MATERIAL SAFETY DATA SHEET

SECTION # 1: PRODUCT INFORMATION

Trade Name : TCPP – Tris (2chloroisopropyl) Phosphate

Synonyms :"phosphoric acid, tris(2-chloro-1-methylethyl) ester", "phosphoricacid,tris(2-chloro-1-methylethyl) ester", tris(monochloro-isopropyl)phosphate, "tris (2-chloro-2-propyl)phosphate", "tris (2-chloro-2-propyl)phosphate", "2-propanol, 1-chloro-, phosphate (3:1)", "2-propanol, 1-chloro-, phosphate (3:1)", TCPP

Manufacturer / Supplier Contact Information:

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Name	**Bloomchemag bvba**
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REACH Registration Number	01-211948677-26-XXXX
Only Representative	NetSun EU B.V
Tonnage Band	1000+
EC No.	237-158-7

SECTION # 2: COMPOSITION/COMPONENT INFORMATION

Name	CAS RN	EC RN	Index No.	%
Tris (2-chloro-1-methylethyl) phosphate	13674-84-5	237-158-7		Min 99.5
Propylene Oxide	75-56-9			Max 0.01

SECTION # 3: HAZARDS INDENTIFICATION

CLP Classification
Acute (Oral)Toxicity Category 4
Lab el Elements

SIGNAL WORDS
WARNING
HAZARD STATEMENTS
H302 Harmful if swallowed.
PRECAUTIONARY STATEMENTS
Prevention
P264 Wash thoroughly after handling.
P270 Do not eat, drink or smoke when using this product.

Response
P301+P312 IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell.

P330 Rinse mouth.

DSD Classificaion

R22 Harmful if swallowed.

SECTION # 4: FIRST AID MEASURES

SWALLOWED

■IF SWALLOWED, REFER FOR MEDICAL ATTENTION, WHERE POSSIBLE, WITHOUT DELAY.
■ For advice, contact a Poisons Information Centre or a doctor.
■Urgent hospital treatment is likely to be needed.
■ In the mean time, qualified first-aid personnel should treat the patient following observation and employing supportive measures as indicated by the patient's condition.

■ If the services of a medical officer or medical doctor are readily available, the patient should be placed in his/her care and a copy of the MSDS should be provided. Further action will be the responsibility of the medical specialist.

■If medical attention is not available on the worksite or surroundings send the patient to a hospital together with a copy of the MSDS.

■ Where medical attention is not immediately available or where the patient is more than 15 minutes from a hospital or unless instructed otherwise:

■INDUCE vomiting with fingers down the back of the throat, ONLY IF CONSCIOUS. Lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration.

NOTE: Wear a protective glove when inducing vomiting by mechanical means.

EYE
■ If this product comes in contact with the eyes:
■Wash out immediately with fresh running water.
■ Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
■ Seek medical attention without delay; if pain persists or recurs seek medical attention.
■Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

SKIN
■ If skin or hair contact occurs:
■ Flush skin and hair with running water (and soap if available).
■Seek medical attention in event of irritation.

INHALED
■If fumes or combustion products are inhaled remove from contaminated area.
■ Lay patient down. Keep warm and rested.
■Prostheses such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures.
■Apply artificial respiration if not breathing, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary.
■ Transport to hospital, or doctor.

NOTES TO PHYSICIAN
■ All persons handling organic phosphorus ester materials regularly should undergo regular

medical examination with special stress on the central nervous systems. Whilst atropine or pyridine-2-aldoxime methiodide (PAM) are beneficial antidotes for acute phosphate ester poisonings, they are of little value in reversing acute or chronic neurological damage due to phosphites and some types of aryl phosphate

SECTION # 5 FIRE FIGHTING MEASURE

EXTINGUISHING MEDIA
Foam.
Dry chemical powder.
BCF (where regulations permit).
Carbon dioxide.
Water spray or fog - Large fires only.

FIRE FIGHTING
Alert Fire Brigade and tell them location and nature of hazard.
Wear full body protective clothing with breathing apparatus.
Prevent, by any means available, spillage from entering drains or water co
Use water delivered as a fine spray to control fire and cool adjacent area.
Avoid spraying water onto liquid pools.
DO NOT approach containers suspected to be hot. Cool fire exposed containers with water spray from a protected location.

