

POTASSIUM PYROPHOSPHATE

This dossier on potassium pyrophosphate presents the most critical studies pertinent to the risk assessment of potassium pyrophosphate in its use in drilling muds. It does not represent an exhaustive or critical review of all available data. The majority of information presented in this dossier was obtained from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch *et al.*, 1997).

Screening Assessment Conclusion – Potassium pyrophosphate is classified as a **tier 1** chemical and requires a hazard assessment only.

1 BACKGROUND

Potassium pyrophosphate dissociates completely in aqueous media to potassium ions (K⁺) and pyrophosphate ions (P₂O₇⁴⁻). The pyrophosphate anion is unstable in aqueous solution and hydrolyses into inorganic phosphate. Both potassium ions (K⁺) and phosphate ions (HPO₄²⁻) are ubiquitous in the environment. Both ions are essential to all living organisms and their intracellular and extracellular concentrations are actively regulated. Neither potassium pyrophosphate nor its dissociated ions are expected to bioaccumulate. Potassium pyrophosphate is expected to be of low toxicity concern to aquatic organisms based on a similar compound.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): tetrapotassium (phosphonoxy)phosphonate

CAS RN: 7320-34-5

Molecular formula: K₄O₇P₂.4K

Molecular weight: 330.33 g/mol

Synonyms: Tetrapotassium diphosphate; potassium pyrophosphate; potassium diphosphate; tetrapotassium diphosphate; TKPP; tetrapotassium pyrophosphate

3 PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1 Overview of the Physico-chemical Properties of Potassium Pyrophosphate

Property	Value	Klimisch score	Reference
Physical state at 20°C and 101.3 kPa	White, granular solid	1	ECHA
Melting Point	>569°C (pressure not provided)	4	ECHA
Boiling Point	-	-	-
Density	2610 kg/m ³ @ 20°C	1	ECHA

Property	Value	Klimisch score	Reference
Vapour Pressure	-	-	-
Partition Coefficient (log K _{ow})	Not applicable	-	-
Water Solubility	10 g/L@ 20°C	1	ECHA

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

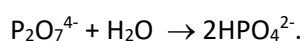
A review of international and national environmental regulatory information was undertaken (Table 2). This chemical is listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for its use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for potassium pyrophosphate.

Table 2 Existing International Controls

Convention, Protocol or other international control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

5 ENVIRONMENTAL FATE SUMMARY

Potassium pyrophosphate dissociates completely in aqueous media to potassium ions (K⁺) and pyrophosphate ions (P₂O₇⁴⁻). The pyrophosphate anion is unstable in aqueous solution and hydrolyses into inorganic phosphate:



Both potassium ions (K⁺) and phosphate ions (HPO₄²⁻) are ubiquitous in the environment. Both ions are essential to all living organisms and their intracellular and extracellular concentrations are actively regulated (Ganong, 1995). Neither potassium pyrophosphate nor its dissociated ions are expected to bioaccumulate.

6 ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

Potassium pyrophosphate is expected to be of low toxicity concern to aquatic organisms based on a similar compound.

B. Aquatic Toxicity

Acute Studies

There are no acute fish or algal toxicity studies on potassium pyrophosphate. Data from phosphoric acid, potassium salt (2:3), dehydrate (CAS No. 6922-99-4) will be used as read-across to potassium pyrophosphate.

The 96-hour LC₅₀ of phosphoric acid, potassium salt (2:3), dehydrate (CAS No. 6922-99-4) to rainbow trout (*Oncorhynchus mykiss*) is >100 mg/L based on growth rate (ECHA). [Kl. score = 2]

The 48-hour EC₅₀ of potassium pyrophosphate to *Daphnia magna* is >100 mg/L (ECHA). [Kl. score = 1]

The 72-hour EC₅₀ of phosphoric acid, potassium salt (2:3), dehydrate (CAS No. 6922-99-4) to *Selenastrum capricornutum* is >100 mg/L based on growth rate (ECHA). [Kl. score = 2]

Chronic Studies

No studies are available.

C. Terrestrial Toxicity

No studies are available.

7 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (DEWHA, 2009; ECHA, 2008).

Potassium pyrophosphate is an inorganic salt that dissociates completely to potassium and pyrophosphate ions (and ultimately to phosphate ions) in aqueous solutions. Biodegradation is not applicable to these inorganic ions; both potassium and phosphate ions are also ubiquitous and are present in most water, soil and sediment. For the purposes of this PBT assessment, the persistent criteria are not considered applicable to this inorganic salt.

Potassium and phosphate ions are essential to all living organisms and their intracellular and extracellular concentrations are actively regulated. Therefore, potassium pyrophosphate is not expected to bioaccumulate.

There are no chronic aquatic toxicity data available on potassium pyrophosphate. The acute EC₅₀ values for potassium pyrophosphate are >1 mg/L in fish, invertebrates and algae. Therefore, potassium pyrophosphate does not meet the screening criteria for toxicity.

The overall conclusion is that potassium pyrophosphate is not a PBT substance.

B. Other Characteristics of Concern

No other characteristics of concern were identified for potassium pyrophosphate.

8 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment ¹	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required ³
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity ²	Chronic Toxicity ²	
Potassium Pyrophosphate	7320-34-5	Not a PBT	No	No	NA	No	No	No	1	1	1

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).

3 - Tier 1 - Hazard Assessment only.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

9 REFERENCES, ABBREVIATIONS AND ACRONYMS

A. References

Department of the Environment, Water, Heritage and the Arts [DEWHA]. (2009). Environmental risk assessment guidance manual for industrial chemicals, Department of the Environment, Water, Heritage and the Arts, Commonwealth of Australia.

ECHA. ECHA REACH database: <https://echa.europa.eu/information-on-chemicals/registered-substances>

European Chemicals Agency [ECHA]. (2008). Guidance on Information Requirements and Chemical Safety Assessment, Chapter R11: PBT Assessment, European Chemicals Agency, Helsinki, Finland.

Klimisch, H.J., Andreae, M., and Tillmann, U. (1997). A systematic approach for evaluating the quality of experimental and toxicological and ecotoxicological data. Regul. Toxicol. Pharmacol. 25:1-5.

Ganong, W.F. (1995). Review of Medical Physiology, 17th Edition, Appleton & Lange, Norwalk, Connecticut, USA.

B. Abbreviations and Acronyms

°C	degrees Celsius
AICS	Australian Inventory of Chemical Substances
COC	constituent of concern
DEWHA	Department of the Environment, Water, Heritage and the Arts
EC	effective concentration
ECHA	European Chemicals Agency
EU	European Union
g/L	grams per litre
IUPAC	International Union of Pure and Applied Chemistry
KI	Klimisch scoring system
kg/m ³	Kilogram per cubic metre
kPa	kilopascal
LC	lethal concentration
mg/L	milligrams per litre
PBT	Persistent, Bioaccumulative and Toxic
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SGG	Synthetic Greenhouse Gases