File No: STD/1406

December 2011

NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME (NICNAS)

PUBLIC REPORT

T-1063FM

This Assessment has been compiled in accordance with the provisions of the *Industrial Chemicals (Notification and Assessment) Act 1989* (Cwlth) (the Act) and Regulations. This legislation is an Act of the Commonwealth of Australia. The National Industrial Chemicals Notification and Assessment Scheme (NICNAS) is administered by the Department of Health and Ageing, and conducts the risk assessment for public health and occupational health and safety. The assessment of environmental risk is conducted by the Department of Sustainability, Environment, Water, Population and Communities.

For the purposes of subsection 78(1) of the Act, this Public Report may be inspected at our NICNAS office by appointment only at Level 7, 260 Elizabeth Street, Surry Hills NSW 2010.

This Public Report is also available for viewing and downloading from the NICNAS website or available on request, free of charge, by contacting NICNAS. For requests and enquiries please contact the NICNAS Administration Coordinator at:

Street Address:	Level 7, 260 Elizabeth Street, SURRY HILLS NSW 2010, AUSTRALIA.
Postal Address:	GPO Box 58, SYDNEY NSW 2001, AUSTRALIA.
TEL:	+ 61 2 8577 8800
FAX	+ 61 2 8577 8888
Website:	www.nicnas.gov.au

Director
NICNAS

TABLE OF CONTENTS

SUMMARY

The following details will be published in the NICNAS *Chemical Gazette:*

ASSESSMENT REFERENCE	APPLICANT(S)	CHEMICAL OR TRADE NAME	HAZARDOUS SUBSTANCE	INTRODUCTION VOLUME	USE
STD/1406	Marubeni Australia Ltd	T-1063FM	Yes	≤120 tonnes per annum	Flame retardant in polymeric resins

CONCLUSIONS AND REGULATORY OBLIGATIONS

Hazard classification
Based on the available data the notified chemical is classified as hazardous according to the *Approved Criteria for Classifying Hazardous Substances* [NOHSC:1008(2004)]. The classification and labelling details are:

R36 Irritating to eyes

and

The classification of the notified chemical using the Globally Harmonised System for the Classification and Labelling of Chemicals (GHS) (United Nations 2009) is presented below. This system is not mandated in Australia and carries no legal status but is presented for information purposes.

	Hazard category	*Hazard statement*
Eye irritation	Category 2A	Irritating to eyes
Aquatic Environment	Acute Category 3	Harmful to aquatic life
	Chronic Category 3	Harmful to aquatic life with long lasting effects

Human health risk assessment
Under the conditions of the occupational settings described, the notified chemical is not considered to pose an unreasonable risk to the health of workers.

When used in the proposed manner, the notified chemical is not considered to pose an unreasonable risk to public health.

Environmental risk assessment
On the basis of limited aquatic exposure and the assessed use pattern, the notified chemical is not considered to pose an unreasonable risk to the environment.

Recommendations

REGULATORY CONTROLS
Hazard Classification and Labelling

- Safe Work Australia, should consider the following health hazard classification for the notified chemical:
  - Xi R36 Irritating to eyes
- Use the following risk phrases for products/mixtures containing the notified chemical:

- ≥20%: Xi R36 Irritating to eyes

CONTROL MEASURES
Occupational Health and Safety

- Employers should implement the following engineering controls to minimise occupational exposure to the notified chemical as introduced:
  - Local exhaust ventilation during reformulation

- Employers should implement the following safe work practices to minimise occupational exposure during handling of the notified chemical as introduced:
  - Avoid contact with eyes
  - Do not inhale dust

- Employers should ensure that the following personal protective equipment is used by workers to minimise occupational exposure to the notified chemical as introduced in powdered form:
  - Eye protection
  - Appropriately fitted respiratory protection
  - Coveralls
  - Gloves

  Guidance in selection of personal protective equipment can be obtained from Australian, Australian/New Zealand or other approved standards.

- A copy of the MSDS should be easily accessible to employees.

If products and mixtures containing the notified chemical are classified as hazardous to health in accordance with the *Approved Criteria for Classifying Hazardous Substances* [NOHSC:1008(2004)] workplace practices and control procedures consistent with provisions of State and Territory hazardous substances legislation must be in operation.

Disposal

- The notified chemical should be disposed of to landfill.

Emergency procedures

- Spills or accidental release of the notified chemical should be handled by physical containment, collection and subsequent safe disposal.

Regulatory Obligations

Secondary Notification
This risk assessment is based on the information available at the time of notification. The Director may call for the reassessment of the chemical under secondary notification provisions based on changes in certain circumstances. Under Section 64 of the *Industrial Chemicals (Notification and Assessment) Act (1989)* the notifier, as well as any other importer or manufacturer of the notified chemical, have post-assessment regulatory obligations to notify NICNAS when any of these circumstances change. These obligations apply even when the notified chemical/polymer is listed on the Australian Inventory of Chemical Substances (AICS).

Therefore, the Director of NICNAS must be notified in writing within 28 days by the notifier, other importer or manufacturer:

(1) Under Section 64(2) of the Act; if
  - the function or use of the chemical has changed from a flame retardant in polymeric resins, or is likely to change significantly;

- the amount of chemical being introduced has increased from 120 tonnes per annum, or is likely to increase, significantly;
- the chemical has begun to be manufactured in Australia;
- additional information has become available to the person as to an adverse effect of the chemical on occupational health and safety, public health, or the environment.

The Director will then decide whether a reassessment (i.e. a secondary notification and assessment) is required.

No additional secondary notification conditions are stipulated.

Material Safety Data Sheet
The MSDS of the product containing the notified chemical provided by the notifier was reviewed by NICNAS. The accuracy of the information on the MSDS remains the responsibility of the applicant.

ASSESSMENT DETAILS

1. APPLICANT AND NOTIFICATION DETAILS

APPLICANT(S)
Marubeni Australia Ltd (ABN 53 000 329 699)
Level 19, 367 Collins Street
Melbourne VIC 3000

NOTIFICATION CATEGORY
Standard: Chemical other than polymer (more than 1 tonne per year).

EXEMPT INFORMATION (SECTION 75 OF THE ACT)
Data items and details claimed exempt from publication: chemical name, other names, CAS number, molecular formula, structural formula, molecular weight, spectral data, purity, residual impurities, import volume, and site of reformulation.

VARIATION OF DATA REQUIREMENTS (SECTION 24 OF THE ACT)
Variation to the schedule of data requirements is claimed as follows: Acute inhalation toxicity, melting point, boiling point, flash point, and chronic toxicity to aquatic invertebrates.

PREVIOUS NOTIFICATION IN AUSTRALIA BY APPLICANT(S)
None

NOTIFICATION IN OTHER COUNTRIES
EU (2004), USA (2003), Canada (2005), Korea (2009) and Philippines (2008)

2. IDENTITY OF CHEMICAL

MARKETING NAME(S)
T-1063FM (notified chemical)
ADK STAB FP-2200 (powder preparation containing the notified chemical at 50-60% concentration)
ADK STAB FP-2100J (powder preparation containing the notified chemical at 55-65% concentration)

MOLECULAR WEIGHT
<500 Da

ANALYTICAL DATA
Reference NMR, IR, HPLC, GC, GPC, UV spectra were provided.

3. COMPOSITION

DEGREE OF PURITY >90%

HAZARDOUS IMPURITIES/RESIDUAL MONOMERS None

ADDITIVES/ADJUVANTS None

4. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE AT 20 °C AND 101.3 kPa: White powder

Property	Value	Data Source/Justification
Melting Point	Decomposed from ~290ºC	Measured
Boiling Point	Decomposed at 95ºC (distillation temperature)	Measured
Density	1735 kg/m^3 at 23ºC	Measured
Vapour Pressure	<6 x 10^{-6} kPa at 25ºC	Measured
Surface Tension	72.7 mN/m at 20°C	Measured
Water Solubility	12.24 g/L at 20ºC	Measured
Hydrolysis as a Function of pH	$t_{½}$ >1 year at 25 ºC, pH 4-9 (organic component)	Measured. The notified chemical is a salt with inorganic and organic components. The inorganic component contains hydrolysable functionality but the rate of hydrolysis under environmental conditions was not determined.
Partition Coefficient (n-octanol/water)	Not determined	The notified chemical is highly dissociated and cannot be converted to the non-ionised form required for the test. However, it is expected to have a low partition coefficient due to its high water solubility and low fat solubility.
Adsorption/Desorption	log K_{oc} = 3.1 at 25°C, pH 5.5 (organic component)	Measured. The adsorption coefficient was not determined for the inorganic component due to limitations of the analytical method, but it is expected to be relatively immobile in soil and sediment.
Dissociation Constant	pKa_1 = 5.5 (organic component) pKa_2 = 9.8 (organic component) pKa_1 = 1.52 (inorganic component) pKa_2 = 2.36 (inorganic component) pKa_3 = 6.75 (inorganic component) pKa_4 = 9.29 (inorganic component)	Measured. Only the pKa of the organic component could be determined due to the complexity of the test substance and limitations of the test methods. Literature values are reported for the inorganic component.
Primary Particle Size	Inhalable fraction (<100 μm): 100% Respirable fraction (<10 μm): ~70%	Measured after ultrasonic treatment to break down agglomerates.
Flash Point	Not determined	The notified chemical is a solid.
Flammability (Solid)	Not a flammable solid	Measured
Autoignition Temperature	>400ºC	Measured
Explosive Properties	Not explosive	Measured
Oxidizing Properties	Not an oxidant	Measured
Fat Solubility	<0.151 mg/100 g fat simulant HB 307 at 37°C	Measured

DISCUSSION OF PROPERTIES
For full details of tests on physical and chemical properties, refer to Appendix A.

