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NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION  
AND ASSESSMENT SCHEME

FULL PUBLIC REPORT

BIS(3-AMINOPROPYL) PIPERAZINE

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Director  
Chemicals Notification and Assessment

**FULL PUBLIC REPORT**

**BIS(3-AMINOPROPYL) PIPERAZINE**

**1. IMPORTER**

PABCO PRODUCTS Pty. Ltd., 16 Davis Road, Wetherill Park, NSW 2164.

**2. IDENTITY OF THE CHEMICAL**

**Chemical name** 1,4-Piperazinedipropanamine

**Chemical Abstract Service  
(CAS No) :** 7209-38-3

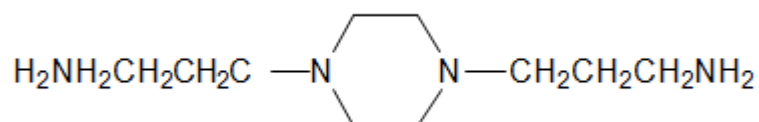
**Trade name:** Tremco HPL Sealant Curative

**Other names:** Bis(3-aminopropyl)piperazine  
1,4-Bis(3-aminopropyl)piperazine

**Molecular Formula:** C<sub>10</sub>H<sub>24</sub>N<sub>4</sub>

**Molecular weight:** 200.34

**Structural Formula:**



### 3. PHYSICAL AND CHEMICAL PROPERTIES

At 20°C and atmospheric pressure, bis(3-aminopropyl) piperazine is a colourless viscous liquid of low volatility with an amine odour. Its physical and chemical properties include:

<b>Melting point:</b>	15°C
<b>Boiling range:</b>	295°C min 325°C max
<b>Specific gravity:</b>	liquid, 0.97 at 20°C (where water=1) vapour, 6.9 at 20°C (where air =1)
<b>Vapour pressure:</b>	0.14 kPa at 25°C
<b>Flash Point:</b>	157°C (closed cup)
<b>Water solubility:</b>	soluble in water
<b>Explosive properties:</b>	none
<b>Reactivity:</b>	reacts violently with acids. Ammonia, carbon monoxide and carbon dioxide may be formed on burning in limited air supply.

#### Comments on Physico-Chemical Properties

No data were provided for hydrolysis, which is acceptable as the notified chemical is unlikely to hydrolyse given its molecular structure.

No data were provided for partition coefficient, which is acceptable given the substance's water solubility.

No data were provided for adsorption/desorption and dissociation constant, which is acceptable given the substance's water solubility.

#### **4. METHODS OF DETECTION AND DETERMINATION**

Gas chromatography with a thermal conductivity detector may be used to quantify the notified chemical.

#### **5. PURITY OF THE CHEMICAL**

**Degree of purity:** 95% w/w

**Non-hazardous Impurities:** aminopropylpiperazine  
(maximum: 5% w/w)

#### **6. INDUSTRIAL USES**

The notified chemical will be imported as an ingredient in a three part polyurethane joint sealant. Bis(3-aminopropyl) piperazine will be incorporated in the curative part of this system at a level of 5% w/w of the curative. It is expected that 120 kg of the notified chemical will be imported per year for the next 5 years.

The sealant will be used in the building industry for sealing concrete expansion and control joints in floors, footpaths, plaza decks, parking areas etc. and will be applied by a bulk caulking gun.

#### **7. OCCUPATIONAL EXPOSURE**

The product containing the notified chemical will be transported and stored in sealed containers. There will be no significant risk of worker exposure during transport or storage except in the event of an accidental breakage.

There will be about 50 applicators using the product throughout Australia. Before application the curative containing the notified chemical will be mixed with the base. A slow speed drill will be used for mixing and this process will take about eight minutes. The possibility of direct contact with the notified chemical could occur through skin and eye contact during mixing and application if personal protective measures like

protective clothing, gloves and eye protection are not used. Exposure of the workers through inhalation of the notified chemical will be limited due to low volatility. After mixing, the notifier states that the notified chemical will be fully reacted in the polymer thus presenting no risk of exposure. Therefore under correct handling and use procedures, worker exposure to the notified chemical will be extremely low.

