File No: PLC 53

November 1997

**NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME**

**FULL PUBLIC REPORT**

1,3-Benzenedicarbonyl dichloride, polymer with 1,4-benzenedicarbonyl dichloride, carbonic dichloride and 4,4'-(1-methylethylidene)bis[phenol], bis[4-(1-methyl-1-phenylethyl)phenyl] ester

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 Worksafe Australia which also conducts the occupational health & safety assessment. The assessment of environmental hazard is conducted by the Department of the Environment and the assessment of public health is conducted by the Department of Health and Family Services.

For the purposes of subsection 78(1) of the Act, copies of this full public report may be inspected by the public at the Library, Worksafe Australia, 92-94 Parramatta Road, Camperdown NSW 2050, between the following hours:

| | |
|---|---|
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Director
Chemicals Notification and Assessment

# FULL PUBLIC REPORT

1,3-Benzenedicarbonyl dichloride, polymer with
1,4-benzenedicarbonyl dichloride, carbonic dichloride and
4,4'-(1-methylethylidene)bis[phenol],
bis[4-(1-methyl-1-phenylethyl)phenyl] ester

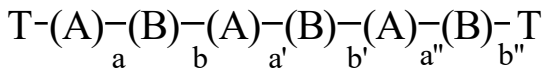
## 1. APPLICANT

GE Plastics (Australia) Ltd of 175 Dandenong Road DANDENONG VIC 3175 has submitted a notification statement accompanying their application for assessment of a synthetic polymer of low concern, 1,3-benzenedicarbonyl dichloride, polymer with 1,4-benzenedicarbonyl dichloride, carbonic dichloride and 4,4'-(1-methylethylidene)bis[phenol], bis[4-(1-methyl-1-phenylethyl)phenyl] ester. The applicant has not claimed confidentiality for any part of the assessment and the information herein is available as the full public report in its entirety.

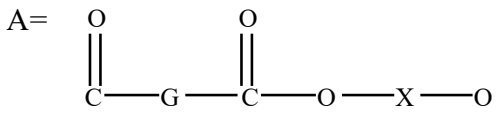
## 2. IDENTITY OF THE CHEMICAL

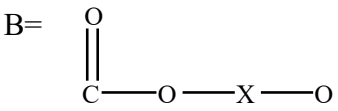
| | |
|---|---|
| **Chemical Name:** | 1,3-benzenedicarbonyl dichloride, polymer with 1,4-benzenedicarbonyl dichloride, carbonic dichloride and 4,4'-(1-methylethylidene)bis[phenol], bis[4-(1-methyl-1-phenylethyl)phenyl] ester |
| **Trade Name:** | LEXAN PCE |
| **Other Name:** | PCE RESIN / P87-0463 |
| **CAS Registry No:** | 114096-64-9 |
| **Molecular Formula:** | $(C_{15}H_{16}O_2\text{-}CH_2O_3)_m(C_{15}H_{16}O_2\text{-}C_8H_6O_4)_n(C_{15}H_{16}O)_z$ |
| **Number-Average Molecular Weight (NAMW):** | 14 410 |
| **Weight-Average Molecular Weight:** | 28 423 |

