File No: NA/ 249

Date: 27 June 1995

NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME

FULL PUBLIC REPORT

Bis(2,6-dimethoxybenzoyl)-2,4,4-trimethylpentylphosphine oxide

(CGI 403)

This Assessment has been compiled in accordance with the provisions of *the Industrial Chemicals (Notification and Assessment) Act 1989, as amended* 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 Arts, Sport, the Environment and Territories and the assessment of public health is conducted by the Department of Health, Housing and Community 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 hours of 10.00 a.m. and 12.00 noon and 2.00 p.m. and 4.00 p.m. each week day except on public holidays.

For Enquiries please contact Ms Mai Le at:

Street Address: 92 Parramatta Rd Camperdown, NSW 2050, AUSTRALIA
Postal Address: GPO Box 58, Sydney 2001, AUSTRALIA
Telephone: (61) (02) 565-9466 **FAX (61) (02) 565-9465**

Director
Chemicals Notification and Assessment

FULL PUBLIC REPORT

Bis(2,6-dimethoxybenzoyl)-2,4,4-trimethylpentylphosphine oxide

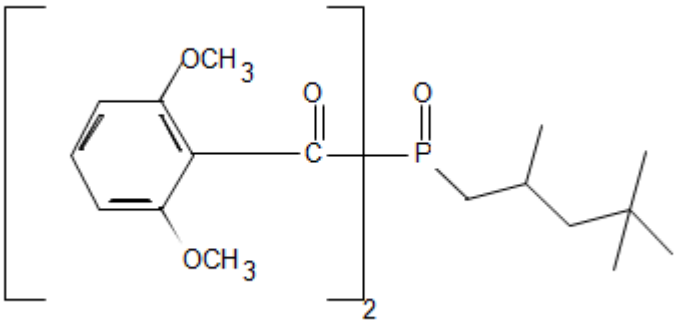
(CGI 403)

1. APPLICANT

Ciba-Geigy Australia Pty. Ltd. of 235 Settlement Rd., Thomastown, Victoria, 3074 have applied for a Standard Notification for Bis(2,6-dimethoxybenzoyl)-2,4,4-trimethylpentylphosphine oxide (CGI 403), a liquid photo-initiator. It will be available only as an admixture with another substance, Darocur 1173 in a product marketed under the trade name Irgacure 1700.

2. IDENTITY OF THE CHEMICAL

Chemical name:	Bis(2,6-dimethoxybenzoyl)-2,4,4-trimethylpentylphosphine oxide.
Chemical Abstracts Service (CAS) Registry No.:	145052-34-2
Other name:	TKA 40049, CGI 403
Trade name:	CGI 403 is marketed as a component of Irgacure 1700; CGI 403 constitutes 25% of the Irgacure 1700 product.
Molecular formula:	$C_{26}H_{35}O_7P$
Structural formula:	



Molecular weight: 490.53

Method of detection and determination:

The notified chemical can be qualitatively determined by UV/Vis and IR spectroscopy, and NMR.

3. PHYSICAL AND CHEMICAL PROPERTIES

Appearance at 20°C and 101.3 kPa:	yellow powder
Odour:	trace of aromatic odour
Melting Point:	105-119°C
Specific Density:	1,200 kg/m^3
Vapour Pressure:	2 x 10^{-5} kPa at 25°C
Water Solubility:	0.0162 g/L at 20°C
Fat Solubility:	1.22 g/100g at 37°C
Partition Co-efficient (n-octanol/water) log P_{OW}:	3.52 +/- 0.02
Hydrolysis as a function of pH:	pH 7: stable at 50°C, t1/2 ≅ 24 days at 25°C pH 4: t1/2 ≅ 268 days at 25°C pH 9: t1/2 < 24 hours at 25°C
Flash Point:	not relevant to solids
Flammability Limits:	not flammable
Autoignition Temperature:	no self-ignition
Explosive Properties:	no reaction to thermal, frictional and mechanical shocks
Reactivity/Stability:	not an oxidizer
Surface Tension:	45.9-48.0 mN/m at 20°C
Particle size distribution:	< 20 µm 4% 20-40 µm 11% 40-100 µm 21% 100-500 µm 59% > 500 µm 5% mean = 144 µm

Comments on physico-chemical properties:

The broad melting range was attributed to the solvent content, which could not be reduced further.

