

File No: NA/918

October 2001

**NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION
AND ASSESSMENT SCHEME**

FULL PUBLIC REPORT

TG-440

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 National Occupational Health and Safety Commission 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 Aged Care.

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, National Occupational Health and Safety Commission, Plaza level, Alan Woods Building, 25 Constitution Avenue, Canberra ACT 2600 between 9 AM and 5 PM Monday to Friday.

Copies of this full public report may also be requested, free of charge, by contacting the Administration Coordinator on the fax number below.

For enquiries please contact the Administration Section at:

Street Address: 92 -94 Parramatta Rd CAMPERDOWN NSW 2050, AUSTRALIA

Postal Address: GPO Box 58, SYDNEY NSW 2001, AUSTRALIA

Telephone: (61) (02) 9577 9514 FAX (61) (02) 9577 9465

Director
Chemicals Notification and Assessment

TABLE OF CONTENTS

FULL PUBLIC REPORT.....	3
1. APPLICANT	3
2. IDENTITY OF THE CHEMICAL.....	3
3. PHYSICAL AND CHEMICAL PROPERTIES	3
Comments on Physico-Chemical Properties	4
4. PURITY OF THE CHEMICAL.....	5
5. USE, VOLUME AND FORMULATION	5
6. OCCUPATIONAL EXPOSURE	6
7. PUBLIC EXPOSURE	7
8. ENVIRONMENTAL EXPOSURE.....	7
8.1 Release	7
8.2 Fate.....	9
9. EVALUATION OF TOXICOLOGICAL DATA	10
9.1 Acute Oral Toxicity	10
9.2 Skin Irritation.....	10
9.3 Eye Irritation.....	11
9.4 Chicken Enucleated Eye Test (CEET).....	11
9.5 <i>Salmonella typhimurium</i> Reverse Mutation Assay.....	11
9.6 Overall Assessment of Toxicological Data.....	12
10. ASSESSMENT OF ENVIRONMENTAL EFFECTS	12
11. ASSESSMENT OF ENVIRONMENTAL RISK.....	13
12. ASSESSMENT OF PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY EFFECTS	14
13. MATERIAL SAFETY DATA SHEET (MSDS) AND LABEL ASSESSMENT ..	15
14. RECOMMENDATIONS	16
15. REFERENCES	17

FULL PUBLIC REPORT**TG-440****1. APPLICANT**

CHT Australia Pty Ltd of 33 Elliot Road Dandenong VIC 3175 (ABN 54 006 849 869) has submitted a limited notification statement in support of their application for an assessment certificate for TG-440.

2. IDENTITY OF THE CHEMICAL

The chemical name, CAS number, molecular and structural formulae, molecular weight, spectral data and details of the polymer composition have been exempted from publication in the Full Public Report and the Summary Report.

3. PHYSICAL AND CHEMICAL PROPERTIES

Physico-chemical parameters were determined in accordance with OECD Test Guidelines and approved European Commission methods.

Appearance at 20°C & 101.3 kPa:	White solid. The imported product containing the notified polymer is an off white emulsion.
Melting Point:	45°C ± 0.2°C
Density:	1383 Kg/m ³ at 20.9°C
Vapour Pressure:	< 5.84 x 10 ⁻¹³ kPa at 25°C (calculated)
Water Solubility/Extractability:	pH 7: <1 mg/L at 20°C, pH 2 and pH 9: <1 mg/L at 37°C
Partition Co-efficient (n-octanol/water):	log P _{ow} = > 14.8 (calculated); see comments below
Hydrolysis as a Function of pH:	Not determined; see comments below
Adsorption/Desorption:	log K _{oc} = 2.7 x 10 ⁹ (calculated)

Particle size:	<div><10 µm = 1.54% w/w</div> <div>10 – 20 µm = 0.59% w/w</div> <div>20 – 60 µm = 1.74% w/w</div> <div>20 –125 µm = 20.63% w/w</div> <div>125 – 250 µm = 23.38% w/w</div> <div>>250 µm = 52.12% w/w</div>
Dissociation Constant:	<div>Amides pKa = 20.7</div> <div>Alcohol (1) pKa = 15.3</div> <div>Alcohol (2) pKa = 17.0 (see comments below)</div>
Flash Point:	Not determined. The notified polymer is a solid substance with a very low vapour pressure.
Flammability Limits:	Not highly flammable (EC Method A.10)
Autoignition Temperature:	> 350°C
Explosive Properties:	Not performed. Not expected to be explosive, as it does not contain any structural features or groups associated with explosive properties.
Reactivity/Stability:	<p>Not determined. The notified polymer does not have any functional groups associated with oxidising activity, and has not demonstrated such activity under normal handling.</p> <p>Sunlight and temperatures above 30°C may affect the stability of the notified polymer. Decomposition products arising from pyrolysis are oxides of carbon, oxides of nitrogen, HCl, HF and perfluorocarbons.</p>

Comments on Physico-Chemical Properties

Melting point was determined in accordance with OECD Guideline No. 102 and EEC Directive 92/69 Method, A.1, using Differential Scanning Calorimetry (RCC Ltd, 2000a). A second small endothermic heat effect was observed at 74.3-74.5°C. On heating from 25°C to 120°C the samples lost 0.1-3.2% of their mass. At about 320°C the decomposition of the test item started. After the experiment, the sample had lost about 67% of its mass and was foamy.

