File No: STD/1563

September 2016

NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME (NICNAS)

PUBLIC REPORT

Poly(oxy-1,2-ethanediyl), α-(2-ethyl-1-oxohexyl)-ω-hydroxy- (INCI name: PEG-5 Ethylhexanoate)

This Assessment has been compiled in accordance with the provisions of the *Industrial Chemicals (Notification and Assessment) Act 1989* (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 conducts the risk assessment for public health and occupational health and safety. The assessment of environmental risk is conducted by the Department of the Environment and Energy.

This Public Report is 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:

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Director
NICNAS

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SUMMARY

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

ASSESSMENT REFERENCE	APPLICANT(S)	CHEMICAL OR TRADE NAME	HAZARDOUS CHEMICAL	INTRODUCTION VOLUME	USE
STD/1563	Symrise Pty Ltd	Poly(oxy-1,2-ethanediyl), α-(2-ethyl-1-oxohexyl)-ω-hydroxy- (INCI name: PEG-5 Ethylhexanoate)	ND*	15 tonnes per annum	Cosmetic ingredient

* ND = not determined

CONCLUSIONS AND REGULATORY OBLIGATIONS

Hazard classification
Based on the limited available information, the notified chemical is not recommended for classification according to the *Globally Harmonised System of Classification and Labelling of Chemicals (GHS),* as adopted for industrial chemicals in Australia, or the *Approved Criteria for Classifying Hazardous Substances* (NOHSC, 2004).

The environmental hazard classification according to the *Globally Harmonised System of Classification and Labelling of Chemicals* (GHS) is presented below. Environmental classification under the GHS is not mandated in Australia and carries no legal status but is presented for information purposes.

Hazard classification	*Hazard statement*
Acute (Category 2)	H401 - Toxic to aquatic life

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.

Based on the available information, when used at ≤ 2.5% concentration in cosmetic products, the notified chemical is not considered to pose an unreasonable risk to public health.

Environmental risk assessment
On the basis of the PEC/PNEC ratio and the assessed use pattern, the notified chemical is not considered to pose an unreasonable risk to the environment.

Recommendations

CONTROL MEASURES

Occupational Health and Safety

- A person conducting a business or undertaking at a workplace should implement the following engineering controls to minimise occupational exposure to the notified chemical during reformulation:
  - Enclosed, automated processes, where possible
  - Adequate local exhaust ventilation

- A person conducting a business or undertaking at a workplace should implement the following safe work practices to minimise occupational exposure during handling of the notified chemical during reformulation:
  - Avoid contact with skin and eyes
  - Avoid inhalation

- A person conducting a business or undertaking at a workplace should ensure that the following personal protective equipment is used by workers to minimise occupational exposure to the notified chemical during reformulation:
  - Coveralls
  - Impervious gloves
  - Eye protection
  - Respiratory protection, if inhalation exposure may occur

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

- A copy of the (M)SDS should be easily accessible to employees.

- If products and mixtures containing the notified chemical are classified as hazardous to health in accordance with the *Globally Harmonised System of Classification and Labelling of Chemicals (GHS)* as adopted for industrial chemicals in Australia, workplace practices and control procedures consistent with provisions of State and Territory hazardous substances legislation should be in operation.

Public Health

- Product formulators should exercise due care when using the notified chemical in cosmetic products given its potential ability to enhance the dermal penetration of other chemicals in the formulation.

Disposal

- Where reuse or recycling are not appropriate, dispose of the notified chemical in an environmentally sound manner in accordance with relevant Commonwealth, state, territory and local government legislation.

Emergency procedures

- Spills and/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 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(1) of the Act; if
  - the concentration of the notified chemical exceeds, or is intended to exceed, 2.5% in cosmetic products;
  - additional information becomes available on the repeated dose toxicity potential of the notified chemical;

or

(2) Under Section 64(2) of the Act; if
  - the function or use of the chemical has changed from a cosmetic ingredient, or is likely to change significantly;
  - the amount of chemical being introduced has increased, 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.

(Material) Safety Data Sheet
The (M)SDSs of the notified chemical and a product containing the notified chemical provided by the notifier were reviewed by NICNAS. The accuracy of the information on the (M)SDSs remains the responsibility of the applicant.