Adsorption/desorption was not submitted on the basis that there will not be significant release of the notified chemical into the environment. Based on the log P_{ow} value, the notified chemical is likely to adsorb to soil/sediment organic matter. Dissociation

constant was deleted on the basis of the low water solubility of the notified chemical. Also the chemical has no ionisable groups.

Explosive property tests were not performed as claimed similar substances in structure and composition are not explosive.

Photochemistry: The photochemistry of the notified chemical has been described in literature articles supplied by the notifier. Upon irradiation, the notified chemical undergoes an efficient cleavage of the carbon-phosphorous bond from a triplet state precursor, producing a benzoyl and a phosphinoyl radical. Both radicals are efficient in the initiation of polymerisation of various types of unsaturated substrates.

4. PURITY OF THE CHEMICAL

Degree of purity : Typical concentration 93%
Lower limit 90%
Upper limit 95%

Toxic or hazardous/impurities:

. **Chemical name:** Toluene
CAS No.: 108-88-3
% by weight: 5.9%

Non-hazardous impurity of the notified chemical (> 1% by weight): none

Additive/Adjuvant: none

5. INDUSTRIAL USE

CGI 403 is a liquid photo-initiator of polymerisation. It will be used for incorporation by resin formulators into free radical polymerisable unsaturated resins, using exposure to UV light.

The photoinitiator will be used in UV curable formulations for clear and for pigmented coatings on wood, metal, paper and optical fibres, as well as for printing inks for and prepregs (preimpregnated glass cloths for moulding). The resin formulations will be used in plants for sewer-pipe lining, chipboard coating, furniture coating, silk screen printing and optical fibre coating.

The volume of notified chemical to be imported in the first year is >1 tonne, rising to >5 tonnes by the fifth year.

6. OCCUPATIONAL EXPOSURE

The notified chemical will only be available as a commercial form which is a liquid, which is a admixture with another substance, Darocur 1173. CGI 403 comprises 25% of the commercial form. Transport will be in sturdy drums as used for international transport.

Any repacking will take place at the notifier's warehouse. A down-flow booth will be used with air flow directed away from the operators. A maximum of 2 people will be involved. Less than 100 kg will need to be re-packed per year. This would occur about 10 days per year and take 15-20 minutes per day.

The incorporation of the commercial form containing the notified chemical in a UV curable coating formulation is as follows: weighing out is performed in a dispensary and dissolution of the product is in a blending vessel with resin formulators, with local exhaust used for both operations. The final concentration of CGI 403 in the doped formulation is between 1 and 3%. The doped formulation is drummed off for sale or internal use.

The dilute solution of the notified substance in resin is pumped through a closed system to the coating heads to coat the product.

On each site where formulations containing the notified substance are prepared there will be an estimated 5 employees. The main type of users will be print ink companies. This gives a maximum 75 employees potentially exposed during the formulation phase. Additionally exposure may exist in the application of the doped formulations with each site using the formulations having 5-6 employees involved. The total potential number of employees exposed to the notified substance will be approximately 255.

7. PUBLIC EXPOSURE

On the basis of the information available, public exposure to the notified chemical would not be expected to occur during production of UV curable coating formulation and subsequent use in coating of various surfaces and products. Controls on manufacturing processes should minimise escape of this substance to the general environment, but it could be predicted that solar UV radiation would destroy any released CGI 403, making public exposure by this route unlikely.

Potential public contact with the cured coatings may be fairly extensive due to its proposed use in chipboard and furniture coating. However, CGI 403 is destroyed during curing and the reaction products are bound within the resin matrix, hence no exposure to CGI 403 is expected to occur from cured films on treated objects.

8. ENVIRONMENTAL EXPOSURE

Release

The notified substance will be used in a small number of formulating plants in Australia. The notified substance will be weighed out in a dispensary, dissolved in a preparation vessel and applied to the substrate to enable curing. Generally the resin formulation would be applied by curtain coater. The film is allowed to smooth down for about one minute and then pre-gelled using fluorescent lamps to provide low-level UV radiation for ~1.5 minutes. The film is then fully cured at a speed of 3m/min using red-shifted medium pressure mercury lamps. In fully cured films, there is no notified substance remaining.

The generation of waste is limited to traces remaining from the clean-up of any spill, trace residues in empty packaging and materials used to clean-down equipment. The volume of the latter is very low, as manufacturers have adopted the recycling of cleaning agents into the product stream. The notifier states that there is further motivation for conservation, as the substance costs of the order of $100/kg.

Emissions to air is expected to be limited as the product is a liquid which does not require heating for transfer to formulating vessels, and negligible fugitive vapour would be generated. Incineration of wastes may produce some acidic phosphorus combustion products, in the absence of strong acid receptors.

