1,2-Benzisothiazolinone preservatives: Environment tier II assessment

16 June 2020

CAS Registry Numbers: 2634-33-5, 58249-25-5, 38521-29-8

Preface

This assessment was carried out by staff of the National Industrial Chemicals Notification and Assessment Scheme (NICNAS) using the Inventory Multi-tiered Assessment and Prioritisation (IMAP) framework.

The IMAP framework addresses the human health and environmental impacts of previously unassessed industrial chemicals listed on the Australian Inventory of Chemical Substances (the Inventory).

The framework was developed with significant input from stakeholders and provides a more rapid, flexible and transparent approach for the assessment of chemicals listed on the Inventory.

Stage One of the implementation of this framework, which lasted 4 years from 1 July 2012, examined 3000 chemicals meeting characteristics identified by stakeholders as needing priority assessment. This included chemicals for which NICNAS already held exposure information, chemicals identified as a concern or for which regulatory action had been taken overseas, and chemicals detected in international studies analysing chemicals present in babies' umbilical cord blood.

Stage Two of IMAP began in July 2016. We are continuing to assess chemicals on the Inventory, including chemicals identified as a concern for which action has been taken overseas and chemicals that can be rapidly identified and assessed by using Stage One information. We are also continuing to publish information for chemicals on the Inventory that pose a low risk to human health or the environment or both. This work provides efficiencies and enables us to identify higher risk chemicals requiring assessment.

The IMAP framework is a science and risk-based model designed to align the assessment effort with the human health and environmental impacts of chemicals. It has 3 tiers of assessment, with the assessment effort increasing with each tier. The Tier I assessment is a high throughput approach using tabulated electronic data. The Tier II assessment is an evaluation of risk on a substance-by-substance or chemical category-by-category basis. Tier III assessments are conducted to address specific concerns that could not be resolved during the Tier II assessment.

These assessments are carried out by staff employed by the Australian Government Department of Health and the Australian Government Department of the Environment and Energy. The human health and environment risk assessments are conducted and published separately, using information available at the time, and may be undertaken at different tiers.

This chemical or group of chemicals are being assessed at Tier II because the Tier I assessment indicated that it needed further investigation.

For more detail on this program please visit: www.nicnas.gov.au.

Disclaimer

Acronyms & Abbreviations

Grouping Rationale

This Tier II assessment considers the environmental risks associated with the industrial uses of 1,2-benzisothiazolinone (BIT) and two of its salts. Chemicals in this group are widely used as preservatives in consumer products, including personal care products and cosmetics. They also have widespread use as preservatives in chemical products used in the construction industry such as paints, sealants and resins.

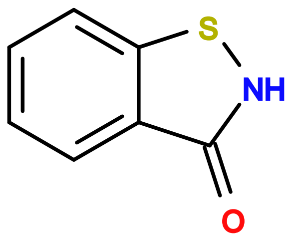
The known industrial uses for the chemicals in this group will lead to their release into the aquatic environment either in the treated effluents produced by sewage treatment plants (STPs) or through direct environmental release to soil and surface waters from rainwater runoff. This is of potential environmental concern because chemicals with preservative and biocidal properties are often very toxic to aquatic life. This assessment will evaluate the potential for emissions of BIT to the aquatic environment in Australia and whether risk reduction measures are required for industrial uses of the chemicals in this group.

BIT is a member of a larger group of preservatives and industrial biocides which all have an isothiazolinone heterocyclic ring system. The other members of this group that are listed on the Inventory are the two octylisothiazolinones, 2-octyl-3-isothiazolinone (OIT, CAS RN 26530-20-1) and 4,5-dichloro-2-octyl-3-isothiazolinone (DCOIT, CAS RN 64359-81-5), and two methylisothiazolinones, 2-methyl-3-isothiazolinone (MIT, CAS RN 2682-20-4) and 5-chloro-2-methyl-4-isothiazolinone (CMIT, CAS RN 26172-55-4). These other isothiazolinone preservatives and industrial biocides and their salts have been assessed separately under the IMAP Framework.