ASSESSMENT DETAILS

1. APPLICANT AND NOTIFICATION DETAILS

APPLICANT(S)
Symrise Pty Ltd (ABN: 67 000 880 946)
168 South Creek Road
DEE WHY NSW 2099

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

EXEMPT INFORMATION (SECTION 75 OF THE ACT)
No details are claimed exempt from publication

VARIATION OF DATA REQUIREMENTS (SECTION 24 OF THE ACT)
Variation to the schedule of data requirements is claimed for all physico-chemical properties and (eco)toxicological endpoints.

PREVIOUS NOTIFICATION IN AUSTRALIA BY APPLICANT(S)
None

NOTIFICATION IN OTHER COUNTRIES
Japan, Korea and USA

2. IDENTITY OF CHEMICAL

MARKETING NAME(S)
PEG-5 Ethylhexanoate (INCI name)

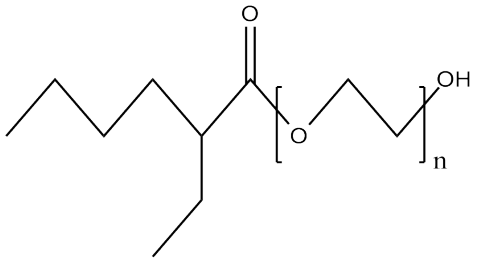
CAS NUMBER
26027-36-1

CHEMICAL NAME
Poly(oxy-1,2-ethanediyl), α-(2-ethyl-1-oxohexyl)-ω-hydroxy-

OTHER NAME(S)
2-Ethylhexanoic acid, ethoxylated (5 mol EO average molar ratio)
Neo-PCL Water Soluble N (mixture containing the notified chemical at 25-50% concentration)

MOLECULAR FORMULA
$(C_2H_4O)_nC_8H_{16}O_2$ (n = 5 on average)

STRUCTURAL FORMULA



n = 5 (on average)

MOLECULAR WEIGHT
364.47 Da (when n = 5)

ANALYTICAL DATA
No analytical data were provided

3. COMPOSITION

DEGREE OF PURITY
> 99%

HAZARDOUS IMPURITIES/RESIDUAL MONOMERS
None

NON HAZARDOUS IMPURITIES/RESIDUAL MONOMERS (> 1% BY WEIGHT)
None

ADDITIVES/ADJUVANTS
None

4. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE AT 20 °C AND 101.3 kPa: clear colourless to yellow liquid*

Property	Value	Data Source/Justification
Melting Point	154.03 °C	Calculated (EPISuite)
Boiling Point	422.06 °C at 101.3 kPa	Calculated (EPISuite)
Density	1025-1035 kg/m^3 at 20 °C*	(M)SDS
Vapour Pressure	2.66 x 10^{-7} kPa at 25 °C	Calculated (EPISuite)
Water Solubility	Not determined	The notified chemical is expected to be water dispersible based on its amphiphilic structure.
Hydrolysis as a Function of pH	Not determined	The notified chemical contains hydrolysable functionalities. However, no significant hydrolysis is expected to occur in the environmental pH range of 4 – 9.
Partition Coefficient (n-octanol/water)	Not determined	The notified chemical is an emulsifier and will tend to accumulate at the phase interface of octanol and water and/or form emulsions.
Adsorption/Desorption	Not determined	The notified chemical is an emulsifier and is expected to adsorb to soil and sediment.
Dissociation Constant	Not determined	The notified chemical does not contain any functional groups that are expected to dissociate in water.
Flash Point	Not determined	Introduced in aqueous solution
Flammability	Not determined	Introduced in aqueous solution
Autoignition Temperature	Not determined	Introduced in aqueous solution
Explosive Properties	Not determined	Contains no functional groups that would imply explosive properties
Oxidising Properties	Not determined	Contains no functional groups that would imply oxidative properties

* For the mixture containing the notified chemical at 25-50% concentration

Reactivity
The notified chemical is expected to be stable under normal conditions of use.

Physical hazard classification
Based on the submitted physico-chemical data depicted in the above table, the notified chemical is not recommended for hazard classification according to the *Globally Harmonised System of Classification and Labelling of Chemicals (GHS),* as adopted for industrial chemicals in Australia.

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 of a mixture at 25-50% concentration for reformulation into cosmetic products, or as a component of finished cosmetic products at ≤ 2.5% concentration.