■ If safe to do so, remove containers from path of fire.

FIRE/EXPLOSION HAZARD
■ Combustion products include: carbon dioxide (CO_2), hydrogen chloride, phosgene, phosphorus oxides (POx), other pyrolysis products typical of burning organic material. The most important route of thermal degradation of the chlorinated trisphosphates is elimination of phosphoric acid, with consequent introduction of double bonds into the aliphatic moiety (such as vinyl chloride from tris(chloroethyl)phosphate and dichloropropenes from tris(dichloropropyl)phosphate)).

In a real situation, where oxygen is present, such as in combustion of materials into which the triphosphate has been incorporated, there will be many products of thermal degradation and Flame retardants may not themselves be immune from combustion but will quickly self-extinguish under fire normal conditions. Their thermal degradation products may be be required to break the combustion cycle of materials in which they are found. When materials burn they introduce flammable gases into the immediate environment, The gas flame itself is maintained by the action of high energy "radicals" (that is H+ and OHin the gas phase) which decompose molecules to give free carbon. This free carbon may react with oxygen in air to " burn" to CO_2, generating heat energy.

Halogenated flame retardants act by effectively removing the H+ and OH- radicals in the gas flame phase. This considerable slows or prevents the burning process, thus reducing heat generation and, as a result, production of further gaseous material. The halogenated flame retardants release bromine or chlorine as free radicals (Br- or Cl- as appropriate) which react with the flammable gases to give off HBr or HCl. These then react with the high energy H+ or OH- radicals to give water and the much lower energy Br- or Cl- radicals which then become available to begin a new cycle of H+ and OH- radical removal.

Because chlorine (from chorinated retardants) is released over a wider range of temperatures than bromine, it is present in the flame zone at lower concentrations and is thus less effective. Phosphorus-containing flame retardants effectively work in the solid phase of burning materials (as distinct from the burning gas above them). When heated the phosphorus reacts to give a polymeric form of phosphoric acid. This acid causes the material to char, forming a glassy layer, and thus inhibits the "pyrolysis" process (which causes breakdown of the solid to release flammable gases which further fuel the fire).
May emit poisonous fumes.

FIRE INCOMPATIBILITY
■ Avoid contamination with oxidising agents i.e. nitrates, oxidising acids, chlorine bleaches, pool chlorine etc. as ignition may result. Personal Protective Equipment Breathing apparatus.

SECTION # 6: ACCIDENTAL RELEASE MEASURES

MINOR SPILLS
Remove all ignition sources.
Clean up all spills immediately.
Avoid breathing vapours and contact with skin and eyes.
Control personal contact by using protective equipment.
Contain and absorb spill with sand, earth, inert material or vermiculite.
Wipe up.
Place in a suitable, labelled container for waste disposal.

MAJOR SPILLS Chemical Class: organophosphates
or release onto land: recommended sorbents listed in order of priority.

ORBENT TYPE AND SPILL - SMALL	RANK	APPLICATION	COLLECTION	LIMITATIONS
ross- linked olymer - articulate	1	shovel	shovel	R, W, SS
ross- linked olymer - pillow	1	throw	pitchfork	R, DGC, R
wood fiber - pillow	1	throw	pitchfork	R, P, DGC
oamed glass - illow	2	shovel	shovel	R, W, P, D
orbent clay - articulate	2	shovel	shovel	R, I, P
wood fibre - articulate	3	shovel	shovel	R, W, P, DGC

AND SPILL - MEDIUM

ross- linked olymer - articulate	1	blower	skiploader	R, W, SS
orbent clay - articulate	2	blower	skiploader	R, I, P
olypropylene - articulate	2	blower	skiploader	R, SS, DGC
xpanded mineral - articulate	3	blower	skiploader	R, I, W,
wood fiber-	3	blower	skiploader	R, W, P,
articulate olypropylene - mat	3	throw	skiploader	DGC, RT

Legend
DGC: Not effective where ground cover is dense
R; Not reusable
I: Not incinerable
P: Effectiveness reduced when rainy
RT:Not effective where terrain is rugged
SS: Not for use within environmentally sensitive sites
W: Effectiveness reduced when windy
Reference: Sorbents for Liquid Hazardous Substance Cleanup and Control;
R.W Melvold et al: Pollution Technology Review No. 150: Noyes Data Corporation 1988. Moderate hazard.