Reactivity
The notified chemical contains no metals or metalloids and it is not expected to react on contact with water. Also, the notified chemical is non-oxidising and the chemical structure gives no indication of pyrophoric properties.

Dangerous Goods classification
Based on the submitted physical-chemical data in the above table, the notified chemical is not classified according to the Australian Dangerous Goods Code (NTC, 2007). However, the data above do not address all Dangerous Goods endpoints. Therefore, consideration of all endpoints should be undertaken before a final decision on the Dangerous Goods classification is made by the introducer of the chemical.

5. INTRODUCTION AND USE INFORMATION

MODE OF INTRODUCTION OF NOTIFIED CHEMICAL (100%) OVER NEXT 5 YEARS
The notified chemical will be imported as a component (50-65%) of a powder preparation.

MAXIMUM INTRODUCTION VOLUME OF NOTIFIED CHEMICAL (100%) OVER NEXT 5 YEARS

Year	*1*	*2*	*3*	*4*	*5*
Tonnes	<10	<30	<50	<100	<120

PORT OF ENTRY
Sydney and Melbourne

TRANSPORTATION AND PACKAGING
The notified chemical will be imported by sea in sealed aluminium bags on pallets. It will be transported from the port by road directly to the notifier's warehouse, where it will be dispatched to the downstream user (polymer compounds formulation site).

USE
The main use of the notified chemical will be as a flame retardant in polymeric resins to make various plastic articles such as electric appliances and electric cables. It is possible that the notified chemical may also be used in making building materials and stadium chairs.

OPERATION DESCRIPTION
During reformulation, the powder preparation containing the notified chemical (50-65%) will be manually weighed and added to a mixing vessel, along with other ingredients such as plastic powder, fillers, colour pigments and other additives. The mixture containing the notified chemical at <21% will then be transferred to a closed system preheated extruder, to produce plastic pellets. The plastic pellets, containing the notified chemical at <21%, will be automatically weighed and packed into plastic bags or bulk bags for delivery to customer sites.

At the customer sites, it is expected that the plastic pellets will be fed into the hopper of an injection moulding machine, in many cases manually. The plastic pellets containing the notified chemical at <21% will be heated in a cylinder, which is a closed system, and no vapours are expected to be released into the environment.

The heated polymer melt containing the notified chemical will be injected into a mould to form the shape of the required plastic article, containing the notified chemical at <21% concentration. Although this process is a closed system, the injection of plastic into mould will be an open system temporarily and negligible vapours are expected to be released. Local exhaust ventilation will be in place during moulding operations.

6. HUMAN HEALTH IMPLICATIONS

6.1. Exposure Assessment

6.1.1. Occupational Exposure

NUMBER AND CATEGORY OF WORKERS

Category of Worker	*Number*	*Exposure Duration (hours/day)*	*Exposure Frequency (days/year)*
Transport	1-2	<8	5-10
Warehouse	1-3	1	10-20
Material handling	1-2	1	60-100
Mixing	1-2	1-2	60-100
Cleaning of mixer, hopper, floor	1-2	1-2	60-100
Extruder operation	1-2	3-5	60-100
Quality Control Testing	1-2	1-2	60-100
Maintenance of extruder	1-2	1	12
Finished article moulding	2-5	6-8	60-100
Maintenance of moulding machinery	1-2	1	12

EXPOSURE DETAILS

Transport and warehousing

Worker exposure to the notified chemical during the importation, transport and storage is not expected, except in the unlikely event of an accident where the packaging may be breached.

Reformulation/Pellets formulation

At the reformulation sites where the powder preparation containing the notified chemical (50-65%) will be converted to pellets, the main potential for exposure to the notified chemical via dermal, ocular or inhalation routes will be during manual weighing of the powder preparation and its transfer into the mixing vessel. The notifier has indicated that the powder preparation containing the notified chemical (50-65%) will be weighed in a dedicated additive preparation room, equipped with a dust extraction system that is isolated from the rest of the factory. In addition, the operator performing this task will be required to wear comprehensive personal protective equipment (PPE) including particle-filter mask, safety glasses, gloves and protective clothing.

Due to the high potential for dermal and inhalation exposure to the notified chemical in powder form during manual weighing and transfer tasks, these exposures were modelled. The Estimation and Assessment of Exposure (EASE) exposure model from the European Chemicals Bureau (ECB) *Technical Guidance Document on Risk Assessment* (ECB 2003) estimated dermal exposure as 'very low', based on the following assumptions:

- Temperature: 25°C
- Physical state: Solid
- Dust inhalation: No
- Mobile solid: No
- Solid vapour pressure: No
- Exposure type: Dermal
- Use pattern: Non-dispersive use
- Pattern of control: Not direct handling

The above estimates do not assume PPE for the user. The notifier has indicated that coveralls and gloves will be worn during reformulation processes. Therefore, based on the estimated 'very low' dermal exposure, and the required PPE, dermal exposure to the notified chemical is expected to be minimal.

Inhalation exposure is considered to be likely, resulting from inhalation of particulates during manual weighing and transfer processes. The EMKG-EXPO-TOOL (REACH 2009) was used to estimate an inhalation exposure range of 0.1-1 mg/m^3 based on the following assumptions:

- Definition of dustiness: High (fine powders)
- Scale of use: Medium (1 to 1000 kg)
- Control Strategies: Engineering control (local exhaust ventilation)
- Short term exposure: No (i.e., >15 minutes per day is likely)

The maximum estimated exposure concentration of 1 mg/m^3 powder preparation containing the notified chemical at 50-65% is then used to determine a typical daily systemic inhalation exposure for workers, based on the following assumptions:

- Inhalation absorption: 100% (default)
- Average Australian male bodyweight: 80 kg (ABS 2005)

- Respiration rate: 1.3 mg/m^3
- Duration of exposure: 1 hour/day (material handling – notifier's information)
- Concentration of notified chemical: 65% (maximum)

Systemic dose = (concentration powder × respiration rate × duration × concentration chemical) / bodyweight
= (1 mg/mg^3 × 1.3 mg/m^3/hour × 1 hour/day × 100% absorption × 65%) / 80 kg bw
= 0.0106 mg/kg bw/day

As the mixing vessel will be sealed during the mixing operation, exposure during this process is expected to be minimal. Similarly, the extruder feeding system will be sealed and equipped with dust extraction, thereby limiting any exposure during transfer of the mixture containing the notified chemical at <21% from the mixing vessel to the preheated extruder. During extrusion operations, exposure is not expected as this process takes place in a closed system equipped with both dust and fume extraction. Once the notified chemical has passed through the extruder, it will be encapsulated in a plastic resin and therefore, the potential for exposure will be significantly reduced. As the plastic pellets containing the notified chemical at <21% will be automatically weighed and packed into plastic bags or bulk bags, exposure during packaging is also expected to be limited.

Manufacture of plastic articles, cleaning, maintenance and quality testing
During moulding operation, exposure is also possible as plastic pellets containing the notified chemical (<21%) are being fed into the hopper of an injection moulding machine manually. Although the actual moulding operation will be a closed system, the injection of heated plastic material into the mould will be an open system. Limited exposure is expected during the moulding process, for the following reasons the notified chemical is not considered to be bioavailable in the plastic pellets, the plastic pellets containing the notified chemical (<21%) are heated in a (closed system), no vapours are expected to be released, and local exhaust ventilation, protective glasses and protective gloves will be used.

Exposure to the notified chemical could also occur to a lesser degree during cleaning, maintenance and quality control testing. PPE such as safety glasses, gloves, dust masks and coveralls will be used by operators involved in these activities to minimize any expected exposure.

Workers could also be dermally exposed when touching finished articles containing the notified chemical at <21%. As the notified chemical will be trapped within the polymer matrix and no release of the notified chemical from finished articles is expected, exposure in this case is unlikely.

Overall, considering the use of engineering controls and PPE, exposure of workers to the notified chemical is expected to be low.

