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NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME

FULL PUBLIC REPORT

IRGAZIN DPP Red 5049B

This Assessment has been compiled in accordance with the provisions of *the Industrial Chemicals (Notification and Assessment) Act 1989,* and Regulations. This legislation is an Act of the Commonwealth of Australia. The National Industrial Chemicals Notification and Assessment Scheme (NICNAS) is administered by Worksafe Australia which also conducts the occupational health & safety assessment. The assessment of environmental hazard is conducted by the Department of the Environment, Sport, and Territories and the assessment of public health is conducted by the Department of Human Services and Health.

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Director
Chemicals Notification and Assessment

FULL PUBLIC REPORT

IRGAZIN DPP Red 5049B

1. APPLICANT

Ciba-Geigy Australia Limited of 140 Bungaree Road PENDLE HILL NSW 2145 has submitted a standard notification statement in support of their application for an assessment certificate for IRGAZIN DPP Red 5049B.

2. IDENTITY OF THE CHEMICAL

LUMIFLON LF-710F is not considered to be hazardous based on the nature of the chemical and the data provided. Therefore the chemical name, chemical abstract service number, molecular and structural formulae, composition of the chemical including purity, methods of detection and determination, spectral data and estimated volume of import have been exempted from publication in the Full Public Report and the Summary Report.

Other name:	C.I. Pigment Red (35% of the notified chemical)
Trade name:	IRGAZIN DPP Red 5049B (35% of the notified chemical)

3. PHYSICAL AND CHEMICAL PROPERTIES

The physico-chemical properties listed below relate to IRGAZIN DPP Red 5049B containing 35.0% of the notified chemical.

Appearance at 20°C and 101.3 kPa:	red powder
Melting Point:	> 400°C
Boiling Point:	not determined
Relative Density:	1400 kg/m^3 at 25°C
Vapour Pressure:	< 8.2 x 10^{-4} kPa at 25°C
Water Solubility:	< 0.06 mg/L at 20°C
Fat Solubility:	7.2 x 10^{-4} g/kg fat at 37°C

Partition Co-efficient (n-octanol/water):	log P_{ow}1.6
Hydrolysis as a Function of pH:	not performed
Adsorption/Desorption:	not performed
Dissociation Constant:	not performed
Flash Point:	not determined
Flammability Limits:	not flammable
Autoignition Temperature:	> 400°C
Explosive Properties:	not explosive
Reactivity/Stability:	not determined
Particle Size Distribution:	mass median diameter 2.7 µm 41% < 0.39µm 56% < 5µm 68% < 10µm 98% < 50µm

Comments on Physico-Chemical Properties

Hydrolysis as a function of pH, is not expected as the test substance is of very low solubility and its structure indicates that it does not contain functionalities likely to hydrolyse or dissociate. Adsorption/desorption tests were not performed due to the very low solubility in water. Release of the chemical to soils is low, with strong sorption expected. The dissociation constant test was also not performed due to the low solubility in water and the structure of the chemical.

4. PURITY OF THE CHEMICAL

Degree of Purity:	> 90%
Toxic Impurities:	none known

5. INDUSTRIAL USE, VOLUME AND FORMULATION

The main use of the notified chemical is as a red pigment for the colouration of lead free high performance industrial paints e.g. automotive and decorative paints. About 20% is expected to be used for the cadmium-free colouration of thermoplastics and 5% may be used for speciality printing inks where high fastness is required.

The notified chemical will not be manufactured in Australia, but imported as a component of crystalline C.I. Pigment Red (IRGAZIN DPP Red 5049B). The

estimated quantities of the notified chemical to be imported during 1996-2000 are < 10 tonnes per annum.

6. OCCUPATIONAL EXPOSURE

The notified chemical will be air freighted in 10-20 kg sealed cardboard boxes lined with antistatic polythene. It is to be distributed by road to industrial facilities throughout Australia. Exposure during transportation will occur only in the event of accidental spills or mishandling.

Pigments containing the notified chemical are normally stored in a dry area on pallets with access to fork lift trucks. Exposure during storage can result due to dust emissions from broken containers.