Relative density was determined in accordance with OECD Guideline No. 109 and EEC Directive 92/69, A.3, using the Gas Comparison Pycnometer Method (RCC Ltd, 2000b).

Vapour pressure was determined in accordance with OECD Guideline No. 104 and EEC Directive 92/69, A.4, using the Modified Watson Correlation, (RCC Ltd, 2000c). The boiling

point was calculated to be ~584°C using Meissner's method. The notified polymer is regarded as very slightly volatile (Mensink, 1995).

Water solubility was determined in accordance with OECD Guideline No. 120 in combination with OECD Guideline No. 105, using the solution/extraction behaviour of polymers in water method (RCC Ltd, 2000d). The notified polymer is considered to be practically insoluble in water.

Hydrolysis as a function of pH was not determined as the content of the water extractable components of the notified polymer was very low (RCC Ltd, 2000e). The notified polymer contains no groups expected to hydrolyse in the environmental pH range of 4-9.

The partition coefficient was estimated by a model calculation based on the theoretical fragmentation of the molecule into suitable substructures for which reliable log P_{ow} values are known (RCC Ltd, 2000f). The log P_{ow} value for the notified polymer was obtained by summing the fragment values and applying correction factors. The notifier has indicated that neither the HPLC method (OECD Guideline No. 117) nor the flask-shaking method (OECD Guideline No. 107 and EEC Directive 92/69, A8) were applicable to the determination of the partition coefficient for the notified polymer, presumably due to its low water solubility. The notified polymer is thus considered to be strongly hydrophobic and will preferentially partition into the organic phase.

The adsorption/desorption was estimated using a regression equation relating the K_{oc} with P_{ow} (RCC Ltd, 2000g). The notified polymer is classified as immobile in soils.

The dissociation constant was estimated using the Taft method (RCC Ltd, 2000h). The notified polymer has several sites which can theoretically be protonated, however, the polymer is not expected to dissociate or protonate within the environmental pH range of 4-9.

4. PURITY OF THE CHEMICAL

Degree of Purity: High

Maximum Content of Residual Monomers: Chemical identity of residual monomers is exempt information. Concentrations of residual monomers are low.

5. USE, VOLUME AND FORMULATION

The notified polymer, TG-440, will not be manufactured in Australia. It will be imported as an emulsion (Unidyne TG-440) containing less than 30% notified polymer, and co-solvent, dipropylene monomethyl ether (6%) and isopropyl alcohol (0.9%) in sealed tanks or drum containers (1 tonne polyethylene tank, 200 kg polyethylene drum, and 120 kg and 60 kg metal drum with polyethylene inner lining).

The notified polymer will be used as a water and oil repellent in textiles such as carpets, blankets, furnishings and upholstery fabric. The end use product will contain less than 1.5% notified polymer.

The estimated import volume of the notified polymer is up to 20 tonnes/year for the next 5 years.

6. OCCUPATIONAL EXPOSURE

Transport and storage

Following importation, transport workers will deliver the polymer emulsion containing 30% notified polymer by road to the notifier's warehouse for subsequent reformulation prior to distribution to textile coaters. Alternatively, the polymer emulsion can be supplied in the original container to textile mills for manual dilution prior to application to textile. Waterside, transport and warehouse workers (10-15 workers, duration of exposure of 2-3 hours/day, 10-15 days/year) are unlikely to be exposed to the notified polymer unless the packaging is breached.

Reformulation of textile treatment and coating products

The imported product, Unidyne TG-440, is weighed and added into a 2000 kg open vessel. Other ingredients are added separately to the vessel, and the mixture blended and agitated to form coating products containing less than 1.5% notified polymer. A small quantity of the coating product is collected for quality testing prior to drumming off. Once approved by the laboratory personnel, the coating product is filled into 20L plastic pails, 200L steel drums or 1000L Schutz tank.

A maximum of 2 – 8 workers will be involved in the reformulation and drumming of diluted coating product. Potential exposure is 2 – 3 hours/day, up to 100 days/year. The main routes of exposure are dermal and ocular exposure during manual weighing and adding of the polymer emulsion (30% notified polymer) into the mixing vessel, and when filling drums and pails with the coating product (1.5% notified polymer). Cleaning and maintenance personnel will have intermittent exposure to the notified polymer when carrying their tasks.

One or two laboratory personnel will have intermittent exposure to the notified polymer for up to 200 hours/year when collecting and performing QC tests.

All workers involved in handling the polymer emulsion and the coating product, including laboratory personnel will wear protective equipment including chemical goggles, overalls, protective vest, safety shoes, protective gloves, helmets, and respiratory protection, if necessary. The reformulation plant has a high volume of airflow and local exhaust ventilation to capture dust and vapours from the mixing tank.