## **8. PUBLIC EXPOSURE**

Under correct usage, general public exposure to the notified chemical will be minimal as its use is restricted to a small number of trained applicators and the chemical will not be available for general sale.

Release into the environment will be minimal, since once mixed the notified chemical will react fully in the polyurethane polymer (the base part of the sealant) and will be no longer free. In addition, its low volatility means insignificant contamination of the air during use.

## **9. ENVIRONMENTAL EXPOSURE**

### **Release**

The notified substance is imported as an ingredient in a curative which is a component in a three part finished product. The curative is packaged in a sealed tin inside a sealed pail which contains the base components of the finished product. The product will be unloaded from shipping containers at the Pabco Products, Wetherill Park site.

The company estimates that there will be fifty customers (trained sealant applicators) who will use an estimated total of 4000 product units. After the applicator mixes the components, the notified chemical is fully reacted in the polymer.

The notifier states that disposal of the curative containing the notified chemical will not be carried out except in the rare case

of faulty product. In this unlikely event, disposal would be conducted through the Metropolitan Waste Management Authority.

### **Fate**

As the notified chemical will be fully reacted into a polyurethane polymer after use and, by nature of the application, the polymer is required to be stable under a wide range of conditions, degradation processes are expected to be extremely slow.

In addition there appears to be little likelihood of movement from the sealing of expansion and control joints.

There may be small amount of substance (bound in the polyurethane polymer) spilt or disposed of with the caulking gun.

### **9.1 Environmental effects**

No ecotoxicological data were provided, which is acceptable for small volume chemicals.

## **10. EVALUATION OF TOXICOLOGY DATA**

### **10.1 Acute Toxicity Studies (1)**

Acute toxicity studies were conducted in 1964 and were not conducted under Good Laboratory Practice procedures. The data provided were limited.

**Table 1. Summary of acute toxicity of 1,4 Bis(3-aminopropyl) piperazine**

Test	Species	Outcome	Reference
Oral	Rat	LD <sub>50</sub> : 2600mg/kg	1
Dermal	Rabbit	LD <sub>50</sub> : 1300mg/kg	1
Inhalational	Rat	LC <sub>50</sub> : not determined (see below)	1
Skin irritation	Rabbit	corrosive	1
Eye irritation	Rabbit	corrosive	1

#### **10.1.1 Oral Toxicity**

Undiluted 1,4 Bis(3-aminopropyl) piperazine at dose levels of 0.625, 1.25, 2.5 and 5.0 ml/kg was administered by single gavage to groups of five male rats (albino-*CF Nelson*). These animals were observed for 14 days (post treatment). Slight diarrhoea, slight depression and hematuria were observed on Day 2 of the study at dose levels of 1.25 and 2.5 ml/kg. These effects were transient as recovery for some animals was noted on Day 4. At the 2.5 ml/kg dose level, 2 deaths were noted on day 2. All the five animals of the 5.0 ml/kg dose group died on Day 1. Gross autopsy revealed haemorrhage of the gastrointestinal tract in the deceased animals but no macroscopic changes were observed in the survivors. Gain in body weight was unaffected by treatment. The results from this study indicate that the acute oral LD<sub>50</sub> for the notified chemical is 2.68 ml/kg, which corresponds to 2600 mg/kg.