The number of industrial establishments, plant operators and laboratory technicians involved in reformulating the notified chemical is estimated as follows:

Type of manufacture	***Establishments***	***Plant operators***	***Laboratory technicians***
Paint manufacturers	3 - 5	12 - 30	3 - 10
Printing ink manufacturers	2 - 3	8 - 18	2 - 6
Masterbatch manufacturers	1 - 2	4 - 12	1 - 4

The manufacturing process for paints and speciality printing inks is similar and involves weighing using mechanical scales or load cells and transferring to the mill area by fork lift, trolley or by hand with high potential for exposure. After addition of other raw materials (resin solutions and solvent oils) to the pre-mix vessel, the dry pigment containing the notified chemical is added in stages and thoroughly mixed between each addition to avoid airborne contamination, and is normally carried out under local exhaust ventilation. The duration of exposure during addition is approximately 30 minutes. The pre-mix is then stirred for 15 minutes before dispersing on bead mills, attritors and ball mills.

The process masterbatch manufacture consists of weighing and blending. The blending is carried out in closed/sealed mixers, thus minimising/avoiding dusting and worker exposure. The pre-blending is followed by an extrusion process that completely encapsulates the notified chemical into the polymer. The extruded strands are cooled, pelletised and packed into bags.

Laboratory staff involved in establishing laboratory scale formulations will be exposed to approximately 300 g of the notified chemical for a period less than 8 hours per annum. They will also be exposed during testing of the incoming pigment powder, for a period less than 1 hour, every 2 - 4 months. Dermal exposure to the notified chemical embedded in resin and solvent is possible when running in-process

checks during manufacture, and quality control checks. It is estimated that 30 g of the notified chemical will be used in these tests with an estimated exposure time of 1 - 2 hours, in every 2 - 4 months.

A number of establishments will be using formulated products containing the notified chemical. The number of workers involved is estimated as follows (1 operator per establishment):

.	industrial spray painting	20 - 30;
.	printing	10 - 20; and
	plastic processing	10 - 30

The use of automated electrostatic multiple-gun spray painting methodology minimises paint overspray and worker exposure during automotive applications. However, a small fraction (< 4% of the notified chemical) of the spray paint is expected to be emitted to the environment. During other paint and printing applications, due to its encapsulated nature in resin/varnish/solvent/oil mix, exposure to the notified chemical will be minimal. Process workers in the plastic industry will not be exposed to the notified chemical, as it will be used in the form of masterbatch (encapsulated in polymer).

7. PUBLIC EXPOSURE

The final concentrations of IRGAZIN DPP Red 5049B in the painted surfaces of end-use products has been estimated to be 3 - 7 g/m^3 and 0.5 g/m^3 for automotive and decorative applications respectively, and 1 g/m^3 for printing applications. As a colouring agent for thermoplastics it will be used at a concentration of less than 0.1%. Public exposure to the notified chemical as a result of contact with end-use products is not expected to occur as it will be embedded in the resin/polymer of printed materials, paint films or plastic materials. The notified chemical is practically insoluble in water, fat, and common solvents, and therefore has negligible potential for migration from finished products, or for dermal absorption.

8. ENVIRONMENTAL EXPOSURE

Release

Practically no waste is generated under normal conditions during the formulation of IRGAZIN DPP Red 5049B. During manufacture of products containing the notified chemical, the possibility of release to the environment would mainly be during the weighing/batching operation. It is estimated that < 1 kg/year will be released to the environment, with dust collectors/air filters limiting the release to the atmosphere and filtration/sedimentation limiting the release to the waterways. After incorporation and dispersion of the pigment into paints, specialty printing inks or masterbatch, the chemical will be embedded and encapsulated by the resin or polymer.

Automotive coatings are applied by spraying the liquid paint on to the primed metal surface. The coating is baked in an oven in the case of original equipment

manufacture (OEM) or air dried (sometimes a temperature cure is used) in the case of Refinish. Spray technique can vary from a simple hand-held spray gun in a small repair shop to automated electrostatic multiple-gun spray systems at car manufacturers.

