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ISOCYANURIC ACID
CAS N°: 108-80-5

SIDS Initial Assessment Report

for

9th SIAM

(France, June 29-July 1, 1999)

Chemical Name: Isocyanuric acid

CAS No: 108-80-5

Sponsor Country: Japan

National SIDS Contact Point in Sponsor Country:

Mr. Kazuhide Ishikawa
Ministry of Foreign Affairs, Japan

HISTORY:

SIDS Testing Plan were reviewed in SIDS Review Process, where the following SIDS Testing Plan was agreed:

no testing ()

testing (X) Water solubility, Vapour pressure, Octanol/water partition coefficient,
Stability in water Biodegradation

Chronic toxicity to daphnia

Combined repeat dose and reproductive toxicity,

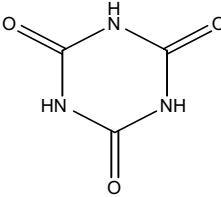
Chromosomal aberration test in vitro

Deadline for circulation: March 31, 1999

Date of Circulation: March 30, 1999

(To all National SIDS Contact Points and the OECD Secretariat)

SIDS INITIAL ASSESSMENT PROFILE

CAS NO.	108-80-5
CHEMICAL NAME	Isocyanuric acid
Structural formula	
<u>RECOMMENDATIONS OF THE SPONSOR COUNTRY</u>	
The chemical is currently of low priority for further work.	
<u>SHORT SUMMARY WHICH SUPPORTS THE REASONS FOR THE RECOMMENDATIONS</u>	
<p>Isocyanuric acid is not readily biodegradable (OECD 301C: 0% after 14-day) and stable in water. Bioconcentration factor to fish is low (<0.5, in Carp for 6 weeks).</p> <p>Toxicity of this chemical to aquatic organisms seems to be low because all toxicity data are higher than 32 mg/l (NOEC for reproduction of <i>Daphnia magna</i>). 48-EC₅₀ for immobilisation of <i>Daphnia magna</i> was 1000 mg/l. For testing in fish, Medaka (<i>Oryzias latipes</i>), both 96-h LC₅₀ and 14-day LC₅₀ were more than 100 mg/l. For algal test (<i>Selenastrum capricornutum</i>), 72-h EC₅₀ and 72-h NOEC were 620.0 mg/l and 62.5 mg/l, respectively. No data are available for effects on terrestrial organisms.</p> <p>Isocyanuric acid is lowly toxic in acute toxicity studies. This chemical is considered to be slightly irritating to eyes, but not to the skin. Several subchronic oral toxicity studies demonstrated renal damages, such as dilatation of the renal tubules, necrosis or hyperplasia of the tubular epithelium, increased basophilic tubules, neutrophilic infiltration, mineralization and fibrosis. These changes were probably caused by crystal of this chemical in renal tubules. The mechanism of this renal toxicity is supported by the toxicokinetics studies in animals and humans, showing that this chemical is quickly absorbed and excreted to urine within a few hours as an unchanged form. NOAEL is considered to be 150 mg/kg/day. In a developmental toxicity study, reduction of fetal body weights and crown/rump lengths was observed and NOAEL was 200 mg/kg/day, but this most likely reflects toxicity to the dams. No reproductive toxicity was observed (NOAEL: 600 mg/kg/day). A variety of <i>in vitro</i> and <i>in vivo</i> genotoxicity studies show this chemical is not genotoxic. Two years studies of rats and mice indicate this chemical has no carcinogenic potential.</p> <p>The production volume is ca. 20,000 tons/year in Japan in 1995. This chemical is used as an intermediate of chemical products in a closed system at industries. A generic fugacity model (Mackey level III) shows that this chemical will be distributed mainly (99.9%) in water phase after it is discharged into water.</p> <p>As for consumer exposure, this chemical is used in the form of chlorides for disinfection of water. In Japan, trichloroisocyanurate is mainly used in swimming pool, and the average concentration of isocyanuric acid is estimated as 50 to 100 µg/ml.</p>	
<u>IF FURTHER WORK IS RECOMMENDED, SUMMARISE ITS NATURE</u>	