6.1.2. Public Exposure
As the powder preparation and plastic pellets containing the notified chemical (50-65% and <21%, respectively) will only be available to industrial end users, direct public exposure to the notified chemical is not expected. However, the public may come into contact with the finished articles containing the notified chemical at <21%. Public exposure, in this case, is unlikely as the notified chemical will be trapped within the polymer matrix, and no release of the notified chemical from finished articles is expected.

6.2. Human Health Effects Assessment

The results from toxicological investigations conducted on the notified chemical are summarised in the table below. Details of these studies can be found in Appendix B.

Endpoint	*Result and Assessment Conclusion*
Rat, acute oral toxicity	LD_{50} > 2000 mg/kg bw; low toxicity
Rat, acute dermal toxicity	LD_{50} > 2000 mg/kg bw; low toxicity
Rabbit, skin irritation	non-irritating
Rabbit, eye irritation	irritating
Guinea pig, skin sensitisation – adjuvant test	no evidence of sensitisation
Rat, repeat dose oral toxicity – 28 days	NOAEL = 100 mg/kg bw/day
Mutagenicity – bacterial reverse mutation	non mutagenic
Genotoxicity – in vitro chromosome aberration	non genotoxic
Genotoxicity – in vivo micronucleus	non genotoxic

Toxicokinetics, metabolism and distribution.
No toxicokinetic data on the notified chemical were submitted. Absorption of the notified chemical through the skin and gastrointestinal (GI) tract is expected to be limited due to the partition coefficient (expected to be low based on the high water solubility and low fat solubility). However, some absorption may occur based on the high water solubility (12.24 g/L) and the low molecular weight (<500 Da). This is supported by the systemic toxicity observed in the 28-day oral study in rats where effects in the kidneys and GI tract were noted. Inhalation of powders of the notified chemical may also occur, given that it contains 100% of particles <100 µm. Additionally, respiration of the notified chemical is likely given that ~70% of particles of the notified chemical when in powdered form are <10 µm. Upon deposition in the airways, due to its high water solubility, the notified chemical may dissolve/diffuse into the mucus lining the respiratory tract and subsequently be transported out of the respiratory tract. This also suggests that the notified chemical may be systemically absorbed following inhalation.

Acute toxicity.
The notified chemical has low acute oral (LD_{50}>2000 mg/kg bw) and dermal toxicity (LD_{50}>2000 mg/kg bw) in rats. There is no data available on the acute inhalational toxicity of the notified polymer.

Irritation and Sensitisation.
The notified chemical is non-irritating to the skin but is an irritant to the eyes of rabbits. The notified chemical is not a skin sensitiser in guinea pigs.

Repeated Dose Toxicity.
In a 28-day repeat dose gavage study, rats were administered the notified chemical at 0, 100, 300 or 1000 mg/kg bw/day. There were some minor decreases in the body weight gain in 1000 mg/kg bw/day males and females. The kidneys were the target organ of toxicity and a dose related increase of corticomedullary mineralisation and basophilic tubules was observed in 300 and 1000 mg/kg bw/day females. There were also histopathological changes in the stomach and small intestines in 300 and 1000mg/kg bw/day males and females that may be a local irritant effect due to oral dosing. However, the study authors did not dismiss these effects and they are therefore considered treatment related. The NOAEL was 100 mg/kg bw/day based on the kidney effects in females, and the histopathological effects in the stomach and small intestines in both sexes.

Mutagenicity.
The notified chemical was not mutagenic in a bacterial reverse mutation study, and not genotoxic in an *in vitro* chromosome aberration study in CHO cells. It was not genotoxic in an *in vivo* mammalian micronucleus test. The bone marrow cells are likely to have been exposed to the notified chemical given that systemic absorption is expected to occur, as indicated by the observed systemic toxicity in the 28-day oral rat study. Therefore, the results from the *in vivo* micronucleus assay, together with the two studies mentioned above provide evidence that the notified chemical is not likely to be an *in vivo* genotoxicant.

Health hazard classification
Based on the conjunctival redness scores of >2.5 in all three animals in the eye irritation study, the notified chemical is classified as hazardous according to the *Approved Criteria for Classifying Hazardous Substances* (NOHSC, 2004) with the following risk phrase:

R36 Irritating to eyes

6.3. Human Health Risk Characterisation

6.3.1. Occupational Health and Safety
The main toxicological effects of concern are eye irritation following ocular exposure and systemic toxicity following repeated dermal or inhalation exposure. Eye irritation is likely to occur from ocular exposure to the notified chemical when present in concentrations greater than 20%, based on the cut-off for the R36 statement set by the *Approved Criteria for Classifying Hazardous Substances* (NOHSC, 2004). Below this level the risk of eye irritation is expected to be low. Before reformulation, the notified chemical will be present in the imported product at 50-65%, therefore eye irritation may occur as a result of ocular exposure to the imported product. The notified chemical will be weighed in a dedicated additive preparation room equipped with dust extraction and isolated from the rest of the factory. In addition, the operator performing this task will be required to wear comprehensive personal protective equipment (PPE) including safety glasses, which will mitigate the risk from ocular exposure to the notified chemical. After reformulation, the notified chemical will be encapsulated in plastic resin and eye irritation will be of low concern. Ocular exposure during plastics

manufacture may also occur as the notified chemical will be present at 21% but because the notifier has indicated that protective eye wear is likely to be worn, the risk to workers from ocular exposure is not considered to be unreasonable.

The estimate of 'very low' dermal exposure does not assume PPE for the user. The notifier has indicated that coveralls and gloves will be worn during reformulation processes. Therefore, based on the estimated 'very low' dermal exposure, and the likely PPE, the risk from systemic exposure via dermal exposure to the notified chemical is not considered to be unreasonable. However, there is a potential for secondary exposure to the notified chemical from adhered particles on the clothing of workers. Coveralls and gloves are recommended when workers are handling the powder preparation to mitigate this risk. Therefore, the risk to workers from secondary exposure is not considered unreasonable when workers wear coveralls and gloves.

For systemic toxicity, the NOAEL of 100 mg/kg bw/day from the 28-day oral rat study based on kidney toxicity is the only study appropriate for risk assessment and calculation of a margin-of-exposure (MOE). A 10-fold safety factor to account for intraspecies variation and a 10-fold safety factor to account for interspecies extrapolation will be used when considering the MOE. There is the potential for long-term worker exposure to occur, and given the NOAEL is from a short-term study, an additional 10-fold safety factor will be applied to account for short-term to chronic extrapolation. Therefore, a MOE of 1000 or greater is considered acceptable for risk assessment of the notified chemical.

Based on the estimated inhalation exposure of 0.0106 mg/kg bw/day, the MOE is determined as follows:

MOE = NOEL / Systemic dose
= 100 mg/kg bw/day / 0.0106 mg/kg bw/day
= 9434

The MOE of 9434 is above the acceptable MOE of 1000 and thus there is no systemic toxicity concern for worker exposure from inhalation of the notified chemical. However, as the notified chemical contains a large proportion of inhalable particles and in the absence of an acute inhalation toxicity study, respiratory protection is still recommended. Therefore, the risk to workers inside facilities with local exhaust ventilation and wearing respiratory protection during manual weighing and transfer processes is not considered to be unreasonable.

Dermal, inhalation and ocular exposure of workers to the notified chemical during other activities such as transport and warehousing; manufacture of plastics; and cleaning, maintenance and quality testing of machinery are likely to be low and the risk to workers exposed during these stages is not considered to be unreasonable.

6.3.2. Public Health

The public will only come into contact with the notified chemical when trapped within a polymer matrix in finished products and therefore is not expected to be bioavailable for exposure. The risk to the public from exposure to finished products is not considered to be unreasonable.

7. ENVIRONMENTAL IMPLICATIONS

7.1. Environmental Exposure & Fate Assessment

7.1.1. Environmental Exposure

RELEASE OF CHEMICAL AT SITE

The notified chemical will not be manufactured in Australia; therefore, there will be no release from this activity. Release to the environment is unlikely during importation, transport and storage but may occur as a result of accidental spills or leaks. This is expected to be minor due to the packaging of the material. Releases that do occur as a result of accidents are expected to be physically contained, collected and disposed of in accordance with local regulations.

The notified chemical will be incorporated into plastic resins and, based on typical industrial processes and controls for the production of plastic pellets, release to the aquatic environment is not expected during reformulation/pellet formation activities. Residues in import packaging are estimated at up to 0.1% of the import volume and, along with an estimated 0.5% reformulation wastage generated by spillage, start up lump, pellet cuts, out of specification material and equipment cleaning, are expected to be collected and disposed of

in accordance with local regulations, namely to landfill.