#### **10.1.2 Dermal Toxicity**

Undiluted bis(3-aminopropyl) piperazine at dose levels of 0.625, 1.25, 2.5 and 5.0 ml/kg was applied by occlusive epidermal application to the shaved skin of groups of five male albino rabbits for 24 hours. These animals were observed for 14-days (post-treatment). Two deaths were noted on Day 3 of study at dose level 1.25 ml/kg. At the 2.5 ml/kg dose level, all the animals had died within 24 hours and at dose level 5.0 ml/kg, all

the animals had died by third day. Severe depression until death was observed in the deceased animals, at which time animals had blood-like exudates at nostrils and rectum. Skin irritation was severe with marked reddening and swelling, and areas burned grey-black with destruction of the skin were also noted. Hard eschars formed after 72 hours and persisted throughout the entire observation period. Results of gross autopsy on rabbits surviving to the end of day 14, were normal. The results from this study indicated that the acute dermal LD<sub>50</sub> for the notified chemical is 1.34 ml/kg, which corresponds to 1300 mg/kg.

#### **10.1.3     Inhalational Toxicity**

Six male albino rats (CF Nelson) were exposed to a single inhalation of near-saturated vapours of bis(3-aminopropyl) piperazine for a period of 7.75 hours at 23°C. These animals were observed for eight days (post treatment). No deaths occurred during the study. No clinical signs of toxicity were observed. Necropsy revealed no treatment-related organ toxicity.

#### **10.1.4     Skin Irritation**

A dermal irritation study was not performed, the "skin irritation" results from the acute dermal LD<sub>50</sub> study were used to estimate the dermal irritation potential for the notified chemical. A Draize score of 6.0 to 8.0 (out of a maximum of 8.0) was estimated for the notified chemical and it is considered to be corrosive to the skin.

#### **10.1.5     Eye Irritation**

**Note:** Under normal regulatory requirements, eye irritation studies are not required for known skin irritants and therefore would not be required for the notified chemical. However a study was done in 1964 and the test results are given here.

A single undiluted dose of 0.1 ml of the notified chemical was instilled in the conjunctival sac of both eyes in six rabbits. The rabbits showed discomfort when eyes were dosed. The eyes were examined at 24, 48 and 72 hours. Ulceration of the cornea, inflammation of the iris and a diffuse deep-crimson appearance of the conjunctivae with obvious swelling and partial eversion of the lids were observed in these animals. The effect on the cornea worsened with time but the iris had returned to normal at



72 hours. The effect on the conjunctivae remained unchanged throughout the study period. Destruction with irreversible changes of the eye tissues were observed at 24 hours. The results from this study indicate that the notified chemical is corrosive to the eyes of the rabbits at the concentration tested.

## **10.2      Overall Assessment of Toxicological Data**

Bis(3-aminopropyl)piperazine has low acute oral toxicity (oral LD<sub>50</sub> in rats: >2000 mg/kg) and moderate acute dermal toxicity (dermal LD<sub>50</sub> in rabbits: 1300 mg/kg). Animal tests indicate that the notified chemical is absorbed through skin and is corrosive to the skin and eyes. The notified chemical has not been found to be toxic by inhalational route (only very low concentrations were tested), its highly irritant and corrosive effect on the skin and eyes suggest that it may irritate the upper respiratory tract.

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

The notified chemical has a molecular weight < 1000 (200.34). It therefore is able to cross biological membranes such as the skin, gastrointestinal tract or lung tissue (2).

As animal tests indicate that the chemical is corrosive to skin and eyes and is likely to irritate the respiratory tract, inhalational, skin and eye contact should be avoided and personal protective equipment such as protective clothing, impervious gloves, eye protection etc should be used while handling the notified chemical.

As the concentration of the notified chemical will be low in the formulated product, it is not expected to present any significant risk to workers, handling or using the formulated product. Once mixed, the notified chemical will be fully reacted in the polyurethane polymer thus presenting no risk to both workers and the public. Therefore under normal use conditions, exposure will be minimal and the notified chemical is unlikely to pose any

significant health or safety hazard to the workers and the public.

## 12. ASSESSMENT OF ENVIRONMENTAL HAZARD

The notified chemical is unlikely to present a hazard to the environment as it is incorporated into a polyurethane sealant where it fully reacts.