FULL SIDS SUMMARY

CAS NO: 108-80-5		SPECIES	PROTOCOL	RESULTS
PHYSICAL-CHEMICAL				
2.1	Melting Point			330 °C
2.2	Boiling Point			Decomposed
2.3	Density			
2.4	Vapour Pressure		OECD TG 104	< 5.0 x 10 ⁻³ Pa at 25 °C
2.5	Partition Coefficient (Log Pow)		OECD TG 107	< 0.3
2.6 A.	Water Solubility		OECD TG 105	2.7 g/L at 25 °C
B.	pH			
	pKa			
2.12	Oxidation: Reduction Potential			
ENVIRONMENTAL FATE AND PATHWAY				
3.1.1	Photodegradation			
3.1.2	Stability in Water		OECD TG 111	Stable at pH 4,7 and 9 pK ₁ = 6.88, pK ₂ = 11.40, pK ₃ = 13.5
3.2	Monitoring Data			In surface water = not detected In soil/sediment = not detected
3.3	Transport and Distribution		Calculated (Fugacity Level III type)	Release: 100% to Water In Air 0.0 % In Water 99.6% In Sediment 0.0 % In Soil 0.4 %
			(local exposure)	0.19 mg/L (Japan)
3.5	Biodegradation		OECD 301C	Not readily biodegradable 0% in 28 days
3.7	Bioaccumulation		OECD 305C	BCF: < 0.5
ECOTOXICOLOGY				
4.1	Acute/Prolonged Toxicity to Fish	<i>Oryzias latipes</i>	OECD TG 203	LC ₅₀ (96hr) > 100 mg/l LC ₅₀ (14 d) > 100 mg/l
4.2	Acute Toxicity to Aquatic Invertebrates <i>Daphnia</i>	<i>Daphnia magna</i>	OECD TG 202	EC ₅₀ (48hr): 1000 mg/l
4.3	Toxicity to Aquatic Plants e.g. Algae	<i>Selenastrum capricornutum</i>	OECD TG 201	EC ₅₀ (72hr) = 620 mg/l NOEC = 62.5 mg/l
4.5.2	Chronic Toxicity to Aquatic Invertebrates (<i>Daphnia</i>)	<i>Daphnia magna</i>	OECD TG 202	EC ₅₀ (21d, Repro) = 65.9 mg/l NOEC = 32.0 mg/l
4.6.1	Toxicity to Soil Dwelling Organisms			None
4.6.2	Toxicity to Terrestrial Plants			None
4.6.3	Toxicity to Other Non-Mammalian Terrestrial Species (Including Birds)			None

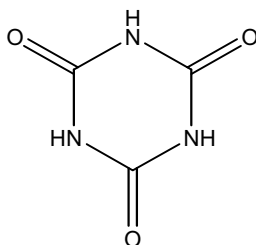
TOXICOLOGY				
5.1.1	Acute Oral Toxicity	Rat	Other (unknown)	LD ₅₀ = 7700 mg/kg
5.1.2	Acute Inhalation Toxicity	Rat	Other (unknown)	Minimum toxic concentration = 612 mg/m ³
5.1.3	Acute Dermal Toxicity	Rabbit	Other (unknown)	LD ₅₀ = > 7940 mg/kg
5.2.1	Skin Irritation/Corrosion	Rabbit	FHSA test	Not irritating
5.2.2	Eye Irritation/Corrosion	Rabbit	FHSA test	Slightly irritating
5.4	Repeated Dose Toxicity	Rat	OECD Combined	NOAEL = 150 mg/kg/day
5.5	Genetic Toxicity In Vitro			
A.	Bacterial Test (Gene mutation)	<i>S. typhimurium</i>	Other (unknown)	- (With metabolic activation) - (Without metabolic activation)
B.	Non-Bacterial In Vitro Test (Chromosomal aberrations)	Chinese hamster CHL cells	Japanese TG and OECD TG 473	- (With metabolic activation) - (Without metabolic activation)
5.6	Genetic Toxicity In Vivo (Chromosomal aberrations)	Rat	Other	-
5.7	Carcinogenicity	Rat	Other	Not carcinogenic
5.8	Toxicity to Reproduction	Rat	OECD combined	NOAEL = 600 mg/kg/day
5.9	Developmental Toxicity/ Teratogenicity	Rabbit	Other	NOAEL = 200 mg/kg/day
5.11	Experience with Human Exposure		Other (Toxicokinetics)	

[Note] Data beyond SIDS requirements can be added if the items are relevant to the assessment of the chemical, e.g. corrosiveness/irritation, carcinogenicity.