RELEASE OF CHEMICAL FROM USE
The notified chemical in plastic pellets is used in the production of plastic articles such as electrical appliances, building materials and stadium chairs, and, based on typical industrial processes for injection moulding, release to the aquatic environment is not expected due to these activities. It is expected that any wastes containing the notified chemical from these activities will be in solid form and disposed of in accordance with local regulations, namely to landfill.

RELEASE OF CHEMICAL FROM DISPOSAL
The majority of the notified chemical will share the fate of the plastic articles in which it is encapsulated. At the end of the useful life of the plastic articles it is expected that disposal will be to landfill.

7.1.2. Environmental Fate

The majority of the notified chemical is expected to be disposed of to landfill and no significant release of the notified chemical to the aquatic environment is expected from the reported use pattern. The notified chemical is not readily biodegradable (refer to Appendix C) and does not hydrolyse under environmental conditions but it is not likely to bioaccumulate due to its expected low partition coefficient. Although the notified chemical has high solubility, when disposed of to landfill the notified chemical is largely expected to be trapped within the inert polymer matrix of pellets or finished articles and in this form it is not expected to leach or be bioavailable. In landfill, the notified chemical is expected to be slowly released from the polymer matrix over time and degrade to form water and oxides of carbon, nitrogen and phosphorous.

7.1.3. Predicted Environmental Concentration (PEC)

The PEC has not been calculated since no significant release of the notified chemical to the aquatic compartment is expected based on the reported use pattern.

7.2. Environmental Effects Assessment

The results from ecotoxicological investigations conducted on the notified chemical are summarised in the table below. Details of these studies can be found in Appendix C.

Endpoint	*Result*	*Assessment Conclusion*
Fish Toxicity	LC50 (96 h) >100 mg/L	Not harmful to fish
Daphnia Toxicity	EC50 (48 h) = 42 mg/L	Harmful to aquatic invertebrates
Algal Toxicity	E_rC50 (71 h) = 93 mg/L	Harmful to algae
Inhibition of Bacterial Respiration	IC50 (3 h) = 487 mg/L	Not inhibitory to microbial respiration at concentrations at or below 100 mg/L.

Under the Globally Harmonised System of Classification and Labelling of Chemicals (GHS; United Nations, 2011) the notified chemical is not harmful to fish but is harmful to aquatic invertebrates and algae, and is formally classified as 'Acute Category 3: Harmful to aquatic life'. On the basis of its toxicity to algae and since it is not rapidly degradable, the notified chemical is formally classified as 'Chronic Category 3: Harmful to aquatic life with long lasting effects'.

7.2.1. Predicted No-Effect Concentration

Calculation of the PNEC was not considered necessary since no significant release of the notified chemical to the aquatic compartment is expected from the reported use pattern.

7.3. Environmental Risk Assessment

The Risk Quotient (PEC/PNEC) was not calculated as limited release of the notified chemical to the aquatic compartment is expected based on the reported use pattern. The majority of the imported notified chemical will be trapped within an inert polymer matrix in plastic pellets and articles and in this form it is not expected to leach or be bioavailable. Therefore, on the basis of limited aquatic exposure and the assessed use pattern, the notified chemical is not considered to pose an unreasonable risk to the environment.

APPENDIX A: PHYSICAL AND CHEMICAL PROPERTIES

Melting Point Test material decomposed around 290ºC

Method EC Directive 92/69/EEC A.1 Melting/Freezing Temperature.
Remarks The melting point of the test substance could not be determined as the test material decomposes around 290ºC.
Test Facility TNO Prins Maurits Laboratory (2003).

Boiling Point Test material decomposed at 95ºC at 101.3 kPa

Method EC Directive 92/69/EEC A.2 Boiling Temperature.
Remarks The boiling temperature could not be determined as the test substance decomposed at a distillation temperature of 95ºC
Test Facility TNO Prins Maurits Laboratory (2003).

Density 1735 ± 9 kg/m^3 at 23ºC

Method EC Directive 92/69/EEC A.3 Relative Density.
Remarks Determined using the gas comparison pycnometer method.
Test Facility TNO Prins Maurits Laboratory (2003).

Vapour Pressure <6 x 10^{-6} kPa at 25ºC

Method EC Directive 92/69/EEC A.4 Vapour Pressure.
Remarks Determined using the gas saturation method was used.
Test Facility TNO Prins Maurits Laboratory (2003).

Water Solubility 12.24 g/L at 20ºC

Method EC Directive 92/69/EEC A.6 Water Solubility.
Remarks Flask Method with determination by capillary electrophoresis with indirect UV detection. The pH of the saturated test solutions was 3.50-3.62.
Test Facility TNO Prins Maurits Laboratory (2003).

Hydrolysis as a Function of pH $t_{½}$ >1 year at 25 ºC, pH 4-9 (organic component)

Method OECD TG 111 Hydrolysis as a Function of pH.
EC Directive 92/69/EEC C.7 Degradation: Abiotic Degradation: Hydrolysis as a Function of pH.

pH	*T (°C)*	$t_{½}$
4	50	>1 year
7	50	>1 year
9	50	>1 year

Remarks The notified chemical is the salt of an organic component and an inorganic component and, with high solubility in water, is expected to dissociate when solubilised in water under environmental conditions.

The decrease in the organic component in all buffer solutions was less than 10% after five days at 50ºC. Therefore, the organic component of the notified chemical was considered to be hydrolytically stable with $t_{½}$ >1 year at 25°C and pH 4-9 and no additional testing was required.

The inorganic component contains hydrolysable functionality. However, the hydrolytic half life of the inorganic component was not determined because of technical difficulties with analysis.
Test Facility TNO Nutrition and Food Research (2004a, 2004b)

Adsorption/Desorption – screening test log K_{oc} = 3.1 at 25°C, pH 5.5 (organic component)

Method OECD TG 121 Estimation of the Adsorption Coefficient (Koc) on soil and on sewage sludge using High Performance Liquid Chromatography (HPLC).

Remarks HPLC-MS was used in the positive and negative mode as the notified chemical contains a positively charged organic component and a negatively charged inorganic component. The adsorption coefficient could not be determined for the inorganic component which eluted before the dead time under pH unadjusted conditions and as a series of undefined peaks at pH 5.5.

For ionisable substances, both the ionised and non-ionised form should be tested where the dissociated form is present at >10% at pH 5.5-7.5. For this test substance, the non-ionised form of the organic component is not expected to be present ≥10% at pH 5.5-7.5 based on the measured dissociation constants. In the pH unadjusted mobile phase the organic component did not elute from the column and the adsorption coefficient could not be determined. In the second test, the pH of the mobile phase was adjusted to 5.5 and the organic component eluted within the range of the reference substances.

The retention time of reference substances with known log Koc was determined using HPLC-MS in the positive mode. The capacity factor (k') was calculated and a plot of log Koc vs. log k' was calculated and used to determine the Koc of the test substance from its observed HPLC retention time.

Test Facility TNO Nutrition and Food Research (2004c)

Dissociation Constant pKa_1 = 5.5 (measured, organic component)
pKa_2 = 9.8 (measured, organic component)
pKa_1 = 1.52 (literature, inorganic component)
pKa_2 = 2.36 (literature, inorganic component)
pKa_3 = 6.75 (literature, inorganic component)
pKa_4 = 9.29 (literature, inorganic component)

Method OECD TG 112 Dissociation Constants in Water.

Remarks The pKa_1 and pKa_2 values attributed to the organic component were 5.6 and 10.4, respectively, when determined using the titration method. These varied slightly from the available literature values of 5.68 and 9.82. Although the available literature for the inorganic component reports four dissociation constants only a further three pKa values were observed, at ~1, 8.0 and 11.9 0. The titration method was not considered suitable for the analysis due to complexity of dissociation for the test substance and with interference suspected due to buffering properties of the inorganic component. Therefore, the pKa of the organic component should be regarded as an estimate only and the pKa of the inorganic component could not be determined.

The pKa of the organic component was subsequently determined by measuring the elecrophoretic mobility as function of the pH using a capillary electrophoresis method. Although not included in the OECD test guidelines, this method was applied since the titration method did not provide satisfactory results. The measured pKa's of the organic component were 5.5 and 9.8. The pKa of the inorganic component could not be determined because the method is not suitable for inorganic substances. However, literature values are available.

Test Facility TNO Prinus Maurits Laboratory (2004)

Primary Particle Size < 1.2 µm

Method In-house method using Malvern Particle Size Analyser 2600.

Remarks The determination of the primary particle size distribution of the test substance was performed using the Malvern Particle Size Analyser 2600. The test substance exists largely as agglomerates that did not fall apart in octane, even when a surface active substance was added. The agglomerates did fall apart in an ultrasonic bath and this solution was used to measure particle size. However, as the particles were too small, the

particle size distribution of the test substance could not be determined using Malvern Particle Size Analyser, which can only measure particles with a particle size > 1.2µm. Therefore, the results indicated that the particle size distribution of the test substance after ultrasonic treatment is largely <1.2 µm.

