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January 2002

NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME

FULL PUBLIC REPORT

Chemical in Infinity PS 6965

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 Ageing.

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Director
Chemicals Notification and Assessment

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Chemical in Infinity PS 6965

1. APPLICANT

Betzdearborn Australia Pty Ltd of 69-77 Williamson Road INGLEBURN NSW 2565 (ABN 84 001 221 941) has submitted a standard notification statement in support of their application for an assessment certificate for 'Chemical in Infinity PS 6965'.

2. IDENTITY OF THE CHEMICAL

The chemical name, CAS number, molecular and structural formulae, molecular weight, and spectral data have been exempted from publication in the Full Public Report and the Summary Report. The two components of the notified chemical are referred as chemical A and chemical B in this report.

Marketing Name: Infinity PS 6965 (60% notified chemical)

3. PHYSICAL AND CHEMICAL PROPERTIES

The notifier did not provide physicochemical data for the notified chemical. However, the two components making up the notified chemical are well known substances, and data is available on their physicochemical properties. The data provided are included in the table below.

Appearance at 20°C & 101.3 kPa:	Colourless liquid.
Boiling Point:	>90°C (with decomposition)
Specific Gravity:	1 210 kg/m^3
Vapour Pressure:	Imported in aqueous solution with an expected vapour pressure of 2.4 kPa at 20°C.
Water Solubility:	Chemical A: (anhydrous): 82.3 % at 0°C Chemical B: 1 080 g/L at 20°C
Partition Co-efficient (n-octanol/water):	Not determined. The notified chemical is a salt and is expected to preferentially partition into the water phase. The log P_{ow} of chemical B is –1.59. The log P_{ow} of the notified chemical is expected to be lower than this value. Chemical A is an inorganic chemical.

Hydrolysis as a Function of pH:	Not determined. Chemical B undergoes hydrolysis when boiled with acids or alkalis, but under normal environmental conditions it is not expected to hydrolyse to an appreciable extent.
Adsorption/Desorption:	Not determined. The notified chemical is not expected to adsorb strongly to organic matter.
Dissociation Constant:	On dilution the notified chemical dissociates in aqueous solution to form a weak base and a strong acid. The pH of a concentrated solution of the notified chemical is <1.
Particle Size:	Not determined (chemical imported as aqueous solution).
Flash Point:	Non-flammable.
Flammability Limits:	Non-flammable.
Autoignition Temperature:	Not determined.
Explosive Properties:	Not explosive.
Reactivity/Stability:	It has reactivity as a salt formed by a weak base and a strong acid.

3.1 Comments on Physico-Chemical Properties

The vapour pressure of the aqueous solution of the notified chemical is 2 400 Pa. The vapour pressure of chemical B is 80 Pa and the Henry's Law Constant is 4.4×10^{-8} atm m^3/mole, indicating chemical B has low volatility (US EPA SIDS Document). The vapour pressure of chemical A (anhydrous) is 4.72×10^3 kPa (Daubert and Danner, 1982), and the Henry's Law Constant, calculated according to the relationship H=(Vapour pressure)x(Molecular Weight/Solubility), is 4.18×10^2 Pa m^3/mole, indicating its high volatility.

Chemical A is highly soluble in water in which it forms a strong acid. The water solubility of chemical A at 0°C is 411.55 g/L and at 30°C is 336.5 g/L. Chemical A is also soluble in alcohol, ethers, aldehydes and esters (Encyclopedia of Chemical Technology 1966, Volume 11). The notified chemical is highly soluble in water.

4. PURITY OF THE CHEMICAL

Degree of Purity: 100%

Hazardous Impurities: None.

Non-hazardous Impurities

(> 1% by weight): None.

Additives/Adjuvants: None.

5. USE, VOLUME AND FORMULATION

The notified chemical will be used in the paper industry to remove calcium carbonate/calcium sulphate scaling of pre-coat filters in the sodium hydroxide regeneration process.

The notified chemical is not manufactured in Australia. It will be imported in an aqueous product, Infinity PS 6965, which contains 60% notified chemical in 1 000 L IBC containers. Approximately 80 tonnes of notified chemical will be imported annually.

