File No: NA/964

January 2002

NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME

FULL PUBLIC REPORT

Substance S178207

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, 92-94 Parramatta Road, Camperdown NSW 2050, between the following hours:

Monday - Wednesday	8.30 am - 5.00 pm
Thursday	8.30 am - 8.00 pm
Friday	8.30 am - 5.00 pm

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 Coordinator at:

Street Address: 334-336 Illawara Road, MARRICKVILLE NSW 2204 AUSTRALIA
Postal Address: GPO Box 58, SYDNEY NSW 2001, AUSTRALIA
Telephone: (61) (02) 8577 8800 FAX (61) (02) 8577 8888

Director
Chemicals Notification and Assessment

TABLE OF CONTENTS

FULL PUBLIC REPORT

Substance S178207

1. APPLICANT

Toxikos Pty Ltd of 293 Waverly Road MALVERN EAST VIC 3145 (ABN 30 095 051 791) has submitted a limited notification statement in support of their application for an assessment certificate for Substance S178207.

2. IDENTITY OF THE CHEMICAL

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

3. PHYSICAL AND CHEMICAL PROPERTIES

The physico-chemical parameters were determined in accordance with OECD Principles of Good Laboratory Practice and EC Commission Directive 92/32/EEC (ASG, 2001).

Appearance at 20°C & 101.3 kPa:	Odourless white powder
Boiling Point:	Decomposes without boiling
Melting Point:	Decomposes without melting when heated
Specific Gravity:	Not determined
Vapour Pressure:	Not determined. The notified chemical is unlikely to have a significant vapour pressure based on its chemical structure.
Water Solubility:	5.9 mg/L at 25°C
Particle Size:	Not provided
Partition Co-efficient (n-octanol/water):	Log Pow 2.52 at 25°C
Hydrolysis as a Function of pH:	Not determined. The notified chemical contains aluminium carboxylate bonds but it is unclear whether these would be expected to undergo hydrolysis in the

	environmental pH range of 4 to 9.
Adsorption/Desorption:	Not determined. As a consequence of its relatively hydrophobic and anionic nature, the notified chemical is expected to associate with the soil matrix and sediments and as such will be immobile in soil.
Dissociation Constant:	Not determined. It is unclear whether the complex would ionise.
Flash Point:	Not applicable
Flammability Limits:	Not determined. The notified chemical is not flammable (EC method A-10), however, it is combustible.
Autoignition Temperature:	Not determined. The notified chemical does not spontaneously ignite at ambient temperature.
Explosive Properties:	Not determined. The notified chemical is not explosive.
Reactivity/Stability:	Not determined. The notified chemical is not an oxidising agent.

3.1 Comments on Physico-Chemical Properties

The water solubility of the notified chemical was determined using both the column elution method and the shake flask method (Avecia Ltd, 2001). However, the notifier indicates the results obtained from the column elution method varied more than the 30%. The water solubility was then determined by the Shake Flask Method A6 of EC Commission Directive 92/69/EEC using distilled water. The notified chemical (~ 1.5 g) was weighed into each of five 25 mL centrifuge tubes and water added to a total weight of approximately 20 g. The tubes were incubated in a shaking water bath for 24, 48, 72, 96 or 120 h at 30ºC. After these times the samples were equilibrated at 25ºC for 24 h, centrifuged for 30 min at 3000 rpm, re-equilibrated at 25ºC and then analysed by UV/Vis spectroscopy. This method indicated that the water solubility of the notified chemical is 5.9 mg/L.

The partition coefficient was determined by the shake-flask method, EC Method A8 (Avecia Ltd, 2001). Solutions of the notified chemical were prepared in n-octanol saturated water at concentrations below 0.01M. These solutions were shaken with varying ratios of water pre-saturated with n-octanol for 2 h at 25ºC. Aliquots of each phase were taken and analysed using UV/Vis spectroscopy. The partition coefficient obtained indicates that the notified chemical is relatively hydrophobic and likely to absorb to soil and sediment.

The notified chemical is classified as a Class 9 dangerous good: environmentally hazardous substance in accordance with the Australian Dangerous Goods Code (ADG, 1998)

4. PURITY OF THE CHEMICAL

Degree of Purity: high

5. USE, VOLUME AND FORMULATION

The notified chemical will not be manufactured, formulated or repackaged in Australia. It will be imported in 100 – 200 g pre-packed sealed toner cartridge for printers or photocopiers. The formulated toner contains a maximum of 2% notified chemical.

