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November 2014

**NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME
(NICNAS)**

PUBLIC REPORT

Formaldehyde, polymer with phenol, cyanate

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.

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:

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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 |
|----------------------|----------------------------------|--|--------------------|---------------------|----------------------------------|
| LTD/1678 | Robert Bosch (Australia) Pty Ltd | Formaldehyde, polymer with phenol, cyanate | ND* | 1.0 tonne per annum | Component in diode manufacturing |

*ND = not determined

CONCLUSIONS AND REGULATORY OBLIGATIONS

Hazard classification

As no toxicity data were provided, the notified polymer cannot be classified according to the *Globally Harmonised System for the Classification and Labelling of Chemicals* (GHS), as adopted for industrial chemicals in Australia, or the *Approved Criteria for Classifying Hazardous Substances* (NOHSC, 2004).

Human health risk assessment

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

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

Environmental risk assessment

Based on its assessed use pattern, the notified polymer 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 isolation and engineering controls to minimise occupational exposure to the notified polymer at < 30%:
 - Enclosed, automated processes, where possible
 - Good ventilation, including local exhaust ventilation where possible
- 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 polymer at < 30%:
 - Avoid contact with skin and eyes
 - Avoid breathing fumes
 - Clean up spills promptly
- 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 polymer at < 30%:
 - Coveralls
 - Eye Protection
 - Impervious gloves
 - Respiratory protection if ventilation is inadequate

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 polymer are classified as hazardous to health in accordance with the *Globally Harmonised System for the 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.

Disposal

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

Storage

- The following precautions should be taken by a person conducting a business or undertaking at a workplace regarding storage of the notified polymer:
 - Keep in original packaging, tightly closed
 - Keep container tightly closed and dry in a cool, well-ventilated place

Emergency procedures

- Spills or accidental release of the notified polymer 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 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(1) of the Act; if
 - the importation volume exceeds one tonne per annum notified polymer;

or

- (2) Under Section 64(2) of the Act; if
 - the function or use of the polymer has changed from component in diode manufacturing, or is likely to change significantly;
 - the polymer has begun to be manufactured in Australia;
 - additional information has become available to the person as to an adverse effect of the polymer 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 MSDS of the product containing the notified polymer 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)

Robert Bosch (Australia) Pty Ltd (ABN: 48 004 315 628)
1555 Centre Road
CLAYTON VIC 3168

NOTIFICATION CATEGORY

Limited-small volume: Synthetic polymer with Mn < 1,000 Da (1 tonne or less 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 as follows: all physico-chemical endpoints

PREVIOUS NOTIFICATION IN AUSTRALIA BY APPLICANT(S)

None

NOTIFICATION IN OTHER COUNTRIES

None

2. IDENTITY OF CHEMICAL

MARKETING NAME(S)

Gießharz CE XP 1110-4/4-1 (product containing the notified polymer)

CAS NUMBER

87397-54-4

CHEMICAL NAME

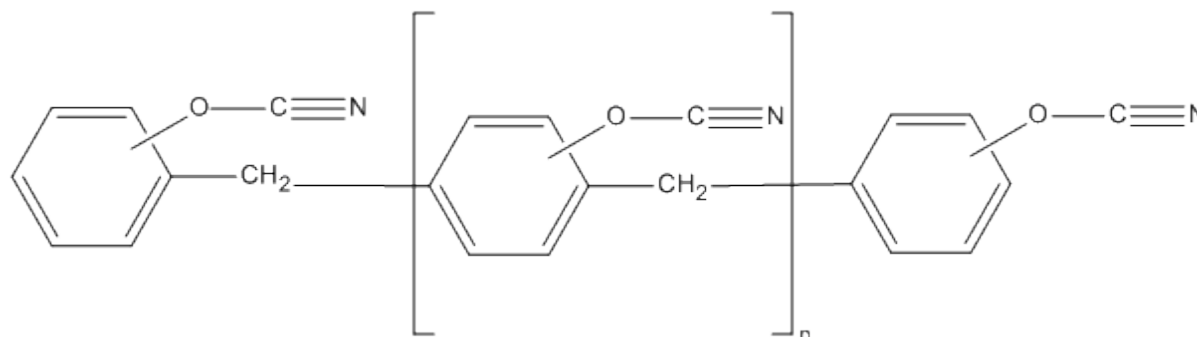
Formaldehyde, polymer with phenol, cyanate

OTHER NAME(S)

Phenol-formaldehyde copolymer cyanate
Polyphenolic Cyanate Resin (generic name)

MOLECULAR FORMULA

$(C_6H_6O.CH_2O)_x.xCHNO$

STRUCTURAL FORMULA**MOLECULAR WEIGHT**

| | |
|--------------------------------------|----------|
| Number Average Molecular Weight (Mn) | 647 Da |
| Weight Average Molecular Weight (Mw) | 1,038 Da |
| Polydispersity Index (Mw/Mn) | 1.6 |
| % of Low MW Species < 1,000 Da | 58% |

% of Low MW Species < 500 Da 18%

ANALYTICAL DATA

Reference GPC spectrum was provided.