Preparation of treatment bath

Some textile treatment sites may prepare their own treatment bath by dilution of the imported polymer emulsion. Similar mixing procedures to the reformulation are employed when preparing the treatment bath. All of the ingredients including the polymer emulsion are manually weighed and added individually into a treatment bath and mixed. It is estimated that a maximum of 20 workers (10 establishments, 2 workers/establishment) will be involved in the preparation of treatment baths. Dermal and ocular exposure can occur when handling polymer emulsion, and from spills and splashes during preparation of the treatment bath. Potential exposure to the polymer emulsion is expected to be 5 – 10 minutes several times/day, for up to 250 days/year. Workers will wear protective equipment including safety

glasses with side shields or chemical goggles, overalls, safety shoes, PVC or rubber gloves and respiratory protection, if necessary.

Textile treatment or coating

Diluted polymer emulsion (1.5% notified polymer) will be applied by cold-pad and thermo fixation method. The material to be treated will run through a paddler, pass through a set of mangle rollers to remove excess liquor from the material, and then through the oven for drying (1-2 minutes at 80 - 100°C) and thermofixation (30 – 60 seconds at 150 – 160°C) of the polymer onto the textile material. It is possible that dermal exposure to drips and spills, may occur if treated materials become entangled with the rollers during application.

An estimated maximum of 120 workers will be applying formulated products or treatment baths. Potential exposure to the coating product is expected to be 8 hours/day, up to 250 days/year. Workers will wear similar protective equipment to those required when preparing a treatment bath. These include safety glasses with side shields or chemical goggles, overalls, safety shoes, PVC or rubber gloves and if necessary, respiratory protection.

Handling of cured treated materials would not result in exposure to the notified polymer as it will be fixed onto the fibre surface or embedded in a matrix of the other polymers and ingredients, and not separately available for exposure.

7. PUBLIC EXPOSURE

It is expected that during import, transport, storage, reformulation or dilution and application, exposure of the public to the notified polymer will be low, except in the event of an accidental spill.

Materials treated with the coating product containing the notified polymer will be available in the public domain. Consequently, there is the potential for widespread public exposure. Exposure is likely to be dermal contact with the dried form of the notified polymer when handling or using treated textiles.

8. ENVIRONMENTAL EXPOSURE

8.1 Release

Reformulation

It is estimated that a maximum of 10 kg per batch (maximum 100 batches/year) of the reformulated product, containing up to 0.15 kg of the notified polymer, will be released to the wastewater pit, that is, a maximum annual discharge of 15 kg per annum of the notified polymer. This wastewater will be discharged into a licensed treatment site via enclosed tankers. Residual material in the import containers is washed out with water and may be used in blending subsequent batches or may be collected in the wastewater pit. The empty containers will then be reused or disposed of to landfill by a licensed waste contractor. The aqueous waste will be treated by sedimentation and filtration at the wastewater facility, prior to discharge in the metropolitan sewer system. It is estimated that approximately 90% of the waste polymer would be separated from the water into the sludge phase, with the sludge being disposed of to landfill by a licensed waste disposal contractor.

Application

The notified polymer will be used industrially as a water and oil repellent in textiles, at concentrations of less than 1.5%. The formulated product will be used at a number of sites.

Release of the notified polymer from formulated products may occur during the cleaning of coating/padding equipment with water. It is estimated that approximately 500 L of washings, containing less than 0.6 kg of the notified polymer, will be released per week from all sites. Depending on the size of the business, the waste product may be released directly into the sewerage system, or collected in designated containers or wastewater pits for secondary treatment and disposal. Additionally, release may occur from spills at the applicator sites, during transfer of the formulated products from the drums to the coating/padding machine, or through accidental damage of drums. Residues from such spills and empty containers at the applicator sites would be disposed of to landfill by a licensed waste contractor.

Summary of Total Release

Importation and reformulation site:

	Total	Landfill (90%)	Sewer (10%) (Melbourne)
Residues from import containers	50 kg/year	45 kg/year	5 kg/year
Equipment cleaning residues	15 kg/year	13.5 kg/year	1.5 kg/year
Spills	15 kg/year	13.5 kg/year	1.5 kg/year
Total	80 kg/year	72 kg/yr	8 kg/year

From formulated products:

	Total	Landfill (90%)	Sewer (10%) (Australia)
Residues from reformulation containers	50 kg/year	45 kg/year	5 kg/year
Equipment cleaning residues	30 kg/year	27 kg/year	3 kg/year
Spills	15 kg/year	13.5 kg/year	1.5 kg/year
Total	95 kg/year	85.5 kg/year	9.5 kg/year

From textile mills using imported product:

	Total	Landfill (90%)	Sewer (10%) (Australia)
Residues from import containers	75 kg/year	67.5 kg/year	7.5 kg/year
Equipment cleaning residues	30 kg/year	27 kg/year	3 kg/year
Spills	45 kg/year	41.5 kg/year	4.5 kg/year
Total	150 kg/year	135 kg/year	15 kg/year
All sources	325 kg/year	292.5 kg/year	32.5 kg/year

8.2 Fate

The notified polymer is not volatile, thus little release of vapours to the atmosphere is expected. Due to the negligible water solubility and the unique hydrophobic and oleophobic nature of the notified polymer, any release to the environment is initially unlikely to become associated with either the aqueous or organic phase. Once cleavage of the C-C bond occurs, the hydrocarbon component is likely to become assimilated with soils, sludges and sediments, while the fluorinated portion is likely to persist in the environment.