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

Year	*1*	*2*	*3*	*4*	*5*
Tonnes	15	15	15	15	15

PORT OF ENTRY
Sydney

TRANSPORTATION AND PACKAGING
The notified chemical will be imported as a component of a mixture at 25-50% concentration in 25 kg HDPE jerry cans. The imported mixture containing the notified chemical will be transported to reformulation sites within Australia by road. The end-use products will be packaged in containers suitable for retail sale.

The notified chemical will also be imported as a component of finished cosmetic products at ≤ 2.5% concentration packaged in containers suitable for retail sale. The finished cosmetic products will be transported to retailers by road.

USE
The notified chemical will be used as an emulsifying agent in a wide range of cosmetic products at ≤ 2.5% concentration.

OPERATION DESCRIPTION
The notified chemical will not be manufactured within Australia. The imported mixture containing the notified chemical (at 25-50% concentration) will be stored at the notifier facility until they are sold and distributed to customer facilities for reformulation into end-use products. The notified chemical will also be imported as a component of finished cosmetic products at ≤ 2.5% concentration.

Reformulation
The procedures for incorporating the mixture containing the notified chemical into end-use products will likely vary depending on the nature of the formulated products and may involve both automated and manual transfer steps. However, in general, it is expected that for the reformulation process, the mixture containing the notified chemical will be weighed and added to the mixing tank where it will be blended with additional additives to form the finished cosmetic products. This will be followed by automated filling of the reformulated products into containers of various sizes up to 500 mL. The blending operations are expected to be highly automated and use closed systems and/or adequate ventilation. During the reformation process, samples of the mixture containing the notified chemical and the finished end-use products will be taken for quality control testing.

Cosmetic products
The finished cosmetic products containing the notified chemical will be used by consumers and professionals (such as beauticians and hair dressers). Depending on the nature of the products, application could be by hand, sprayed or through the use of an applicator.

6. HUMAN HEALTH IMPLICATIONS

6.1. Exposure Assessment

6.1.1. Occupational Exposure

CATEGORY OF WORKERS

Category of Worker	*Exposure Duration (hours/day)*	*Exposure Frequency (days/year)*
Transport workers	Unknown	Unknown
Mixer	4	2
Drum handling	4	2
Drum cleaning	4	2
Maintenance	4	2
Quality control	0.5	1
Packaging	4	2
Salon workers	Unspecified	Unspecified
Cleaners	Unspecified	Unspecified

EXPOSURE DETAILS

Transport and storage
Transport and storage workers may come into contact with the notified chemical at ≤ 50% concentration only in the event of accidental rupture of the drum containers.

Reformulation
During reformulation at the consumer product manufacture facilities, dermal, ocular and perhaps oral and inhalation exposure of workers to the notified chemical (at ≤ 50% concentration) may occur during weighing and transfer stages, blending, quality control analysis, and cleaning and maintenance of equipment. Exposure is expected to be minimised through the use of PPE such as coveralls, goggles and impervious gloves. The notifier also states that use of automated processes at the reformulation site is also expected to minimise the exposure.

End-use
Exposure to the notified chemical in end-use products (at ≤ 2.5% concentration) may occur in professions where the services provided involve the application of cosmetic products to clients (i.e., hair and beauty salons). The principal route of exposure will be dermal, while ocular and inhalation exposure is also possible. Such professionals may use some PPE to minimise repeated exposure, and good hygiene practices are expected to be in place. If PPE is used, exposure of such workers is expected to be of a similar or lesser extent than that experienced by consumers using products containing the notified chemical.

6.1.2. Public Exposure
There will be widespread and repeated exposure of the public to the notified chemical at ≤ 2.5% concentration through the use of cosmetic products. The principal route of exposure will be dermal, while ocular and inhalation exposure is also possible, particularly if products are applied by spray.

Data on typical use patterns of product categories in which the notified chemical may be used are shown in the following tables (SCCS, 2012; Cadby *et al.*, 2002). For the purposes of the exposure assessment, Australian use patterns for the various product categories are assumed to be similar to those in Europe. A dermal absorption (DA) of 100% was assumed for the notified chemical for calculation purposes. For the inhalation exposure assessment, a 2-zone approach was used (Steiling *et al*., 2014; Rothe *et al*., 2011; Earnest, Jr, 2009). An adult inhalation rate of 20 m^3/day (enHealth, 2012) was used and it was conservatively assumed that the fraction of the notified chemical inhaled is 50%. A lifetime average female body weight (BW) of 64 kg (enHealth, 2012) was used for calculation purposes.