SIDS INITIAL ASSESSMENT REPORT

1. IDENTITY

- OECD Name: Isocyanuric acid
- Synonym: sym-Triazine-2,4,6-triol; sym-Triazinetriol; normal Cyanuric acid; 2,4,6-Trihydroxy-1,3,5-triazine; Trihydroxycyanidine; Tricyanic acid; Isocyanuric acid; Pseudocyanuric acid; 1,3,5-Triazine-2,4,6(1H,3H,5H)-trione; 1,3,5-Triazine-2,4,6-triol; 1,3,5-Triazinetriol; 1,3,5-Triazinetrione; Tricarbimide; Trihydroxy-1,3,5-triazine
- CAS Number: 108-80-5
- Empirical Formula: $C_3H_3N_3O_3$
- Structural Formula:



- Degree of Purity: 99.7 %
- Major Impurity: None
- Essential Additives: None
- Physical-chemical properties
 - Melting Point: 330 °C
 - Vapour pressure: $< 5.0 \times 10^{-3}$ Pa at 25 °C
 - Water solubility: 2.7 g/L
 - Log Pow: < 0.3

2. GENERAL INFORMATION ON EXPOSURE

2.1 Production and import

The production volume of isocyanuric acid in Japan is 20,000 tonnes/year in 1995.

2.2 Use pattern

All of isocyanuric acid produced in Japan is used as intermediate of chemical products, and no consumer use is reported.

2.3 Other information

None

3. ENVIRONMENT

3.1 Environmental Exposure

3.1.1 General Discussion

Isocyanuric acid is not readily biodegradable (OECD 301C: 0 % after 14d) and stable in water. Direct photodegradation is not expected because isocyanuric acid has not absorption band in UV and VIS region.

Isocyanuric acid is low bioaccumulative (BCF < 0.5, Carp).

The potential environmental distributions of isocyanuric acid obtain from a generic Mackay level III fugacity model is shown in Table 1. Parameters used for this model are shown as Annex to this report. The results show that, if isocyanuric acid is released into water, it is unlikely to be distributed into other compartments. If isocyanuric acid is released into air and soil, it is likely to be distributed in other compartments.

Table 1
Environmental distribution of isocyanuric acid
Using a generic level III fugacity model.

Compartment	Release 100% to air	Release 100% to water	Release 100% to soil
Air	0.1 %	0.0 %	0.0 %
Water	46.5 %	99.6 %	40.5 %
Soil	53.3 %	0.0 %	59.3 %
Sediment	0.2 %	0.4 %	0.2 %

As this chemical is used in closed system as an intermediate of chemical products and is not included in consumer products, its release to the environment may occur only from the production cite.

3.1.2 Predicted Environmental Concentration

As isocyanuric acid is produced under the well-controlled closed system, amount of release to air phase is negligibly small. The waste of isocyanuric acid from the production system is released to water phase after treated its own wastewater treatment plant. Therefore, Predicted Environmental Concentration (PEC) will be calculated only for the water environment.

a. Regional exposure

According to report from a Japanese manufacturer, 407.7 tonnes/year (measured) of isocyanuric acid are released with 2.19×10^{10} L/year of effluent into river. Local Predicted Environmental Concentration (PEC_{local}) is calculated to be 0.186 mg/L as a worst case scenario, employing the following calculation model and dilution factor of 100.

$$\frac{\text{Amount of release (4.08 x 10}^{11} \text{ mg/y)}}{\text{Volume of effluent (2.19 x 10}^{10} \text{ L/y) x Dilution Factor (100)}}$$

3.2 Effects on the Environments

3.2.1 Effects on aquatic organisms

Acute and chronic toxicity data of isocyanuric acid to aquatic organisms are summarized below (Table 2). Toxicity of this chemical to aquatic organisms seems low because all toxicity data are higher than 32 mg/l (NOEC of reproduction of *Daphnia magna*). Predicted No Effect Concentration (PNEC) of this chemical was determined based mainly on the toxicity data obtained by the Environment Agency of Japan through a GLP-laboratory. Toxicity data by different organizations were few. As the lowest acute and chronic toxicity data, 96 h LC₅₀ of *Oryzias latipes* and 21 d NOEC (reproduction) of *D. magna* were used, respectively (Table 2). All toxicity in Table 2 were calculated based on the nominal concentration as the measured concentrations were kept within 95 to 102 % of the nominal concentrations.