■ Clear area of personnel and move upwind.
■ Alert Fire Brigade and tell them location and nature of hazard.
■ Wear breathing apparatus plus protective gloves.
■ Prevent, by any means available, spillage from entering drains or water course.
■ No smoking, naked lights or ignition sources.
■ ncrease ventilation.
■ Stop leak if safe to do so.
■ Contain spill with sand, earth or vermiculite.
■ Collect recoverable product into labelled containers for recycling.
■ Absorb remaining product with sand, earth or vermiculite.
■ Collect solid residues and seal in labelled drums for disposal.
■ Wash area and prevent runoff into drains.
■ If contamination of drains or waterways occurs, advise emergency services.
Personal Protective Equipment advice is contained in Section 8 of the MSDS.

SECTION # 7: HANDLING AND STORAGE

PROCEDURE FOR HANDLING

■ Avoid all personal contact, including inhalation.
■ Wear protective clothing when risk of exposure occurs.
■ Use in a well-ventilated area.
■ Prevent concentration in hollows and sumps.

■ DO NOT enter confined spaces until atmosphere has been checked.
■ DO NOT allow material to contact humans, exposed food or food utensils.
■ Avoid contact with incompatible materials.
■ When handling, DO NOT eat, drink or smoke.

■ Keep containers securely sealed when not in use.
■ Avoid physical damage to containers.
■ Always wash hands with soap and water after handling.
■ Work clothes should be laundered separately. Launder contaminated clothing before re-use.
■ Use good occupational work practice.
■ Observe manufacturer's storing and handling recommendations.
■ Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.

SUITABLE CONTAINER
■ Metal can or drum
■ Packaging as recommended by manufacturer.
■ Check all containers are clearly labelled and free from leaks.

STORAGE INCOMPATIBILITY
■ A number of phosphate and thiophosphate esters are of limited thermal stability and undergo highly exothermic self-accelerating decomposition reactions which may be catalysed by impurities.
■ The potential hazards can be reduced by appropriate thermal control measures. BRETHERICK L.: Handbook of Reactive Chemical Hazards.
■ Avoid reaction with oxidising agents.

STORAGE REQUIREMENTS
■ Store in original containers.
■ Keep containers securely sealed.
■ No smoking, naked lights or ignition sources.
■ Store in a cool, dry, well-ventilated area.
■ Store away from incompatible materials and foodstuff containers.
■ Protect containers against physical damage and check regularly for leaks.
■ Observe manufacturer's storing and handling recommendations.

SECTION # 8: EXPOSURE CONTROL / PERSONAL PROTECTION

EXPOSURE CONTROLS
The following materials had no OELs on our records
■ tris(2- chloroisopropyl)phosphate: CAS:13674- 84- 5 CAS:16839- 32- 0 CAS:98112- 32- 4

MATERIAL DATA
TRIS(2-CHLOROISOPROPYL)PHOSPHATE:
■ No exposure limits set by NOHSC or ACGIH.

Bis(1-chloro-2-propyl)-3-(3-chloropropoxy)propyl phosphate:
Not available

PERSONAL PROTECTION

EYE
■ Safety glasses with side shields
■ Chemical goggles.

■ Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants. A written policy document, describing the wearing of lens or restrictions on use, should be created for each workplace or task. This should include a review of lens absorption and adsorption for the class of chemicals in use and an account of injury experience. Medical and first-aid personnel should be trained in their removal and suitable equipment should be readily available. In the event of chemical exposure, begin eye irrigation immediately and remove contact lens as soon as practicable. Lens should be removed at the first signs of eye redness or irritation - lens should be removed in a clean environment only after workers have washed hands thoroughly. [CDC NIOSH Current Intelligence Bulletin 59].

HANDS/FEET

■ Wear chemical protective gloves, eg. PVC.

■ Wear safety footwear or safety gumboots, eg. Rubber.

Suitability and durability of glove type is dependent on usage. Important factors in the selection of gloves include: such as:

■ frequency and duration of contact,

■ chemical resistance of glove material,

■ glove thickness and

■ dexterity

Select gloves tested to a relevant standard

■ When prolonged or frequently repeated contact may occur, a glove with a protection class of 5 or higher (breakthrough time greater than 240 minutes according to EN 374) is recommended.