The notified chemical is also unlikely to present a hazard to aquatic organisms as it is fully reacted into the polyurethane polymer.

The notified chemical is unlikely to present a hazard to the environment when is applied as a sealant for expansion and control joints in concrete constructions.

## 13. RECOMMENDATIONS FOR SAFETY PROCEDURES TO CONTROL OCCUPATIONAL EXPOSURE

To minimise occupational exposure to the bis(3-aminopropyl) piperazine in the curative agent of the sealant, the following guidelines and precautions should be observed:

- . Engineering control procedures such as local exhaust ventilation should be employed in areas where the base and the curative agent mixing will be done;
- . Personal protection measures should be implemented such as the wearing of safety glasses (wraparound which completely shield eyes), impervious elbow length gloves, protective clothing and appropriate foot protection. Personal protection equipment should comply with Australian Standards (AS) such as:
  - . appropriate splash-proof safety goggles (AS 1337)
  - *Eye Protection for Industrial Applications* (3), during mixing when chemical may contact the eyes,

- . elbow length impervious nitrile gloves (AS 2161) - *Industrial Safety Gloves and Mittens (excluding Electrical and Medical Gloves)* (4),
- . appropriate impervious protective clothing (AS 3765) - *Clothing for protection against Hazardous Chemicals* (5),
- . appropriate footwear (AS 2210) - *Safety Footwear* (6) and,
- . appropriate respirators (AS 1716) - *Respiratory Protective Devices* (7), when ventilation is insufficient;
- . A system should be established which should allow early detection of any defect in personal protective equipment which could result in a reduced level of protection. Defects should be identified by routine maintenance, carried out by trained and competent personnel;
- . storage of the base and the curative agent should be in accordance with relevant State or Territory Dangerous Goods legislation.
- . good work practices should be followed to avoid spillages or splashings;
- . good housekeeping should be maintained. Disposal should be in accordance with local regulations. Full personal protection should be worn in the event of a spillage or leakage;
- . a copy of the MSDSs for the base and curative agent should be easily accessible to employees.

#### 14. **RECOMMENDATIONS FOR MATERIAL SAFETY DATA SHEET (MSDS)**

The MSDS for curative agent containing bis(3-aminopropyl) piperazine (Attachment 1) have been compiled according to Worksafe Australia format (8).

## 15. REQUIRMENTS FOR SECONDARY NOTIFICATION

Under the *Industrial Chemicals (Notification and Assessment) Act 1989 (the Act)*, secondary notification of 1,4-Bis(3-aminopropyl) piperazine shall be required if any circumstances stipulated under subsection 64(2) of the Act arise. A secondary notification will also be required if the formulated product is to be sold to the general public in future.

## 16. REFERENCES

1. Toxicity Testing Report, Bis(aminopropyl) piperazine, American Cynamid Company, U.S.A., Central Medical Department, Environmental Health Laboratory (1964).
2. United States Federal Register, 40 CFR Part 723, Premanufacture Notification Exemptions; Exemptions for Polymers, 1984.
3. Australian Standard 1337-1984 *Eye Protectors for Industrial Applications*, Standards Association of Australia Publication, Sydney, 1984.
4. Australian Standard 2161-1978 *Industrial Safety Gloves and Mittens (excluding Electrical and Medical Gloves)*, Standards Association of Australia Publ., Sydney, 1978.
5. Australian Standard 3765-1990 *Clothing for Protection Against Hazardous Chemicals*, Standards Association of Australia Publ., Sydney, 1990.
6. Australian Standard 2210-1980 *Safety Footwear*, Standard Association of Australia Publ., Sydney, 1980.
7. Australian Standard 1716-1984 *Respiratory Protective Devices*, Standards Association of Australia Publ., Sydney, 1984.
8. National Occupational Health and Safety Commission *Guidance Note for the Completion of a Material Safety Data Sheet*, Second Edition, Australian Government Publishing Services, Canberra, 1990.