Product Safety Assessment
AQUCAR™ THPS 75 Water Treatment Microbiocide

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Names
• CAS No. 55566-30-8
• AQUCAR™ THPS 75 Water Treatment Microbiocide
• THPS
• Tetrakis(hydroxymethyl) phosphonium sulphate (2:1)
• Tetrakis(hydroxymethyl) phosphonium sulfate
• Bis[tetrakis(hydroxymethyl)phosphonium] sulfate
• Phosphonium, tetrakis(hydroxymethyl)-, sulfate (2:1) (salt)

Product Overview
• AQUCAR™ THPS 75 Water Treatment Microbiocide is a colorless-to-yellow liquid that is sold as a nominal 76.5% concentrated solution in water. It is a biocide containing the active substance tetrakis(hydroxymethyl) phosphonium sulfate (THPS).\(^1\) For further details, see Product Description.
• AQUCAR THPS 75 Water Treatment Microbiocide is primarily used as a slimicide for gas- and oil-field applications, as well as for water-treatment uses. It is also used as a preservative in coatings, pigments, and slurries.\(^2,3\) For further details, see Product Uses.
• Workers handling concentrated THPS may be exposed by inhalation or skin contact. Consumer exposure to dilute THPS in formulated products is possible, but is considered much lower than occupational exposure. For further details, see Exposure Potential.
• Eye contact with THPS, the active substance, may cause severe irritation with corneal injury. Brief skin contact is essentially nonirritating, but repeated skin contact may cause severe irritation. Skin contact may also cause allergic reactions. Inhalation of mist may cause severe irritation of the upper respiratory tract and lungs. THPS is harmful if swallowed or absorbed through skin and has been reported to cause birth defects in laboratory animals.\(^4,5\) For further details, see Health Information.
• THPS is degradable, unlikely to accumulate in the food chain, and highly toxic to aquatic organisms.\(^6,7\) For further details, see Environmental Information.
• AQUCAR THPS 75 Water Treatment Microbiocide is thermally stable under typical use temperatures, and hazardous polymerization of the product is not expected to occur. The active substance can decompose at temperatures above 160°C (320°F).\(^8,9\) For further details, see Physical Hazard Information.

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Manufacture of Product

- **Capacity** – Dow Microbial Control is a supplier of THPS for biocidal use. The product is manufactured under United States Environmental Protection Agency (U.S. EPA) requirements.

- **Process** – THPS is manufactured in a batch process that involves the chemical reaction of phosphine gas with aqueous formaldehyde in the presence of sulfuric acid and water. THPS exists in equilibrium with tris(hydroxymethyl)phosphine and methylene glycol. Under manufacturing, shipping, and storage conditions, the equilibrium strongly favors the formation of THPS. The chemical structure is shown below.

\[
\text{CH}_2\text{O} \quad \text{HOH}_2\text{C} \quad \text{P} \quad \text{CH}_2\text{O} \quad \text{H} \quad \text{SO}_4^{2-} \quad \text{CH}_2\text{OH} \\
\quad \text{CH}_2\text{OH}
\]

Product Description

AQUCAR™ THPS 75 Water Treatment Microbiocide is a colorless-to-yellow liquid with a pH range of 3 to 5 and a density of 11.5 pounds/gallon (0.086 g/cm³). It is sold as a 76.5% concentrated solution in water. The product is typically supplied in recyclable totes and drums with a capacity of 1249 and 208 liters, respectively.