The major environmental exposure route of the notified polymer is likely be from disposal to landfill, incineration, and some minor discharge of wash waters to the sewage system. On disposal to landfill, the hydrocarbon portion of the polymer will remain bound within the soils and sediments of the landfill to slowly degrade by biotic and abiotic processes. If incinerated, the polymer would be rapidly destroyed and converted to water vapour and oxides of carbon, nitrogen and hydrogen fluoride. Any polymer entering receiving waters at a sewage treatment plant is initially unlikely to become associated with either the aqueous, or the sludge and sediment compartment. In time, the hydrocarbon portion will become assimilated with the organic phase, while the fluorinated portion will rise to the water surface and subject to cleavage as a result of exposure to UV radiation. As the polymer has a high molecular weight, it is not expected to cross or react with biological membranes, to bioaccumulate or to be of toxicological concern in the aquatic environment.

No biodegradation data was provided, but it is probable that the hydrocarbon portions of the polymer will ultimately biodegrade and slowly mineralise to water and oxides of carbon and nitrogen. However, the fluorocarbon portion is unlikely to be susceptible to biodegradation (Remde and Debus, 1996) in view of the electronegativity of fluorine and the great strength of the carbon-fluorine bond. Perfluorocarbons are more thermally stable than their corresponding hydrocarbon analogues. In particular, perfluorocarboxylic acids and perfluoroalkane sulfonic acids are considered the most thermally stable fluorinated surfactants. In addition to thermal stability, perfluorinated hydrocarbons are stable against degradation by acids, bases, oxidants and reductants (Moody, 2000). Fluorinated carboxylic acids can undergo hydrolytic defluorination, reductive defluorination, and decarboxylation. To date, however, significant defluorination has only been observed for hydrolytic attack of monofluorinated carboxylic acids, and compounds of more than one fluorine atom per carbon atom are generally recalcitrant (Blake, 1997). The notified polymer has a nominal fluorine content of approximately 34% and studies have shown that fluorinated compounds with a fluoride content in the order of 50% will not biodegrade over a period of 60 days (Remde and Debus, 1996). Further, fluorocarbons have little affinity for either water or organic phases and ultimately will concentrate near the surface of water bodies, for example, when released in sewage treatment plant effluent. Here they are likely to degrade by abiotic cleavage, with assistance from UV radiation, into smaller fluorocarbon species, which will be volatile and partition into the atmosphere. Here further reaction with hydroxyl radicals and action by UV radiation is expected to lead to degradation to hydrogen fluoride and precipitation to the surface in rain. However, the fluorocarbon species may not take part in the destruction of the ozone layer, as is typical of chlorofluorocarbons.

Although the high molecular weight of the notified polymer would tend to preclude bioaccumulation (Connell, 1990), recent studies have shown evidence of significant accumulation of fluorinated hydrocarbons in the blood of higher trophic level organisms, including humans. The origin of the fluorocarbons is strongly suspected to be anthropogenic,

and results from these studies have led a major fluorocarbon manufacturer to cease production of these compounds (Chemical Engineering News, 2001). Research found fluorinated compounds in human blood and animal tissue in parts of the world where these are not manufactured (Environmental Science and Technology/News, 2000). Laboratory toxicity studies in rats and primates showed that such compounds can cause death in adult monkeys and rat offspring. In addition, the US EPA have stated "This widespread presence, persistence and bioaccumulation potential and the reproductive and subchronic toxicity of the chemical raises concerns for potential adverse effects on people and wildlife" (Chemical Regulation Observer, 2000).

9. EVALUATION OF TOXICOLOGICAL DATA

The notifier submitted reports of a limited number of toxicological tests, which are summarised below. Toxicity tests were carried out on the imported polymer emulsion, Unidyne TG-440, containing <30% notified polymer.