Cosmetic products (dermal exposure)

Product type	Amount (mg/day)	C (%)	RF	Daily systemic exposure (mg/kg bw/day)
Body lotion	7820	2.5	1	3.0547
Face cream	1540	2.5	1	0.6016
Hand cream	2160	2.5	1	0.8438
Liquid Foundation	510	2.5	1	0.1992
Hair styling products	4000	2.5	0.1	0.1563
Shower gel	18670	2.5	0.01	0.0729
Hand wash soap	20000	2.5	0.01	0.0781
Shampoo	10460	2.5	0.01	0.0409
Hair conditioner	3920	2.5	0.01	0.0153
Total				5.0628

C = concentration of notified chemical
RF = retention factor.
Daily systemic exposure = (Amount x C x RF x DA)/BW

Aerosol products (Inhalation exposure)

Product type	Amount (g/day)	C (%)	Inhalation Rate (m^3/day)	Exposure Duration (Zone 1) (min)	Exposure Duration (Zone 2) (min)	Fraction Inhaled (%)	Volume (Zone 1) (m^3)	Volume (Zone 2) (m^3)	Daily systemic exposure (mg/kg bw/day)
Hairspray	9.89	2.5	20	1	20	50	1	10	0.0805

Daily systemic exposure = [(Amount x C x Inhalation Rate x Fraction Inhaled x 0.1)/(body weight x 1440)] x [(Exposure Duration (Zone 1)/Volume (Zone 1)) + (Exposure Duration (Zone 2)/Volume (Zone 2))]

The worst case scenario estimation using these assumptions is for a person who is a simultaneous user of all products listed in the above tables that contain the notified chemical. This would result in a combined internal dose of 5.1433 mg/kg bw/day for the notified chemical. It is acknowledged that inhalation exposure to the notified chemical from use of other cosmetic products (in addition to hair spray) may occur. However, it is considered that the combination of the conservative (screening level) hair spray inhalation exposure assessment parameters, and the aggregate exposure from use of the dermally applied products, which assumes a conservative 100% absorption rate, is sufficiently protective to cover additional inhalation exposure to the notified chemical from use of other spray cosmetic products with lower exposure factors.

6.2. Human Health Effects Assessment

No toxicity studies were submitted for the notified chemical. Information was provided by the notifier for an analogue chemical, PEG-5 isononanoate (Chemical Name: poly(oxy-1,2-ethanediyl), α-(1-oxoisooctyl)-ω-hydroxy-; CAS No. 127739-58-6), which is summarised in the following table. The analogue chemical is considered structurally similar to the notified chemical differing by only one carbon atom.

Endpoint	*Result and Assessment Conclusion*
Rat, acute oral toxicity	LD50 > 2,500 mg/kg bw; low toxicity
Rabbit, skin irritation	slightly irritating
Rabbit, eye irritation	slightly irritating
Mouse, skin sensitisation – Local lymph node assay	no evidence of sensitisation
Mutagenicity – bacterial reverse mutation	non mutagenic
Genotoxicity – *in vitro* chromosomal aberration test	non genotoxic
Genotoxicity – *in vitro* mammalian cell gene mutation test	non genotoxic

In addition, information on the possible metabolites, 2-ethyl-hexanoic acid (2-EHA, CAS No. 149-57-5) and polyethylene glycol (PEG), were also considered for estimating the hazard potential of the notified chemical.

Toxicokinetics
Based on the low molecular weight (< 500 Da) of the notified chemical, absorption across biological membranes may occur. However, given the surfactant properties of the notified chemical dermal absorption may be limited, although it may enhance the dermal absorption of other chemicals.

In the gastrointestinal tract the notified chemical is expected to be hydrolysed to 2-EHA and polyethylene glycol (i.e. PEG-5). 2-EHA is readily absorbed from the gastrointestinal tract and excreted rapidly, primarily via urine (IMAP, 2016). In the mouse and rat, distribution of 2-EHA following absorption was reported to be greatest in the kidneys, liver, and blood. 2-EHA has also been reported to have crossed the placenta in a study in pregnant mice (IMAP, 2016).