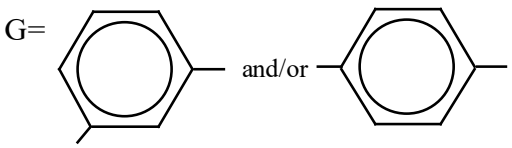
**Structural Formula:**

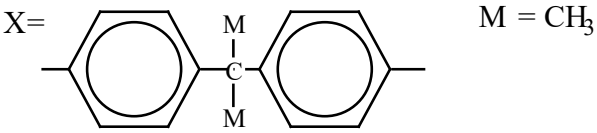


where a + b + a' + b' + a" + b" = 28 - 400

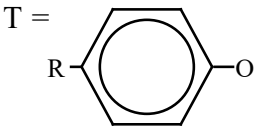


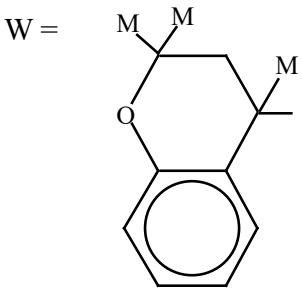






M = $CH_3$





**Polymer Constituents**

| *Constituent* | *CAS No.* | *% Weight* |
|---|---|---|
| 4,4'-(1-methylethylidene)-bisphenol | 80-05-7 | 57-66 |
| 1,4-benzenedicarboxylic acid dichloride | 100-20-09 | 2 |
| 1,3-benzenedicarboxylic acid dichloride | 99-63-8 | 29-30 |
| carbonic dichloride | 75-44-5 | 2 |
| 4-(1-methyl-1-phenylethyl)-phenol | 599-64-4 | 2-4 |

**Means of Identification :** gel permeation chromatography

**Comments on Chemical Identity**

Data from Gel Permeation Chromatography have been provided for the polymer. No other identification provided.

## 3. PHYSICAL AND CHEMICAL PROPERTIES

| | |
|---|---|
| **Appearance at 20°C and 101.3 kPa:** | colourless solid |
| **Melting Point/Glass Transition Temperature:** | approximately 150°C |
| **Density:** | 1.2 kg/$m^3$ AT 25°C |
| **Water Solubility:** | < 1 mg.$L^{-1}$ (estimated), nearly insoluble |
| **Partition Coefficient (n-octanol/water):** | not estimated, insoluble in water<br>20% by weight soluble in methylene chloride at 25°C indicates solubility in strong organic solvent |
| **Hydrolysis:** | not determined |
| **Flammability Limits:** | flash point is approximately 449°C (American Society for Testing and Materials standard 1929) |
| **Autoignition Temperature:** | 662°C (approximately) |
| **Reactivity:** | stable |
| **Particle Size Distribution**: | approximately 3% less than 160 μm |

### Comments on Physico-Chemical Properties

The notifier has provided an expert opinion that water solubility will be < 1 mg.$L^{-1}$. It is agreed that the polymer should exhibit very low water solubility. The polymer contains ester groups which are potentially able to undergo hydrolysis within the environmental pH range. However, this is not anticipated due to the expected very low water solubility of the polymer. The polymer has no reactive functional groups. The data provided are acceptable for a polymer of low concern

## 4. PURITY OF THE CHEMICAL

### Maximum Weight-percentage of Residual Monomers

| *Constituent* | *CAS No.* | *% Weight* |
|---|---|---|
| 4,4'-(1-methylethylidene)-bisphenol | 80-05-7 | 0.01 |
| 1,4-benzenedicarboxylic acid dichloride | 100-20-09 | not detected |
| 1,3-benzenedicarboxylic acid dichloride | 99-63-8 | not detected |
| carbonic dichloride | 75-44-5 | not detected |
| 4-(1-methyl-1-phenylethyl)-phenol | 599-64-4 | 0.002 (estimated) |

**Maximum Weight-percentage of Impurities**

| *Constituent* | *CAS No.* | *% Weight* |
|---|---|---|
| sodium chloride | 7647-14-5 | 0.003 |
| methylene chloride | 75-09-2 | 0.12 |
| iron | 7439-89-6 | 0.00004 |
| triethylamine | 121-44-8 | 0.002 |

## 5. USE, VOLUME AND FORMULATION

The notified polymer will not be manufactured in Australia. It will be imported into Australia as the pure polymer in 25 kg bags and 500 kg cardboard containers. Import volumes of the notified polymer are as follows:

| Year | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Import Volume (tonnes) | 5-7 | 7-9 | 9-15 | 15-18 | 20 |

It will be used in a range of end-use products including electrical equipment parts, medical equipment, computer parts, lighting fixture lenses and small automotive parts.

## 6. OCCUPATIONAL EXPOSURE

LEXAN PCE will be imported in a ready-to-use form for incorporation into plastic formulations by manufacturers of engineering master-batches or articles. Typically, the pellets of the notified polymer would be dried at about 125°C and fed into an injection moulding machine to be heated to approximately 300°C to 350°C for injecting under pressure into the final part moulds. Exposure of transport and storage workers to LEXAN PCE will normally be negligible, given the solid pelletised form of the polymer in containers which they will be handling.