6. OCCUPATIONAL EXPOSURE

The notified chemical is used to clean the pre-coat filters responsible for the removal of water from lime mud produced in the paper making process. It will be used in one paper mill in Australia.

Transport & storage
Infinity PS 6965, which contains 60% notified chemical in 1 000 L IBC containers is imported from overseas. In Australia, the notified chemical is transported to the paper mill by truck and stored in a bunded area. Transport and storage workers are unlikely to be exposed to the notified chemical unless the packaging is breached.

Paper mill site
It is expected that 6 operators at the recovery re-causticising area of the paper mill will handle the notified chemical twice a week.

The IBC containers of Infinity PS 6965 containing 60% notified chemical are connected via permanent fixed pipes to cleaning equipment. When the clean process starts, Infinity PS 6965 is pumped directly from the containers to the vat/filter system. All processes are automatically controlled. The cleaning solution is re-used in the system.

Operators are expected to make only incidental contact with the notified chemical. Dermal and inhalation exposure may occur during connection and disconnection of the IBC containers to the pumping lines. The whole operating area is naturally ventilated and an overhead covering is located above the pre-coat filters. The notifier indicated that the paper mill will utilise the existing engineering controls which were implemented to control exposure to hydrochloric acid. Workers will wear overalls, gloves and safety glasses.

7. PUBLIC EXPOSURE

It is expected that during import, transport, storage, and industrial use, there will be no exposure of the general public to the notified chemical, except in the event of an accidental spill.

Infinity PS 6965 will not be sold to the public. It is used for cleaning drum filters which remove water in the regeneration of quicklime, which used to treat a by-product of paper making in a paper mill. Consequently, there will be no public exposure.

8. ENVIRONMENTAL EXPOSURE

8.1 Release

No release data were provided. According to the notifier, no wastes are generated on site from the cleaning process. The chemical is fully maintained in the cleaning system and any residual is either destroyed in the recovery process or continually reused in the cleaning process. Residues in the import containers are returned to the manufacturer along with the import containers.

8.2 Fate

No environmental release of the notified chemical is expected during use. However, in the event of accidental release into the aquatic environment, the physical and chemical properties indicate the notified chemical will partition predominantly into the water compartment owing to its high water solubility. The notified chemical is a salt and is expected to completely dissociate when diluted in water to form a weak base (chemical B) and a strong acid (chemical A).

Chemical B is highly water-soluble, has a low partition coefficient, and a low vapour pressure. Mackay level 1 fugacity modelling indicates that 99.85% of the chemical will partition into water, and the remaining 0.16% will partition into the atmosphere (US EPA, undated). Chemical B is readily eliminated from sewerage treatment facilities. An inherent biodegradability test (OECD TG 302B) indicated 96% elimination after 16 days (BUA, 1991). In natural aquatic environments, the rate of degradation depends on environmental conditions such as temperature, aeration, and the composition of the bacterial population. Degradation may occur within a few days in warm (20°C), aerated water (BUA, 1991). In soil environments, chemical B is expected to biodegrade fairly rapidly. A large number of fungi and bacteria can produce enzymes, which are able to break down the chemical (Gould *et al.,* 1986). Chemical B is expected to be highly mobile in soils owing to its high water solubility. Hence the chemical may leach from the soil into surface waters and groundwater (US EPA, undated). However, the log Pow of chemical B indicates a low potential to bioaccumulate.

In water, chemical A dissociates almost completely to form an acid (WHO, 1982). In effluent and sewage treatment facilities, it is expected that all excess acids will be neutralised as part of the standard treatment process, prior to release of the effluent to the receiving waters, in accordance with EPA regulations. The pH of effluent water is easily monitored and adjusted.

9. EVALUATION OF TOXICOLOGICAL DATA

9.1 Summary of Toxicological Investigations

Endpoint & Result	*Assessment Conclusion*
Rat, acute oral LD50 1 120.9 mg/kg bw	Harmful
Rabbit, skin irritation	Slightly irritating
Genotoxicity - bacterial reverse mutation	Non mutagenic

9.1.1 Acute Oral Toxicity

TEST SUBSTANCE 60% notified chemical

METHOD OECD 401 Acute Oral Toxicity.
Species/Strain Rat/Sprague-Dawkey
Vehicle None.
Remarks - Method GLP & QA.