The notified chemical will be in the final paint product at a concentration < 4%. In the application of automotive paints at car manufacturers (OEM), overspray (about 15% of paint applied) is passed through extraction scrubbers before release resulting in only a small fraction being released to the environment. Trapped material is estimated at less than 0.01 kg of the notified chemical per vehicle. With a total of 5 000 - 10 000 new vehicles being painted annually, 50 - 100 kg/year of the notified substance is estimated to be collected and landfilled.

In applications at car repair finishers wastage may be as high as 50%. As generally only part of the vehicle is re-painted during repairs, the amount of notified chemical released is estimated to be ~0.02 kg per vehicle. The total waste at car repair shops is estimated to be less than 200 kg/year of the notified substance. Waste paint from panel repair shops may not be treated before disposal to the sewer. Here the paint should become associated with the sludge during sewage treatment or with the soil at the site that receives the overspray. At repair shops where the overspray is treated by passage through interceptor pits, the notified chemical should be in the settled solids and disposed of by landfill.

Release may occur through other uses. It is estimated that losses of the notified substance will be < 1 kg/year through its use in the specialty printing industry and < 1 kg/year in the colouration of thermoplastics. Both processes consist of simple addition of the pigment, with the substance being incorporated in the plastic into the latter case. The majority of this is expected to be collected and disposed of to landfill or the sewer.

Exposure during transportation will occur only in the event of accidental spill or mishandling. All clean up of spills and disposal should be carried out according to the Material Safety Data Sheet (MSDS).

Fate

The bulk of the notified substance will be chemically bound to painted automotive surfaces and in this state is not expected to impact on the environment. Surface coatings are designed to be resistant to weathering, thus erosion of the painted film will be gradual and diffuse. This also applies for the polishing and cutting back of car finishes by members of the public. Articles coated with the notified substance would eventually be disposed of to landfill or recycled by metal smelting resulting in incineration of the notified chemical.

Similar comments, as given above for industrial paints, apply for specialty printing inks containing the notified chemical. The use and application of coloured masterbatch (containing the notified chemical) for thermoplastics is also not expected to generate any significant loss of pigment to the environment. Products containing the chemical will either be recycled, sent to landfill or incinerated.

Disposal of the notified chemical to landfill is unlikely to result in contamination of surface and ground water. The insoluble nature of the substance will ensure any hydrolysis or breakdown to occur at an extremely low rate, if at all. Products of combustion include oxides of carbon and nitrogen, hydrogen chloride and water.

Contaminated packaging should be disposed of according to local and national regulations, and can possibly be recycled.

Biodegradation

Biodegradation was assessed using the OECD Guideline No. 301B (the modified Sturm Test). The substance exhibited 0% degradation after 28 days, indicating that it is not biodegradable under the conditions of the test. However, it is noted that the substance is virtually insoluble and therefore the test conditions were not adequately met for this method.

Bioaccumulation

Whilst the substance is not biodegradable, it is not expected to bioaccumulate due to the very low lipid solubility (7.2×10^{-4} g/kg @ 37°C), extremely low water solubility (< 0.06 mgL @ 20°C) and the low partition coefficient (n-octanol/water) (Log P_{ow} < 1.6) (1,2,3 & 4).

9. EVALUATION OF TOXICOLOGICAL DATA

9.1 Acute Toxicity

Summary of the acute toxicity of IRGAZIN DPP Red 5049B

Test	Species	Outcome	Reference
acute oral toxicity	rat	LD_{50} > 2000 mg/kg	(5)
acute dermal toxicity	rat	LD_{50} > 2000 mg/kg	(7)
skin Irritation	rabbit	not irritant	(8)
eye irritation	rabbit	not irritant	(10)
skin sensitisation	guinea pig	non sensitiser	(11)

9.1.1 Oral Toxicity (5))

Species/strain: WISTAR SPF rat

Number and sex of animals: 5 males, 5 females

Observation period: 14 days

Method of administration (vehicle):	gavage (2000 mg/kg) in corn oil
Clinical observations:	no signs of toxicity observed
Mortality:	no deaths
Morphological findings:	no abnormalities were observed
Test Method:	based on OECD Guidelines for Testing Chemicals (6)
LD_{50}:	> 2000 mg/kg
Result:	low oral toxicity in the rat