Product Uses

AQUCAR™ THPS 75 Water Treatment Microbiocide is a broad-spectrum bactericide and fungicide that is used in a variety of in-can and process-water applications. It is also effective in controlling sulfate-reducing bacteria and general aerobic bacteria, including microorganisms that contribute to biofilm formation in oil-field recovery, processing, and distribution applications and supporting systems. It is used in:

- **Oil field and petrochemical operations** – for use in fluids for drilling and stimulation of oil and gas wells, injection water, water holding tanks, disposal-well water, recirculating-water handling systems, and pipelines
- **Heat-transfer systems and industrial and commercial cooling and wastewater systems** – for control of microbial growth in the holding and processing tanks of industrial fresh-water systems and in water for pulp and paper mills, textile mills, and other manufacturing facilities
- **Air-washer systems** – for control of bacteria and fungi in air-washer systems that have mist-eliminating components
- **Paper and paperboard manufacturing** – for use as a slimicide in the manufacture of paper and paperboard products and adhesives that do not come into contact with food
- **Coatings, pigments, and filler slurries** – for use as a preservative to retard microbial growth in nonfood-contact, water-based coatings, starches, pigments, and filler slurries
- **Emulsion and solution preservation** – for the preservation of solutions, emulsions, adhesives, and other aqueous liquid products that do not come into contact with food
Exposure Potential\textsuperscript{15,16,17}

AQUCAR™ THPS 75 Water Treatment Microbiocide is used in multiple applications, leading to the potential for both occupational and consumer exposure to THPS and/or its degradates. In either group, exposure is most likely via inhalation or dermal absorption. Oral exposure is unlikely since THPS is not approved for use in products that come in contact with food.

- **Workplace exposure** – Workers handling AQUCAR THPS 75 Water Treatment Microbiocide in industrial and commercial settings could be exposed to this product and/or its degradates during product manufacturing, maintenance, sampling, testing, or other procedures. Safe use and handling guidance are provided, and this information includes recommendations for limiting exposure via engineering controls and use of personal protective equipment. Each manufacturing facility should have a thorough training program for employees and appropriate work processes, ventilation, and safety equipment in place to limit unnecessary exposure. See Health Information.

- **Consumer exposure to products containing AQUCAR THPS 75 Water Treatment Microbiocide** – This product is not sold for direct consumer use, but it is formulated into products that may be purchased and used by consumers, such as adhesives and coatings. When used properly, the potential exposure to THPS and/or its degradates in such products is low, with the concentration not exceeding 0.24% by weight. See Health Information.

- **Environmental releases** – Small amounts of THPS may be released into the environment during use of products containing it. The compound is susceptible to both biodegradation and other degradation processes, and it will be removed from water and soil environments, including biological wastewater treatment plants. Because the substance is highly toxic to aquatic organisms such as algae, in the event of a spill, the focus is on containing the spill to prevent contamination of soil, surface or ground water. Any controlled discharge must be in compliance with local laws and regulations. See Environmental, Health, and Physical Hazard Information.

- **Large release** – A spill plan should be in place to address both small and large spills. The plan should include instructions for easy access to personal protective equipment and specific equipment for cleaning up the spill. Spilled material should be covered with appropriate inert material such as clay, sand, or vermiculite and collected in suitable and properly labeled containers. A person familiar with the local spill response plan should lead the cleanup. Prompt and cautious attention to drips, splashes, and spills is important to reduce the potential for exposure to this product. Avoiding container punctures and mishandling of containers are important elements in preventing spills. Storing containers in contained areas and use of spill-containment pallets will control the size of potential spills. See Environmental, Health, and Physical Hazard Information.

- **In case of fire** – During a fire, containers can rupture and residues can burn. Smoke may contain the original material in addition to toxic and/or irritating compounds. Decomposition products depend upon temperature, air supply, and the presence of other materials. These decomposition products can include and are not limited to phosphines, phosphorus oxides, and sulfur oxides. Deny any unnecessary entry into the area and consider the use of unmanned hose holders. Isolate the fire. Firefighters should wear positive-pressure, self-contained breathing apparatus (SCBA) and protective firefighting clothing. Use water fog or fine spray, dry-chemical or carbon-dioxide extinguishers, or foam to extinguish the fire. Contain fire-water run-off if possible to minimize the potential for environmental damage. When relevant in scale or risk, the community should be notified of the hazards associated with the specific release event. Follow emergency procedures carefully. See Environmental, Health, and Physical Hazard Information.