Absorption of polyethylene glycols (PEGs) across the gastrointestinal tract is dependent on the molecular weight. Low molecular weight PEGs, such as PEG-5, are readily absorbed and excreted primarily in the urine with less excretion in the faeces, based on studies conducted with PEG-8 (CIR, 2010).

Acute toxicity.
The analogue chemical (PEG-5 isononanoate) was found to be of low acute oral toxicity in a study conducted in rats (CIR, 2011).

No information is available on the acute dermal and inhalation toxicity of the analogue chemical. However, 2-EHA and PEGs, in general, have been found to be of low acute dermal and inhalation toxicity in animal tests (IMAP, 2016; CIR, 2010).

Irritation and sensitisation.
The analogue chemical (PEG-5 isononanoate) was found to be a mild skin irritant in a study conducted in rabbits, with skin reactions including well-defined erythema and very slight oedema (Johnson *et al.,* 2011).

The analogue chemical (PEG-5 isononanoate) was classified as a non-irritant to eyes in a study conducted in rabbits with only slight irritation effects observed, including conjunctival redness and oedema, which cleared within 14 days (Johnson *et al.,* 2011).

The analogue chemical (PEG-5 isononanoate) was found to be non-sensitising when tested at 25%, 50% and 100% concentrations in a local lymph node assay with stimulation indices (SI) of 1.70, 2.42 and 1.85, respectively (Johnson *et al*., 2011).

Repeated dose toxicity.
No information is available on the repeated dose toxicity of the analogue chemical (PEG 5 isononanoate).

Two repeat dose dietary studies have been reported for the predicted metabolite, 2-EHA (IMAP, 2016).

In a 90-day dietary study in rats, a lowest observed adverse effect level (LOAEL) of 917 mg/kg bw/day was reported based on reduced body weight gain in conjunction with reduced feeding. A lowest observed effect level (LOEL) of 303 mg/kg bw/day was also reported based on increased relative liver weight and hepatocyte hypertrophy.

In a 90-day dietary study in mice, a LOAEL of 1040 mg/kg bw/day was reported based on reduced body weight. A LOEL of 885 mg/kg bw/day was also reported based on effects including increased relative liver weight, hepatocyte hypertrophy, kidney effects and forestomach lesions.

Polyethylene glygols (PEGs) are, in general, of low toxicity from repeated exposure (CIR, 2010). However, there is some evidence of renal toxicity at higher exposure levels. For example, there was evidence of some renal toxicity at doses > 1,100 mg/kg bw/day for PEG-8 in a 13 week repeated dose oral (gavage) toxicity study in rats.

Reproductive toxicity/Developmental toxicity.
No information is available on the reproductive and developmental toxicity of the analogue chemical (PEG 5 isononanoate).

The predicted metabolite, 2-EHA, is classified as a reproductive (R62: Possible risk of impaired fertility) and developmental (R63: Possible risk of harm to the unborn child) toxicant (HSIS) based on results from animal

studies. In a reproductive study in rats, effects on the male reproductive system (reduction in sperm motility) were observed at 100 mg/kg bw/day, and increases in abnormal sperm were observed at 300 and 600 mg/kg bw/day. Dose-dependent delays in mating at 300 and 600 mg/kg bw/day were also reported, in addition to some animals being reported to be 'totally infertile' (IMAP, 2016). Developmental toxicity effects were noted in the absence of maternal toxicity from several studies in rats following exposure to the chemical via the oral route. The LOAEL was reported to be 100 mg/kg bw/day based on skeletal variations (wavy ribs) and skeletal malformations (club foot) of the foetuses (IMAP, 2016).

In reproductive and developmental toxicity studies in rats and mice, PEGs (including PEG-6) did not produce biologically significant embryotoxicity or teratogenicity (CIR, 2010).

Mutagenicity/Genotoxicity.
The analogue chemical (PEG-5 isononanoate) was negative in a bacterial reverse mutation study. A formulation containing 29% PEG-5 isononanoate was non-genotoxic to human lymphocytes in an *in vitro* chromosomal aberration assay and non-genotoxic to mouse lymphoma in an *in vitro* mammalian cell gene mutation test (Johnson *et al*., 2011).