Proper manufacturing practices should prevent the disposal of wastes containing the notified substance via aqueous effluent streams. In the rare case of emissions to water

any free substance should be removed by apparatus needed to prevent oily wastes being carried to the sewer with water.

The notifier states that users of photoinitiators use a technique of multiple rinses using process liquid, of the receptacle containing the formulation of the notified substance. The MSDS instructions for the disposal of waste are incineration or landfill in accordance with local regulations.

The notified substance may enter the water or soil compartment as a result of accidental loss at containment at warehouse, at formulating plant or in transit, or through leaching of incompletely emptied containers disposed to land fill. The MSDS contains adequate instructions for the proper disposal of empty containers and the measures needed to avoid transport incidents.

Release of the notified substance from the disposal of objects coated with the cured film is unlikely to occur as the notified substance bleaches (is destroyed) in the process of providing free radicals for curing.

Fate

Biodegradation of the notified substance was investigated using the Modified Sturm Test (OECD TG 301B). Bacteria collected from activated sludge of a sewage treatment plant was used as the inoculum. Concentrations of the test substance were 10.6 $mg.L^{-1}$ and 20.9 $mg.L^{-1}$. After 28 days biodegradation was calculated as 6% for both test concentrations. Therefore, the notified substance is not readily biodegradable.

No bioaccumulation study was provided. The notified substance has the potential for bioaccumulation as it is not readily biodegradable, and its log P_{ow} of 3.5, molecular weight of 490 and relatively high lipid solubility (1.22 g/100 g simulant) is indicative of chemicals that bioaccumulate.

The notified chemical is stable to hydrolysis under acidic and to a lesser extent neutral pH conditions. Based on the photochemistry of the notified chemical it will undergo rapid photolysis when it enters the environment. Photolysis of the notified chemical occurs even in deep opaque coatings. Therefore, the notified chemical is unlikely to persist in the environment or bioaccumulate. Also, exposure to the aquatic environment is unlikely to be significant.

Waste chemical disposed to landfill is unlikely to leach due the chemical's expected rapid photolysis and adsorption to soil organic matter. Phosphorous containing residues may be utilised by some organisms.

Based on the application and curing process the amount of waste chemical that enters the sewer is likely to be negligible. Any waste chemical present in the sewers is expected to be associated with suspended matter. Notified chemical in solution present at the sewage treatment plant is likely to photodegrade.

9. EVALUATION OF TOXICOLOGICAL DATA

9.1 Acute Toxicity

Table 1 Summary of the acute toxicity of CGI 403

Test	Species	Outcome	Reference
Acute oral toxicity	Rat	LD_{50} > 2000 mg/kg	(1)
Acute dermal toxicity	Rat	LD_{50} > 2000 mg/kg	(2)
Skin Irritation	Rabbit	No irritation	(3)
Eye irritation	Rabbit	No irritation	(4)
Skin sensitisation	Guinea-pig	Sensitiser	(5)

9.1.1 Oral Toxicity (1)

This study was performed in accordance with OECD guideline No. 401 (6).

CGI 403 was administered to albino rats (5/sex/group) by oral gavage at a single dose of 2000 mg/kg. The vehicle used was 0.5% (w/v) carboxymethylcellulose in 0.1% (w/v) aqueous polysorbate. Clinical observations were made over 14 days. Necropsies were conducted at the end of the study.

No mortalities occurred during the study. Body weight gains were not affected by treatment. Clinical signs observed were piloerection, hunched posture and dyspnea. Reduced locomotor activity was observed in females. All symptoms had fully resolved by day 3 after administration.

Necropsy on sacrificed animals revealed no significant macroscopic lesions, except for a spotted thymus in one female.

The study indicated that CGI 403 had an oral LD_{50} > 2000 mg/kg.

9.1.2 Dermal Toxicity (2)

This study was performed in accordance with OECD guideline No. 402 (7).

CGI 403 was applied to the clipped backs of albino rats (5/sex/group) at a single dose of 2000 mg/kg, covered with a semi-occlusive dressing, over 24 h. The vehicle used was 0.5% (w/v) carboxymethylcellulose in 0.1% (w/v) aqueous polysorbate. Clinical observations were made over 14 days. Necropsies were conducted at the end of the study. No mortalities occurred during the study.