For more information, see the relevant Safety Data Sheet and the Safe Use and Handling Guidance brochure.
Health Information

AQUCAR™ THPS 75 Water Treatment Microbiocide contains 76.5% THPS in water. The health information below is based on the active component, THPS.

**Eye contact** – THPS may cause severe eye irritation with the potential for corneal injury.

**Skin contact** – Brief contact with THPS is nonirritating to the skin. However, repeated contact may cause severe skin irritation with local redness and discomfort. Additionally, THPS is harmful if absorbed through the skin and has caused allergic skin reactions in laboratory animals.

**Ingestion** – THPS may be fatal if swallowed. Swallowing smaller amounts may cause gastrointestinal irritation.

**Inhalation** – Inhalation of THPS mist may cause severe irritation of the upper respiratory tract (nose and throat) and lungs. Prolonged excessive exposure may cause serious adverse effects, even death.

**Repeated exposure** – Long-term oral feeding studies performed in laboratory animals reported some adverse effects on liver, spleen and bone marrow, but did not show any evidence of carcinogenicity.

**Other** – In vitro genetic toxicity tests with THPS were negative in some and positive in others. However, THPS tested negative in in vivo genetic toxicity tests designed to evaluate genotoxic potential. In several studies with THPS salts (sulfate and chloride), test substances produced evidence of developmental toxicity (i.e., birth defects) in rats and rabbits. Under certain use conditions, this product may generate small amounts of formaldehyde in aqueous solutions. Formaldehyde is classified as a possible human carcinogen.

For more information, see the relevant Safety Data Sheet.

Environmental Information

THPS has a high water solubility and very low volatility. Once introduced, the compound has a tendency to remain in water with minimal tendency to adsorb to soil or sediments.

THPS is unlikely to persist in the environment. It is inherently biodegradable, which suggests the chemical will be removed from water and soil environments, including biological wastewater treatment plants. In addition, the compound is susceptible to other degradation processes, including hydrolysis, photolysis, and oxidation.

THPS is not likely to accumulate in the food chain (bioconcentration potential is low) and is highly toxic to aquatic organisms, particularly algae, on an acute basis.

For more information, see the relevant Safety Data Sheet.

Physical Hazard Information

AQUCAR™ THPS 75 Water Treatment Microbiocide is water soluble and slightly acidic, with a characteristic aldehyde odor. The active substance THPS has a low vapor pressure; however, the 76.5% aqueous solution has a higher vapor pressure due to its water content. The product is thermally stable under typical use temperatures, and hazardous polymerization of the product is
not expected to occur. The active substance can decompose at temperatures above 160°C (320°F). Under recommended storage conditions, the product is stable in its packaging for a minimum of 12 months.

For more information, see the relevant Safety Data Sheet.

Regulatory Information
Regulations may exist that govern the manufacture, sale, transportation, use, and/or disposal of AQUCAR™ THPS 75 Water Treatment Microbiocide. These regulations may vary by city, state, country, or geographic region. Information may be found by consulting the relevant Safety Data Sheet, Technical Data Sheet, or Contact Us.

Additional Information
- Safety Data Sheet (www.dow.com/webapps/msds/msdssearch.aspx)
- Contact Us (www.dow.com/assistance/dowcig.htm)
- United States Environmental Protection Agency (EPA) Approved Pesticide Label, Registration No. 464-8126 (http://www.epa.gov/pesticides/pestlabels/)
- ESIS Database, European Commission, Joint Research Center, Institute for Health and Consumer Protection (http://ecb.jrc.it/esis/, Search CAS No. 55566-30-8)

For more information about AQUCAR THPS 75 Water Treatment Microbiocide, the Dow Customer Information Group at www.dow.com/assistance/dowcig.htm.

References

US EPA Approved Pesticide Label, Registration No. 464-8126.


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