The import volume of the notified chemical is expected to be less than 1 tonne/year for the first 5 years.

6. OCCUPATIONAL EXPOSURE

Office workers and printer maintenance workers may be intermittently exposed to the notified chemical contained in the ink cartridge when replacing the spent ink cartridge, and during repair maintenance and cleaning of printers or photocopiers. Maintenance workers for printers or photocopiers may potentially come in contact with the notified chemical more often than office workers. Exposure would be principally by skin contamination, however, inhalation exposure could also occur, particularly if spillage occurs. Particle size data were not provided, however, toners are usually fine powders, with a significant proportion of particles in the respirable fraction (less than 10 μm). Exposure is expected to be controlled through the design of the ink cartridges and the printing and photocopier machines. Printer and photocopier maintenance personnel often wear cotton disposable gloves. Pre-packed ink cartridges are sealed and worker exposure to the ink is minimised by the use of the replacement procedures recommended by the manufacturer.

Waterside, warehouse and transport workers are unlikely to be exposed to the notified chemical unless the packaging is breached.

Contact with paper printed with printing inks containing the notified chemical is unlikely to result in dermal exposure, as it will be bound in the structure of the paper.

7. PUBLIC EXPOSURE

Since the toner is contained in the sealed cartridge, public exposure during handling and replacement will only occur if the cartridge is faulty and ruptures.

Under conditions of the end use, the notified chemical is designed to be fixed to paper. One toner is likely to print approximately 6000 sheets of paper, resulting in 0.3-0.7mg of notified chemical per page. As the toner becomes non-removable on contact with the surface of the paper, public exposure to the notified chemical is considered to be low.

8. ENVIRONMENTAL EXPOSURE

8.1 Release

Release of the toner containing the notified chemical to the environment is not expected under normal use as the cartridge is designed to prevent leakage. However, if leakage does occur, the toner will be contained and presumably disposed of in landfill. Environmental exposure will result from the disposal of printed paper and discarded cartridges as well as the possibility of accidental leakage of the cartridges during use. Toner residues contained in the empty cartridges are expected to be about 2% of the import volume and remain within these containers, although release could occur from deterioration of the cartridge. The total import volume of the notified chemical will ultimately be disposed of in either landfill or incinerated or recycled with paper.

8.2 Fate

Some waste paper may be disposed of directly to landfill with the notified chemical strongly bound to the paper. It is anticipated that prolonged residence in an active landfill environment would eventually degrade the notified chemical. Incineration of waste paper will destroy the compound with the generation of water vapour and oxides of carbon.

In addition to landfill, some of the toner printed on paper will enter the paper recycling process. During such processes, waste paper is repulped using a variety of alkaline, dispersing and wetting agents, water emulsifiable organic solvents and bleaches. These agents enhance fibre separation, ink detachment from the fibres, pulp brightness and the whiteness of paper. De-inking wastes are expected to go to trade waste sewers. Trade sources estimate the washing process will recover 30-60% of toner and therefore at least 30% of the notified chemical in the recycled paper will be disposed of with sludge in landfill.

A biodegradation study was conducted according to OECD TG 301F – Ready Biodegradability; Manometric Respirometry (AstraZeneca UK Ltd 2001a). Activated sludge, obtained from Buckland Sewage Treatment Plant in Devon, UK, was mixed with the test substance or standard material (sodium acetate) to give final test concentrations of 10 mg carbon/L. The study was carried out at 22°C. The sodium acetate standard attained 72% biodegradation after 28 days, indicating the test conditions were valid. After 28 days, the biodegradation of the test substance was determined to be less than 6% and as such was not considered to be readily biodegradable under the conditions of the test.

The substance is not expected to bioaccumulate due to its moderate partition coefficient and limited release to water (Connell 1990).

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 notified chemical and identified as S178207/1, S178207 or substance S178207 in the test reports.