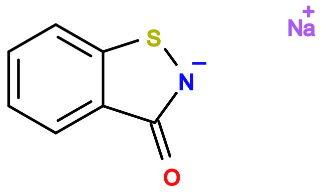
Chemical Identity

1,2-Benzisothiazolinone has a bicyclic structure wherein a benzene ring is fused with a five-membered heterocyclic ring which contains an *endo*-cyclic sulfur atom bonded to an *endo*-cyclic nitrogen atom. This group includes the neutral organic chemical, 1,2-benzisothiazolinone (BIT; CAS RN 2634-33-5), its sodium salt (NaBIT; CAS RN 58249-25-5) and an unspecified mixture of BIT and ethylenediamine (BITen; CAS RN 38521-29-8). The combination of BIT and ethylenediamine increases the stability of aqueous dispersions of BIT at concentrations above its water solubility (Premachandran, et al., 2012). Use of ethylenediamine for this purpose has largely been replaced in modern technical mixtures with alkanolamines, dipropylene glycol (CAS RN 25265-71-8) and other glycol based co-solvents for BIT (Baum and Bitterman, 2017, Premachandran, et al., 2012).

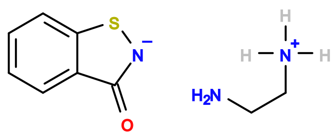
BIT is prepared by the cleavage of the disulfide bond of 2,2′-dithiobis-benzoyl chloride (CAS RN 19602-82-5) with chlorine gas to generate the thiochloride adduct, which is then cyclised by reaction with ammonia to form the final product (McClelland and Gait, 1926). This process generates a small amount of 5-chloro-1,2-benzisothiazolin-3(2*H*)-one (CAS RN 4337-43-3) which is an incidental impurity and has no identified industrial uses (SCCNFP, 2004).

CAS RN	2634-33-5
Chemical name	1,2-Benzisothiazol-3(2*H*)-one
Synonyms	1,2-benzisothiazolinone (BIT) proxel
Structural Formula	
Molecular Formula	C_7H_5NOS
Molecular Weight (g/mol)	151.19
SMILES	O=C1c2ccccc2SN1

CAS RN	58249-25-5
Chemical name	1,2-Benzisothiazol-3(2*H*)-one, sodium salt

Synonyms	1,2-benzisothiazolinone, sodium salt (NaBIT) promex
Structural Formula	
Molecular Formula	C_7H_4NNaOS
Molecular Weight (g/mol)	173.19
SMILES	[Na+].O=C1c2ccccc2S[N-]1

An idealised structural formula for BITen has been presented below which depicts this salt as a 1:1 mixture of the mono-anion produced by deprotonation of 1,2-benzisothiazolinone and the corresponding mono-protonated ethylenediammonium counter cation. However, according to the patent literature this salt is prepared with an excess of ethylenediamine and the stoichiometry of this chemical is typically undefined in technical mixtures (Greenwood, et al., 1970).

CAS RN	38521-29-8
Chemical name	1,2-Benzisothiazol-3(2*H*)-one, compound with 1,2-ethanediamine
Synonyms	1,2-benzisothiazolinone ethylenediamine salt (BITen) proxel CRL
Representative Structural Formula	
Molecular Formula	$C_7H_4NOS.C_2H_9N_2$

SMILES	O=C1c2ccccc2S[N-]1.NCC[N+H3]

Physical and Chemical Properties

The measured physical and chemical property data for BIT were retrieved from the European Commission's Scientific Committee on cosmetic products and non-food products opinion concerning benzisothiazolone (SCCNFP, 2004):

Physical Form	solid
Melting Point	157–158°C
Boiling Point	327°C
Vapour Pressure	0.00037 Pa
Water Solubility	938 mg/L (pH 4.8 and 20°C) 1288 mg/L (pH 6.7 and 20°C) 1651 mg/L (pH 9.1 and 20°C)
Ionisable in the Environment?	yes
log K_{ow}	0.70 (pH 7 and 20°C)

BIT is a weak organic acid. It has an acid-dissociation constant (pK_a) of 7.3 (SCCNFP, 2004). This indicates that the chemical will exist in both protonated (neutral) and deprotonated (anionic) forms in environmental surface waters where the pH is typically in the range 4 to 9. The chemical is readily soluble in water and its solubility increases as the pH increases.

The low measured octanol-water partition coefficient (log K_{ow}) at neutral pH indicates that BIT has a low tendency to partition from water into octanol and is not lipophilic. The partitioning properties of the chemical are pH dependent and the log K_{ow} value ranges from 0.99 at pH 5 (where the chemical is predominantly in its neutral form) to -0.90 at pH 9 (where the chemical is predominantly in its anionic form) (SCCNFP, 2004).

