent in accordance with good agricultural practices as inert (or occasionally active) ingredients in pesticide formulations applied to growing crops or to raw agricultural commodities after harvest.

As the federal pesticide law FIFRA directs, EPA is conducting a comprehensive review of older pesticides to consider their health and environmental effects and make decisions about their future use. Under this pesticide reregistration program, EPA examines health and safety data for pesticide active ingredients initially registered before November 1, 1984, and determines whether they are eligible for reregistration. In addition, all pesticides must meet the new safety standard of the Food Quality Protection Act of 1996. Pesticides for which EPA had not issued Registration Standards prior to the effective date of FIFRA, as amended in 1988, were divided into three lists based upon their potential for human exposure and other factors, with List B containing pesticides of greater concern and List D pesticides of less concern. Sodium tripolyphosphate is found on List D. Case No: 4053; Pesticide type: fungicide, herbicide, and antimicrobial; Case Status: None of the active ingredients in the case are being supported for reregistration by their registrants. All are unsupported, or some are unsupported and some are cancelled. Cases described as "unsupported" generally are being processed for cancellation.; Active ingredient (AI): sodium tripolyphosphate; AI Status: The active ingredient is no longer contained in any registered pesticide products ... "cancelled."

FDA Requirements
Sodium tripolyphosphate used as a multiple purpose food substance in food for human consumption is generally recognized as safe when used in accordance with good manufacturing practice.

Sodium tripolyphosphate used as a sequestrant in food for human consumption is generally recognized as safe when used in accordance with good manufacturing practice.

Sodium tripolyphosphate used as a general purpose food additive in animal drugs, feeds, and related products is generally recognized as safe when used in accordance with good manufacturing or feeding practice.

Sodium tripolyphosphate used as a sequestrant in animal drugs, feeds, and related products is generally recognized as safe when used in accordance with good manufacturing or feeding practice.

Sodium tripolyphosphate is a food additive permitted for direct addition to food for human consumption, as long as
1) the quantity of the substance added to food does not exceed the amount reasonably required to accomplish its intended physical, nutritive, or other technical effect in food, and
2) any substance intended for use in or on food is of appropriate food grade and is prepared and handled as a food ingredient.

Chemical safety assessment:
Yes.

16 Other information

Other information

Full text of H & P statements referred to under section 2.
Hazard Statements

H315	Causes skin irritation.
H319	Causes serious eye irritation.
H335	May cause respiratory irritation.

Precautionary statements

P261	Avoid breathing dust/fume/gas/mist/vapours/spray.
P264	Wash thoroughly after handling.
P271	Use only outdoors or in a well-ventilated area.
P280	Wear protective gloves/protective clothing/eye protection/face protection.
P302+P352	IF ON SKIN: Wash with plenty of soap and water.
P304+P340	IF INHALED: Remove victim to fresh air and Keep at rest in a position comfortable for breathing.
P305+P351+P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P312	Call a POISON CENTER or doctor/physician if you feel unwell.
P321	Specific treatment (see P351+P352 on this label).
P332+P313	If skin irritation occurs: Get medical advice/attention.
P337+P313	IF eye irritation persists: Get medical advice/attention.
P362	Store in a well-ventilated place. Keep container tightly closed.
P403+P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents and container in accordance with local, regional, national, international regulations.

Labelling REGULATION (EC) No 1272/2008

Signal Word

Warning

Pictograms Hazard to Human

GHS07 Health Hazard

Pictogram Hazard during Transport

None

Training advice

Provide adequate information, instruction and training for operators.

Information Sources

1. European Chemicals Agency
   https://echa.europa.eu/de/registration-dossier/-/registered-dossier/15386/11

2. PUBCHEM database from National Institutes of Health (NIH)
   National Center for Biotechnology Information. PubChem Compound Database; CID=24455,
   https://pubchem.ncbi.nlm.nih.gov/compound/24455 (accessed Mar. 16, 2019).

Compiled by Aquatrade Water Treatment Chemicals (Pty) Ltd, R. van Rooyen, SHEQ Co-ordinator and E. Le Sar, Director.

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Revision History

Revision:	Date:	Change:
1.0	2019/03/16	Preparation of the safety data sheet according to Regulation (EC) No 1907/2006 of the European Parliament and of the Council
2.0	2019/03/16	Section 1. Correct spelling