9.1 Acute Oral Toxicity (Prinsen MK, 1995)

<i>Species/strain:</i>	Rats/Crl:WI(WU)BR
<i>Number/sex of animals:</i>	5/sex
<i>Observation period:</i>	14 days
<i>Method of administration:</i>	A single oral dose 2200 mg/kg was given by gavage
<i>Test method:</i>	OECD TG 401 (limit test)
<i>Mortality:</i>	None
<i>Clinical observations:</i>	All animals showed piloerection within 1 to 4 hours after dosing.
<i>Comment:</i>	All animals gained weight during the study.
<i>LD₅₀:</i>	>2000 mg/kg
<i>Result:</i>	the test substance was of very low acute oral toxicity in rats

9.2 Skin Irritation (Prinsen MK, 1995)

<i>Species/strain:</i>	Rabbits/New Zealand
<i>Number/sex of animals:</i>	3/males
<i>Observation period:</i>	3 days
<i>Method of administration:</i>	A single dose (approximately 0.5 mL test substance) was

applied under a semi-occlusive dressing for 4 hours

Test method: OECD TG 404

Comment: No skin reactions were observed during the study

Result: the test substance was not irritating to the skin of rabbits

9.3 Eye Irritation (Prinsen MK, 1995)

Species/strain: Rabbits/New Zealand White

Number/sex of animals: 3/males

Observation period: 3 days

Method of administration: A single dose (approximately 0.1 ml test substance) was placed into the conjunctival sac of the right eye of the animal. The eyes remained unwashed. The untreated eye served as a control.

Test method: OECD TG 405

Comment: All animals showed slight redness of the conjunctivae 1 hour after treatment. No signs of eye irritation were evident at 24 to 72 hour observations.

Result: the test substance was slightly irritating to the eyes of rabbits

9.4 Chicken Enucleated Eye Test (CEET) (Prinsen MK, 1995)

Species/strain: Spring chickens/ROSS

Number/sex of animals: 3/males and females

Observation period: 4 hours

Comment: Slight increase in corneal thickness of the test eyes was observed after treatment. Slight corneal opacity and fluorescein retention by damaged epithelial cells were observed in the test eyes.

The control eye did not show irritation effects.

Result: the test substance was slightly irritating to the eyes

9.5 *Salmonella typhimurium* Reverse Mutation Assay (Blijleven WGH, 1995)

<i>Strains:</i>	<i>Salmonella typhimurium:</i> TA1535, TA1537, TA98 and TA100
<i>Metabolic activation:</i>	Liver S9 fraction from rats pre-treated with Arochlor 1254 in soya bean oil
<i>Concentration range:</i>	0 – 5000 µg/plate Each concentration was tested in triplicate, with or without metabolic activation with S9, in two independent experiments. Appropriate strain specific positive control reference substances were used.
<i>Test method:</i>	OECD TG 471
<i>Comment:</i>	There were no significant, reproducible increases in the number of revertant colonies in the presence or absence of metabolic activation at any test concentration. A slight increase in the number of revertants was observed without S9 for strain TA1537 in the first experiment. However, no increase was seen in the repeat experiment. No toxicity or precipitation was observed for any of the tester strains at any test concentration. Concurrent positive controls induced marked increases in the number of revertant colonies and the activity of the S9 fraction was found to be satisfactory.
<i>Result:</i>	the test substance was non mutagenic under the conditions of the test

9.6 Overall Assessment of Toxicological Data

The imported polymer emulsion, Unidyne TG-440, containing <30% notified polymer was of very low acute oral toxicity in rats. It was not a skin irritant to rabbits. However, it was slightly irritating to the eyes of rabbits, with a slight reaction also observed in the CEET. It was not mutagenic in the bacterial strains tested in an Ames assay.

Based on the information available, the notified polymer is not classified as a hazardous substance in accordance with NOHSC *Approved Criteria for Classifying Hazardous Substances* (NOHSC, 1999)

10. ASSESSMENT OF ENVIRONMENTAL EFFECTS

No ecotoxicological data were provided for the notified polymer but various perfluorinated hydrocarbons are considered mildly toxic to marine life. Effects are seen at concentrations

near 6,000 mg/L towards fish, and this represents a considerable safety factor. Realistic toxicity evaluations of fluorocarbon wastewater in the environment are difficult because of the possible synergistic effects between mixture components (Moody, 2000).

11. ASSESSMENT OF ENVIRONMENTAL RISK

Ultimately, most of the polymer will be released to landfill or incinerated at the end of the useful life of the treated textiles. Significant leaching from the treated material is not expected because of the negligible water solubility of the notified polymer and its affinity for the textile surfaces to which it is heat cured. The majority of wastes generated from the reformulation and application of the polymer will go to landfill (up to 292.5 kg per annum). The notified polymer is not volatile and little release to the atmosphere is expected. The hydrophobic and oleophobic nature of the polymer suggests that it will initially have little affinity with either organic matter (sediments, soil or sludge) or the aqueous phase. In landfill, the hydrocarbon portions of the polymer will probably slowly degrade to carbon and nitrogen oxides through abiotic and biotic processes, with the fluorocarbon fraction remaining. If incinerated, the polymer would be rapidly destroyed and converted to water vapour and oxides of carbon, nitrogen and hydrogen fluoride.