3. COMPOSITION

DEGREE OF PURITY

> 99%

HAZARDOUS IMPURITIES/RESIDUAL MONOMERS

None

NON HAZARDOUS IMPURITIES/RESIDUAL MONOMERS (> 1% BY WEIGHT)

None

ADDITIVES/ADJUVANTS

None

POLYMER CONSTITUENTS

| <i>Chemical Name</i> | <i>CAS No.</i> | <i>Weight % starting</i> | <i>Weight % residual</i> |
|----------------------|----------------|------------------------------|------------------------------|
| Phenol | 108-95-2 | 66 | 0 |
| Formaldehyde | 50-00-0 | 15 | 0 |
| Hydrogen cyanate | 420-05-3 | 19 | 0 |

LOSS OF MONOMERS, OTHER REACTANTS, ADDITIVES, IMPURITIES

The notified polymer is stable under normal handling conditions. Cool transport and storage containers are used to avoid overheating.

DEGRADATION PRODUCTS

Degradation products are expected to be oxides of nitrogen and carbon.

4. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE AT 20 °C AND 101.3 kPa: yellow viscous liquid

| Property | Value | Data Source/Justification |
|---|---------------------------------|--|
| Stock Point | 12 °C | SDS |
| Boiling Point | > 144 °C | SDS |
| Density | 1200 kg/m ³ at 20 °C | SDS |
| Vapour Pressure | Not determined | Estimated to be low based on the relative high molecular weight. |
| Water Solubility | Not determined | Expected to be low due to the predominant hydrophobic structure of the notified polymer. |
| Hydrolysis as a Function of pH | Not determined | Not expected to be significantly hydrolysed due to the expected low water solubility of the notified polymer. |
| Partition Coefficient (n-octanol/water) | Not determined | Expected to partition from water to n-octanol on the basis of its expected low water solubility. |
| Adsorption/Desorption | Not determined | Expected to sorb to soil and sediment, and have low mobility in the environment on the basis of its expected low water solubility. |
| Dissociation Constant | Not determined | Contains ionisable functionalities. However, the notified polymer is not expected to ionise under normal |

| | | |
|--------------------------|-----------------------|---|
| Flash Point | > 200 °C (closed cup) | environmental pH range of 4 – 9. |
| Autoignition Temperature | > 200 °C | SDS (DIN 51758) |
| Explosive Properties | Not determined | Estimated |
| | | Not expected to be explosive based on structure |
| Oxidising Properties | Not determined | Not expected to be oxidising based on structure |

DISCUSSION OF PROPERTIES

Reactivity

The notified polymer is expected to be stable under normal handling conditions, however it will polymerise if heated.

Physical hazard classification

Based on the submitted physico-chemical data depicted in the above table, the notified polymer is not recommended for hazard classification according to the *Globally Harmonised System for the 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 polymer will be imported as a component of a liquid resin at < 30% concentration.

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

| Year | 1 | 2 | 3 | 4 | 5 |
|--------|-----|-----|-----|-----|-----|
| Tonnes | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |

PORT OF ENTRY

Melbourne

IDENTITY OF MANUFACTURER/RECIPIENTS

Robert Bosch (Australia) Pty Ltd

TRANSPORTATION AND PACKAGING

The resin containing the notified polymer at < 30% concentration will be transported in 25 kg drums by road.

USE

The resin containing the notified polymer at < 30% concentration will be used for automotive power diode manufacturing. The resin is used to encapsulate and create mechanical stability for the power diode.

OPERATION DESCRIPTION

There will be no reformulation or repackaging of the resin containing the notified polymer at < 30% concentration in Australia.

At the diode manufacturing site the resin containing the notified polymer will be manually loaded from the 25 kg drums into a preparation vessel to mix with the catalyst in a specially designed casting machine. Specialised encapsulating equipment then delivers and doses a specific amount of resin containing the notified polymer directly into the cavity of the power diode from the closed preparation vessels. The diodes will be removed from the encapsulating equipment, placed on a tray and transferred to a rack for curing to complete the hardening process of the resin. All diodes will be electrically tested and then packed and delivered to overseas customers who assemble the diodes into alternators.

6. HUMAN HEALTH IMPLICATIONS

6.1. Exposure Assessment

6.1.1. Occupational Exposure

CATEGORY OF WORKERS

| <i>Category of Worker</i> | <i>Exposure Duration (hours/day)</i> | <i>Exposure Frequency (days/year)</i> |
|---------------------------|--|---|
| Transport and Storage | 2-3 | 5 |
| Operator | 8 | 20 |
| Maintenance | 1 | 10 |

EXPOSURE DETAILS

Transport and Storage

Transport and storage workers are not expected to be exposed to the notified polymer except in the unlikely event of an accident.

Manufacturing of diodes

Incidental dermal and ocular exposure to the notified polymer at < 30% concentration may occur during the manual addition of the resin containing the notified polymer to the manufacturing equipment. Dermal exposure may also occur during the manufacture and curing of the diodes and during the cleaning of equipment.