■ When only brief contact is expected, a glove with a protection class of 3 or higher (breakthrough time greater than 60 minutes according to EN 374) is recommended.

■ Contaminated gloves should be replaced.

Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly.

Application of a non-perfumed moisturiser is recommended.

OTHER

■ Overalls.

■ P.V.C. apron.

■ Barrier cream.

■ Skin cleansing cream.

■ Eye wash unit.

RESPIRATOR

■ Cartridge respirators should never be used for emergency ingress or in areas of unknown vapour concentrations or oxygen content. The wearer must be warned to leave the contaminated area immediately on detecting any odours through the respirator. The odour may indicate that the mask is not functioning properly, that the vapour concentration is too high, or that the mask is not properly fitted. Because of these limitations, only restricted use of cartridge respirators is considered appropriate.

Selection of the Class and Type of respirator will depend upon the level of breathing zone contaminant and the chemical nature of the contaminant. Protection Factors (defined as the ratio of contaminant outside and inside the mask) may also be important.

Breathing Zone Level Maximum Protection Half- face Respirator Full- Face Respirator

ppm (volume) Factor

1000 10 a- AUS p -

1000 50 - a- AUS p

5000 50 Airline * -
5000 100 - a- 2 p
10000 100 - a- 3 p
100+ Airline**
* - Continuous Flow ** - Continuous-flow or positive pressure demand.
ENGINEERING CONTROLS
■ Local exhaust ventilation usually required. If risk of overexposure exists, wear approved respirator.
Correct fit is essential to obtain adequate protection. Supplied-air type respirator may be required in special circumstances. Correct fit is essential to ensure adequate protection.
An approved self contained breathing apparatus (SCBA) may be required in some situations.
Provide adequate ventilation in warehouse or closed storage area.

SECTION # 9: PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE
Clear colourless viscous liquid with a slightly sweet odour; does not mix with water (1080 mg/l, 20mC).
Hydrolyses slowly under weak alkaline or acidic conditions.
The flame retardant product supplied in the world marketed as TCPP, is actually a reaction mixture containing four isomers. The individual isomers in this reaction mixture are not separated or marketed. The individual components are never produced as such. These data are true for TCPP produced by all world manufacturers. The other isomers in the mixture include bis(1-chloro-2-propyl)-2-chloropropyl phosphate (CAS 76025-08-6); bis(2-chloropropyl)-1-chloro-2-propyl phosphate (CAS 76649-15-5) and tris(2-chloropropyl) phosphate (CAS 6145-73-9). The assumption is made that all isomers have identical properties in respect of risk assessment. The assumption is justified in part by the fact that they exhibit very similar chromatographic properties, even under conditions optimised to separate them. Predicted physicochemical properties differ to only a small extent
PHYSICAL PROPERTIES
Liquid.
Does not mix with water.
Sinks in water.
Trade name: TCPP
State Liquid Molecular Weight 327.59
Melting Range (°C) - <20 Viscosity 89.1, 20 mC
cSt@40°C
Boiling Range (°C) 288 (decomposes) Solubility in water (g/L) Immiscible
Flash Point (°C) 218 COC pH (1% solution) Not applicable
Decomposition Temp (°C) >150 pH (as supplied) Not applicable
Autoignition Temp (°C) >400 Vapour Pressure (kPa) 1.4 x 10- 6, 25
C
Upper Explosive Limit (%) Not available Specific Gravity (water=1) 1.3
Lower Explosive Limit (%) Not available Relative Vapour Density >1
(air=1)
Volatile Component (%vol) Negligible Evaporation Rate Not applicable

SECTION # 10: STABILITY AND REACTIVITY

CONDITIONS CONTRIBUTING TO INSTABILITY
■ Presence of incompatible materials.
■ Product is considered stable.
■ Hazardous polymerisation will not occur.
For incompatible materials - refer to Section 7 – Handling and Storage.