Test Facility TNO Prins Maurits Laboratory (2003).

Flammability (solid) Not a flammable solid

Method EC Directive 92/69/EEC A.10 Flammability (Solids).

Remarks In the preliminary screening test, the notified chemical did not ignite in contact with the flame of the gas burner. Therefore, no further testing was required.

Test Facility TNO Prins Maurits Laboratory (2003).

Autoignition Temperature >400ºC

Method EC Directive 92/69/EEC A.16 Relative Self-Ignition Temperature for Solids.

Remarks Applying a linear increase in temperature of about 0.5ºC/min to 400ºC, a minor endothermal effect was observed on the test substance in an oven at 265ºC. The sample temperature increased to approximately 335ºC. As the peak sample temperature did not attain the level of 400ºC, the test substance was not considered to be a self-ignition.

Test Facility TNO Prins Maurits Laboratory (2003).

Explosive Properties Not explosive

Method EC Directive 92/69/EEC A.14 Explosive Properties.

Remarks The test substance was tested for explosive properties under thermal sensitivity (effect of a flame) and mechanical sensitivity (effects of shock and friction). The test substance did not show explosive properties under these conditions.

Test Facility TNO Prins Maurits Laboratory (2003).

Fat (or n-octanol) Solubility <0.151 mg/100 g fat simulant HB 307 at 37°C

Method OECD TG 116 Fat Solubility of Solid and Liquid Substances.

Remarks The notified chemical was determined by capillary electrophoresis with indirect UV detection. The standard fat used was fat simulant HB 307.

Test Facility TNO Prins Maurits Laboratory (2004)

Surface Tension 72.7 mN/m at 20ºC

Method EC Directive 92/69/EEC A.5 Surface Tension.

Remarks Concentration: 1.012 g/L

Test Facility TNO Prins Maurits Laboratory (2003).

Oxidizing Properties Not an oxidant

Method EC Directive 92/69/EEC A.17 Oxidizing Properties (Solids).

Remarks The results showed that the sample/cellulose mixtures could not be ignited by means of a burner. Hence, the addition of the test substance to cellulose did not enhance the burning of cellulose and the test substance was not considered to an oxidant.

Test Facility TNO Prins Maurits Laboratory (2003).

APPENDIX B: TOXICOLOGICAL INVESTIGATIONS

B.1. Acute toxicity – oral

TEST SUBSTANCE	Notified chemical
METHOD	OECD TG 423 Acute Oral Toxicity – Limit Test. EC Directive 96/54/EC, Annex IV B:B.1 Acute Oral Toxicity – Limit Test.
Species/Strain	Rat/Wistar (Crl:(WI) WU BR
Vehicle	Water
Remarks - Method	Humidity of up to 100% was recorded during the study.

RESULTS

Group	*Number and Sex of Animals*	*Dose mg/kg bw*	*Mortality*
1	3females	2000	0/3
2	3 females	2000	0/3

LD50	> 2000 mg/kg bw
Signs of Toxicity	No clinical signs were observed.
Effects in Organs	None observed following necropsy.
Remarks - Results	All animals continued to gain weight over the 14 day observation period.

CONCLUSION	The notified chemical is of low toxicity via the oral route.
TEST FACILITY	TNO Chemistry (2003a)

B.2. Acute toxicity – dermal

TEST SUBSTANCE

METHOD	OECD TG 402 Acute Dermal Toxicity – Limit Test. EC Directive 92/69/EEC B.3 Acute Toxicity (Dermal) – Limit Test.
Species/Strain	Rat/Wistar (Crl:(WI) WU BR
Vehicle	Water
Type of dressing	Occlusive
Remarks - Method	Humidity of up to 100% was recorded during the study.

RESULTS

Group	*Number and Sex of Animals*	*Dose mg/kg bw*	*Mortality*
1	5 males	2000	0/5
2	5 females	2000	0/5

LD_{50}	> 2000 mg/kg bw
Signs of Toxicity - Local	None.
Signs of Toxicity - Systemic	No clinical signs were observed.
Effects in Organs	None observed following necropsy.
Remarks - Results	All animals continued to gain weight over the 14 day observation period.

CONCLUSION	The notified chemical is of low toxicity via the dermal route.
TEST FACILITY	TNO Chemistry (2003b)

B.3. Irritation – skin

TEST SUBSTANCE	Notified chemical
METHOD	OECD TG 404 Acute Dermal Irritation/Corrosion. EC Directive 92/69/EEC B.4 Acute Toxicity (Skin Irritation).
Species/Strain	Rabbit/New Zealand White
Number of Animals	3 males
Vehicle	Water
Observation Period	72 hours
Type of Dressing	Semi-occlusive.
Remarks - Method	Humidity of up to 99.9% was recorded during the study.

RESULTS

Remarks - Results	Scores of zero were observed at 1, 24, 48 and 72 hours for all three rabbits.
CONCLUSION	The notified chemical is non-irritating to the skin.
TEST FACILITY	TNO Chemistry (2003c)

B.4. Irritation – eye

TEST SUBSTANCE	Notified chemical
METHOD	OECD TG 405 Acute Eye Irritation/Corrosion. EC Directive 92/69/EEC B.5 Acute Toxicity (Eye Irritation).
Species/Strain	Rabbit/New Zealand White
Number of Animals	3 males
Observation Period	14 days
Remarks - Method	Humidity of up to 99.9% was recorded during the study.

RESULTS

Lesion	*Mean Score* Animal No.*			*Maximum Value*	*Maximum Duration of Any Effect*	*Maximum Value at End of Observation Period*
	1	2	3			
Conjunctiva: redness	2.7	3.0	3.0	3	14 days	0
Conjunctiva: chemosis	1	1.3	2.0	2	14 days	0
Conjunctiva: discharge	0.7	0.7	2.7	3	7 days	0
Corneal opacity	0	0	1	1	7 days	0
Iridial inflammation	0	0	1	1	7 days	0

*Calculated on the basis of the scores at 24, 48, and 72 hours for EACH animal.

Remarks - Results	Haemorrhage of the lower conjunctivae noted in all three animals at the 48 and 72 hour observation point with recovery observed by 7 days. Ischemic necrosis was observed in one animal at 48 and 72 hours.
CONCLUSION	The notified chemical is irritating to the eye.
TEST FACILITY	TNO Chemistry (2003d)

B.5. Skin sensitisation

TEST SUBSTANCE	Notified chemical
METHOD	OECD TG 406 Skin Sensitisation - GPMT EC Directive 96/54/EC B.6 Skin Sensitisation
Species/Strain	Guinea pig/Albino (Dunkin Hartley)
PRELIMINARY STUDY	Maximum Non-irritating Concentration Intradermal: not determined topical: 10%

MAIN STUDY

Number of Animals	Test Group: 10 Control Group: 4
INDUCTION PHASE	Induction Concentration: intradermal: 0.3% in maize oil (2 injections), 0.3% in maize oil and Freund's Complete Adjuvant (FCA) (2 injections) topical: 30% in maize oil (one application)
Signs of Irritation	Moderate erythema and abscesses. It is noted that moderate erythema was observed from the injections that contained FCA
CHALLENGE PHASE	
1st challenge	intradermal: None topical: 10% in maize oil (one application), maize oil alone (one application).
Remarks - Method	No significant protocol deviations.

RESULTS

Animal	*Challenge Concentration*	*Number of Animals Showing Skin Reactions after:*	
		24 h	*48 h*
Test Group	10%	4/10	0/10
	0%	4/10	0/10
Control Group	10%	3/4	0/4
	0%	3/4	0/4

Remarks - Results	Only slight erythema (grade 1) was observed in control and test groups during the challenge.
CONCLUSION	There was no evidence of reactions indicative of skin sensitisation to the notified chemical under the conditions of the test.
TEST FACILITY	TNO Chemistry (2003e)

B.6. Repeat dose toxicity

TEST SUBSTANCE	Notified chemical
METHOD	OECD TG 407 Repeated Dose 28-day Oral Toxicity Study in Rodents. EC Directive 96/54/EC B.7 Repeated Dose (28 Days) Toxicity (Oral).
Species/Strain	Rat/Wistar
Route of Administration	Oral – gavage
Exposure Information	Total exposure days: 28 days Dose regimen: 7 days per week Post-exposure observation period: None
Vehicle	Water
Remarks - Method	A range-finding study was conducted at 0, 300 and 1000 mg/kg bw/day (3 males/dose) for five days. No effect on body weight, food consumption or organ weights were noted in any treatment group and 1000 mg/kg bw/day was selected as the high dose for the main study. Urinalysis was not conducted.