Import, Manufacture and Use

Australia

BIT is used as a preservative to inhibit microbial growth in consumer products (NICNAS, 2019a). It is often used in combination with other isothiazolinone preservatives as it has a gap in its antimicrobial effectiveness against the *Pseudomonas* genus of bacteria (Uhr, et al., 2013). It has reported domestic uses in automotive aftermarket products including car wash soaps, boat wash soaps, polishes, waxes, rubbing compounds and sealants (NICNAS, 2019a). BIT is also used as an in-can preservative for architectural and automotive paints, and resins (NICNAS, 2019a).

BIT is used in domestic coal seam gas (CSG) applications (Commonwealth of Australia, 2014). The environmental risks associated with this use were considered in the national assessment of chemicals associated with coal seam gas extraction in Australia (Commonwealth of Australia, 2018).

No specific Australian use, import, or manufacturing information has been identified for NaBIT and BITen.

International

BIT is used as a preservative in many consumer products, including personal care products, perfumes, fragrances, and disinfectants (REACH, 2019). BIT and NaBIT are also used as in-can preservatives in products such as cutting fluids, adhesives, surface treatments, fillers, corrosion inhibitors, colouring agents, fillers, absorbents, surface active agents and lubricants (Nordic Council of Ministers, 2016). BIT has also been reported to be used as a preservative in tattoo inks (NICNAS, 2019a).

BIT is used to prevent microbial growth in concrete additives (THOR, 2019). It is also used as a preservative in water-based process liquids such as textile solutions and coatings in paper production (Dow, 2012).

BIT is listed on the US EPA and OECD High Production Volume (HPV) chemical lists indicating production of over 454 tonnes per year (US) or 1000 tonnes per year (OECD) (OECD, 2009, US EPA, 2013). BIT is manufactured in or imported into the European Economic Area in volumes between 100–1000 tonnes per year (REACH, 2019).

Environmental Regulatory Status

Australia

The use of the chemicals in this group is not subject to any specific national environmental regulations.

United Nations

No chemicals in this group are currently identified as a Persistent Organic Pollutant (UNEP, 2001), an ozone depleting substance (UNEP, 1987), or a hazardous substance for the purpose of international trade (UNEP & FAO, 1998).

OECD

BIT has been identified as a high production volume chemical by the OECD, which indicates that more than 1000 tonnes of the chemical are produced annually in at least one member country (OECD, 2009).

No chemicals in this group have been sponsored for assessment under the Cooperative Chemicals Assessment Programme (OECD, 2017).

Canada

BIT, NaBIT and BITen are listed on the Canadian Domestic Substances List (DSL) as existing substances already in commerce in Canada (Environment and Climate Change Canada, 2018).

European Union

BIT is registered under the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) legislation (ECHA, 2019b). NaBIT and BITen are pre-registered under REACH (ECHA, 2019a).

BIT is approved for use under the EU Biocidal Products Regulation (BPR) (ECHA, 2018). The regulation authorises the manufacture and use of biocidal and preservative chemicals on the European market, with the aim of high level consumer and environmental protection. BIT is under review for use in the following product types: PT02: disinfectants and algaecides not intended for direct application to humans or animals; PT6: in-can preservatives; PT09: fibre, leather, rubber and polymerised materials preservatives; PT10: construction material preservatives; PT11: preservatives in liquid cooling and processing systems; PT12: slimicides; and PT13: metal working fluids. NaBIT and BITen are not registered under the BPR.

BIT is listed on the European Commission’s Cosmetic Ingredient database (CosIng) as an antimicrobial ingredient in cosmetics (European Commission, 2017).

United States of America

BIT is listed on the United States Environmental Protection Agency (US EPA) Chemical Substance Inventory, established under the Toxic Substances Control Act 1976. It is registered as ‘active’ on the Chemical Substance Inventory, which indicates that it has recently been manufactured, imported or processed by industry in the USA (US EPA, 2018a). BIT is also listed on the US EPA Safer Chemical Ingredients List (US EPA, 2018b). This list identifies chemicals deemed to be safer alternatives to other chemicals employed for the same functional use. The criteria for adding chemicals to the list cover a broad range of human health and environmental toxicological effects.

NaBIT and BITen are not listed on the TSCA chemical substance inventory.

Environmental Exposure

BIT is a synthetic chemical and its occurrence in the environment results exclusively from human activity. Emissions can occur from point sources such as STPs and from diffuse sources. The diffuse sources include external hard surfaces of buildings that were coated with paints that contain BIT as a preservative. This water soluble preservative can be released from coated surfaces as a result of leaching by rainwater.