SECTION # 11: TOXICOLOGICAL INFORMATION

POTENTIAL HEALTH EFFECTS
ACUTE HEALTH EFFECTS
SWALLOWED
■ Accidental ingestion of the material may be harmful; animal experiments indicate that ingestion of less than 150 gram may be fatal or may produce serious damage to the health of the individual.
EYE
■ Although the liquid is not thought to be an irritant (as classified by EC Directives), direct contact with the eye may produce transient discomfort characterised by tearing or conjunctival redness (as with windburn).
SKIN
■ The liquid may be miscible with fats or oils and may degrease the skin, producing a skin reaction described as non-allergic contact dermatitis. The material is unlikely to produce an irritant dermatitis as described in EC Directives .
■ Open cuts, abraded or irritated skin should not be exposed to this material.
■ Entry into the blood-stream, through, for example, cuts, abrasions or lesions, may produce systemic injury with harmful effects. Examine the skin prior to the use of the material and ensure that any external damage is suitably protected.
INHALED
■ The material is not thought to produce respiratory irritation (as classified by EC Directives using animal models). Nevertheless inhalation of vapours, fumes or aerosols, especially for prolonged periods, may produce respiratory discomfort and occasionally, distress.
■ Inhalation of aerosols (mists, fumes), generated by the material during the course of normal handling, may be damaging to the health of the individual.
■ Inhalation hazard is increased at higher temperatures.
■ Chlorinated phosphate esters can cause loss of sensation and relax the muscle.
CHRONIC HEALTH EFFECTS
■ Long-term exposure to the product is not thought to produce chronic effects adverse to the health (as classified by EC Directives using animal models); nevertheless exposure by all routes should be minimised as a matter of course.

TOXICITY AND IRRITATION

■ For tris(2-chloro-1-methylethyl)phosphate (TCPP)

The flame retardant product supplied in the world marketed as TCPP, is actually a reaction mixture containing four isomers. The individual isomers in this reaction mixture are not separated or marketed. The individual components are never produced as such. These data are true for TCPP produced by all world manufacturers. The other isomers in the mixture include bis(1-chloro-2-propyl)-2-chloropropyl phosphate (CAS 76025-08-6); bis(2-chloropropyl)-1-chloro-2-propyl phosphate (CAS 76649-15-5) and tris(2-chloropropyl) phosphate (CAS 6145-73-9). The assumption is made that all isomers have identical properties in respect of risk assessment. The assumption is justified in part by the fact that they exhibit very similar chromatographic properties, even under conditions optimised to separate them. Predicted physicochemical properties differ to only a small extent. Chlorinated alkyl phosphate esters (particularly TCPP) were identified as possible substitutes for the fire retardant pentabromodiphenyl ether They appear to be relatively persistent substances, and there is some human health concern. Three substances in this group have been characterised to a degree and serve as a read across reference for TCPP.They include tris(2-chloroethyl)phosphate(TCEP,CAS115-96-8), tris chloromethyl)ethyl]phosphate (TDCP, CAS 13674-87-8) and 2,2-bis(chloromethyl)trimethylene bis[bis(2-chloroethyl)phosphate] (V6, CAS 38051-10-4). Other flame retardants in this family, which do not appear as HPV (High Production Volume) substances, include tetrakis[2-(chloroethyl)ethylene)diphosphate (CAS 33125-86-9), tris (2,3-dichloro-1-propyl)phosphate (CAS 78-43-3, an isomer of TDCP)) Acute toxicity: The inhalation exposure studies in animals were somewhat equivocal and in general lacking in detailed information. One study yielded an LC50 of > 7 mg/L/4 hr. A limit test yielded an acute LC50 value of >4.6 mg/L/4h. No deaths occurred at this concentration. Toxic signs observed in this study, and in 2 further poorly reported studies, included mild lethargy, matted fur, acute bodyweight depression and convulsions.From the studies, it appears that TCPP is more toxic when administered whole body as aerosol than by noseonly exposure. This suggests that some of the systemic toxicity observed when TCPP is administered whole body may result from dermal or oral uptake, rather than inhalation. Therefore, it is concluded that TCPP is of low toxicity via the inhalation route.

Studies in rats indicated that TCPP is of moderate toxicity via the oral route of exposure, with LD50 values from the better quality studies ranging from 632 mg/kg up to 4200 mg/kg, with the majority of values determined to be <2000 mg/kg. Common clinical and macroscopic signs of toxicity observed on nearly all studies included depression, ataxia, hunched posture, lethargy, laboured respiration, increased salivation, partially closed eyelids, body tremors, pilo-erection, ptosis, haemorrhagic lungs and dark liver and/or kidneys. A NOAEL of 200 mg/kg can be identified for acute oral toxicity. This is taken from a 1996 study, in which no clinical signs of toxicity were observed in animals dosed with 200 mg/kg TCPP. Based on the results of the acute oral studies, TCPP should be classified with R22, harmful if swallowed.
In a delayed neurotoxicity study conducted in hens, TCPP showed moderate toxicity. The principle effects were reduced mean body weight and food consumption, feather loss and cessation of laying. There was no evidence of inhibited plasma acetylcholinesterase or brain neurotoxic esterase enzyme levels. Therefore, there is no concern for acute delayed neurotoxicity for TCPP.