Clinical signs observed were piloerection, hunched posture and dyspnea, with females affected more than males. Reduced locomotor activity was observed in one female on day 4. This female was found dead on day 5. At the application site, erythema and necrosis was observed in female rats. All other animals recovered within 3 to 5 days. The clinical signs suggests that some absorption is occurring.
Necropsy on sacrificed animals revealed no significant macroscopic lesions.

The study indicated that CGI 403 had an dermal LD_{50} > 2000 mg/kg.

9.1.3 Skin Irritation (3)

This study was performed in accordance with OECD guideline No. 404 (8).

A single dose of 0.5 g CGI 403 on a gauze patch slightly moistened with 0.5% (w/v) carboxymethylcellulose in 0.1% (w/v) aqueous polysorbate, was applied to the clipped right flank (12-16 cm^2) of 3 male New Zealand White rabbits. A control gauze was applied to the contralateral flank. The area was covered by an aluminium foil and exposure time was 4 h. Skin reactions were assessed 1, 24, 48 and 72 hours after removal of the dressing.

No mortalities or clinical signs were noted during the study.

No reaction to the notified substance was noted.

The results of the study indicate that CGI 403 is not a skin irritant in rabbits.

9.1.4 Eye Irritation (4)

This study was performed in accordance with OECD guideline No. 405 (9).

A single dose of 0.1 mL (58 mg) CGI 403 was instilled into the conjunctival sac of the left eye of each of 3 male New Zealand White rabbits. It was not absolutely clear whether the notified chemical was instilled as a powder. The right eye served as the untreated control. The eyes were examined for ocular irritation 1, 24, 48 and 72 hours after application.

No mortalities or clinical signs were recorded during the study. Body weight gains were unaffected by treatment.

Mild redness of the conjunctivae was noted in all treated eyes which resolved within 24 h of instillation. Mild chemosis of the conjunctivae was also observed, which resolved within one hour of instillation. The control eyes were normal.

Based on the EEC classification of the results obtained CGI 403 was not an eye irritant in the rabbit.

9.1.5 Skin Sensitisation (5)

This study was performed in accordance with OECD Guideline No. 406 (10).

The Magnusson-Kligman Maximisation Test (11) was used. The test animals used were albino Pirbright White guinea-pigs. Ten animals/sex were used in the test group and 5 animals/sex in the control group. Potassium dichromate served as a positive control.

Induction

On day 1, the 20 guinea pigs were injected three pairs of intradermal injection (0.1 mL per injection)(on either side of a 2 x 4 cm clipped area of the dorsal scapular position) with ta 1:1 (v/v) mixture of FCA and physiological saline, 5% w/v CGI 403 in arachid oil and 5% w/v CGI 403 in a 1:1 (v/v) mixture of FCA and physiological saline.

On day 8, after clipping the scapular region again, a filter paper patch saturated with CGI 403 (50% in vaseline) was applied over the injection sites and covered with dressing for 48 hours. Skin reactions were assessed by the Draize method (12) 24 and 48 hours after patch removal.

Challenge

On day 29, filter paper patches saturated with test article at 50% concentration or vaseline vehicle alone were applied to the clipped flank of each guinea pig, and occluded for 24 hours with dressing. Sensitisation reactions were scored 24 and 48 hours after patch removal according to the Draize method.

Controls

During the induction period the no treatment control animals were treated with adjuvant and the vehicle. During the challengeperiod these animals were treated with the vehicle as well as with notified substance to check the maximum subirritant concentration of the notified chemical in adjuvant treated animals.

The positive controls were treated similarly as the test animals.

Results

Under the experimental conditions of this study, 70% and 90% of the animals of the test group showed skin reactions 24 and 48 hours, respectively, after removing the dressing after the challenge phase. No sensitisation was observed in the control group.

The positive control produced a sensitisation rate of 70% and 60% after 24 and 48 hours, respectively.

Other Data

Body weight gains were unaffected by treatment. No other data was provided in the report.

In conclusion, CGI 403 is a sensitiser in albino guinea-pigs.

9.2 Repeated Dose Toxicity

9.2.1 28 Day Oral Toxicity Study in Rats (13)

This study was performed in accordance with OECD Guideline No. 407 (14). GLP and QA statements were provided.

CGI 403 was administered orally to albino Sprague Dawley rats (10/sex/group) at doses of 0, 5, 25, 100 or 500 mg/kg/day for 28 days - groups 1 to 5, respectively. The control and highest dose animals had additional groups of 10/sex/group for four week recovery periods. The vehicle used was distilled water containing 0.5% carboxymethylcellulose and 0.1% Tween 80. Neurotoxicity of the compound was also assessed. Animals were sacrificed at the end of 28 days except for the recovery animals which were sacrificed 14 days later.