The predicted metabolite, 2-EHA, was negative in bacterial reverse mutation tests, positive in several *in vitro* mammalian cell genotoxicity tests and negative in one *in vivo* micronucleus assay in mice. Overall, it is considered there is insufficient consistent evidence to classify the chemical for genotoxicity (IMAP, 2016).

Polyethylene glycols (PEGs), including PEG-4 and PEG-8, have not shown any evidence of mutagenicity or genotoxicity in a range of *in vitro* and *in vivo* studies (CIR, 2010). Furthermore, PEG-8 was not carcinogenic when administered orally, intraperitoneally, or subcutaneously to various test animals (CIR, 2010).

Based on the weight of evidence, the notified chemical is not expected to be genotoxic.

Health hazard classification
Based on the limited available information, the notified chemical is not recommended for classification according to the *Globally Harmonised System of Classification and Labelling of Chemicals (GHS),* as adopted for industrial chemicals in Australia, or the *Approved Criteria for Classifying Hazardous Substances* (NOHSC, 2004).

6.3. Human Health Risk Characterisation

6.3.1. Occupational Health and Safety
Based on the available information on analogues and predicted primary metabolites of the notified chemical, the notified chemical may be mildly irritating to the skin and eyes. This is supported by the surfactant properties of the notified chemical. The notified chemical is expected to be of low acute toxicity, not sensitising and non genotoxic; however, systemic effects from repeated exposure cannot be ruled out. However, absorption by the dermal route may be limited by the surfactant properties of the notified chemical.

Reformulation
During reformulation, workers may be at risk of skin and eye irritation when handling the notified chemical at ≤ 50% concentration. It is anticipated by the notifier that engineering controls such as enclosed and automated processes and local ventilation will be implemented where possible, and appropriate PPE (coveralls, imperious gloves, eye protection and respiratory protection) will be used to limit worker exposure.

Therefore, under the occupational settings described, the risk to the health of workers from use of the notified chemical is not considered to be unreasonable.

End-use
Workers involved in professions where the services provided involve the application of cosmetic products containing the notified chemical to clients (*e.g.*, hairdressers, beauty salon workers) may be exposed to the notified chemical at concentrations up to 2.5%. Such professionals may use PPE to minimise repeated exposure, and good hygiene practices are expected to be in place. If PPE is used, the risk to such workers is expected to be of a similar or lesser extent than that experienced by consumers using the various products containing the notified chemical.

6.3.2. Public Health

Cosmetic products containing the notified chemical at ≤ 2.5% concentration will be available to the public. The main route of exposure is expected to be dermal and inhalation, with some potential for accidental ocular or oral exposure.

Irritation

The notified chemical is expected to have potential to be slightly irritating to the skin and eyes. However, skin and eye irritation effects are not expected from use of the notified chemical at the proposed low use concentrations in cosmetic products.

Repeated-dose toxicity

No information is available on the repeated dose toxicity for the notified chemical. The notified chemical is expected to be readily metabolised to 2-EHA and PEG-5, if absorbed. PEG-5 is expected to be of low systemic toxicity. 2-EHA is a reproductive and developmental toxicant, and is included in Schedule 6 of the Poisons Standard (SUSMP) except at levels 5 per cent or less in preparations. The notified chemical will be used in cosmetic products at ≤ 2.5% concentration, equivalent to 2-EHA at ≤ 1%, which is below the Scheduling criteria.

As the notified chemical may have the potential to enhance dermal absorption of other chemicals, care should be taken in formulating end-use products containing it.

Overall, based on the information available, the risk to the public associated with use of the notified chemical at ≤ 2.5% concentration in cosmetic 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 is no release of the notified chemical to the environment from this activity. Environmental release during importation, transport and distribution may occur as a result of accidental spills. In the event of a spill, the notified chemical is expected to be contained and collected with an inert absorbent material and disposed of in accordance with local regulations.

The notified chemical will be blended with other ingredients in automated/enclosed facilities to produce cosmetic products. Release from blending is expected to be very low. A total of up to < 2% of the import volume (or up to 300 kg) is estimated to be generated as waste from residues in empty containers and spills during blending. Empty containers containing the notified chemical will either be recycled or disposed of through an approved waste management facility.