The assessment factors of 100 were used to both acute and chronic toxicity data to determine PNEC, according to the OECD Provisional Guidance for Initial Assessment of Aquatic Effects (EXCH/MANUAL/96-4-5.DOC/May 1996), because chronic toxicity data for fish was absent.

From chronic toxicity data (21 d NOEC of *Daphnia*):

$$\text{PNEC} = 32/100 = 0.32 \text{ mg/l}$$

Thus, PNEC of isocyanuric acid is 0.32 mg/l.

Table 2

Acute and chronic toxicity data of isocyanuric acid to aquatic organisms at different trophic levels. The data were obtained by the Environmental Agency of Japan based on the OECD Test Guide Lines.

Species	Endpoint	Conc. (mg/l)	Remarks
<i>Selenastrum capricornutum</i> (algae)	Bms 72 h EC50	620.0	a, 1)
	Bms. 72 h NOEC	62.5	c, 1),
<i>Daphnia magna</i> (Water flea)	Imm 48 h EC50	1000	a, 1),
	Rep 21 d EC50	65.9	c, 1)
	Rep 21 d NOEC	32.0	c, 1), C
<i>Oryzias latipes</i> (fish, Medaka)	Mor 96 h LC50	> 100	a, 1), A
	Mor 14 d LC50	> 100	a, 1)

Notes: Bms; biomass, Mor; mortality, Rep; reproduction, NR; not recorded.

A), C); the lowest values among the acute or chronic toxicity data of algae, Cladocera (water flea) and fishes to determine PNEC of isocyanuric acid.

- 1) Toxicity data were obtained by the Environment Agency of Japan based on OECD Test Guidelines and GLP.

3.2.2 Terrestrial effects

No data available

3.2.3 Other effects

No data available

3.3 Initial Assessment for the Environment

Predicted No Effect Concentration (PNEC) of this chemical has been calculated as 0.32 mg/l.

PEC from Japanese local exposure scenario is 0.186 mg/l.

$$PEC_{\text{local}} / PNEC = 0.186/0.32 = 0.58 < 1$$

Therefore, it is currently considered of low potential risk for environments and low priority for further work.

4. HUMAN HEALTH

4.1 Human Exposure

4.1.1 Occupational exposure

Isocyanuric acid is produced in a closed system and used as an intermediate for organic chemicals. The occupational exposure is expected through inhalation and the dermal route is assumed negligible because this chemical is solid. As the atmospheric concentration in plant was not measured, the maximum exposure level is estimated according to working schedules as follows. If a single worker (body weight; 70 kg, respiratory volume; 1.25 m³/hr) is assigned to implement this operation without protection, the highest daily intake (EHE) is calculated as 0.23 mg/kg/day as the worst case. Practically, workers always wear protective gloves and respiratory protective equipment (mask) during the operation.

	Frequency Times/day	Duration hr	Working hr/day	Maximum Concentration mg/m ³	Maximum EHE mg/kg/day
Bag Filling	80	0.08	6.5	2	0.23

EHE: Estimated Human Exposure

4.1.2 Consumer exposure

Chloroisocyanurates such as sodium dichloroisocyanurate, potassium dichloroisocyanurate, sodium dichloroisocyanurate hydrate, potassium dichloroisocyanurate hydrate and trichloroisocyanuric acid have been used in sterilizing water tank, swimming pool, bathing water, and kitchen. In water, chloroisocyanurates are hydrolyzed to isocyanuric acid and hypochloric acid, that is the active agent (Golaszewski & Seux: 1994). The antimicrobial activity of sodium dichloroisocyanurate was evaluated against Gram negative bacteria such as *E. coli* or *Salmonella typhimurium* and against some fungi (D'Auria, *et al.*: 1989).