RESULTS

Group	*Number & Sex of Animals*	*Dose mg/kg bw*	*Mortality*
1	5/sex	1 000	4/10
2	5/sex	1 130	5/10
3	5/sex	1 250	6/10
4	5/sex	1 400	7/10
5	5/sex	1 560	9/10

LD50 1 120.9 mg/kg bw
Signs of Toxicity Most mortality occurred within the first 24 hours after dosing.

Clinical signs included convulsions, tremors, dyspnoea, cyanosis, prostration, piloerection, apathy, passivity, distended abdomen and melena. These symptoms in some animals progressed into a coma-like state followed by death.
Effects in Organs Necropsy showed that dead animals had stomach ulcers and haemorrhaging of the stomach and small intestines. Those survived animals had adhesions of the stomach to liver, spleen, small intestines and omentum. These findings were consistent and a consequence of perforated stomach ulcers and subsequent peritonitis.
Remarks - Results The LD50 was found to be 721.1 and 1 234.9 mg/kg for the males and females, respectively.

CONCLUSION The test material is harmful via the oral route.

TEST FACILITY Nucro Technics (1997a)

9.1.2 Skin Irritation

TEST SUBSTANCE 60% notified chemical

METHOD OECD 404 Acute Dermal Irritation/Corrosion.
Species/Strain Rabbit/New Zealand White
Number of Animals 3 females.
Observation Period 72 hours.
Vehicle None.
Type of Dressing Occlusive
Remarks - Method GLP & QA.

RESULTS

Lesion	*Mean Score* Animal No.*			*Maximum Value*	*Maximum Duration of Any Effect*	*Maximum Value at End of Observation Period*
	1	2	3			
Erythema/Eschar	1	1.3	0.3	3	1 hour	1
Oedema	0	0.3	0	2	1 hour	0

*Calculated on the basis of the scores at 24, 48, & 72 hours for EACH animal.

Remarks - Results None.

CONCLUSION The test material is slightly irritating to skin.

TEST FACILITY Nucro Technics (1997b)

9.1.3 Genotoxicity-Bacteria

TEST SUBSTANCE 60% notified chemical

METHOD OECD 471 Bacterial Reverse Mutation Test.
Plate incorporation procedure
Species/Strain *S. typhimurium*: TA1538, TA1535, TA98, TA100, TA97A.
Metabolic Activation System Liver fraction (S9 mix) from rats pretreated with Aroclor 1254.
Concentration Range in Main Test a) With metabolic activation: 0.1-100 µg/plate.
b) Without metabolic activation: 0.1-100 µg/plate.
Vehicle Water.
Remarks - Method GLP & QA.

RESULTS

Metabolic Activation	*Test Substance Concentration (µg/plate) Resulting in:*			
	Cytotoxicity in PreliminaryTest	*Cytotoxicity in Main Test*	*Precipitation*	*Genotoxic Effect*
Present				
Test 1	5 000	None.	None.	Not seen.
Test 2		None.	None.	Not seen.
Absent				
Test 1	5 000	None.	None.	Not seen.
Test 2		None.	None.	Not seen.

Remarks - Results None.

CONCLUSION The test material chemical was not mutagenic to bacteria under the conditions of the test.

TEST FACILITY Nucro Technics (1997c)

9.2 Overall Assessment of Toxicological Data

The notifier provided 3 toxicity study reports in the submission. The 60% notified chemical aqueous solution was harmful by oral administration in rats, and was a slight skin irritant in rabbits. In a bacterial reverse mutation test, the 60% notified chemical solution was not mutagenic to the bacterial strains under the test conditions. Based on the available limited data, the 60% notified chemical solution is determined to be a hazardous substance with R22 (Harmful if swallowed) according to the NOHSC *Approved Criteria for Classifying Hazardous Substances* (NOHSC, 1999a).