Workers directly involved in fabrication of plastic products will be exposed to the notified polymer during:

- loading of dryers and moulding machines,
- purgings at machine start-up,
- post-moulding operations and
- mechanical grinding of scrap for recycle.

Dermal contact is expected to be the main form of exposure during loading operations since the level of fines is low.

Workers involved in moulding operations may be exposed to fumes, from the notified polymer and other additives, produced at the high temperatures necessary for moulding. Mechanical grinding for recycling may produce a significant level of fines which, like fumes, may irritate workers' skin, eyes and respiratory passages. Once the solid products are cooled to their final form exposure should be limited to direct contact and the inert nature of LEXAN PCE should prevent absorption from any other route of exposure.

## 7. PUBLIC EXPOSURE

There is negligible potential for public exposure to the polymer arising from importation, storage, transportation and formulation into plastic products. Similarly, the potential for public exposure to the polymer during transport and disposal of process waste and clean-up of waste after a spill is very minor. There is potential for public exposure from the end-use application of the chemical within final plastic products.

## 8. ENVIRONMENTAL EXPOSURE

### Release

Release to the environment of the notified polymer as a result of repackaging should be minimal as the notifier estimates only 100 kg will be repackaged each year. The notifier estimates that, because the product is in granular form, only trace amounts of the polymer will be left in empty packaging or will be left over from any spill. Release to the environment of the notified polymer as a result of manufacturing is expected to be minimal. The polymer will be fed automatically into moulding machinery from a hopper. Waste material will be reground and reused. Small quantities of machinings may be deposited into municipal landfills. Overall, it is estimated such waste streams could account for between 1% (large production runs) and 5% (small production runs) of the annual throughput (ie. a maximum of 350 kg waste polymer to landfill is possible in year one increasing to a possible 1 000 kg in year five). Used articles (eg. electrical equipment and car parts) containing the polymer will also eventually be deposited of in landfills.

### Fate

In the case of accidental spillage, granules of the polymer are expected to remain where they are deposited. Should a spill occur to water, the granules should settle onto the bottom sediments, where they could be collected and landfilled. Scraps from the moulding process, if not reused, will also be disposed of to landfill. Due to the anticipated negligible solubility of the polymer, leaching from landfill is highly unlikely with no movement from the landfill site expected.

The majority of the polymer is not expected to be released to the environment until it has been moulded into components and will share the fate of these components. Biodegradation is unlikely. The high molecular weight of the substance also means that bioaccumulation is not likely to occur (1, 2).

Surface photodegradation of the finished components is expected with sunlight, but this is only likely to occur after the product has been disposed of to landfill, or discarded inappropriately.

## 9. ASSESSMENT OF ENVIRONMENTAL EFFECTS

No ecotoxicological data were provided which is acceptable for polymers of low concern with a NAMW greater than 1 000 according to the Act.

## 10. ASSESSMENT OF ENVIRONMENTAL HAZARD

Disposal of the notified polymer to landfill is unlikely to present a hazard to the environment as it will be largely in a granular form or as a finished product. Bioconcentration and leaching are both considered to be unlikely to occur, due to the high molecular weight of the product and its insoluble nature. Biodegradation of the product is also considered unlikely.

The low environmental exposure of the polymer as a result of the proposed use, together with its expected negligible environmental toxicity, indicate that the overall environmental hazard should be negligible.

## 11. ASSESSMENT OF OCCUPATIONAL AND PUBLIC HEALTH AND SAFETY EFFECTS

LEXAN PCE has been notified as a synthetic polymer of low concern under section 23 for the purposes of section 24A of the Act. The polymer meets the criteria for a synthetic polymer of low concern specified in regulation 4A of the Act and can, therefore, be considered to be of low hazard to human health. The constituent monomers contain extremely hydrophobic groups which when reacted form a polymer of NAMW greater than 10 000 which contains no chemically reactive side chains. This structure ensures low aqueous solubility and reduces the likelihood of the notified polymer entering biological systems. The total level of unreacted monomers is less than 0.015% and the most significant impurity, methylene chloride, is present at 0.12%. The risk of adverse public health effects is expected to be negligible given the low intrinsic hazard of the polymer and limited opportunity for exposure.