RELEASE OF CHEMICAL FROM USE

During use as a component of cosmetic products, the entire volume of the notified chemical in washings is expected to be released to sewers on a nationwide basis. Residues of the notified chemical in the empty containers (up to 2% of the total import volume, or 300 kg) are expected to be disposed of to landfill.

RELEASE OF CHEMICAL FROM DISPOSAL

The majority of the notified chemical is expected to be released to sewer. A small amount of the notified chemical is likely to be disposed of to landfill when empty containers with residues of cosmetic products containing the notified chemical are discarded.

7.1.2. Environmental Fate

The notified chemical is expected to be readily biodegradable based on the ready biodegradability determined for the analogue chemical (PEG-5 isononanoate) (60% in 28 days). The analogue is structurally similar to the notified chemical and therefore, they are expected to have similar physical chemical properties and environmental fate.

Following its use in cosmetic products in Australia, the majority of the notified chemical is expected to enter the sewer system before potential release to surface waters nationwide. Notified chemical remaining in treated

sewage effluents is likely to be released to surface waters, or applied to land when used for irrigation. Notified chemical in sewage sludge is anticipated to be disposed of to landfill, or applied to land when sludge is used for soil remediation. Based on its surface activity and expected biodegradability, the notified chemical is not expected to bioaccumulate.

The notified chemical is expected to degrade in STPs, surface waters, soils and landfill due to its expected degradability. The metabolites are expected to further degrade in both the aquatic and terrestrial compartments through biotic and abiotic processes to form water, oxides of carbon.

7.1.3. Predicted Environmental Concentration (PEC)

The notified chemical will be released to sewers following its use in cosmetic products. Therefore, under a worst case scenario, it is assumed that 100% of the total import volume of the notified chemical will be discharged into sewers nationwide over 365 days per year. At the sewage treatment plants (STPs), 60% of the notified chemical is expected to be removed from STPs effluent based on its ready biodegradability. The resultant Predicted Environmental Concentration (PEC) in sewage effluent on a nationwide basis is estimated as follows:

Predicted Environmental Concentration (PEC) for the Aquatic Compartment		
Total Annual Import/Manufactured Volume	15,000	kg/year
Proportion expected to be released to sewer	100%	
Annual quantity of chemical released to sewer	15,000	kg/year
Days per year where release occurs	365	days/year
Daily chemical release:	41.10	kg/day
Water use	200.0	L/person/day
Population of Australia (Millions)	22.613	million
Removal within STP	60%	**(readily biodegradable)**
Daily effluent production:	4,523	ML
Dilution Factor - River	1.0	
Dilution Factor - Ocean	10.0	
PEC - River:	3.6	µg/L
PEC - Ocean:	0.36	µg/L

STP effluent re-use for irrigation occurs throughout Australia. The agricultural irrigation application rate is assumed to be 1,000 L/m^2/year (10 ML/ha/year). The notified chemical in this volume is assumed to infiltrate and accumulate in the top 10 cm of soil (density 1,500 kg/m^3). Using these assumptions, irrigation with a concentration of 3.64 µg/L may potentially result in a soil concentration of approximately 24.23 µg/kg. Assuming accumulation of the notified chemical in soil for 5 and 10 years under repeated irrigation, the concentration of notified chemical in the applied soil in 5 and 10 years may be approximately 121.2 µg/kg and 242.3 µg/kg, respectively.

7.2. Environmental Effects Assessment

The results from ecotoxicological investigations conducted on an acceptable close analogue (PEG-5 isononanoate) is summarised in the table below. Details of the study of the analogue can be found in Appendix C.

Endpoint	*Result*	*Assessment Conclusion*
Daphnia Toxicity	EC50 = 5.87 mg/L	Toxic to aquatic invertebrates

The analogue chemical is expected to be toxic to aquatic invertebrates. As such, on the basis of the acute toxicity data for the analogue, the notified chemical is expected to be toxic to aquatic organisms. Therefore, under the Globally Harmonised System of Classification and Labelling of Chemicals (GHS; United Nations, 2009), the notified chemical is formally classified as Acute Category 2; Toxic to aquatic life. Based on the acute toxicity, ready biodegradability and lack of potential for bioaccumulation of the notified chemical, it has not been formally classified under the GHS for long term toxicity.