Chemical A is on the NOHSC *List of Designated Hazardous Substances* (NOHSC, 1999b) with R23 (Toxic by inhalation) and R35 (Causes severe burns). The national Exposure Standard for chemical A is 5 ppm (peak limitation) (NOHSC, 1995). The notifier provided a copy of USEPA Integrated Risk Information System (IRIS) record on chemical A. The inhalation Reference Concentration for chronic inhalation exposure (RfC) for chemical A is determined to be 0.02 mg/m^3 based on the effects of hyperplasia of nasal mucosa larynx and trachea. The LOAEL from a rat chronic (lifetime) inhalation study was 15 mg/m^3 (10 ppm).

Chemical B is not on the NOHSC *List of Designated Hazardous Substances* (NOHSC, 1999b). In fact, it is used therapeutically in humans in skin creams and ointments at less than 10% concentration. It is also excreted in the urine of humans. Screening Information Data Set (SIDS) (UN, 1996) indicates that chemical B is of low acute toxicity in mammals. In mice and rats, chemical B is of low toxicity even by the subcutaneous and intravenous route. No well-conducted repeated dose toxicity studies on chemical B were located. Chronic toxicity and carcinogenicity screening studies in mice and rats fed with 4 500, 9 000 or 45 000 pprn in diet (up to about 6 750 mg/kg body weight/day for mice and about 2 250 mg/kg body weight/day for rats) did not uncover any treatment-related toxic syndromes in the various organs studied. Neither was any weight depression noted at terminal necropsy for animals of either sex or species at any dose levels. Thus the NOAELs were about 6 750 mg/kg body weight/day for mice and about 2 250 mg/kg body weight/day for rats. Although the value for NOAEL by dermal route can be determined, it can be concluded that the repeated dose toxicity of chemical B by dermal route was low. The studies cited under repeated dose

toxicity did not indicate any toxic effects on the reproductive organs of mice and rats. Chemical B has been negative in several appropriately conducted bacterial mutagenicity tests.

The notifier provided a copy of BUA Report 76 (BUA, 1991). The report indicated that the acute toxicity of chemical B is low. Chemical B does not cause irritation to skin or mucous membranes (eye), and has no sensitising effect. Repeated-dose studies of different duration on a variety of animal species and via various routes of administration revealed no adverse effects. Chemical B was non-mutagenic in bacterial tests and non-carcinogenic in both in vitro and in vivo studies. Studies with rats, mice and cattle showed no potential for reproductive toxicity or teratogenicity.

The notifier indicated that the notified chemical is 100% pure without any free base or acid. However, as the notified chemical is formed by a weak base and a strong acid, the pH of the notified chemical solution is expected to be less than 1. Based on the available information, the notified chemical is considered to be a hazardous substance with risk phrases R22 (Harmful if swallowed) and R36/37/38 (Irritating to eyes, respiratory system and skin).

10. ASSESSMENT OF ENVIRONMENTAL EFFECTS

No reports of ecotoxicity test studies were provided for the notified chemical. However, the following aquatic toxicology data are listed in the MSDS for Infinity PS6965.

A Fathead Minnow 96 hour static bioassay with 48-hour renewal showed no mortalities at the highest test concentration of 5000 mg/L. *Daphnia magna* and *Ceriodaphnia* 48 hour static screen tests showed no mortalities when exposed to the test concentration of 5000 mg/L. These data indicate Infinity PS6965 is not toxic to fish or Daphnia.

The notifier provided toxicological data for the individual chemicals making up Infinity PS6965. The notifier anticipates that the ecotoxicological profile of the chemical will be best reflected by the profile of chemical A.

Fish
The following LC_{50} values are given for chemical A: Fathead minnow = 21.9 mg/L; Goldfish = 178 mg/L; Mosquitofish = 282 mg/L. In one test, a concentration of 10 mg/L caused 100% death in trout. These results suggest that the effect of chemical A on fish varies from slightly to very slightly toxic (Mensink *et al.,* 1995).

The 96 hour LC_{50} of chemical B are given as follows: *Tilapia mossambica* = 22,500 mg/L; Golden Orfe >6,810 mg/L; *Barilius barna* = 9,100 mg/L. These results indicate that chemical B is not toxic to fish.