RESULTS

Group	*Number and Sex of Animals*	*Dose mg/kg bw/day*	*Mortality*
control	5 males + 5 females	0	0/10
low dose	5 males + 5 females	100	0/10
mid dose	5 males + 5 females	300	0/10
high dose	5 males + 5 females	1000	0/10

Mortality and Time to Death

There were no mortalities in the study.

Body Weight and Food Consumption

There was a statistically significant decrease in body weight gains over the study period in 1000 mg/kg bw/day males (↓27%) compared to controls. The decrease observed in 1000 mg/kg bw/day females (↓22%) was considered by the study directors to be similar to controls and was not statistically significant.

The food consumption was slightly lower in 1000 mg/kg bw/day males in each of the measured weekly intervals compared to controls. In females, food consumption was similar to controls with the exception of a slight decrease in the first week. Food conversion efficiency (weight gain ÷ food consumed) was slightly lower in 1000 mg/kg bw/day males and females at some of the measured intervals and the overall mean values were less in 1000 mg/kg bw/day males and females.

Clinical Observations and Neurobehavioural Testing

There were no treatment related clinical signs. The neurobehavioural testing (arena test, FOB and motor activity assessment) did not reveal any treatment related findings, with the exception of a slight decrease in total distance moved in 1000 mg/kg bw/day males and females.

Laboratory Findings – Haematology and Clinical Chemistry

There were no treatment related findings in haematology parameters.

There were statistically significant decreases at the1000 mg/kg bw/day dose in total protein in males (↓12%), albumin in males (↓7%) and females (↓13%), and urea in males (↓22%). These effects are considered treatment related, but given the small magnitude in the decreases, are not considered to be severe. A statistically significant decrease in triglycerides in 100 mg/kg bw/day females (↓34%) was not considered treatment related due to the lack of associated decreases at higher doses.

Effects in Organs

There were no treatment related changes in absolute or relative organ weights and there were no macroscopic findings.

KIDNEYS: There was a dose related increased incidence of basophilic tubules in treated females (see following Table). The toxicological relevance of this effect remains unclear because it occurred in control males (3/5) and females (1/5), and the severity in the single female control was similar to that seen in 1000 mg/kg bw/day males and females. However, the incidence in 300 and 1000 mg/kg bw/day females is considered treatment related. The incidence in 100 mg/kg bw/day females, is unlikely to be a toxicologically relevant because the same incidence and similar severity was observed in controls males, thus it is not considered treatment related in this group.

There was a dose related increase in corticomedullary mineralisation in 300 and 1000 mg/kg bw/day females. This also highlights a clear species difference in kidney toxicity.

SMALL INTESTINES AND STOMACH: Deudenal pigment deposit of the small intestine and gastritis was observed at 300 and 1000 mg/kg bw/day males and females. These gastrointestinal tract effects may be due to the gavage dosing.

	Males (mg/kg bw/day)				*Females (mg/kg bw/day)*			
	0	*100*	*300*	*1000*	*0*	*100*	*300*	*1000*
Kidneys								
Basophilic tubules	3(1.3)	-	0	2(2.0)	1(2.0)	3(1.0)	3(1.6)	5(2.2)
Corticomedullary mineralisation	0	-	0	0	0	0	3(1.6)	5(2.2)
Small intestines								
Deudenal pigment deposit	0	0	3(1.0)	5(1.6)	0	0	2(1.0)	4(1.0)
Stomach								
Gastritis	0	0	3(1.0)	5(2.0)	0	0	1(2.0)	5(1.4)

() Average severity of affected animals: 1=very slight, 2=slight, 3=moderate, 4=marked.

Remarks – Results

There was a slight decrease in bodyweight gains in 1000 mg/kg bw/day males and females, but the effect was not severe. There were also treatment related changes in haematological parameters in 1000 mg/kg bw/day males and females. At 300 and 1000 mg/kg bw/day females there was an increase in corticomedullary mineralisation and basophilic tubules of the kidneys that was considered treatment related. The histopathological changes in the stomach and small intestines have an unclear relationship to treatment. However, the study authors did not dismiss these effects and are therefore considered treatment related.

CONCLUSION
The No Observed Adverse Effect Level (NOAEL) was established as 100 mg/kg bw/day in this study, based on corticomedullary mineralisation and basophilic tubules in the kidney of females, and histopathological changes of the GI tract in males and females.

TEST FACILITY TNO Chemistry (2003f)

B.7. Genotoxicity – bacteria

TEST SUBSTANCE Notified chemical

METHOD OECD TG 471 Bacterial Reverse Mutation Test.
Plate incorporation procedure

Species/Strain	*S. typhimurium*: TA1535, TA1537, TA98, TA100 *E. coli*: WP2uvrA
Metabolic Activation System	S9 rat liver
Concentration Range in Main Test	a) With metabolic activation: 62-5000 µg/plate b) Without metabolic activation: 62-5000 µg/plate
Vehicle	Ethanol
Remarks - Method	Preliminary study was not conducted and cytotoxicity was assessed in the main study.

RESULTS

Metabolic Activation	*Test Substance Concentration (µg/plate) Resulting in:*			
	Cytotoxicity in Preliminary Test	*Cytotoxicity in Main Test*	*Precipitation*	*Genotoxic Effect*
Absent				
Test 1	-	>5000	None	Negative
Test 2	-	>5000	None	Negative
Present				
Test 1	-	>5000	None	Negative
Test 2	-	>5000	None	Negative

CONCLUSION The notified chemical was not mutagenic to bacteria under the conditions of the test.

TEST FACILITY TNO Chemistry (2004a)

B.8. Genotoxicity – in vitro

TEST SUBSTANCE Notified chemical

METHOD OECD TG 473 In vitro Mammalian Chromosome Aberration Test.
US EPA OPPTS 870.5375 In vitro Mammalian Chromosome Aberration Test.

Cell Type/Cell Line	Chinese hamster ovary cells
Metabolic Activation System	S9 rat liver
Vehicle	Ethanol
Remarks - Method	A preliminary cytotixicity assay was not conducted and cytotixicity was assessed in the main study.

Metabolic Activation	*Test Substance Concentration (µg/mL)*	*Exposure Period*	*Harvest Time*
Absent			
Test 1a	0*, 0.5, 1, 2, 3.9, 7.8, 15.6, 31.3, 62.5, 125, 250*, 500*, 1000*, 2000, MMC*	4	18
Test 1b	0*, 0.5, 1, 2, 3.9, 7.8, 15.6, 31.3, 62.5*, 125*, 250*, 500*, 1000, 2000, MMC*	18	18
Test 2a	0*, 50, 75*, 100*, 300*, 500*, 750*, MMC*	18	18
Test 2b	0*, 10, 30, 50*, 75*, 100*, 300*, 500, 750, MMC*	32	32
Present			
Test 1	0*, 0.5, 1, 2, 3.9, 7.8, 15.6, 31.3, 62.5, 125, 250*, 500*, 1000*, 2000, CP*	4	18
Test 2A	0*, 500*, 750*, 1000*, 1500*, 2000, CP*	4	18
Test 2B	0*, 500, 750*, 1000*, 1500*, 2000*, CP*	4	32

*Cultures selected for metaphase analysis.
MMC = Mitomycin C, CP = Cyclophosphamide.

RESULTS

Metabolic Activation	*Test Substance Concentration (µg/mL) Resulting in:*			
	Cytotoxicity in Preliminary Test	*Cytotoxicity in Main Test*	*Precipitation*	*Genotoxic Effect*
Absent				
Test 1a	-	>1000	-	Negative
Test 1b		≥250	-	Negative
Test 2a	-	>300	-	Negative
Test 2b		≥300	-	Negative
Present				
Test 1	-	>1000	-	Negative
Test 2A	-	>1000	-	Negative
Test 2B		>1000	-	Negative

CONCLUSION The notified chemical was not clastogenic to CHO cells treated in vitro under the conditions of the test.

TEST FACILITY TNO Chemistry (2003g)

B.9. Genotoxicity – in vivo

TEST SUBSTANCE Notified chemical

METHOD OECD TG 474 Mammalian Erythrocyte Micronucleus Test.
EEC protocol B.12 (Mutagenicity: Micronucleus Test) of Council Directive 67/548/EEC, L 136, volume 43 adopted 8 June 2000.
US EPA Health Effects Testing Guidelines 40 CFR C.1 (7-1-89 Edition) paragraph 798.5395.

Species/Strain Mice/Swiss
Route of Administration Oral – gavage
Vehicle Physiological saline

Group	*Number and Sex of Animals*	*Dose mg/kg bw*	*Sacrifice Time hours*
I (vehicle control)	5 females	0	24
II (vehicle control)	5 females	0	48
III (high dose)	5 females	2000	24
IV (high dose)	5 females	2000	48
III (positive control, MC)	5 females	0.75	48

MC=mitomycin C.