7.2.1. Predicted No-Effect Concentration

The predicted no-effect concentration (PNEC) has been calculated and is presented in the table below. The PNEC is calculated based on the endpoint for the sensitive species (daphnia) for the analogue chemical. Only one ecotoxicity endpoint for aquatic species for a close analogue is available. Therefore, a conservative assessment factor of 1,000 has been used.

Predicted No-Effect Concentration (PNEC) for the Aquatic Compartment		
Daphnia (EC50, 48 h)	5.87	mg/L
Assessment Factor	1,000	
Mitigation Factor	1.00	
PNEC:	5.87	µg/L

7.3. Environmental Risk Assessment

Based on the above PEC and PNEC values, the following Risk Quotients (RQ = PEC/PNEC) have been calculated:

Risk Assessment	PEC µg/L	PNEC µg/L	Q
Q – River	3.6	5.87	**0.613**
Q – Ocean	0.36	5.87	**0.0613**

The risk quotients for discharge of treated effluents containing the notified chemical to the aquatic environment indicate that the notified chemical is unlikely to reach ecotoxicologically significant concentrations in surface waters, based on its maximum annual importation quantity. The notified chemical is readily biodegradable, and is expected to have a low potential for bioaccumulation. On the basis of the PEC/PNEC ratio, maximum annual importation volume and assessed use pattern in cosmetic products, the notified chemical is not expected to pose an unreasonable risk to the environment.

APPENDIX C: ENVIRONMENTAL FATE AND ECOTOXICOLOGICAL INVESTIGATIONS

C.1. Environmental Fate

C.1.1. Ready biodegradability

TEST SUBSTANCE	Analogue chemical (PEG-5 isononanoate)
METHOD	OECD TG 301 F Ready Biodegradability: Manometric Respirometry Test
Inoculum	Activated sludge
Exposure Period	28 days
Auxiliary Solvent	None
Analytical Monitoring	Dissolved oxygen measured by oxygen meter
Remarks – Method	No significant protocol deviations

RESULTS

Test substance		*Sodium benzoate*	
Day	*% degradation*	*Day*	*% degradation*
7	27	7	82
14	63	14	94
21	66	21	90
28	60	28	92

Remarks – Results	All relevant OECD criteria were met. The toxicity control attained 82% degradation after 28 days thereby confirming that the test material was not toxic to the sewage treatment microorganisms used in the study. Sodium benzoate attained 92% degradation after 28 days thereby confirming the suitability of the inoculum and test conditions.
CONCLUSION	The analogue chemical, and by inference the notified chemical, is considered to be ready biodegradable.
TEST FACILITY	Symrise GMBH (2006)

C.2. Ecotoxicological Investigations

C.2.1. Acute toxicity to aquatic invertebrates

TEST SUBSTANCE	Analogue chemical (PEG-5 isononanoate)
METHOD	OECD TG 202 Daphnia sp. Acute Immobilisation Test and Reproduction Test - Static.
Species	*Daphnia magna*
Exposure Period	48 hours
Auxiliary Solvent	None reported
Water Hardness	160-180 mg $CaCO_3$/L
Analytical Monitoring	Liquid chromatography–mass spectrometry (LC-MS)
Remarks - Method	The test item was clearly dissolved in the tested concentrations throughout exposure. Recovery rates of the test item were > 80 %. Therefore, all effects are given based on nominal test item concentrations. The test was conducted in accordance with the test guideline without significant deviations. Good Laboratory Practice (GLP) was followed.

RESULTS

Nominal Concentration mg/L	*Number of D. magna*	*Cumulative Immobilised (%)*	
		24 h	*48 h*
Control	100	0	0
0.625	100	0	0
1.25	100	0	0
2.50	100	10	10
5.0	100	15	15
10.0	100	55	100

LC50	5.87 mg/L at 48 hours
NOEC	2.5 mg/L at 48 hours
Remarks - Results	All validity criteria were within acceptable limits. Immobilisation rates of ≤ 10 % are considered as not biologically significant.

CONCLUSION The analogue chemical, and by inference the notified chemical, is toxic to aquatic invertebrates.

Test Facility DR. U. NOACK-Laboratorien (2006)

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