Studies in rats and rabbits indicated that TCPP is of low toxicity via the dermal route of exposure
with LD50values of >2000mg/kg. There is an extensive database in animals, indicating that TCPP is non-irritant in the rabbit eye and skin. The lack of any substantial skin or eye irritation and the lack of irritation observed in the acute inhalation studies suggest that TCPP would be unlikely to produce significant respiratory tract irritation. Evidence from a guinea pig study as well as from a local lymph

node assay, indicates that TCPP does not possess significant skin sensitisation potential. No information is available on the respiratory sensitisation potential of TCPP.

Repeat dose toxicity: A study is available in which male and female rats were fed diets containing TCPP for 13 weeks at concentrations corresponding to mean substance intake values of up to 1349 mg/kg/day and 1745 mg/kg/day for males and females respectively. This study indicated the liver and thyroid to be the main target organs affected by TCPP. Effects observed included statistically significant increases in absolute and relative liver weights in males at all doses and females at the two highest doses, periportal hepatocyte swelling in high dose groups and mild thyroid follicular cell hyperplasia in males at all doses and females at the highest dose.Based on the increase in both absolute and relative liver weights, accompanied by mild thyroid follicular cell hyperplasia observed in males of all dose groups, a LOAEL of 52 mg/kg/day is derived and taken forward to risk characterisation. This LOAEL is taken forward in preference to the NOAEL
which was identified in a 4-week study in which rats were dosed with TCPP at concentrations of 0, 10, 100 and 1000 mg/kg/day, as it was derived from a study of longer duration. The 4-week study also showed the liver as the target organ, with increased liver weight changes observed in the high dose groups, accompanied by hepatocyte hypertrophy in all high-dose males and one mid-dose male and changes in ALAT activity in high-dose animals.
A two-week study in which rats were fed diets of TCPP at concentrations corresponding to mean substance intake values of up to 1636 mg/kg/day for males and 1517 mg/kg/day for females showed no major clinical signs of toxicity. There was a significant reduction in weight gain and food consumption in high dose males during week 2, but there were no other significant findings.

In a 2-generation reproductive toxicity study in which rats were fed TCPP in the diet over two successive generations, the low-dose of 99 mg/kg for females is considered to be the LOAEL for parental toxicity. This is based on decreased body weight and food consumption seen in mid and high dose parental animals and the effects on uterus weight seen in all dosed animals. For males, a NOAEL of approximately 85 mg/kg is derived for parental toxicity, based on decreased body weights, food consumption and organ weight changes observed at mid and high dose groups.

No data are available on inhalation and dermal repeated dose toxicity. Genotoxicity: The mutagenic potential of TCPP has been well investigated in vitro. Evidence from several bacterial mutagenicity studies shows that TCPP is not a bacterial cell mutagen. TCPP was also shown to be nonmutagenic in fungi. In mammalian cell studies, TCPP did not induce forward mutations at the TK locus in L5178Y mouse lymphoma cells in one study, but in a second study, the result was considered equivocal (in the presence of rat liver S9 fraction). A confirmatory mouse lymphoma was conducted in accordance with the relevant regulatory guidelines. The results of the assay indicate that TCPP shows clastogenic activity in vitro in the presence of metabolic activation.

The main concern for TCPP is clastogenicity, owing to the clearly positive in vitro mouse lymphoma study. In vivo, TCPP was not clastogenic in a mouse bone marrow micronucleus test. TCPP did not induce an increase in chromosomal aberrations in a rat bone marrow cytogenetics assay. In order to further investigate the potential for TCPP to induce DNA damage, an in vivo Comet assay in the rat liver was conducted. The liver was chosen for comet analysis as TCPP caused an increased mutation frequency in the mouse lymphoma assay in the presence of S9 and also induced liver enlargement in repeat dose studies. Under the conditions of this study, TCPP did not induce DNA damage in the liver of rats treated with either 750 or 1500 mg/kg TCPP.