The reformulation and application of the notified polymer will generate waste polymer, which will be released to the sewer system (up to 32.5 kg per annum). Within the sewer system, the hydrocarbon portion is likely to become assimilated with the organic phase (sediments and sludges), while it is possible that the fluorocarbons will partition to surface waters where they will be subject to cleavage by UV radiation with subsequent volatilisation to the atmosphere and abiotic degradation to hydrogen fluoride. As the Werribee sewage treatment plant will be impacted the most from the introduction of the notified polymer, it is assumed that around one half of the national annual release (ie 16 kg) will go to this plant, and release will occur for 300 days of the year. The Predicted Environmental Concentration (PEC) for this facility is calculated below:

Amount of polymer discharged to sewer/day:	$16 \text{ kg}/300 = 53.3 \text{ g}$
Volume of Dilution Water:	550 ML
PEC:	$0.097 \text{ } \mu\text{g/L}$

Given the available data, the overall environmental risk associated with the introduction of the notified polymer appears to be low. However, there are uncertainties surrounding the behaviour of fluorocarbon compounds in the environment and these are addressed in the recommendations below.

12. ASSESSMENT OF PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY EFFECTS

Health Hazard

A limited number of toxicological tests have been provided for the imported polymer emulsion, Unidyne TG-440, containing <30% notified polymer. The acute oral toxicity of the polymer emulsion is very low. It is a slight eye irritant but not a skin irritant in rabbits. It is not mutagenic in an Ames assay.

A number of potential health effects are also listed in the Material Safety Data Sheet for the imported polymer emulsion. These include eye, skin, mucous membrane and respiratory irritation, and central nervous depression which may lead to loss of coordination and impaired judgement. These effects are related to the presence of co-solvents, dipropylene monomethyl ether and isopropyl alcohol, rather than effects due to the notified polymer. Dipropylene glycol monomethyl ether and isopropyl alcohol are on the NOHSC *List of Designated Hazardous Substances* (NOHSC, 1999a).

The notified polymer has a high NAMW, and absorption across biological membranes and resultant systemic toxicity would be restricted. Therefore, the notified polymer is unlikely to be a hazardous substance according to the NOHSC *Approved Criteria for Classifying Hazardous Substances* (NOHSC, 1999b).

The notified polymer is not a dangerous good for road or rail transport.

Occupational Health and Safety

Occupational exposure to the notified polymer can be divided into exposure to the imported polymer emulsion (containing <30% notified polymer) and the coating product (containing <1.5% notified polymer). Dermal and ocular exposure to spills, drips and splashes is the most probable hazard for workers involved in the reformulation, drumming of coating product, treatment of textiles and in cleaning equipment. Workers involved in the reformulation and preparation of treatment bath will be exposed to the imported polymer emulsion (<30% notified polymer), and exposure for these workers may be high. Therefore, there is a risk of eye irritation for these workers.

The workers involved in drumming of the coating product, treatment of textile and cleaning equipment may be exposed to the diluted polymer solution (<1.5% notified polymer). Exposure is likely to be dermal and ocular exposure to drips and spills. Dermal exposure to treated textile prior to curing can also occur if treated materials become entangled with the rollers during application. However, the risk of adverse health effects arising from exposure to the notified polymer is low due to the low toxicity of the polymer and its low concentration in the textile coating.

Workers involved in handling the polymer emulsion and coating product should wear safety glasses, overalls, safety shoes and protective gloves.

Although inhalation exposure to the notified polymer is unlikely, the presence of co-solvents in formulations containing the notified polymer will require that adequate precautions be taken to prevent inhalation exposure. The relevant NOHSC exposure standards (NOHSC,

1995) are: isopropyl alcohol, 400 ppm (TWA*) and 500 ppm (STEL#); dipropylene glycol monomethyl ether, 100 ppm (TWA) and 150 ppm (STEL), with skin notation.

Occupational exposure to the notified polymer after the treated material is cured is unlikely since the notified polymer is fixed onto the fibre surface or embedded in a matrix of other polymers and ingredients. In this form, the polymer is not bioavailable, hence no risk to workers is expected.

Exposure to the notified polymer is not expected during transport and storage as long as the packaging is intact. The risk of adverse effects for transport and storage workers is considered to be low.

Public Health

It is expected that public exposure to the products containing the notified polymer will be minimal except in the rare event of an accidental spill. There will be public exposure from dermal contact with textiles treated with the notified polymer. However, in this form, the notified polymer is thermo-fixed, and consequently will be encapsulated within an inert, very high molecular weight polymer matrix. This will render the notified polymer biologically unavailable. Therefore, the public hazard from exposure to the notified polymer through all phases of its life cycle is considered low.

13. MATERIAL SAFETY DATA SHEET (MSDS) AND LABEL ASSESSMENT

13.1 MSDS

The MSDS for the product containing the notified polymer was provided in a format consistent with the *National Code of Practice for the Preparation of Material Safety Data Sheets* (NOHSC, 1994a).

The MSDS was provided by the applicant 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 applicant.

13.2 Label

The label for the product containing the notified polymer provided by the notifier was in accordance with the NOHSC *National Code of Practice for the Labelling of Workplace Substances* (NOHSC, 1994b). The accuracy of the information on the label remains the responsibility of the applicant.