It is considered that the potential for exposure to pool chemicals through swallowing water and/or dermal absorption is quite high. Allen *et al.* (1982) reported cumulative recovery of isocyanuric acid in the urine of swimmers, 20 hr after swimming, averaging 9.8 mg. As the worst case, high performance athletes in training are known to spend up to 4 hr/day in the pool for 300 day/year and are estimated to swallow up to 60 ml/hr of pool water (Datta: 1979). In Japan, trichloroisocyanurate is mainly used in swimming pool and the average concentration of isocyanuric acid is estimated as 50 to 100 µg/ml. Based on this information, oral daily intake of isocyanuric acid for 60 kg b.w.

person is calculated as 0.17 to 0.33 mg/kg/day. Continuous-dose automated *in vitro* dermal absorption studies conducted with isocyanuric acid demonstrated minimal absorption through rat, hairless guinea pig, human, and Test skin (Moody: 1993). Total cumulative absorption of isocyanuric acid by 24 h in Test skin and human skin was 0.02 µg/cm² in both cases. As 1.5 m² of body surface is estimated for 60 kg b.w. person, the daily intake through skin is calculated as 5 µg/kg/day as the maximum value.

4.1.3 Indirect exposure via the environment

As isocyanuric acid is persistent in water and low bioaccumulative, the exposure to the general population via the environment would be possible through drinking water processed from surface water and through fish which may accumulate this chemical.

The concentration in drinking water should be estimated to be equal to PEC calculated in Section 3.1, i.e. 0.186 mg/l. The daily intake through drinking water is calculated as 6.20 x 10⁻³ mg/kg/day (2 l/day, 60 kg b.w.).

Using the maximum bioconcentration factor of 0.5 obtained by tests, the concentration of this chemical in fish can be calculated as follows:

$$PEC_{\text{fish}} = 0.186 \text{ mg/l} \times 0.5 = 9.03 \times 10^{-5} \text{ mg/g-wet}$$

As a daily intake of fish in Japan is estimated to be 90 g for 60 kg body weight person, a daily intake of this chemical will be 1.40 x 10⁻⁴ mg/kg/day.

4.2 Effects on Human Health

a) Acute toxicity

[SIDS data] Oral LD₅₀ for isocyanuric acid was 7,700 mg/kg b.w. for rats. In inhalation study, the minimum toxic concentration was reported to be 612 mg/m³ in rats. (Babayan and Aleksandryan: 1985) Dermal LD₅₀ for isocyanuric acid was higher than 7940 mg/kg b.w. for rabbits (Toxikologische Bewertung: 1993).

Other acute toxicity information including sodium isocyanurate are given in Table. In addition, it is also reported that a single oral dosage of isocyanuric acid up to 10 g/kg was tolerated by rats and daily dosage of 20 g/kg was tolerated by rabbits for periods up to 4 days (Hodge et al.: 1965). Based on these data, isocyanuric acid is considered to be low toxic when administered as a single dose.

Routes	Strain	Type	Values	
<u>Isocyanic acid</u>				
Oral	Rats	LD ₅₀	7,700 mg/kg	SIDS data, Ref.1
	Mice	LD ₅₀	3,400 mg/kg	Ref.1
	Rabbits	LDL ₀	> 10 g/kg	Ref.2
Inhalation	Rats	Other*	612 mg/m ³	SIDS data, Ref.1
Dermal	Rabbits	LD ₅₀	> 7,940 mg/kg	SIDS data, Ref.3

Intravenous	Rats	LD ₅₀	> 100 mg/kg	Ref.4
	Mice	LD ₅₀	> 500 mg/kg	Ref.4
<u>Sodium isocyanurate</u>				
Oral	Rats	LD ₅₀	> 7,500 mg/kg	Ref.4
Intravenous	Cats	LD ₅₀	2,144 mg/kg	Ref.5

Ref.1: Babayan & Aleksandryan: 1985, Ref.2: Toxicity Information: 1972, Ref.3: Toxikologische Bewertung: 1993, Ref.4: *Gigiiena i Sanitariya*: 1962, Ref.5: *J Pharmacol Exp Ther*: 1951, *: Minimum toxic concentration

b) Irritation

Federal Hazardous Substances Act (FHSA) tests of isocyanuric acid were performed in rabbits. As a result, isocyanuric acid slightly irritated to eyes but not to the skin (Hammond *et al.*: 1986). As for eye irritation, there are two other data. Moderate eye irritation followed administration into the rabbit eyes for 24 hr at 20 or 500 mg (Toxicity Information: 1972, Marhold: 1972). This chemical is not listed in IUCLID labelling and classification.