To minimise exposure to the notified polymer, manufacturing workers will wear eye protection, coveralls and gloves. Fumes may be released during the curing process in enclosed bath curing ovens. Where ventilation is not sufficient, a ventilator/mask will be worn.

Workers may make dermal contact with diodes; however once the diode is cured, the notified polymer is expected to remain bound within the solid diode and will not be bioavailable.

6.1.2. Public Exposure

The notified polymer will not be sold to the public. It is possible that contact with diodes may occur. However, once the diode is cured, the notified polymer is expected to remain bound within the diode and will not be bioavailable.

6.2. Human Health Effects Assessment

No toxicity data were submitted.

Toxicokinetics

Based on the low molecular weight (NAMW 647 Da) of the notified polymer, passive diffusion across the gastrointestinal (GI) tract and dermal absorption may occur.

Acute toxicity

Based on the Material Safety Data Sheet (MSDS) provided for the resin containing the notified polymer (< 30% concentration), the notified polymer is of low toxicity through the oral (LD50 > 2,000 mg/kg bw, rat) and dermal (LD50 > 2,000 mg/kg bw, rat) route. No acute inhalation study was provided.

Irritation and sensitisation

No data on irritation was provided. Based on the MSDS, the notified polymer was slightly irritating to the skin and eyes in rabbit studies.

No data on sensitisation was provided. The notified polymer is classified by the notifier as sensitising to the skin. The MSDS indicates that this is based on a study on guinea pigs.

Repeated dose toxicity

No repeated dose toxicity was provided.

Mutagenicity/Genotoxicity

Based on MSDS, the notified polymer was not mutagenic in a bacterial reverse mutation assay and it was not genotoxic in an *in vivo* micronucleus test in mice.

Health hazard classification

As no toxicity data were provided, the notified polymer cannot be classified according to the *Globally Harmonised System for the 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

The notified polymer may be sensitising and may be slightly irritating to the skin and eyes.

The notifier states that exposure to operators and maintenance workers is expected to be limited by the largely automated and enclosed processes, good ventilation, including local exhaust ventilation where possible, and the use of PPE including coveralls, eye protection and impervious gloves. In addition, the product containing the notified chemical is classified as a skin sensitiser. The controls in place to reduce exposure to the product would inherently reduce exposure to the notified polymer. In addition, the use of respiratory protection is recommended, in the absence of adequate ventilation. Therefore, provided that the stated PPE is used and engineering controls are in place to limit exposure, the risk to the health of operators and maintenance workers is not considered to be unreasonable.

6.3.2. Public Health

The notified polymer will be used in industrial settings only and will not be sold to the public. The public may come into contact with the diode containing the notified polymer. However, once the diode is cured, the notified polymer is expected to remain bound within the diode and will not be bioavailable. Therefore, when used in the proposed manner, the risk to public health 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 polymer will be imported into Australia as a liquid concentrate in 25 kg drums. Environmental release is unlikely during importation, storage and transportation, and spillage during a transport accident will be the most likely reason for environmental release.

RELEASE OF CHEMICAL FROM USE

The resin containing the notified polymer will be used for automotive power diode manufacturing in industrial settings. Releases from automotive power diode manufacturing facilities are anticipated to be limited given the use of fully automated systems. Wastes from residues in drums and spills are expected to be collected and disposed of to landfill.

RELEASE OF CHEMICAL FROM DISPOSAL

The empty drums are expected to be sealed and transferred to designated prescribed waste storage areas to be disposed of according to approved procedures.

7.1.2. Environmental Fate

The notified polymer is not expected to be readily biodegradable in the environment based on the data provided in the MSDS. A full study report was not submitted and therefore this data should be treated with caution. The notified polymer will be irreversibly bound within the end products, power diodes. At the end of their useful lives, the power diodes containing the notified polymer will eventually be sent to landfill. Leaching of the notified polymer in landfill is not expected given the irreversible binding of the notified polymer within the diode. The bound notified polymer will not be bioavailable. It will undergo slow degradation processes via biotic and abiotic pathways, eventually forming water and oxides of carbon and nitrogen.

7.1.3. Predicted Environmental Concentration (PEC)

The predicted environmental concentration (PEC) for the notified polymer has not been calculated since no significant release to the environment is expected based on its reported use pattern.

7.2. Environmental Effects Assessment

No ecotoxicity data were submitted. The notified polymer will be irreversibly bound within automotive power diodes. Therefore, the notified polymer is not expected to be isolated from automotive power diodes and be bioavailable.

7.2.1. Predicted No-Effect Concentration

A predicted no-effect concentration (PNEC) has not been calculated for the notified polymer as, based on its reported use pattern, ecotoxicologically significant quantities are not expected to be released to the aquatic environment.

Environmental Risk Assessment

A risk quotient (PEC/PNEC) for the notified polymer was not calculated as neither a PEC nor PNEC was derived. Release of the notified polymer to the aquatic environment in ecotoxicologically significant quantities is not expected based on its reported use pattern. The notified polymer is not expected to be bioaccumulative and is expected to slowly degrade in the environment. Based on the assessed use pattern of the notified polymer, it is not expected to pose an unreasonable risk to the environment.

BIBLIOGRAPHY

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

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>.