Overall, it is considered that TCPP is not genotoxic in vivo. Carcinogenicity: TCPP is structurally similar to two other chlorinated alkyl phosphate esters, TDCP (tris [2-chloro-1-(chloromethyl)ethyl] phosphate) and TCEP (tris (2-chloroethyl) phosphate). TDCP and TCEP are nongenotoxiccarcinogens, invivo,and have agreed classifications of Carc Cat 3 R40.Based on the available repeat dose toxicity data for TCPP, supported by a qualitative read-across from TDCP and TCEP, there is a potential concern for carcinogenicity for TCPP by a nongenotoxic mechanism. No quantitative read-across can be performed since there are no insights into an underlying mode of action for TCEP and TDCP which would make a prediction on a relatively potency of TCPP possible. Therefore, as a reasonable worst case approach, a risk characterisation will be carried out for this end-point.

It is proposed that the effects observed in the 90-day study for TCPP are taken as a starting point for risk characterisation. If these effects were to progress to cancer, they would do so by a non-genotoxic mechanism. Therefore, it is proposed that the LOAEL of 52 mg/kg/day, identified from the 90-day study with TCPP, should be used as a basis for risk characterisation of the carcinogenicity endpoint.

Reproductive toxicity: In a two-generation reproductive toxicity study with TCPP, there were no treatment related effects in pre-coital time, mating index, female fecundity index, male and female fertility index, duration of gestation and post-implantation loss. There was no effect on sperm parameters at necropsy. In females, the length of the longest oestrus cycle and the mean number of cycles per animal were statistically significantly increased in high dose animals of both generations. A decrease in uterus weight was observed in all dosed females in F0 and in high dose females in F1. Effects were also noted on pituitary weights, significant in high dose females of both generations. A LOAEL of 99 mg/kg is derived for effects on fertility. This is based on effects on the effect on uterus weight seen in all dosed females in F0 and high dose females in F1. Developmental toxicity: From the same study, a LOAEL of 99 mg/kg is derived for developmental toxicity. This is based on a treatment related effect on the number of runts observed in all TCPP-treated groups of the F0 generation.

In a separate study, no treatment-related effects on foetal mortality, implantation number, resorption or foetal weight were observed following treatment of pregnant dams with TCPP.

Cervical ribs and missing 13th ribs were noted at a low incidence in all treatment groups, but not in the control group. However, as a specific rib count undertaken in the 2-generation study did not reveal an increase in this effect, it is concluded that this is not toxicologically significant. Weaning rate and rearing condition were unaffected by treatment and there was no evidence of any abnormality.

For non-polymeric chlorinated trisphosphates (typically (tris(chloroethyl)phosphate (TCEP), tris(chloropropyl)phosphate (TCPP) and tris(dichoropropyl)phosphate (TDCPP) Chlorinated trisphosphates do not necessarily have similar chemical, physical, toxicological or environmental properties.

Blooming has been identified as a source of potential exposure (human and environmental) to trisphosphate plasticers/ flame retardants. Blooming is defined as the migration (or more appropriately, diffusion) of an ingredient in rubber or plastic to the outer surface after curing. Thus is generally a slow process. Increased temperature may accelerate the rate of migration. For example trisphosphates are know to bloom from car interior plastics, TVs and computer VDUs

SECTION # 12: ECOLOGICAL INFORMATION

TRIS(2-CHLORO-1-PROPYL)PHOSPHATE:
■ DO NOT discharge into sewer or waterways.
■ for alkyl esters of phosphoric acid:
Environmental fate:
The physicochemical properties and environmental fate of the chemicals in this category are similar.
They have a low melting point, a high boiling point or decomposition temperature, and low vapour pressure. The triesters are slightly soluble and the others are moderately soluble to soluble in water. The results of the hydrolysis studies with 2-ethylhexyl phosphate (CAS RN: 12645-31-7), and triisobutyl phosphate (CAS RN: 126-71-6), and tributyl phosphate (CAS RN: 126-73-8) indicate that the mono-, di-, and tri-esters all are hydrolytically stable. Fugacity Level III calculations indicate that if they are released into the environment, they will exist predominantly in the soil and/ or soil or the aquatic environment depending on the environmental compartment that they first contact. The log Kow, indicates that they will not bioconcentrate. They exhibit appreciable biodegradation in 28 days or sooner indicating that they are moderately degradable if soluble and will not persist in the environment Tris(2-ethylhexyl)phosph has limited solubility in water, exhibited 0% biodegradation after 28 days in the OECD 301D closed bottle test.