No mortalities were recorded during the study. Clinical signs observed were shedding of skin in all group 5 animals and females of group 4, which may have been due to vasodilatation of the skin vessels. Neurological examinations consisting of fore- and hindlimb grip strength, sensorimotor functions (vision, audition, pain, vestibular functions), autonomic functions (pupillary reflex), motor coordination (landing foot splay) and physiological parameters, found no treatment-related effects.

Body weight gain and food consumption were not affected by treatment.

Clinical chemistry values demonstrated a dose-related inhibition of cholinesterase

activity in various tissues in males and females of groups 3, 4 and 5 (25, 100 and 500 mg/kg/day doses, respectively). In males, plasma cholinesterase was inhibited by 24, 48 and 57%, respectively. The corresponding figures for females were 51, 74 and 86%, respectively. Erythrocyte cholinesterase was inhibited in group 4 and 5 females by 21 and 32%, respectively, and in group 5 males by 25%. Brain cholinesterase was inhibited in group 4 and 5 females by 22 and 32%, respectively. Slightly higher plasma cholesterol levels were noted in group 5 animals (19% in males and 13.8% in females). Also gamma-glutamyl transpeptidase activity was increased at treatment end in the highest dose animals.

All these effects were reversible at the end of the recovery period apart from the brain cholinesterase levels in group 5 females which were still 21% higher than corresponding controls and the gamma-glutamyl transpeptidase activity. No other clinical chemistry parameters were affected by treatment.

At the 500 mg/kg/day dose, a reversible increase in platelet count (10.5% in males and 12.2% in females) was observed at end of dosing period, which was not considered treatment-related. All other haematology parameters remained within their normal limits.

Mean liver weights and mean liver to bodyweight ratios were increased in group 5 males (17 and 26%, respectively) and females (29% and 30%, respectively) and in group 4 females (16 and 14%, respectively). At the end of the recovery period results were fully reversible in males and group 4 females and partially reversible in group 5 females. In group 5 females mean absolute and relative adrenal weights were increased, which were reversible at the end of the recovery period.

Macroscopically, enlarged livers were seen in 2/10 males and enlarged adrenal glands in 2/10 female rats of group 5 sacrificed at the end of treatment. Similar changes were not observed in the recovery animals.

Histopathology revealed treatment-related effects in the liver consisting of minimal to moderate hypertrophy in group 5 males and females. Also, adrenal cortex changes were observed in group 4 and 5 animals consisting of fatty changes (males) and cellular hypertrophy (females). All these effects were reversed at the end of the recovery period. No neuropathological changes were noted by histopathology.

The effects observed on the liver were not reflected in the clinical chemistry results which remained normal.

In conclusion, the primary target organs for toxicity of CGI 403 were the liver and the adrenal gland. Most results were readily reversible during a recovery period. Females appeared to be more susceptible to the effects of the notified substance.

9.3 Genotoxicity

9.3.1 *Salmonella typhimurium* and *Escherichia coli* Reverse Mutation Assays (15)

This study was performed in accordance with OECD Guideline No. 471 and 472 (16, 17).

A preliminary toxicity/range finding study was performed with *Salmonella typhimurium* strain TA 100 and *Escherichia coli* strain WP2 *uvrA* without and with metabolic activation at 6 concentrations ranging from 20.6 to 5000 μg/plate. Normal background growth was observed with both strains, with slight toxicity observed at the highest concentration in the presence of metabolic activation.

Strains used in the main study were *Salmonella typhimurium* strains TA 1535, TA 1537, TA 98 and TA 100 and *Escherichia coli* strain WP2 *uvrA*. The assays were performed in two independent experiments both without and with metabolic activation using S9 mix.

Each concentration including controls was tested in triplicate. The following concentrations were tested: 312.5 to 5000 μg/plate without metabolic activation and 156.3 to 2500 μg/plate with metabolic activation. The vehicle used for dissolving CGI 403 was dimethylsulfoxide. Positive reference controls used were a) sodium azide, 4-nitro-o-phenylene-diamine, 2-nitrofluorene and 9(5)-aminoacridine in the absence of metabolic inactivation and b) cyclophosphamide·H_2O red and 2-aminoanthracene in the presence of metabolic activation.

Up to the highest investigated concentration no toxic effects were observed on growth of any strains either in the absence or presence of metabolic activation.