Based on these data, this chemical is considered as a slightly irritant to eyes, but not to the skin.

c) Sensitisation

There is no available data.

d) Repeated toxicity

[SIDS data] Oral toxicity study was performed in SD (Crj: CD) rats by an OECD combined repeat dose and reproductive/developmental toxicity screening test. Isocyanuric acid was administered by gavage at doses of 10, 40, 150 and 600 mg/kg/day for 45 days in males and from 14 days before mating to day 3 of lactation in females. (MHW, Japan: 1997)

Isocyanuric acid induced toxic effects at 600 mg/kg in both sexes. Excretion of reddish urine was evident. In addition, depression of body weight gain was observed in males. Urinalyses of males revealed appearance of crystals, which is considered this chemical precipitated from urine, and increases of erythrocytes and leukocytes. In hematological examination of males, significant decreases in erythrocyte counts, hemoglobin concentrations and hematocrit values were observed. In blood chemical examination of males, increases in urea nitrogen and creatinine, and a decrease of sodium were revealed. In histopathological examination, dilatation of the renal tubules, necrosis or hyperplasia of the tubular epithelium, increased basophilic tubules, neutrophilic infiltration, mineralization and fibrosis in the kidney, hyperplasia of the mucosal epithelium in the urinary bladder and vacuolization of the zona fasciculata in the adrenals were observed in both sexes. In addition, the incidence of atrophic thymus also showed a tendency for increase in females. Absolute and relative kidney weights and relative adrenal weights were increased in both sexes. As no toxic sign was observed at doses of 150 mg/kg and the less, NOAEL was considered to be 150 mg/kg/day in both sexes.

Oral toxicity study of sodium isocyanurate for 90 days was performed in B6C3F1 mice at doses of 896, 1,792 and 5,375 ppm in drinking water. Sodium hippurate was used as a second control in order

to have the sodium burden as the top concentration. Although an increase in water consumption in both sexes and absolute and relative weights of ovaries in females were observed, these changes were considered due to the high sodium intake. Therefore, NOAEL was considered to be 5,375 ppm (male: 1,994 mg/kg/day, female: 2,200mg/kg/day). (Hazleton: 1982)

Hodge *et al.* (1965) conducted oral toxicity study in rats and beagle dogs, and skin and eye application study in rabbits.

In first study, rats of the Rochester strain were maintained for 20 weeks on diets containing 0.8 %, and 8 % sodium isocyanurate. As a result, 14/20 males and 4/20 females died at 8 %, but no died at 0.8 %. Considerable decrease in body weight gain was observed at 8 %. Urine samples taken prior to the start of feeding and again near termination of the study showed normal concentrations of protein and sugar. In hematological examination no change was observed. There were no changes in organ weights (thyroid, liver, brain, lungs, heart, etc.), except kidney weight, which increased at 8 % in females. In histologic study, dilatation of distal collecting tubules and ducts of Bellini, with focal areas of epithelial proliferation were observed at 8 % in both sexes. Therefore, NOAEL was considered to be 0.8 % (56 mg/kg/day).

In second study, groups of 3 dogs were maintained in diets of 0.8 % sodium isocyanurate for 6 months and 8 % for 2 years. In 0.8 % dogs, there were no changes in body weight gain, organ weight, and sugar and protein in urine. In addition, hematological and histological changes were not observed. In 8 % group, 2 dogs died after 16 and 21 months on the regimen. No change or slight increase in body weights was observed. Periodic urinalyses gave normal trace values for sugar and protein. In hematologic study, only a survival dog showed changes, which are low red blood cell counts, hemoglobin values, and hematocrits. There was no change in organ weights (thyroid, liver, brain, lungs, heart, etc.), except decrease in kidney weight of 2 dogs surviving more than 20 months. In these dogs, there was gross evidence of kidney fibrosis. Sections revealed numerous linear streaks of gray fibrous tissue extending from the papillary tip to the cortical surface. Microscopically, similar changes were observed in the kidneys of all three dogs. The collecting tubules were more uniformly and severely involved, but all portions of the nephron were compressed by fibrosis. There were slight focal dilatation and epithelial proliferation in the ducts of Bellini. In survival dog, focal areas of thyroid atrophy were found with lymphocytic infiltration, but without evidence of hyperplasia. Therefore, NOAEL for 6 months study was considered to be 0.8 % (291 mg/kg/day) and LOAEL for 2 years study to be 8 % (2,912 mg/kg/day).