BIT used as a preservative in consumer products such as personal care and cosmetic products will be released down the drain to sewers in domestic wastewater as a normal part of this use pattern. Treatment of this wastewater in sewage treatment plants will remove some fraction of the quantity of the chemical in influent, depending on the efficiency of various degradation and partitioning processes. Analysis of the concentration of BIT in wastewater influent and effluent at ten STPs in China indicate an average of 85% removal of BIT from wastewater (Liu, et al., 2017). Emission of BIT to surface waters in STP effluent may, therefore, occur in Australia.

BIT will slowly leach from painted surfaces and some surface treated construction materials exposed to the weather through the action of rainfall (Bollmann, et al., 2014). The surface run-off containing this chemical can be discharged directly onto soil or indirectly into surface waters through the discharge of stormwater from drainage systems. Emissions from these sources may contribute to cumulative diffuse emissions of BIT into the environment.

There is some potential for release of BIT to STPs from the use of water-based paints. Chemicals in this group are used to protect paints from microbial degradation when they are stored in the can and may be present in concentrations up to 400 parts per million (ppm) in paint (Schwensen, et al., 2014). In Australia, the current industry practice is to label paint products with guidance on environmentally responsible disposal. Solid paint material can be disposed to landfill and liquid paints can be recycled through various council or industry run recycling schemes such as Paintback (Paintback, 2017).

The exposure assessment of BIT conducted for this assessment includes the contribution from the use of the sodium salt (NaBIT) and the mixture of BIT with ethylenediamine (BITen). The environmental emissions of ethylenediamine (CAS RN 107-15-3) that may result from the use of BITen have not been considered in this assessment because this chemical has been separately assessed at Tier I level under the IMAP framework (NICNAS, 2019b). This chemical is rapidly degraded in the environment and has low ecotoxicity. Emissions of ethylenediamine to the environment through sewage treatment systems are currently considered to be of low concern.

Environmental Fate

Partitioning

BIT is expected to partition primarily to the water compartment when released into the environment.

BIT is present as both the neutral and charged species within the pH range of environmental surface waters. The proportion of the charged species will increase with increasing pH. Both neutral and charged species are readily soluble in water which is expected to dominate the partitioning of this chemical in the aquatic environment.

The calculated Henry's Law constant for the partitioning of the neutral form of BIT between air and water is 0.00071 Pa-m^3/mol (US EPA, 2008). This low value indicates that BIT is only very slightly volatile from water and moist soil. The calculated organic carbon normalised soil adsorption coefficient (K_{oc}) for BIT is low (log K_{oc} = 1.53) (US EPA, 2008). This low K_{oc} value indicates that it will have very high mobility in soil, assuming that there are no specific interactions between the chemical and soil.

Degradation

BIT is biodegradable at expected environmental exposure concentrations.

Biodegradation studies on BIT have been hindered by its toxicity to bacteria. Tests conducted on BIT with OECD Test Guideline (TG) 301C for ready biodegradability at a test concentration of 100 mg/L showed 0% degradation of the chemical after 28 days (NITE, 2017). This concentration is significantly higher than the median effective concentration endpoint for respiration inhibition of bacteria by BIT (REACH, 2019) and is far above the expected environmental concentration.

The apparent non-degradability of this biocide in standard biodegradability screening tests is a result of its toxicity to microbes in activated sludge innocula. When the tests are conducted at lower exposure concentrations the chemical is biodegraded. A CO_2 evolution test (OECD TG 301B) on BIT at test concentrations of 1.8 mg/L showed 62% degradation after 83 days (REACH, 2019). The rate of biodegradation in these tests demonstrate inherent biodegradability.

Degradation studies on BIT in soil showed rapid primary biodegradation. Monitoring of the lifetime of BIT in soil showed that the primary degradation half-life is 12.5 h at a test concentration of 2 micrograms (μg) of BIT per gram of soil (Bollmann, et al., 2017).

BIT is hydrolytically stable based on hydrolysis measurements indicating a half-life greater than 30 days (HSDB, 2015). Although BIT is stable towards hydrolysis, it can react with a range of naturally occurring nucleophilic chemicals such as thiols and other chemicals with a reduced sulfur functional group which are likely to have a significant presence in natural waters and sewage treatment systems (Collier, et al., 1990).

Bioaccumulation

BIT is not expected to bioaccumulate.

Studies of the bioconcentration of BIT in bluegill sunfish (*Lepomis macrochirus*) at an exposure concentration of 0.1 mg/L showed bioconcentration factors (BCF) in this species of 6.62 L/kg (REACH, 2019). This BCF value is lower than the domestic categorisation criterion for bioaccumulation (BCF ≥ 2000 L/kg). The octanol-water partition coefficient for this hydrophilic chemical is also lower than the domestic categorisation threshold for bioaccumulation hazards in aquatic organisms (log K_{ow} ≥ 4.2).