No increase in revertant colony numbers was observed for any of the strains at any dose level of CGI 403 used in comparison to controls either in the absence or presence of metabolic activation.

The positive controls produced the expected responses i.e. significant increases in revertant numbers per plate which met the criteria for a positive response.

In conclusion, under the conditions of these assays, CGI 403 did not induce point mutations by base pair changes or frameshifts in any of the four *Salmonella typhimurium* and the one *Escherichia coli* strains used.

9.3.2 Chromosomal Aberrations in Chinese Hamster Ovary Cells (18)

This study was performed in accordance with OECD Guideline No. 473 (19).

Notified substance was dissolved in dimethylsulfoxide. Based on a preliminary cytotoxicity study, 28.44 μg/mL was used as the highest concentration, being the highest concentration allowing surviving metaphases to be scorable.

Two independent experiments were carried out. In the absence of metabolic activation, CHO cells were incubated for 18 hours or 42 hours after initiation of treatment with CGI 403. In the presence of metabolic activation (S9 mix) the exposure time was 3 hours with harvesting occurring 15 hours or 39 hours later. In all experiments three concentrations were used: 7.11, 14.2 and 28.44 μg/mL.

One hundred metaphases per culture were scored for structural chromosomal aberrations. Positive controls used were mitomycin C (0.2 μg/mL) without metabolic activation or cyclophosphamide (20 μg/mL) with metabolic activation.

In both independent experiments, there was no biologically and statistically relevant increases in cells with structural aberrations after treatment with CGI 403 at both fixation intervals either with or without metabolic activation.

The positive control mutagens produced significant increases in incidence of specific chromosomal aberrations.

In conclusion, under the assay conditions described, CGI 403 did not induce clastogenic effects in Chinese hamster ovary cells.

9.4 Overall Assessment of Toxicological Data

Animal studies indicate that CGI 403 has low acute oral and dermal toxicity in the rat (LD_{50} > 2000 mg/kg). After acute dermal application, erythema and necrosis was observed in female rats which was resolved by day 3 to 5. This and clinical signs observed suggest that the notified substance was absorbed across the skin.

It was neither a skin nor an eye irritant in rabbits. CGI 403 was found to be a skin sensitiser in the guinea-pig according to the findings of the Magnusson-Kligman maximisation test.

In a 28 day repeat-dose study, administration resulted in inhibition of cholinesterase activity (at doses ≥ 25 mg/kg). At the highest dose (500 mg/kg/day), enlarged livers (2 males) and adrenal gland (2 females) were seen. No neurological effects were associated with the inhibition of cholinesterase. Histopathology showed hypertrophy of liver (both sexes) and adrenal glands (females only) at doses of ≥ 100 mg/kg. The effects on the liver were not reflected in the clinical chemistry values for liver enzymes. Nearly all changes were reversed at the end of a 4 week recovery period. Overall, CGI 403 had low toxicity, with its principal effect on cholinesterase activity which was reversible. As the structure of CGI 403 resembles that of pesticide organophosphates, neurotoxicity was also investigated in the rat 28-day study. No abnormalities were found despite large inhibitions of cholinesterase activity in the brain, erythrocytes and plasma.

Genotoxicity studies indicated that it had no mutagenic potential *in vitro*. No *in vivo* studies were performed. Therefore, CGI 403 is not classified as being mutagenic.

On the basis of the submitted data, CGI 403 is classified as hazardous according to Worksafe Australia's *Approved Criteria for Classifying Hazardous Substances* (20) in relation to sensitising effects (skin).

10. ASSESSMENT OF ENVIRONMENTAL EFFECTS

The following studies on the ecotoxicological effects of the notified substance have been provided.

Test	Species	Result
Acute toxicity	Zebra fish	96h LC50 = 18.9 mg/L NOEC = 10.5 mg/L
Acute toxicity	*Daphnia magna*	48h EC50 > 22.5 mg/L NOEC = 18.6 mg/L
Algal growth inhibition	*Scendesmus subspicatus*	72h EC50 = 1.5 mg/L
Respiration inhibition	Aerobic bacteria	3h EC50 > 100 mg/L

The above results indicate that the notified substance is practically non-toxic to aerobic wastewater bacteria, slightly toxic to fish and daphnia, and moderately toxic to algae. The tests were conducted according to EEC and OECD test guidelines. Results were based on measured concentrations except for the fish result (nominal concentrations).