In skin application study, 5 ml of 0.8 % or 8 % aqueous suspension were administered to the skin of albino rabbits 5 days/week for about 3 months, respectively. Urinalyses (sugar and protein) and hematological study showed no changes. There were no irritation or other adverse effects on the skin. In histological findings of liver and skin from treated and untreated area, no change was observed at the termination of the study. In the kidneys of the rabbits treated with the 8 % sodium isocyanurate suspension, slight dilation of the ducts of Bellini and mild tubular changes were found. Therefore, NOAEL was considered to be 0.8 %.

In eye application studies, 0.1 ml of 0.8 % or 8 % aqueous suspension were administered to eye of albino rabbits 5 days/week for about 3 months, respectively. Increase in body weight was observed during the period of the study in all treated groups. No eye injury and irritation was caused. Therefore, NOAEL was considered to be 8 %.

e) Reproductive/developmental toxicity

Reproductive toxicity

[SIDS data] Oral toxicity study was performed in SD (Crj: CD) rats by an OECD combined repeated dose and reproductive/developmental toxicity screening test. Isocyanuric acid was administered by gavage at doses of 10, 40, 150 and 600 mg/kg/day for 45 days in males and from 14 days before mating to day 3 of lactation in females. (MHW, Japan: 1997)

The parental animals exhibited no alteration in reproductive parameters including the copulation index, fertility index, gestation length, numbers of corpora lutea or implantation, implantation index, gestation index, delivery index, and behavior at delivery and lactation. There were no significant differences in offspring parameters including number of offspring or live offspring, the sex ratio, live birth index, viability index and body weight. No external or visceral abnormalities related to the test substance were detected in any of the offspring. Therefore, NOAEL for parents and offsprings was considered to be 600 mg/kg/day.

Three-generation study was conducted. Sodium isocyanurate was given by drinking water at concentrations of 400, 1,200 and 5,375 ppm to CD rats. Treatment was initiated at 36 days of age and continued for a minimum of 100 days before mating. Weanlings from the F1 and F2 litters were randomly selected as the next parents and continued on treatment for the additional 120 days. Selected litters and F3 offsprings were sacrificed 4 weeks after weaning, and organ weight measurements and microscopic examination of tissues were carried out. (Wheeler *et al.*: 1985)

No compound-related changes were observed in mortality, body weights, food consumption, gestation length, litter size, pup survival to weaning, sex ratio, and pup weight. In pathological and histological findings, epithelial hyperplasia with chronic cystitis was observed only in a few of high-dose treated males in F2 offsprings, which were attributed to chronic irritation by the calculi in the urinary bladder. However, this change is considered not to be due to reproductive toxicity of this chemical. In other treated groups, there were no changes. Therefore, NOAEL for reproductive toxicity was considered to be 5,375 ppm (approx. 370 mg/kg/day for male and 630 mg/kg/day for female).

Male CD-1 mice were treated intraperitoneally at doses of sodium isocyanurate (125 and 250 mg/kg/day). As positive control, methyl methane sulfonate was used at dose of 50 mg/kg/day. Males were mated with non-treated females. Although early resorptions were observed in females mated with males treated with methyl methane sulfonate, any chemical-related effects were not observed in females, mated with sodium isocyanurate treated males. Therefore, NOAEL was considered to be 250 mg/kg/day. (FMC Corporation: 1972)

Developmental toxicity

[SIDS data] Pregnant Dutch belted rabbits were given sodium isocyanurate at doses of 50, 200 and 500 mg/kg/day by gavage during days 6-18 of gestation. (FMC Corporation, unpublished observations)

Although slight decrease in body weight was observed in mid- and high-dose dams during the treatment period, compensatory weight gains occurred after termination of treatment on day 18. There were no compound related mortality or other adverse reactions in all treated dams. The mean number of live fetus/dam and sex ratio was essentially comparable for all groups. Fetal body weights and crown/rump lengths were reduced slightly in high-dose groups, compared to control. These changes may have resulted from the slight manifestations of maternal toxicity that occurred during treatment. There was no evidence of external or internal malformations or skeletal anomalies. Therefore, NOAEL for developmental toxicity was considered to be 200 mg/kg/day.