9.1.2 Dermal Toxicity (7)

Species/strain:	WISTAR SPF rat
Number and sex of animals:	5 males, 5 females
Observation period:	14 days
Method of administration:	occluded patch to abraded skin; 24 hour exposure; 2000 mg/kg in corn oil
Clinical observations:	the treated skin of all animals were discoloured red by the test substance from day 2 until day 14; no signs of systemic toxicity were observed
Mortality:	nil
Morphological findings:	nil
Test Method:	based on OECD Guidelines for Testing Chemicals (6)
LD_{50}:	> 2000 mg/kg
Result:	low oral toxicity in the rat

9.1.3 Skin Irritation (8)

Species/strain:	New Zealand White, SPF rabbit
Number/ sex of animals:	3 males
Observation period:	3 days

Method of administration: 500 mg of the notified chemical was applied under occluded dressing for 24 hours

Draize (9) Scores[i] (refer to endnote)

	Time after treatment			
	60 min	***1 day***	***2 days***	***3 days***
ERYTHEMA				
1	*	*	*	0
2	*	*	*	0
3	*	*	*	0
OEDEMA				
1	0	0	0	0
2	0	0	0	0
3	0	1	1	0

* due to red colouration possible erythema reactions could not be observed at these times

Test Method: based on OECD Guidelines for Testing Chemicals (6)

Result: not irritant to rabbit skin

9.1.5 Eye Irritation (10)

Species/strain: New Zealand White, SPF rabbit

Number of animals: 3 males

Observation period: 3 days

Method of administration: 100 mg (96% pure solid) into conjunctival sac of one eye.

	Time after instillation			
	60 min	***1 day***	***2 days***	***3 days***
CORNEA				
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
IRIS				
1	0	0	0	0
2	0	0	0	0

3	0		0		0		0	
CONJUNCTIVA	r^1	c^2	r^1	c^2	r^1	c^2	r^1	c^2
1	0	0	0	0	0	0	0	0
2	0	1	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0

1 redness
2 chemosis

Test Method: based on OECD Guidelines for Testing Chemicals (6)

Result: not irritant to rabbit eyes

9.1.6 Skin Sensitisation (11)

Species/strain: Albino guinea pig

Number and sex of animals: 20 males test, 10 males control

Induction procedure: three pairs of injections of 0.1 mL: FCA in saline (1:1); 5 % notified chemical in polyethylene glycol with and without FCA (1:1); topical induction: at day 6, 0.2 mL 50% notiified chemical in vaseline

Challenge procedure: use of 10% v/v notified chemical in vaseline

Challenge outcome:

Challenge	***24 hrs***		***48 hrs***	
Concentration	***test***	***control***	***test***	***control***
10%	0/20	1/10	1/20	0/10
10%(rechallenge)	1/20	0/10	0/20	0/10

Test Method: based on OECD Guidelines for Testing Chemicals (6)

Result: not a skin sensitiser in guinea pigs

9.2 Repeated Dose Toxicity (12)

Species/strain: WISTAR SPF rat

Number and sex of animals: 30 males and 30 females

Method of administration: orally by gavage in corn oil

Dose/Study duration: 0, 50, 200 and 1000 mg/kg body weight/day for 28 days

Clinical observations/ Histopathology:	red discolouration of the faeces of all treated animals were noted. An increased in total cholesterol, total protein and globulin concentrations in females of the high-dose group; however, no relevant histopathological correlations were found to support these changes
Gross pathology/Organ weights:	increased liver weights observed in both sexes of the high dose group after four weeks; however, no relevant histopathological correlations were found to support this change
Test Method:	based on OECD Guidelines for Testing Chemicals (6)
Result:	no systemic signs of significant toxicity were observed when tested with up to 1000 mg/kg/day of the notified chemical

9.3 Genotoxicity

9.3.1 Salmonella typhimurium Reverse Mutation Assay (13)

Strains:	*Salmonella typhimurium* TA 1535, TA 1537, TA 98, TA 100 and *Escherichia coli* WP2 and *WP2 uvrA*
Concentration range:	33.3-5000 μg/plate with or without rat liver S9
Test Method:	based on OECD Guidelines for Testing Chemicals (6)
Result:	non-mutagenic in bacteria