Daphnia
The 48 hour EC_{50} (immobilisation) of chemical A toward *Daphnia Magna* is 0.56 mg/L, indicating it is highly toxic to Daphnia (Mensink *et al*. 1995). The 24-hour EC_{50} of chemical B against *Daphnia magna* is >10,000 mg/L, indicating chemical B is not toxic to Daphnia.

Algae
The LC_{50} for chemical A against the green algae *Chlorella pyrenoidosa* is 0.8 mg/L, indicating it is highly toxic to algae (Mensink *et al* 1995). The adverse affect on the growth of

algae result from a pH effect. Optimum pH for algal growth is between 6 and 9, while the chemical has a pH <1.

The 8-day cell multiplication inhibition toxicity threshold concentration (TTC) of chemical B toward the green algae *Scenedesmus quadricauda* is >10,000 mg/L and toward the blue-green algae, *Miscrocyctis aeruginosa,* is 47 mg/L. These results indicate that chemical B is not toxic to *Scenedesmus quadricauda*, but is slightly toxic to *Miscrocyctis aeruginosa*.

Bacteria
The toxicity threshold concentration (TTC) of chemical B to the bacteria *Pseudomonas putida* is >10,000 mg/L (16 hour), while the EC_{50} (5 minutes) of *Photobacterium luminescence* is 24,000 mg/L, indicating it is not toxic to these bacteria.

In summary, the ecotoxicological data indicate that Infinity PS6965 is not toxic to fish or daphnia, while chemical A is slightly to very slightly toxic to fish, and is highly toxic to Daphnia and algae. Chemical B is not toxic to fish, daphnia or bacteria, but is slightly toxic to *Miscrocyctis aeruginosa*.

11. ASSESSMENT OF ENVIRONMENTAL HAZARD

No environmental release or waste generation is expected from use of the notified chemical because the chemical is fully maintained in the cleaning system and any residual is either continually recycled and reused, or destroyed in the cleaning and recovery process. However, in the event of accidental release into the aquatic environment, the notified chemical is expected to partition predominantly into the aquatic compartment owing to its high water solubility.

On dilution in water, the notified chemical will dissociate to form a weak base (chemical B) and a strong acid (chemical A). Chemical B is a common commodity chemical and is widely distributed in the natural environment (BUA, 1991). Furthermore, it is inherently biodegradable and is not toxic to aquatic organisms. As such, should chemical B enter the aquatic environment, it is not expected to adversely effect aquatic organisms or pose an environmental hazard.

In water, chemical A forms an acid. Many organisms require an optimum pH range for their survival and any major change in the pH of the water can adversely affect the quality of an aquatic ecosystem. For example, pH can affect the solubility, polarity, volatility, stability, and speciation of compounds, thereby affecting their bioavailability and toxicity (Cooney 1995). As a consequence, the major impact of the notified chemical on the aquatic environment would result from increased acidity caused by the presence of the acid. To illustrate, the toxicological data show that chemical A is highly toxic to Daphnia and algae, mainly due to its impact on the pH of the test water, while being slightly to very slightly toxic to most fish species. However, chemical recovery systems are in place at the paper mill whereby over 98% of pulping chemicals are recovered. In addition, to ensure compliance with EPA regulations, all waste water released from the paper mill undergoes primary and secondary treatment either on site or through the local Water and Sewage Board treatment facilities before final discharge. In any case, no release of the notified chemical is expected during cleaning operations because the entire process occurs in a closed loop, and all spills are contained and collected and put back into the circuit.

Given these considerations the notified chemical is not expected to pose a hazard to the environment.

12. ASSESSMENT OF PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY EFFECTS

Health Hazard Assessment

Three toxicity study reports on an aqueous solution of 60% notified chemical were provided. The 60% notified chemical solution was harmful by oral administration, and was a slight skin irritant. In a bacterial reverse mutation test, the solution was not mutagenic to the bacterial strains tested.

The notifier provided toxicity information of the two components of the notified chemical. Due to the paucity of toxicological data available on the notified chemical, the notifier provided data on its two components, which have both been extensively tested. Chemical A is corrosive and toxic by inhalation (R23, R35) and a LOAEL of 15 mg/m^3 (10 ppm) was observed in a lifetime rat inhalation study. Chemical B is not a hazardous substance. As the notified chemical is formed by a weak base and a strong acid, the pH of the notified chemical solution is expected to be less than 1. Therefore, based on all the available information, the notified chemical is considered to be a hazardous substance with risk phrases R22 (Harmful if swallowed) and R36/37/38 (Irritating to eyes, respiratory system and skin).