The low bioconcentration potential, hydrophilicity, and the reactivity of this chemical with biomolecules indicate that it will not biomagnify in aquatic or terrestrial food webs.

Transport

BIT is not expected to undergo long range transport based on its short-half life in the environment.

Predicted Environmental Concentration (PEC)

No Australian environmental monitoring data were identified for BIT. The estimated PEC for BIT in surface waters is 21 nanograms per litre (ng/L).

The exposure scenario considered in this assessment involves emissions of BIT to surface water in treated STP effluent. International monitoring studies indicate that the removal of BIT from wastewater in STPs is highly effective (Liu, et al., 2017, Raforth, et al., 2007). In a study conducted in Germany, BIT was not detected above the 21 ng/L limit of detection in STP effluent despite comparatively high measured influent concentrations of 1700–3200 ng/L (Raforth, et al., 2007). In a study of STPs in China, the highest concentration of BIT in influent was 611 ng/L while the maximum effluent concentration was 11.7 ng/L (Liu, et al., 2017).

In the absence of domestic monitoring information, the limit of detection for BIT in STP effluent from the study conducted in Germany (21 ng/L) has been taken to provide a conservative upper estimate of the maximum concentration of BIT in effluent from STPs in Australia.

A study of BIT concentrations in urban rainwater runoff in Denmark found BIT in the range between 50–120 ng/L in runoff collected from an urban stormwater catchment (Bollmann, et al., 2014). These measurements are not considered to be reliable predictors of the environmental concentrations of BIT in surface water run-off from urban areas in Australia. However, they do demonstrate that leaching of BIT does occur from hard surfaces in urban areas and that this is a possible diffuse source of low level emissions of these biocides to surface waters.

Environmental Effects

Effects on Aquatic Life

BIT is toxic at low concentrations to aquatic organisms from multiple trophic levels.

Acute toxicity

The following measured median lethal concentration (LC50) and median effective concentrations (EC50) for the effects of BIT on fish and invertebrates were retrieved from the US EPA Pesticide Ecotoxicity Database (US EPA, 1992). The protocols used to measure these endpoint values follow the guidelines of the US EPA Office of Chemical Safety and Pollution Prevention (OCSPP). The algal and bacterial toxicity endpoint values were retrieved from the REACH registration dossier for BIT (REACH, 2019):

Taxon	Endpoint	Method
Fish	96 h LC50 = 0.167 mg/L	Experimental *Oncorhynchus mykiss* US EPA OCSPP 850.1075

Taxon	Endpoint	Method
Invertebrates	48 h EC50 = 0.097 mg/L	Experimental *Daphnia magna* US EPA OCSPP 850.1010
Algae	72 h EC50 = 0.11 mg/L	Experimental *Selenastrum capricornutum* OECD TG 201
Bacteria	3 h EC50 = 13.0 mg/L	Experimental Activated sludge respiration inhibition OECD TG 209

BIT has a specific mode of toxicity due to its electrophilic sulfur atom. The isothiazolinone moiety undergoes a ring opening reaction at the electrophilic sulfur atom with a range of biological sulfur-containing nucleophiles (Alvarez-Sanchez, et al., 2003, Collier, et al., 1990, Fullers, et al., 1985). The chemical diffuses across cellular membranes where it reacts with nucleophilic thiol-containing proteins or thiol-containing biomolecules like glutathione. Reaction with proteins inhibits the enzymes critical to respiration which slows or stops cellular growth (Williams, 2007).

Chronic toxicity

The following no-observed-effect concentration (NOEC) value for the effects of BIT on algae was taken from the REACH registration dossier for this chemical (REACH, 2019):

Taxon	Endpoint	Method
Algae	72 h NOEC = 0.04 mg/L	Experimental *Selenastrum capricornutum* OECD TG 201

Effects on Terrestrial Life

BIT is slightly toxic to soil dwelling invertebrates and plants.

An OECD TG 207 test on the effects of BIT on the earthworm *Eisenia fetida* gave a 14 d LC50 of 410.6 milligrams per kilogram dry weight (mg/kg dw) (REACH, 2019) and a no-observable effect concentration (NOEC) based on mortality of 234.5 mg/kg dw. An OECD TG 208 test on cabbage (*Brassica oleracea var. capitata*) showed inhibition of plant growth by BIT at an EC50 of 200 mg/kg dw with a NOEC of 30 mg/kg dw (REACH, 2019).