Biodegradation of phosphoric acid esters involves stepwise hydrolysis to ortho-phosphate and alcohol moieties. The alcohol would then be expected to undergo further degradation Ecotoxicity: Studies of the ecotoxicity of the chemicals in this category indicate that none of the members are highly toxic to aquatic species. The fish 96-hour LC50 values ranged from >500 mg/l in 0. Latipes and >I00 mg/l in 0. mykiss for 2-ethylhexyl phosphate to 23 mg/l in 0. mykiss for triisobutyl phosphate. The invertebrate 48-hour ECso values with Daphnia ranged from 110 mg/l for 2-ethylhexyl phosphate to 11 mg/l for triisobutyl phosphate. The algal 96-hour EC50 values ranged from 4.4 mg/l with tributyl phosphate in S. capricornutum and to 161 mg/l with 2-ethylhexylphosphate in S. capricornutum.

SECTION # 13: DISPOSAL CONSIDERATIONS

■ Containers may still present a chemical hazard/ danger when empty.
■ Return to supplier for reuse/ recycling if possible.
Otherwise:
■ If container can not be cleaned sufficiently well to ensure that residuals do not remain or if the container cannot be used to store the same product, then puncture containers, to prevent re-use, and bury at an authorised landfill.
■ Where possible retain label warnings and MSDS and observe all notices pertaining to the product. Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws operating in their area. In some areas, certain wastes must be tracked.

A Hierarchy of Controls seems to be common - the user should investigate:
■ Reduction
■ Reuse
■ Recycling
■ Disposal (if all else fails)

This material may be recycled if unused, or if it has not been contaminated so as to make it unsuitable for its intended use. If it has been contaminated, it may be possible to reclaim the product by filtration, distillation or some other means. Shelf life considerations should also be applied in making decisions of this type. Note that properties of a material may change in use, and recycling or reuse may not always be appropriate.

■ DO NOT allow wash water from cleaning or process equipment to enter drains.
■ It may be necessary to collect all wash water for treatment before disposal.
■ In all cases disposal to sewer may be subject to local laws and regulations and these should be considered first.
■ Where in doubt contact the responsible authority.
■ Recycle wherever possible or consult manufacturer for recycling options.
■ Consult State Land Waste Authority for disposal.
■ Bury or incinerate residue at an approved site.
■ Recycle containers if possible, or dispose of in an authorised landfill.
■ According to the European Waste Catalogue, Waste Codes are not product specific but application specific. Waste Codes should be assigned by the User based on the application in which the product is used.

SECTION # 14: TRANSPORT INFORMATION

HAZCHEM: None

NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS: ADR, IATA, IMDG

SECTION # 15: REGULATIONS

U.S.A. (TSCA)	Complies
Canada (DSL)	Complies
EU (ELINCS)	Does not Comply
EU (EINECS)	Complies
Japan (ENCS)	Complies
China	Complies
Korea (KECL)	Complies
Philippines (PICCS)	Complies
Australia (AICS)	Complies

Chemical Name	U.S.A. (TSCA)	Canada (DSL)	EU (EINECS)
EU (ELINCS)Trichloropropyl Phosphate	X	X	X

-

Chemical Name	Japan (ENCS)	China Korea (KECL)	Philippines (PICCS)
Australia (AICS) Trichloropropyl Phosphate	X	X	X X X

X

USA Federal Regulations SARA 313

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372.

SECTION # 16: OTHER INFORMATION

This product should be stored, handled and used in accordance with good industrial hygiene practices and in conformity with any legal regulation. The information contained herein is based on the present state of our knowledge and is intended to describe our product from the point of view of safety requirements. It should not therefore be construed as guaranteeing specific properties. Many factors determine whether the reported Hazards are Risks in the workplace or other settings. Risks may be determined by reference to Exposures Scenarios. Scale of use, frequency of use and current or available engineering controls must be considered.

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