* TWA = Time-weighted average

STEL = Short term exposure limit

14. RECOMMENDATIONS

Control Measures

Occupational Health and Safety

- Employers should implement the following engineering controls to minimise occupational exposure to the notified polymer in the product, Unidyne TG-440:
 - Enclosure of process as much as possible to reduce splashing
 - exhaust ventilation during reformulation, preparation of treatment bath and application of coating product
- Employers should implement the following safe work practices to minimise occupational exposure during handling of the notified polymer in the product, Unidyne TG-440:
 - when manually weighing and charging the mixing vessel, prevent splashes and spills
- Employers should ensure that the following personal protective equipment is used by workers to minimise occupational exposure to the notified polymer in the product, Unidyne TG-440:
 - chemical goggles or safety glasses
 - PVC or rubber gloves
 - safety shoes
 - overalls

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

- A copy of the MSDS should be easily accessible to employees.

If products and mixtures containing the notified polymer are classified as hazardous to health in accordance with the NOHSC *Approved Criteria for Classifying Hazardous Substances*, workplace practices and control procedures consistent with provisions of State and Territory hazardous substances legislation must be in operation.

Secondary notification

The NICNAS Director must be notified in writing within 28 days by the notifier, or other importer or manufacturer:

- (1) Subsection 64(1) of the Act:
 - if new information becomes available which may impact on the environmental exposure or fate or ecotoxicity of the notified polymer, particularly in relation to understanding the behaviour of fluorocarbons in the environment; or
- (2) Subsection 64(2) of the Act:
 - if any of the circumstances listed in the subsection arise.

The Director will then decide whether secondary notification is required.

15. REFERENCES

Blake D., Howell R. D., Criddle C. S., (1997) Fluorinated Organics in the Biosphere. Environmental Science and Technology. Vol. 13, No. 9, p 2445-2454.

Blijleven WGH (1995) Ames Test with Unidyne TG-440, Project No. 450064-024, TNO Nutrition and Food Research, The Netherlands.

Chemical Engineering News (January, 2001). Filling 3M's Void, pg 17-18.

Chemical Regulation Observer, 2000. Vol. 24, No. 43, p 2118-2119.

Connell, DW (1990). General Characteristics of Organic Compounds Which Exhibit Bioaccumulation. In: Bioaccumulation of Xenobiotic Compounds, pp. 47-57. CRC Press, Boca Raton, USA.

Ellis D. A., Henson M. L., Sibley P. K., Shahid T., Fineberg N. A., Solomon K. R., Muir D. C. G., Mobury S. A., (2000) The Fate and Persistence of Trifluoroacetic Acid and Chloroacetic Acid in Pond Waters. Chemosphere 42 (2001) p 309-318.

Environmental Science and Technology/News (2000). September 1 (2000) pp 371A-373A.

Mensink BJWG, Montforts M, Wijkhuizen-Maslankiewicz L, Tibosch H and Linders JBHJ (1995). Report no. 679101022: Manual for Summarising and Evaluating the Environmental Aspects of Pesticides. National Institute of Public Health and Environmental Protection, Bilthoven, The Netherlands.

National Occupational Health and Safety Commission (1994a) National Code of Practice for the Preparation of Material Safety Data Sheets [NOHSC:2011(1994)]. Australian Government Publishing Service, Canberra.

National Occupational Health and Safety Commission (1994b) National Code of Practice for the Labelling of Workplace Substances [NOHSC:2012(1994)]. Australian Government Publishing Service, Canberra.

National Occupational Health and Safety Commission (1995) Adopted National Exposure Standards for Atmospheric Contaminants in the Occupational Environment, [NOHSC:1003(1995)]. In: Exposure Standards for Atmospheric Contaminants in the Occupational Environment: Guidance Note and National Exposure Standards. Australian Government Publishing Service, Canberra.

National Occupational Health and Safety Commission (1999a) List of Designated Hazardous Substances [NOHSC:10005(1999)]. Australian Government Publishing Service, Canberra.

National Occupational Health and Safety Commission (1999b) Approved Criteria for Classifying Hazardous Substances [NOHSC:1008(1994)]. Australian Government Publishing Service, Canberra.

Prinsen MK (1995) Acute Oral Toxicity Study (Limit Test) with Unidyne TG-440 in Rats, Project No. 450060/27, TNO Nutrition and Food Research, The Netherlands.

Prinsen MK (1995) Acute Dermal Irritation/Corrosion Study with Unidyne TG-440 in Albino Rabbits, Project No. 450061/22, TNO Nutrition and Food Research, The Netherlands.

Prinsen MK (1995) Acute Eye Irritation/Corrosion Study with Unidyne TG-440 in Albino Rabbits, Project No. 450069/20, TNO Nutrition and Food Research, The Netherlands.

RCC Ltd (2000a): Determination of the Melting Point/Melting Range of Fluoroalkyl Acrylate and Alkyl Acrylate Copolymer (Study Number 775978). CH-4452, Itingen/Switzerland, RCC Ltd, Environmental Chemistry & Pharamanalytics Division (unpublished report).