9.3.2 Induction of germ cell damage (in vitro) (14)

Type of cell:	Chinese Hamster, V79
Concentration range:	1-60 μg/mL
Metabolic activation:	Aroclor-induced rat liver S9-mix

Test Method:	based on OECD Guidelines for Testing Chemicals (6)
Result:	no biologically relevant increases in cells with structural chromosomal aberrations were observed, with or without metabolic activation. Positive controls with reference mutagens gave a statistically significant increase in cells with structural chromosomal aberrations.

9.4 Overall Assessment of Toxicological Data

Animal studies indicate that IRGAZIN DPP Red 5049B has low acute oral and dermal toxicity in the rat (LD_{50} >2000 mg/kg). It is a non-irritant to the skin and eye of rabbit. It is not a sensitiser to the skin of the guinea-pig. When rats were treated orally with up to 1000 mg/kg/day for 28 days only small changes to any of the measured parameters were observed. No effects were observed at doses of 200 mg/kg/day or less and effects noted at a dose rate of 1000 mg/kg/day were reversible.

IRGAZIN DPP Red 5049B was not mutagenic in a bacterial reverse mutation assay *in vitro* and was not clastogenic in chinese hamster V79 cells *in vitro*.

In accordance with Worksafe Australia's Approved Criteria for Classifying Hazardous Substances, the notified chemical would not be classified as hazardous with respect to acute lethal effects (oral, dermal), irritant effects (skin, eye), sensitising effects (skin) or serious effects after repeated or prolonged exposure.

10. ASSESSMENT OF ENVIRONMENTAL EFFECTS

The following ecotoxicity studies for IRGAZIN DPP Red 5049B have been provided by the notifier. The tests were carried out to OECD Test Methods.

Test	***Species***	***Result (nominal)***
Acute Toxicity	Rainbow Trout *Oncorhynchus mykiss*	96h LC_{50} > 50 mg/L
Acute Toxicity	*Daphnia magna*	48h EC_{50} > 50 mg/L
Growth Inhibition	Green algae *Scenedesmus subspicatus*	72h EbC_{50} > 50 mg/L NOEC = 2.3 mg/L
Respiration Inhibition	Micro-organisms from activated sludge	30 min EC_{50} > 100 mg/L

50 mg/L, which is far above the water solubility of the test substance was the maximum concentration, that could be brought homogeneously into the test water by use of an auxiliary emulsifier (Tween 80). During the tests some substance had settled out of solution, however the test media were tested and found to be

sufficiently stable. During the fish acute toxicity test, the test medium was renewed after periods of 24 hours.

The ecotoxicity data for the substance shows that the pigment is unlikely to be toxic to aquatic organisms, up to the limit of its solubility in water. However, since the test solution is intensely coloured down to the lowest test concentration of 2.3 mg/L, visual observations may have been hampered. Since the test solution is intensively coloured, algistatic effects can be caused by interception of light (shading effect) necessary for algae growth.

11. ASSESSMENT OF ENVIRONMENTAL HAZARD

The low environmental exposure of the chemical as a result of normal use indicates that the overall environmental hazard should be low. Spillage during transport or from plants during inclusion into various products is possible. However, given the low water solubility and low toxicity to aquatic organisms such spills should not represent a hazard to the environment. Colouration of the water may occur, but the pigment would most likely sorb to the sediments.

The paint containing the chemical will be formulated for use as part of paint systems used by professional spray painters only. It is claimed that the overspray may constitute 15% of the paint applied for new car manufacturers and up to 50% for car repair finishers. This overspray is expected to be collected in air filters or interceptor pits, with almost all the overspray expected to be collected for disposal. Where the overspray is not treated and disposed of directly to the sewer, the chemical is expected to become associated with sludge during the sewage treatment process or with soil at the site that receives the overspray. Estimated losses through other uses of products containing the chemical amount to < 2 kg/year. The majority of this is expected to be collected and disposed of to landfill or the sewer.