RESULTS

Doses Producing Toxicity	No toxicity observed at 2000 mg/kg bw.
Genotoxic Effects	There were no increases in micronucleated polychromatic erythrocytes (MPE) in the treatment groups.
Remarks - Results	The positive control showed a statistically significant increase in the MPE, therefore confirms the sensitivity of the study. There were no observed clinical signs of toxicity and the study authors did not comment on whether the notified chemical reached systemic circulation.
CONCLUSION	The notified chemical was not clastogenic to chromosomes in the bone marrow of mice under the conditions of this in vivo micronucleus test.
TEST FACILITY	TNO Chemistry (2004b)

APPENDIX C: ENVIRONMENTAL FATE AND ECOTOXICOLOGICAL INVESTIGATIONS

C.1. Environmental Fate

C.1.1. Ready biodegradability

TEST SUBSTANCE	Notified chemical
METHOD	OECD TG 301 D Ready Biodegradability: Closed Bottle Test. EC Directive 92/69/EEC C.4-E Biodegradation: Determination of Ready Biodegradability: Closed Bottle Test.
Inoculum	Activated sludge, domestic sewage
Exposure Period	28 days
Auxiliary Solvent	None specified
Analytical Monitoring	Chemical oxygen demand, O_2 concentration
Remarks - Method	The test was conducted in accordance with the guideline above and in compliance with GLP standards and principles. There were no significant deviations from the protocol. ThOD was calculated to be 0.61 mg O_2/mg for notified chemical and did not account for nitrification.

RESULTS

% Degradation	*Notified chemical*		*Inoculum activity control*	*Toxicity control*
Day	*4.27 mg/L*	*8.28 mg/L*	*Sodium acetate 4 mg/L*	*Sodium acetate 4 mg/L, notified chemical 8.28 mg/L*
7	15	4	81	28
14	10	7	88	33
21	9	9	-	-
28	13	12	-	-

Remarks - Results	Oxygen consumption by the blank controls of 1.99 mg O_2/L was above the validity criterion of 1.5 mg O_2/L. As validity criteria were achieved after 14 days for the reference substance and toxicity controls, only the precision of some results were considered to have been affected to a minor extent and the test result is still considered to be reliable. Degradation of the reference compound, sodium acetate, exceeded the pass level of 60% (ThOD) after 14 days. In the toxicity test, there was more than 25% degradation (ThOD) after 14 days. The notified chemical is therefore not inhibitory to the inoculum at the tested concentration. The maximum biodegradation of the notified chemical during the test was 15%. The notified chemical did not pass the criterion for ready biodegradability of >60% degradation (ThOD) reached within the 10 day window.
CONCLUSION	The notified chemical is not readily biodegradable.
TEST FACILITY	TNO Chemistry (2003a)

C.2. Ecotoxicological Investigations

C.2.1. Acute toxicity to fish

TEST SUBSTANCE	Notified chemical
METHOD	OECD TG 203 Fish, Acute Toxicity Test – Semi-static. EC Directive 92/69/EEC C.1 Acute Toxicity for Fish – Semi-static.
Species	Zebra fish (*Danio rerio, Teleostei cyprinidae*)
Exposure Period	96 hours

Auxiliary Solvent	None
Water Hardness	250 mg $CaCO_3$/L
Analytical Monitoring	HPLC analysis with MS detection. The limit of quantification (LOQ) is 0.07-0.25 mg/L and the limit of detection (LOD) is 0.04-0.12 mg/L.
Remarks – Method	After a range finding test, a definitive limit test (100 mg/L) was conducted in accordance with the guideline above and in compliance with GLP standards and principles. Since the inorganic part of the test substance affected the pH of the test medium, the pH of the test medium was adjusted to 6.0 in the final test. There were no significant deviations from the protocol.

RESULTS

Concentration mg/L		*Number of Fish*	*Mortality*				
Nominal	*Actual*		*1 h*	*24 h*	*48 h*	*72 h*	*96 h*
Range finding							
0.1	Not measured	3	0	0	0	0	0
1.0	Not measured	3	0	0	0	0	0
10	8.02-9.69	3	0	0	0	0	0
100	Not measured	3	0	0	0	0	0
Definitive test							
0 (control)	<LOD	7	0	0	0	0	0
100	91.56-108.07	7	0	0	1	1	1

LC50	>100 mg/L at 96 hours.
NOEC (or LOEC)	Not determined
Remarks – Results	The validity criteria were met. The pH in the 100 mg/L solution in the definitive test ranged 5.6-5.8 throughout the test, just below 6.0 (the lower limit prescribed by the protocol). The pH in the blank control ranged 5.9-6.4. Since the given pH range in the protocol describes the optimum pH range (6.0-8.5), and pH values were only just below this range, the test results are still considered to be reliable. Based on the results of the range finding test, the death of one fish in the definitive limit test was not considered significant. However, the NOEC could not be determined. The 96 h LC50 could not be calculated but was estimated to be >100 mg/L.

CONCLUSION The notified chemical is not harmful to fish.

TEST FACILITY NOTOX B.V. (2003a)

C.2.2. Acute toxicity to aquatic invertebrates

TEST SUBSTANCE Notified chemical

METHOD OECD TG 202 *Daphnia* sp. Acute Immobilisation Test - Static.
EC Directive 92/69/EEC C.2 Acute Toxicity for Daphnia - Static.

Species	*Daphnia magna*
Exposure Period	48 hours
Auxiliary Solvent	None
Water Hardness	250 mg $CaCO_3$/L
Analytical Monitoring	HPLC analysis with MS detection. The limit of quantification (LOQ) is 0.25 mg/L and the limit of detection (LOD) is 0.12 mg/L.
Remarks - Method	After a range finding test, a definitive test was conducted in accordance with the guideline above and in compliance with GLP standards and principles. Since the inorganic part of the test substance caused change in the pH of the test medium, the pH of the test medium was adjusted to 6.0 in the final test. There were no significant deviations from the protocol.

RESULTS

Concentration mg/L		*Number of D. magna*	*Number Immobilised*	
Nominal	*Actual*		*24 h*	*48 h*
0	<LOD	20	0	0
10	9.3-10.7	20	0	0
18	Not measured	20	0	0
32	27.0-29.7	20	1	2
56	Not measured	20	9	17
100	95.1-95.8	20	14	19

LC50 (95% confidence level)	69 mg/L at 24 hours (56-91 mg/L) 42 mg/L at 48 hours (36-53 mg/L)
NOEC	18 mg/L at 48 hours
Remarks - Results	The validity criteria were met. The pH in the 32, 56 and 100 mg/L solutions at the start of exposure and in the 100 mg/L solution at 48 hours of exposure (ranging 5.6-5.8) were just below the lower limit prescribed by the protocol of 6.0. Since the given pH range in the protocol describes the optimum pH range for *Daphnia magna*, and pH values were only just below this range, the test results are still considered to be reliable. A floating layer was observed in the 32, 56 and 100 mg/L test solutions and precipitate was also observed in the 56 and 100mg/L test solutions. Immobilised daphnids were examined under microscope and no test substance was observed to be attached to their bodies. Therefore, the observed toxicity is not associated with mechanical (physical) effect of the notified chemical. The EC50 results were calculated using probit analysis.
CONCLUSION	The notified chemical is harmful to aquatic invertebrates.
TEST FACILITY	NOTOX B.V. (2003b)

C.2.3. Algal growth inhibition test

TEST SUBSTANCE	Notified chemical
METHOD	OECD TG 201 Alga, Growth Inhibition Test. EC Directive 92/69/EEC C.3 Algal Inhibition Test.
Species	*Selenastrum capricornutum*
Exposure Period	71 hours
Concentration Range	Nominal: 0, 11, 36, 113 mg/L
Auxiliary Solvent	None
Water Hardness	24.2 mg $CaCO_3$/L
Analytical Monitoring	HPLC analysis with MS detection. The limit of quantification (LOQ) is 0.07-0.46 mg/L and the limit of detection (LOD) is 0.04-0.22 mg/L.
Remarks - Method	After a range finding test, a definitive test was conducted in accordance with the guidelines above and in compliance with GLP standards and principles. The pH value of the T-1063FM stock solution was pH 5.8 and was not adjusted. All flasks were incubated at 23 ± 2°C and shaken (at approximately 100 rpm) in an orbital shaker. The light intensity radiated by the fluorescent lamps was within the standard range of 60-120 µmol.s^{-1}.m^{-2}.

RESULTS

Biomass		*Growth*	
E_bC50 mg/L at 71 h (95% confidence limit)	*NOEC mg/L*	*E_rC50 mg/L at 71h (95% confidence limit)*	*NOEC mg/L*

55 (36-63)	36	93 (84-103)	Not determined

Remarks - Results

The validation criteria were met.