9.1 Acute Toxicity

9.1.1 Oral Toxicity (Driscoll R, 2000)

Species/strain: Rat/Sprague-Dawley CD

Number/sex of animals:	3/sex
Observation period:	14 days
Method of administration:	A single oral dose of 2000 mg/kg notified chemical in Arachis oil BP was given by gavage.
Test method:	OECD TG 401
Mortality:	Two animals (1/sex) were found dead during the day of dosing.
Clinical observations:	Ataxia, hunched posture, lethargy, decreased respiratory rate, laboured or noisy respiration and splayed or tiptoe gait with incidents of pallor of the extremities and emaciation.
Morphological findings:	The animals died on the day of dosing had haemorrhagic lungs, dark liver and dark kidneys. None of these observations were noted from surviving animals at the end of the study.
Comment:	Surviving animals appeared normal by day 11 and showed expected weight gain over the study period.
LD_{50}:	>2000 mg/kg
Result:	the notified chemical was of very low acute oral toxicity in rats

9.1.2 Skin Irritation (Driscoll R, 2000)

Species/strain:	Rabbit/New Zealand White
Number/sex of animals:	2 males and 1 female
Observation period:	3 days
Method of administration:	A single dermal dose of 500 mg notified chemical (moistened with 0.5 mL distilled water) was applied to the intact skin under semi-occlusive dressing for 4 hours.
Test method:	OECD TG 404
Comment:	No evidence of skin irritation was observed.
Result:	the notified chemical was not irritating to the skin of rabbits

9.1.3 Eye Irritation (Driscoll R, 2001)

Species/strain:	Rabbit/New Zealand White
Number/sex of animals:	1 male and 2 females
Observation period:	3 days
Method of administration:	A single dose (approximately 35 mg notified chemical) was placed into the conjunctival sac of the left eye of each animal. The eyes remained unwashed. The untreated eye served as a control.
Test method:	OECD TG 405
Comment:	Redness of the conjunctivae was observed in test animals following 1 hour of treatment. No other signs of irritation were observed during the study.
Result:	the notified chemical was slightly irritating to the eyes of rabbits

9.1.4 Skin Sensitisation (Driscoll R, 2001)

Species/strain:	Guinea pigs/Dunkin Hartley
Number of animals:	Control group: 5 Test group: 10
Induction procedure:	
test group: day 1	Intradermal Induction Three pairs of intradermal injections (0.1mL) across the scapular region of the animals: - Freund's Complete Adjuvant (FCA) 1:1 in distilled water - 5% w/w preparation of the test substance in arachis oil BP - 5% w/w preparation of the test substance in 1:1 mixture of FCA and distilled water
day 7	Topical Induction A 48-hour occluded application of 25% w/w test substance in arachis oil BP to the test area.
control group:	Treated similarly to the test animals using arachis oil BP in intradermal injections and topical application instead of the notified chemical.
Challenge procedure:	
day 21	Test and Control Animals: Occluded applications of patches containing 1% w/w and 2% w/w notified chemical in arachis oil BP on the right and

left flank of each animal for 24 hours.

Test method: OECD TG 406, Magnusson and Kligman Maximization Test

Challenge outcome:

	Test animals		***Control animals***	
Challenge concentration	***24 hours****	***48 hours****	***24 hours***	***48 hours***
1%	**0/9	0/9	0/4	0/4
2%	0/9	0/9	0/4	0/4

* time after patch removal
** number of animals exhibiting positive response

Comment: One test and one control animal were found dead on Day 6 and Day 7, respectively. The deaths were not related to the toxicity of the test material.

Moderate to confluent erythema was noted at the intradermal induction sites of test group animals.

Discrete or patchy to moderate and confluent erythema and very slight oedema were noted at the topical induction sites of the test groups animals.

Result: the notified chemical was not sensitising to the skin of guinea pigs

9.2 Genotoxicity

Salmonella typhimurium and *Escherichia coli* Reverse Mutation Assay (Thompson PW, 2001)

Strains: *Salmonella typhimurium*: TA1535, TA1537, TA98 and TA/100
Escherichia coli: WP2*uvrA*

Metabolic activation: Liver S9 fraction from rats pretreated with combined phenobarbital and β-naphthoflavone in sterilised co-factors.

Concentration range: 50, 150, 500, 1500 and 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.