Occupational Health and Safety

The solution containing the notified chemical will be imported in 1 000 litre intermediate bulk containers. Transport and storage workers should not become contaminated with the notified chemical unless there is accidental spillage.

At the paper mill site, the IBC containers are connected to cleaning equipment via permanent fixed pipes. The transfer and cleaning processes are enclosed and automated, and the cleaning solution will be re-used in the system. Thus, there should be minimal release of the notified chemical at the recovery re-causticising area. Although dermal and eye exposure to drips, splashes and spills is expected to be low, it is most likely to be the predominant route of exposure for workers at the paper mill site. Inhalation exposure is expected to be minimal because the notified chemical has a low vapour pressure and is not used in such a manner as to generate aerosols. The notifier indicated that they will utilise the existing engineering controls designed for handling chemical A. The whole operating area is naturally ventilated and an overhead covering is located above the pre-coat filters. Workers will wear safety glasses, gloves and industrial clothing to minimise exposure.

The notified chemical is expected to be hazardous, but anticipated low level exposure if the above controls are adopted. In this situation, the occupational health risk posed to workers performing these tasks is low.

Public Health

It is expected that there will be no public exposure to Infinity PS 6965 containing 60% of the notified chemical, except in the rare event of an accidental spill. Consequently, the public hazard from exposure to the notified chemical through all phases of its life-cycle, is considered to be negligible.

13. RECOMMENDATIONS

Regulatory controls

- The NOHSC Chemicals Standards Sub-committee should consider the following health hazard classification for the notified chemical:
  - R22 (Harmful if swallowed)
  - R36/37/38 (Irritating to eyes, respiratory system and skin).

- Use the following risk phrases for products/mixtures containing the notified chemical:
  - ≥25% R22 (Harmful if swallowed)
  - ≥20% R36/37/38 (Irritating to eyes, respiratory system and skin).

Control Measures

Occupational Health and Safety

- Employers should implement the following engineering controls to minimise occupational exposure to the notified chemical:
  - Enclosed transfer and cleaning process.

- Employers should implement the following safe work practices to minimise occupational exposure during handling of the notified chemical:
  - When connecting pipes, avoid splashing and generation of aerosols.

- Employers should ensure that the following personal protective equipment is used by workers to minimise occupational exposure to the notified chemical:
  - Safety glasses
  - Gloves
  - 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 chemical 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 Director of Chemicals Notification and Assessment must be notified in writing within 28 days by the notifier, other importer or manufacturer:

(1) Under Subsection 64(1) of the Act:
If any of the proposed uses of the notified chemical should result in any significant aquatic exposure, then full reports of aquatic toxicity testing of the notified chemical should be provided.

(2) Under 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.

14. MATERIAL SAFETY DATA SHEET

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

This 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.

15. REFERENCES

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

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Nucro Technics (1997a) Acute oral toxicity study of [60% notified chemical] in rats, Nucro Technics, Canada.

Nucro Technics (1997b) Dermal irritation/corrosion test of [60% notified chemical] in rabbits, Nucro Technics, Canada.

Nucro Technics (1997c) Salmonella typhimurium reverse mutation assay of [60% notified chemical], Nucro Technics, Canada.

United Nations (1996) Screening Information Data Set (SIDS) for high production volume chemicals, Vol 3, United Nations, New York and Geneva.

US EPA (undated). SIDS Document for [Chemical B].

USEPA Integrated Risk Information System (IRIS).

WHO (1982). WHO Environment Health Criteria: Chlorine and Hydrogen Chloride, 1982.

Attachment 1

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

Erythema Formation	*Rating*	*Oedema Formation*	*Rating*
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

Opacity	*Rating*	*Area of Cornea involved*	*Rating*
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

Redness	*Rating*	*Chemosis*	*Rating*	*Discharge*	*Rating*
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

Values	*Rating*
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

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