During moulding temperatures above 300°C cause the emission of fumes containing a complex mixture of vapours, droplets and suspended particulates from colorants, additives or the polymer formulation itself. The vapours may contain thermal decomposition products from LEXAN PCE itself or additives. Since the health effects of such vapours is not always known, local exhaust ventilation adequate to remove such vapours is provided to ensure protection from hazardous effects.

Grinding operations involved in finishing products or recycling may cause the production of fine organic particles which have the capacity to irritate eyes, respiratory passages and the skin. The accumulation of such dusts may constitute an explosion or fire hazard from spark ignition from electrical equipment. Exhaust ventilation should ensure the removal of such fines from the workplace.

There is negligible potential for public exposure to the polymer arising from importation, storage, transportation and melt extrusion or injection moulding, Similarly, the potential for public exposure to the chemical during transport and

disposal of process waste and clean-up waste after a spill is very minor. While there may be significant public contact with plastic products made from the notified polymer, the solid form of the plastic products and the large molecular weight of the notified polymer would preclude its absorption through biological membranes.

## 12. RECOMMENDATIONS

To minimise occupational exposure to notified polymer the following guidelines and precautions should be observed:

- Spillage of the notified chemical should be avoided, spillages should be cleaned up promptly which should then be put into containers for disposal or recycling;
- Good personal hygiene should be practised to minimise the potential for ingestion;
- A copy of the relevant Material Safety Data Sheets (MSDS) should be easily accessible to employees.

Additionally, good general and local exhaust ventilation should be used to maintain low levels of fumes and dust and if ventilation fails respiratory protection (selected and fitted) in accordance with Australian/ New Zealand Standard 1715 (3) should be worn; eye protection should be selected and fitted in accordance with Australian Standard 1336 (4) and meet the requirements of Australian/ New Zealand Standard 1337 (5); gloves conforming to Australian Standard 2161 (6) should also be worn.

## 13. MATERIAL SAFETY DATA SHEET

The MSDS for the polymer solution to be imported was provided in accordance with the *National Code of Practice for the Preparation of Material Safety Data Sheets* (7).

This MSDS was provided by the notifier as part of the notification statement. It is reproduced here as a matter of public record. The accuracy of this information remains the responsibility of the notifier.

## 14. REQUIREMENTS FOR SECONDARY NOTIFICATION

Under the Act secondary notification of the notified polymer shall be required if any of the circumstances stipulated under subsection 64(2) of the Act arise. No other specific conditions are prescribed.

## 15. REFERENCES

1. Anliker, R., Moser, P. & Poppinger, D. 1988, 'Bioaccumulation of dyestuffs and organic pigments in fish. Relationships to hydrophobicity and steric factors', *Chemosphere*, vol. 17, no. 8, pp. 1631-1644.

2. Gobas, F.A.P.C., Opperhuizen, A. & Hutzinger, O. 1986, 'Bioconcentration of hydrophobic chemicals in fish: relationship with membrane permeation', *Environmental Toxicology and Chemistry*, vol. 5, pp. 637-646.

3. Standards Australia/Standards New Zealand, 1994, Australian/New Zealand Standard 1715-1994, Selection, Use and Maintenance of Respiratory Protective Devices, Standards Association of Australia Publ., Sydney, Standards Association of New Zealand Publ. Wellington, New Zealand.

4. Standards Australia, 1994, *Australian Standard 1336-1994, Recommended Practices for Eye Protection in the Industrial Environment*, Standards Association of Australia Publ., Sydney.

5. Standards Australia, Standards New Zealand 1992, *Australian/ New Zealand Standard 1337-1992, Eye Protectors for Industrial Applications*, Standards Association of Australia Publ., Sydney, Standards Association of New Zealand Publ. Wellington, New Zealand.

6. Standards Australia 1978, *Australian Standard 2161-1978, Industrial Safety Gloves and Mittens (excluding Electrical and Medical Gloves*), Standards Association of Australia Publ., Sydney.

7. National Occupational Health and Safety Commission 1994, *National Code of Practice for the Preparation of Material Safety Data Sheets [NOHSC:2011(1994)]*, AGPS, Canberra.