Incineration of the chemical will generate oxides of carbon and nitrogen, hydrogen chloride and water. The environmental hazard can be rated as negligible. As the chemical is practically insoluble in water, the chemical waste consigned to landfill is unlikely to leach and will stay in the landfill. The environmental hazard from the disposal of paint waste containing the chemical is rated as low.

The overall hazard from the use of the chemical is rated as low.

12. ASSESSMENT OF PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY EFFECTS

The notified chemical is expected to exhibit low oral and dermal toxicity and to be non irritating to skin and eyes. It is not expected to be a sensitising agent, to exhibit significant toxicity following repeated or prolonged exposure and is not expected to genotoxic.

Occupational exposure to the notified chemical in dust form may occur during storage and reformulation into paint and inks. During storage, dermal and inhalation

exposure is possible from accidental breakage of containers and cleaning up of spills. During reformulation, inhalation exposure is possible when dry pigment containing the notified chemical is added to the pre-mix vessel. Such exposure is limited to a certain extent by the fact that pigment is added in stages and thoroughly mixed between each addition and such operations are carried out under local exhaust ventilation for short durations. Dermal and inhalational exposure is also possible during weighing and blending. Blending which is carried out in closed/sealed mixers, minimises exposure to dust. Laboratory staff will be exposed to the notified polymer for insignificant durations during laboratory scale formulations.

During the use of formulated products containing the notified chemical, exposure is expected to be low due to encapsulation of the chemical in the resin and the small fraction (< 4% of the notified chemical) of the spray paint expected to be emitted to the environment.

The risk of adverse occupational health effects is expected to be low, due to the low hazard and likely low exposure level.

Public exposure to the notified chemical as a result of contact with end-use products is not expected to occur as it will be embedded in the resin/polymer of printed materials, paint films or plastic materials. If public exposure were to occur exposure levels would be low, and the low fat solubility of the notified chemical sggests that the dermal absorption is unlikely. There is negligible risk to public safety resulting from use of the notified chemical.

13. RECOMMENDATIONS

To minimise occupational exposure to IRGAZIN DPP Red 5049B the following guidelines and precautions should be observed:

- If engineering controls and work practices are insufficient to reduce exposure to IRGAZIN DPP Red 5049B to a safe level, then the following personal protective equipment which conforms to Australian Standards (AS) and Australian/New Zealand Standard should be worn:

  respiratory protection conforming to AS/NZS 1715 (15) and AS/NZS 1716 (16).

- safe practices, as should be followed when handling any chemical formulation, should be adhered to - these include:

  minimising spills and splashes;

  practising good personal hygiene; and

  practising good housekeeping and maintenance including bunding of large spills which should be cleaned up promptly with absorbents and put into containers for disposal.

- It is expected that, in the industrial environment, protective clothing conforming to and used in accordance with AS 2919 (17) and protective footwear conforming to AS/NZS 2210 (18) should be worn as a matter of course; in addition it is advisable that when handling chemical formulations to wear chemical-type goggles (selected and fitted according to AS1336 (19) and meeting the requirements of AS/NZS 1337 (20)) and impermeable gloves (AS 2161) (21) should be worn to protect against unforseen circumstances.

- work practices should minimise the formation of dusts.

- ensure that good general exhaust ventilation is installed in areas where dust aerosols can be generated

- non-dusting formulation to be imported for use

14. MATERIAL SAFETY DATA SHEET

The attached MSDS for IRGAZIN DPP Red 5049B was provided in accordance with the *Code of Practice for the Preparation of Material Safety Data Sheets* (22).

This MSDS was provided by the applicant as part of their notification statement. The accuracy of this information remains the responsibility of applicant.

15. REQUIREMENTS FOR SECONDARY NOTIFICATION

Under the *Industrial Chemicals (Notification and Assessment) Act 1989*, secondary notification of IRGAZIN DPP Red 5049B shall be required if any of the circumstances stipulated under subsection 64(2) of the Act arise. No other specific conditions are prescribed.

16. REFERENCES

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[i1] The Draize Scale 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. 1mm)	3
Severe erythema (beet redness)	4	Severe oedema (raised more than 1 mm and extending beyond area of exposure)	4

[2] The Draize scale 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