11. ASSESSMENT OF ENVIRONMENTAL HAZARD

Exposure of the notified chemical to the environment is expected to be low as waste chemical generated on-site at the resin formulation plants is recycled into the product stream and the notified chemical is destroyed in the resin curing process.
The notifier has estimated the "extreme worst case" concentration of the notified chemical reaching the aquatic environment based on its water solubility of 16 mg/L. Considering the likely dilution factor in plant effluent streams and sewage treatment plants, the notifier proposes that:

(a) The water leaving the plant could never be saturated with the substance, a conservative estimate would be 10% of saturated solution, leading to a concentration of 1.6 mg/L; and

(b) A factor of at least 250:1 dilution in sewage treatment works (STW), leading to a concentration of 6 µg/L.

The estimated environmental concentration of the notified chemical is likely to be reduced further by dilution in the receiving waters by factors of 5 to 250:1. Also, photodegradation of the notified chemical is likely to occur in the sewage treatment works and the receiving waters. The EEC of the notified chemical is several orders of magnitude lower than the acute toxicity values for aquatic organisms. Therefore, the notified chemical is unlikely to present a hazard to the environment.

Conclusions and Recommendations

The Material Safety Data Sheet supplied gives adequate instruction as to containment and cleanup procedures aimed at reducing the environmental impact of spillages during storage, transport and use.

The notified chemical is unlikely to present a hazard to the environment when it is used in the proposed manner. Measures for reduction of environmental contamination have been addressed and procedures for dealing with spills are in place.

12. ASSESSMENT OF PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY EFFECTS

It is noted that the notified substance is to be brought in as a liquid commercial formulation of which it constitutes 25%. Sturdy drums will be used for transport, but the size of the drums was not provided. Spillage during transport is unlikely to be a source of occupational exposure. If it does occur, guidelines in the MSDS should be followed.

Exposure may occur during re-packing, which is expected to occur infrequently and involve two workers maximally. Because of potential skin absorption, respiratory and skin sensitisation potential and possible liver and adrenal gland effects of the notified substance, suitable protective clothing should be worn. Work should be done in well ventilated areas. The use of down-flow booths during re-packing will also reduce any exposure to vapours arising after the drum is re-opened. However, no information was provided on the storage containers to be used for re-packing.

Occupational exposure is most likely to occur during the preparation of doped resin formulations and the coating application phases. This will be minimised by the use of closed systems and the wearing of suitable protective clothing including respiratory protection.

The respirable fraction is low (< 4%) and therefore exposure via inhalation is low and expected to be minimised by the wearing of respiratory protection at all times, working in well ventilated areas and using closed systems during batching and application phases.

As the notified substance, CGI 403, is destroyed during curing and the reaction products are bound within the resin matrix, no exposure is expected to occur from cured films on treated objects.

The public will not be exposed to CGI 403 during its importation, preparation and application to objects. Public exposure to CGI 403 in cured chipboard and furniture coatings should be negligible. Since CGI 403 is destroyed during curing, and the reaction products are bound within the resin matrix, the notified chemical is unlikely to constitute a hazard to public health.

13. RECOMMENDATIONS

To minimise occupational exposure to CGI 403 the following guidelines and precautions should be observed:

. If engineering controls and work practices are insufficient to reduce exposure to formulations containing CGI 403 to a safe level, the following personal protective equipment should be used:

  - respiratory protection conforming to Australian Standards (AS) 1715 (20) and 1716 (21),

  - eye protection conforming to AS 1336 (22) and AS 1337 (23),

  - impervious handgloves conforming to AS 2161 (24), and

  - overalls conforming to AS 3765.2 (25)

. Good personal hygiene practices should be observed.

. A copy of the Material Safety Data Sheet (MSDS) should be easily accessible to employees.

Additionally, the MSDS should be modified to more accurately reflect the findings of the 28 day repeat-dose toxicity study in rats. The Chronic section of Health Effects should contain a statement as follows:

'Repeated exposure of rats over 28 days to GCI 403 at doses exceeding 100 mg/kg of body weight each day, was associated with fully reversible hypertrophy of the liver.'

14. MATERIAL SAFETY DATA SHEET

The Material Safety Data Sheet (MSDS) for CGI 403 was provided in Worksafe Australia format (26).

15. REQUIREMENTS FOR SECONDARY NOTIFICATION

Under the *Industrial Chemicals (Notification and Assessment) Act 1989* (the Act), secondary notification of CGI 403 shall be required if any of the circumstances stipulated under subsection 64(2) of the Act arise. No other specific conditions are prescribed.