RCC Ltd (2000b): Determination of the Relative Density of Fluoroalkyl Acrylate and Alkyl Acrylate Copolymer (Study Number 775980). CH-4452, Itingen/Switzerland, RCC Ltd, Environmental Chemistry & Pharamanalytics Division (unpublished report).

RCC Ltd (2000c): Calculation of the Vapour Pressure of Fluoroalkyl Acrylate and Alkyl Acrylate Copolymer (Study Number 796397). CH-4452, Itingen/Switzerland, RCC Ltd, Environmental Chemistry & Pharamanalytics Division (unpublished report).

RCC Ltd (2000d): Determination of the Solution/Extraction Behaviour of Fluoroalkyl Acrylate and Alkyl Acrylate Copolymer (Study Number 775991). CH-4452, Itingen/Switzerland, RCC Ltd, Environmental Chemistry & Pharamanalytics Division (unpublished report).

RCC Ltd (2000e): Hydrolysis of Fluoroalkyl Acrylate and Alkyl Acrylate Copolymer (Study Number 776068). CH-4452, Itingen/Switzerland, RCC Ltd, Environmental Chemistry & Pharamanalytics Division (unpublished report).

RCC Ltd (2000f): Calculation of the Partition Coefficient (n-Octanol/Water) of Fluoroalkyl Acrylate and Alkyl Acrylate Copolymer (Study Number 796408). CH-4452, Itingen/Switzerland, RCC Ltd, Environmental Chemistry & Pharamanalytics Division (unpublished report).

RCC Ltd (2000g): Calculation of the Dissociation Constant of Fluoroalkyl Acrylate and Alkyl Acrylate Copolymer (Study Number 777046). CH-4452, Itingen/Switzerland, RCC Ltd, Environmental Chemistry & Pharamanalytics Division (unpublished report).

RCC Ltd (2000h): On the Adsorption Coefficient for Soils and Sediment of TG-440 (Study Number 796410). CH-4452, Itingen/Switzerland, RCC Ltd, Environmental Chemistry & Pharamanalytics Division (unpublished report).

Remde A and Debus R (1996). Biodegradability of Fluorinated Surfactants Under Aerobic and Anaerobic Conditions. Chemosphere 32 (1996) pp. 1563-1574.

Attachment 1

The Draize Scale (Draize, 1959) for evaluation of skin reactions is as follows:

<i>Erythema Formation</i>	<i>Rating</i>	<i>Oedema Formation</i>	<i>Rating</i>
No erythema	0	No oedema	0
Very slight erythema (barely perceptible)	1	Very slight oedema (barely perceptible)	1
Well-defined erythema	2	Slight oedema (edges of area well-defined by definite raising)	2
Moderate to severe erythema	3	Moderate oedema (raised approx. 1 mm)	3
Severe erythema (beet redness)	4	Severe oedema (raised more than 1 mm and extending beyond area of exposure)	4

The Draize scale (Draize *et al.*, 1944) for evaluation of eye reactions is as follows:

CORNEA

<i>Opacity</i>	<i>Rating</i>	<i>Area of Cornea involved</i>	<i>Rating</i>
No opacity	0 none	25% or less (not zero)	1
Diffuse area, details of iris clearly visible	1 slight	25% to 50%	2
Easily visible translucent areas, details of iris slightly obscure	2 mild	50% to 75%	3
Opalescent areas, no details of iris visible, size of pupil barely discernible	3 moderate	Greater than 75%	4
Opaque, iris invisible	4 severe		

CONJUNCTIVAE

<i>Redness</i>	<i>Rating</i>	<i>Chemosis</i>	<i>Rating</i>	<i>Discharge</i>	<i>Rating</i>
Vessels normal	0 none	No swelling	0 none	No discharge	0 none
Vessels definitely injected above normal	1 slight	Any swelling above normal	1 slight	Any amount different from normal	1 slight
More diffuse, deeper crimson red with individual vessels not easily discernible	2 mod.	Obvious swelling with partial eversion of lids	2 mild	Discharge with moistening of lids and adjacent hairs	2 mod.
Diffuse beefy red	3 severe	Swelling with lids half-closed	3 mod.	Discharge with moistening of lids and hairs and considerable area around eye	3 severe
		Swelling with lids half-closed to completely closed	4 severe		

IRIS

<i>Values</i>	<i>Rating</i>
Normal	0 none
Folds above normal, congestion, swelling, circumcorneal injection, iris reacts to light	1 slight
No reaction to light, haemorrhage, gross destruction	2 severe

Draize, J. H., Woodward, G., Calvery, H. O. (1944) Methods for the Study of Irritation and Toxicity of Substances Applied Topically to the Skin and Mucous Membranes, *J. Pharmacol. Exp. Ther.* 82 : 377-390.

Draize J. H. (1959) Appraisal of the Safety of Chemicals in Foods, Drugs and Cosmetics. Association of Food and Drug Officials of the US, 49 : 2-56.