Test method:	OECD TG 471 and 472
Comment:	A small decrease in the frequency of revertant colonies was observed in most tester strains with or without metabolic activation (S9) at 5000 μg/plate. A white, oily precipitate was also observed but did not prevent scoring of revertant colonies. There were no significant increases in the number of revertant colonies in the presence and absence of metabolic activation at any test concentration for any of the bacterial strains. Concurrent positive controls induced marked increases in the number of revertant colonies and the activity of the S9 fraction was found to be satisfactory.
Result:	The notified chemical was non mutagenic under the conditions of the test

9.3 Overall Assessment of Toxicological Data

The notified chemical was of very low acute oral toxicity (LD50 >2000 mg/kg) toxicity in rats. It was not a skin irritant to rabbits, but was a slight eye irritant. Evidence of skin sensitisation potential was not observed in guinea pigs in an adjuvant study.

The notified chemical was not mutagenic in the bacterial strains tested.

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

10. ASSESSMENT OF ENVIRONMENTAL EFFECTS

The notifier has provided a summary of the toxicity report for the notified chemical to *Daphnia magna*.

Test	***Species***	***Results***
Acute toxicity	*Daphnia magna*	48 h EC_{50} = 0.77 mg/L

The immobilisation tests with *Daphnia* (AstraZeneca, 2001b) were performed using 5 daphnids per flask and observations made after 48 hours. The tests were conducted at the nominal concentrations of 0.01, 0.032, 0.1, 0.32, 1.0, 3.2 mg/L. The test substance concentrations were prepared by serial dilution of a 3.2 mg/L stock solution of the notified chemical prepared in acetone. After 48 h, no immobilised daphnids were observed in the test vessels with less than 0.32 mg/L, 80 % immobilisation in the test vessel containing 1.0 mg/L and 100 % immobilisation was observed after 48 h at test concentrations of 3.2 mg/L. The 48-hour EC_{50} for the notified chemical to *Daphnia magna* is 0.77 mg/L.

The ecotoxicity data indicate the notified chemical is highly toxic to daphnia.

In the EC, the notified chemical is classified as 'very toxic to aquatic organisms' (risk phrase R50) and 'may cause long-term adverse effects in the aquatic environment' (R53).

11. ASSESSMENT OF ENVIRONMENTAL HAZARD

The notified chemical will enter environmental compartments indirectly by disposal of waste paper (for recycling, to landfill or for incineration) and by direct release from discarded printer cartridges at landfill sites. Based on the import volume, method of packaging and low concentration of the notified chemical in printer ink, release of the notified chemical to the environment is expected to be low but widespread. Waste from the recycling process includes sludge which is dried and disposed of to landfill, and very little of the notified chemical will partition to the supernatant water which is released to the sewer.

Abiotic or slow biotic processes would be largely responsible for the degradation of the notified chemical as it was not found to be readily biodegradable. As a consequence of its low water solubility, the notified chemical is likely to be immobilised through adsorption onto soil particles and sediments.

Although highly toxic to daphnia, releases to the sewer will be low because very little of the notified chemical is expected to be released to water and partition to supernatant water. Furthermore, the substance is not expected to bioaccumulate due to its moderate partition coefficient and limited release to water (Connell 1990).

On the basis of the available information, the overall environmental hazard of the notified chemical is expected to be low.

12. ASSESSMENT OF PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY EFFECTS

Hazard Assessment
Based on the toxicological data provided, the notified chemical was of very low acute toxicity. It was not a skin irritant and not a skin sensitiser, but was a slight eye irritant.

The notified chemical was not mutagenic in the bacterial strains tested.

The notified chemical would not be classified as a hazardous substance according to NOHSC *Approved Criteria for Classifying Hazardous Substances* (NOHSC, 1999) based on the

toxicological data provided.

The MSDS for a typical toner containing the notified chemical warns against contact with skin and eyes and inhalation of the fine powder.

Occupational Health and Safety
Exposure to printing inks containing the notified chemical during transport of pre-packed cartridges should not result in exposure except in the event of accidental spillage.

The notified chemical will be imported in pre-packed cartridges at a maximum of 2%. Dermal and inhalation exposure of office workers to the notified chemical will potentially occur when replacing spent cartridges and clearing paper jams from the printer or photocopier. However, the design of the cartridges is such that exposure to the notified chemical should be low.