If the conditions of use are varied, further information may be required to assess the hazards to public health.

16. REFERENCES

1. Hartmann, P.H.R.: Acute oral toxicity in the rat. Test No. 924170 TKA 40049 (CGI 403). Short-term Toxicology CIBA-GEIGY Ltd. Toxicology Services, 4332 Stein, Switzerland, 1992.

2. Hartmann, P.H.R.: Acute dermal toxicity in the rat. Test No. 924169 TKA 40049 (CGI 403). Short-term Toxicology CIBA-GEIGY Ltd. Toxicology Services, 4332 Stein, Switzerland, 1992.

3. Hagemann, Ch.: Acute dermal irritation/corrosion in the rabbit. Test No. 924168 TKA 40049 (CGI 403). Short-term Toxicology CIBA-GEIGY Ltd. Toxicology Services, 4332 Stein, Switzerland, 1992.

4. Hagemann, Ch.: Acute eye irritation/corrosion in the rabbit. Test No. 924167 TKA 40049 (CGI 403). Short-term Toxicology CIBA-GEIGY Ltd. Toxicology Services, 4332 Stein, Switzerland, 1992.

5. Hagemann, Ch.: Skin sensitisation test in the guinea pig. Maximisation test. Test No. 924166 TKA 40049 (CGI 403). Short-term Toxicology CIBA-GEIGY Ltd. Toxicology Services, 4332 Stein, Switzerland, 1992.

6. OECD Guidelines for Testing of Chemicals - Acute Oral Toxicity No. 401, 1981.

7. OECD Guidelines for Testing of Chemicals - Acute Dermal Toxicity No. 402, 1981

8. OECD Guidelines for Testing of Chemicals - Acute Dermal Irritation/Corrosion No. 404, 1981.

9. OECD Guidelines for Testing of Chemicals - Acute Eye Irritation/Corrosion No. 405, 1987.

10. OECD Guidelines for Testing of Chemicals - Skin Sensitisation No. 406, 1981.

11. Magnusson B, Kligman A.M., 1969, 'The Identification of Contact Allergens by Animal Assay. The Guinea Pig Maximization Test.' J. Invest. Dermatol., **52:** 268-276.

12. Draize et al. 1944, J. Pharmacol. Exp. Ther. **82:** 377-390.

13. Gerspach, R.: 28 Day sub-acute, oral toxicity study in rats (gavage). Test No. 924164 TKA 40049 (CGI 403). CIBA-GEIGY Ltd., Short/Long-term toxicology. 4332 Stein, Switzerland, 1993.

14. OECD Guidelines for Testing of Chemicals - Repeated Dose Oral Toxicity No. 407, 1981.

15. Ogorek, B.: *Salmonella* and *Escherichia*/Liver microsome test. Genetic Toxicology CIBA-GEIGY Ltd., Basle, Switzerland, 1992.

16. OECD Guidelines for Testing of Chemicals - *Salmonella typhimurium*, Reverse Mutation Assay No.471, 1983.

17. OECD Guidelines for Testing of Chemicals - *Escherichia coli*, Reverse Mutation Assay No. 472, 1983.

18. Ogorek, B.: Cytogenetic test on Chinese hamster cells *in vitro*. Genetic Toxicology CIBA-GEIGY Ltd., Basle, Switzerland, 1993.

19. OECD Guidelines for Testing of Chemicals - In Vitro Mammalian Cytogenetic Test No. 473, 1983.

20. Australian Standard 1715-1991, Selection, use and maintenance of respiratory protective devices. Standards Association of Australia Publ., Sydney, 1991.

21. Australian Standard 1716-1991, Respiratory protective devices. Standards Association of Australia Publ., Sydney, 1991.

22. Australian Standard 1336-1982, Eye protection in the industrial environment. Standards Association of Australia Publ., Sydney, 1982.

23. Australian Standard 1336-1982, Eye protectors for industrial applications. Standards Association of Australia Publ., Sydney, 1982.

24. Australian Standard 2161-1978, Industrial safety gloves and mittens (excluding electrical and medical gloves). Standards Association of Australia Publ., Sydney, 1978.

25. Australian Standard 3765.2-1990, Clothing for protection against hazardous chemicals. Part 2 Limited protection against specific chemicals. Standards Association of Australia Publ., Sydney, 1990.

26. National Occupational Health and Safety Commission, Guidance note for completion of a material safety data sheet, 3rd edition, Australian Government Publishing Service Publ., Canberra, 1991.