Predicted No-Effect Concentration (PNEC)

The PNEC for BIT is 0.4 micrograms per litre (µg/L).

The algal 72 h NOEC value of 0.04 mg/L for BIT was used to derive the PNEC for this chemical. An assessment factor of 100 was used as there are incomplete chronic aquatic toxicity data available to fully characterise the toxic hazard of this chemical.

Categorisation of Environmental Hazard

The categorisation of the environmental hazards of 1,2-benzisothiazol-3(2*H*)-one; 1,2-benzisothiazol-3(2*H*)-one, sodium salt; and 1,2-benzisothiazol-3(2*H*)-one, compound with 1,2-ethanediamine according to domestic environmental hazard thresholds is presented below (NICNAS, 2017):

Persistence

Not Persistent (Not P). Based on the rates of abiotic and biotic degradation of BIT at environmentally relevant exposure concentrations, the chemicals in this group are categorised as Not Persistent.

Bioaccumulation

Not Bioaccumulative (Not B). Based on the low measured bioconcentration factors for BIT in fish all of the chemicals in this group are categorised as Not Bioaccumulative.

Toxicity

Toxic (T). BIT has high acute toxicity to aquatic species from multiple trophic levels and all chemicals in this group are categorised as Toxic.

Summary

1,2-Benzisothiazol-3(2*H*)-one; 1,2-benzisothiazol-3(2*H*)-one, sodium salt; and 1,2-benzisothiazol-3(2*H*)-one, compound with 1,2-ethanediamine are categorised as:

- Not P
- Not B
- T

Risk Characterisation

Based on the PEC and PNEC values determined above, the following Risk Quotient (RQ = PEC ÷ PNEC) has been calculated for release of BIT into the riverine compartment:

PEC (µg/L)	PNEC (µg/L)	RQ
0.021	0.4	0.053

An RQ value less than 1 indicates that the environmental concentrations of BIT are unlikely to exceed levels which cause ecotoxic effects in exposed organisms. BIT is, therefore, unlikely to be present in the aquatic environment at concentrations that are of concern.

The emission of BIT from painted surfaces to stormwater is of potential concern for the aquatic environment. Emissions from this source are not mitigated by the biodegradation processes of STPs prior to release to natural waters. However, the potential impacts of emissions from this exposure pathway are reduced by a combination of the intermittent nature of the release and the dilution and the abiotic and biotic degradation of the chemical as it moves through the stormwater system. The highest measured concentration of BIT in urban rainwater run-off is lower than the calculated PNEC for this chemical, which indicates a generally low risk to the aquatic environment from this exposure pathway.

Key Findings

The chemicals in this group are used as preservatives in consumer and industrial products. They are degradable, have low bioaccumulation potential, and high acute aquatic toxicity.

The main source of environmental emissions of BIT in Australia are expected to be through release of the chemical in the treated effluents from STPs. BIT is effectively removed from wastewater by biodegradation processes in sewage treatment plants and the concentrations of this chemical likely to be present in surface waters in Australia are not expected to pose a significant risk to the environment. Minor environmental emissions of BIT may also occur as a result of the leaching of this chemical from the hard surfaces of buildings and other structures. This emission pathway is not considered to be of environmental concern based on the currently available information.

The chemicals in this group are not PBT substances according to domestic environmental hazard criteria.

Recommendations

No further assessment of this chemical under the IMAP framework is currently required.

Environmental Hazard Classification

In addition to the categorisation of environmental hazards according to domestic environmental thresholds presented above, the classification of the environmental hazards of 1,2-benzisothiazol-3(2*H*)-one (BIT); 1,2-benzisothiazol-3(2*H*)-one, sodium salt (NaBIT); and 1,2-benzisothiazol-3(2*H*)-one, compound with 1,2-ethanediamine (BITen) according to the third edition of the United Nations' Globally Harmonised System of Classification and Labelling of Chemicals (GHS) is presented below (UNECE, 2009):

Hazard	GHS Classification (Code)	Hazard Statement
Acute Aquatic	Category 1 (H400)	Very toxic to aquatic life
Chronic Aquatic	Category 1 (H410)	Very toxic to aquatic life with long lasting effects

The classification of the aquatic hazards of the chemicals in this group was performed based on the acute toxicity data presented in this assessment. The long term aquatic hazards were classified based on the chronic aquatic toxicity data taking into account the inherent degradability of the chemicals in aquatic ecosystems.

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