Dermal and inhalation exposure of maintenance workers to the notified chemical is possible during routine maintenance but is expected to be low due to the low concentration of the notified chemical in the toner. Overall, the risk of adverse health effects arising from exposure to the notified chemical is low due to its expected low toxicity, low concentration in toner and low potential for exposure. Nevertheless, due to the probable fine nature of the toner, skin, eye and respiratory exposure should be avoided. The national exposure standard for nuisance dusts is 10 mg/m3 TWA [NOHSC, 1995]. Australia has no exposure standard for respirable dust, however, the ACGIH TLV of 3 mg/m3 TWA is recommended [ACGIH, 2001]. Due to their frequent exposure to inks, maintenance personnel should wear cotton or disposable gloves.
It is concluded that the health risk to workers involved in transport, storage, and disposal of the notified chemical in this application is low.

Public Health
The imported toner cartridge containing the notified chemical will be used in printers and photocopiers for consumer and business purposes. The toner is contained within the cartridge and is not directly contacted by users.

After printing, the quantity of the toner transferred and bound to a sheet of paper is very small. In view of its low toxicity and the use pattern, the notified chemical is unlikely to pose a significant hazard to public health.

13. MSDS AND LABEL ASSESSMENT

13.1. MSDS

The MSDS for the notified chemical and toner were provided by the notifier was in accordance with the NOHSC *National Code of Practice for the Preparation of Material Safety Data Sheets* (NOHSC, 1994a). They are published here as part of the assessment report. The accuracy of the information on the MSDS remains the responsibility of the applicant.

13.2. Label

The label for the notified chemical 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.

14. RECOMMENDATIONS

Regulatory controls

Labelling

- The notified chemical should be classified as follows under the ADG Code:
  - class 9: environmentally hazardous substance – Packaging Group III

Control Measures

Occupational Health and Safety
No special precautions are required for the notified chemical when used at low quantities in inkjet printer cartridges. However, in the interests of good occupational health and safety, the following guidelines and precautions should be observed for use of toners containing the notified chemical:

- Avoid contact with skin and eyes
- Avoid generation of dust
- Service personnel should wear cotton or disposable gloves when servicing printers.

  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:

Under Under subection 64(1) of the Act:
- if the import volume increases above 1 tonne per year, the notifier should provide toxicity studies for the notified chemical towards daphnia and algae, including acute and long-term effects

Under subection 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.

No additional secondary notification conditions are stipulated.

15. REFERENCES

ACGIH, (2001); The American Conference of Governmental Industrial Hygienists (ACGIH): Threshold Limit Values for Chemical Substances and Physical Agents and Biological Indices 2001; ACGIH Cincinnati, Ohio.

Analytical Science Group (ASG) (2000) Upgrade to Annex VIIB Notification, Avecia Research Centre, Project 1259157, Blackley, Manchester.

AstraZeneca UK Ltd (2001a) BL7025/B: S178207 Determination of 28 Day biodegradability; Devon, UK, (unpublished report submitted by Avecia Ltd).

AstraZeneca UK Ltd (2001b) BLS2910/B: Acute Toxicity to *Daphnia Magna*, Devon, UK, (unpublished report submitted by Avecia Ltd).

Avecia Ltd (2001) RD12755B: S178207, Upgrade to Annex VIIB Notification, Project 1259157, Manchester, UK, (unpublished report submitted by Avecia Ltd).

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

Driscoll R (2000). Acute Oral Toxicity Study in Rat – Acute Toxic Class Method. Safepharm Laboratories Ltd, Project No: 780/030, Derby, UK.

Driscoll R (2000). Acute Dermal Irritation in the Rabbit. Safepharm Laboratories Ltd, Project No: 780/092, Derby, UK.

Driscoll R (2001). Acute Eye Irritation in the Rabbit. Safepharm Laboratories Ltd, Project No: 780/093, Derby, UK.

Driscoll R (2001). Skin Sensitisation in the Guinea Pig – Magnusson and Kligman Maximisation Method. Safepharm Laboratories Ltd, Project No: 780/094, Derby, UK.

Federal Office of Road and Safety, Australian code for the Trnasport of Dangerous Goods by Road and Rail (1998). Australian Dangerous Goods Code, 6th Edition, Australian Government Publishing Service, Canberra.

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 (1999) Approved Criteria for Classifying Hazardous Substances [NOHSC:1008(1999)]. Australian Government Publishing Service, Canberra.

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

Thompson PW (2001). Reverse Mutation Assay "Ames Test" Using Salmonella typhimurium and Escherichia coli. Safepharm Laboratories Ltd, Project No: 780/091, Derby, UK.

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

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.