The measured concentrations were found to be 76 - 122% of the nominal concentrations (mean value at the start of the test 103% and at the end of the test 116%), and they show a linear relationship with the nominal concentrations. Reanalysis of samples was conducted where the measured concentration varied from the nominal concentration by more than 20%; the results were within 80-120% of the nominal concentration. The concentrations decreased by < 20% over the duration of the study. Therefore, nominal concentrations were used to report the test results.

The results indicated a slight hormetic effect at the lower concentration of notified chemical. The NOEC was determined as the highest concentration at which no statistically (determined with a one tailed t-test, α=5%) significant inhibition was observed. The results for growth rate (E_rC values) were calculated using a Kooijman parametric model. The results for area under the growth curve (E_bC values) were calculated using the method in the OECD test guideline.

CONCLUSION: The notified chemical is harmful to algae.

TEST FACILITY: TNO Nutrition and Food Research (2003b, 2004d)

C.2.4. Inhibition of microbial activity

TEST SUBSTANCE: Notified chemical

METHOD: OECD TG 209 Activated Sludge, Respiration Inhibition Test.
- Inoculum: Activated sludge, domestic
- Exposure Period: 3 hours
- Concentration Range: Nominal: 0, 10, 32, 100, 320, 1000 mg/L
- Remarks – Method: The definitive test was conducted according to the guidelines above and in compliance with GLP standards and principles. A blank control and reference (3,5-dichlorophenol) control were run in parallel. There were no significant deviations from the protocol.

RESULTS
- IC50 (95% confidence limit): 487 mg/L at 3 h (315-752)
- NOEC: 100 mg/L
- Remarks – Results: The validation criteria were met. At the higher concentration the pH of the test medium was less than 6.0. This may have influenced the respiration rate. However, based on the results this influence was considered negligible compared with the toxic effects.

  The results were calculated by linear regression of the linear part of the oxygen depletion curve. The no-observed effect concentration is the highest test substance concentration showing no effect, or less than 10% inhibition with respect to the control.

CONCLUSION: The notified chemical is considered not inhibitory to microbial respiration at concentrations at or below 100 mg/L.

TEST FACILITY: TNO Nutrition and Food Research (2003c)

BIBLIOGRAPHY

NOHSC (1994) National Code of Practice for the Labelling of Workplace Substances [NOHSC:2012(1994)]. National Occupational Health and Safety Commission, Canberra, Australian Government Publishing Service.

NOHSC (2003) National Code of Practice for the Preparation of Material Safety Data Sheets, 2nd edition [NOHSC:2011(2003)]. National Occupational Health and Safety Commission, Canberra, Australian Government Publishing Service.

NOHSC (2004) Approved Criteria for Classifying Hazardous Substances, 3rd edition [NOHSC:1008(2004)]. National Occupational Health and Safety Commission, Canberra, AusInfo.

NOTOX B.V. (2003a) 96-Hour acute toxicity study in zebra-fish with T-1063FM (semi-static) (Guidelines OECD No. 203 and EU No. C.1) (Report Number: 5042/06, 17 December 2003). NOTOX B.V., 's-Hertogenbosch, The Netherlands. (Unpublished report provided by the notifier).

NOTOX B.V. (2003b) Acute toxicity study in *Daphnia magna* with T-1063FM (static) (Guidelines OECD No. 202 and EU No. C.2) (Report Number: 373668, 17 December 2003). NOTOX B.V., 's-Hertogenbosch, The Netherlands. (Unpublished report provided by the notifier).

TNO Chemistry (2003a) Acute oral toxicity study with [notified chemical] in rats. Final Report May 2003, TNO Study Number: 4410/28. TNO Nutrition and Food Research, Zeist, Netherlands. (Unpublished report provided by the notifier).

TNO Chemistry (2003b) Acute dermal toxicity study with [notified chemical] in rats. Final Report May 2003, TNO Study Number: 4416/07. TNO Nutrition and Food Research, Zeist, Netherlands. (Unpublished report provided by the notifier).

TNO Chemistry (2003c) Acute dermal irritation/corrosion study with [notified chemical] in albino rabbits. Final Report May 2003, TNO Study Number: 4411/17. TNO Nutrition and Food Research, Zeist, Netherlands. (Unpublished report provided by the notifier).

TNO Chemistry (2003d) Acute eye irritation/corrosion study with [notified chemical] in albino rabbits. Final Report May 2003, TNO Study Number: 4415/28. TNO Nutrition and Food Research, Zeist, Netherlands. (Unpublished report provided by the notifier).

TNO Chemistry (2003e) Sensitisation study with [notified chemical] in guinea pigs (maximisation test). Final Report May 2003, TNO Study Number: 4413/23. TNO Nutrition and Food Research, Zeist, Netherlands. (Unpublished report provided by the notifier).

TNO Chemistry (2003f) Repeated dose (28-day) oral toxicity study with [notified chemical] in rats. Final Report October 2003, TNO Study Number: 5042/01. TNO Nutrition and Food Research, Zeist, Netherlands. (Unpublished report provided by the notifier).

TNO Chemistry (2003g) Chromosomal aberration test with [notified chemical] in Chinese hamster ovary (CHO) cells. Final Report July 2003, TNO Study Number: 5002/03. TNO Nutrition and Food Research, Zeist, Netherlands. (Unpublished report provided by the notifier).

TNO Chemistry (2003h) Determination of the effect of T-1063FM [Notified chemical] on the growth of the fresh water green alga *Selenastrum capricomutum.* (Guidelines: OECD 201 and EU C.3) (Report Number: V5042/02, 7 November 2003). TNO Nutrition and Food Research, Zeist, The Netherlands. (Unpublished report provided by the notifier).

TNO Chemistry (2004a) Bacterial reverse mutation test with [notified chemical]. Final Report June 2004, TNO Study Number: 5005/04. TNO Nutrition and Food Research, Zeist, Netherlands. (Unpublished report provided by the notifier).

TNO Chemistry (2004b) Micronucleus test in bone marrow cells of mice treated with [notified chemical]. Final Report April 2004, TNO Study Number: 5604/01. TNO Nutrition and Food Research, Zeist, Netherlands. (Unpublished report provided by the notifier).

TNO Nutrition and Food Research (2003a) Determination of the ready biodegradability of T-1063FM [Notified chemical] in a closed bottle test (OECD Guideline No. 301D, EU C.4-E) (Report Number: V5042/04, 14 October 2003). TNO Nutrition and Food Research, Zeist, The Netherlands. (Unpublished report provided by the notifier).

TNO Nutrition and Food Research (2003c) Screening the effect of T-1063FM [Notified chemical] on the respiration of activated sludge (OECD Guideline No. 209) (Report Number V5042/03, 27 October 2003). TNO Nutrition and Food Research, Zeist, The Netherlands. (Unpublished report provided by the notifier).

TNO Nutrition and Food Research (2004a) Hydrolysis of the [organic component] of T-1063FM as a function of pH according to OECD guideline 111 – a preliminary test (Tier 1) (Report Number: V5687, 23 April 2004). TNO Nutrition and Food Research, Zeist, The Netherlands. (Unpublished report provided by the notifier).

TNO Nutrition and Food Research (2004b) STATEMENT Hydrolysis of T-1063FM (Project Number: V5042/07, 2 March 2004). TNO Nutrition and Food Research, Zeist, The Netherlands. (Unpublished report provided by the notifier).

TNO Nutrition and Food Research (2004c) Estimation of the Adsorption Coefficient (KOC) of T-1063FM on soil and on sewage sludge using HPLC (OECD 121) (Report Number: V5595, 23 March 2004). TNO Nutrition and Food Research, Zeist, The Netherlands. (Unpublished report provided by the notifier).

TNO Nutrition and Food Research (2004d) Addendum I to Determination of the effect of T-1063FM [Notified chemical] on the growth of the fresh water green alga *Selenastrum capricomutum.* (Guidelines: OECD 201 and EU C.3) (Report Number: V5042/02, 17 February 2004). TNO Nutrition and Food Research, Zeist, The Netherlands. (Unpublished report provided by the notifier).

TNO Prins Maurits Laboratory (2003) Determination of some physico-chemical properties of [Notified chemical] (Report Number: PML 2003-C78, August 2003). TNO Prins Maurits Laboratory, Rijswijk, The Netherlands. (Unpublished report provided by the notifier).

TNO Prins Maurits Laboratory (2004) Determination of some physico-chemical properties of [Notified chemical] part II (Report Number: PML 2004-C23, March 2004). TNO Prins Maurits Laboratory, Rijswijk, The Netherlands. (Unpublished report provided by the notifier).

NTC (National Transport Commission) 2007 Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG code), 7th Edition, Commonwealth of Australia

United Nations (2009) Globally Harmonised System of Classification and Labelling of Chemicals (GHS), 3rd revised edition. United Nations Economic Commission for Europe (UN/ECE), <http://www.unece.org/trans/danger/publi/ghs/ghs_rev03/03files_e.html >.