Sodium isocyanurate was administered at doses of 200, 1,000, and 5,000 mg/kg/day by oral gavage to pregnant CD rats during days 6-15 of gestation. Sodium control groups received sodium hippurate at dose of 1,118 and 5,590 mg/kg/day. (Industry ad hoc Committee for Isocyanurates: 1982)

There was no mortality in all treated groups. Although decrease in body weight and crown/rum length, increase in post-implantation loss, incidence incomplete ossification were observed in sodium control group, no treatment related effect on maternal appearance, behaviour and body weight gain, and no teratogenic effect were observed in all groups treated with sodium isocyanurate. Therefore, NOAEL for developmental toxicity was considered to be 5,000 mg/kg/day.

f) Genetic toxicity

Bacterial test

[SIDS data] Isocyanuric acid was not mutagenic to *S. typhimurium* TA1535, TA1537, TA98, TA100 with or without metabolic activation (Hayworth *et al.*: 1983).

Isocyanuric acid did not induce the bacteriophage Lambda in *Escherichia coli* K12 en VA UVRB (NORSOLOR/APC: 1977).

Non-bacterial test in vitro

[SIDS data] In chromosomal aberration test *in vitro*, clastogenicity or polyploidy in CHL/IU cells was not induced in the absence or presence of an exogenous metabolic activation system (MHW, Japan: 1997).

In lymphoma assay, this chemical also showed negative result at up to a concentration of 2000 µg/ml in the TK locus of L5178Y mouse lymphoma cells (Industry ad hoc Committee for Isocyanurates: 1981a). This chemical did not induce sister chromatid exchange in CHO cells (Industry ad hoc committee for Isocyanurates: 1981b), and this negative result was confirmed on human lymphoid cell line (LAZ-007) by Sobti *et al.* (1981), although the concentration was very low (2µg/ml).

in vivo Test

[SIDS data] In chromosomal aberration test *in vivo*, rats were killed 24 and 48 hr after administration of sodium isocyanurate by gavage at single dosages up to 5000 mg/kg, and bone marrow cells were collected and examined. As a result, this chemical did not induce chromosomal aberrations in rat bone marrow cells (Hammond *et al.*: 1985).

g) Carcinogenicity

CD rats were administered sodium isocyanurate in drinking water at concentrations of 400, 1,200, 2,400 or 5,375 ppm for 2 years. Estimated daily doses were indicated only for 2,400 and 5,375 ppm (male: 154 and 371 mg/kg/day, female: 266 and 634 mg/kg/day, respectively). For a second control, sodium hippurate was administered as the same amount of sodium as the highest dose. Treatment-related mortality was observed in some males of the highest dose group, which died during the first 12 months of the study. This mortality was due to the development of calculi in the urinary tract. In some males that died on test and in some that were sacrificed at 12 months, there were pathologic changes, including hyperplasia, bleeding, and inflamed ureters, and renal tubular nephrosis. Although slight tubular nephrosis was also observed in a few females of the highest dose group during the first 12 months, these animals did not exhibit bladder calculi. Inflammatory

lesions in the heart were also apparent in some of the highest dose males that died early. There was no evidence of a test article related carcinogenic effect. (Cascieri *et al.*: 1985)

B6C3F1 mice were administered sodium isocyanurate in drinking water at concentrations of 100, 400, 1,200 and 5,375 ppm for 2 years. Apparently swollen enlarged abdomen was observed at the highest dose groups, related to increase in water consumption. There were no effects on survival, clinical pathology (except for urinary sodium), organ weight, gross and histopathology. There was no evidence of a test article related carcinogenesis. (Industry Ad hoc Committee for Isocyanurates: 1986)

h) Toxicodynamics/toxicokinetics

Toxicokinetics study of sodium isocyanurate was performed in rats and dogs, using [¹⁴C] sodium isocyanurate. Administration was performed at 5 mg/kg by oral or intravenous route and at 500 mg/kg by oral route. At 5 mg/kg, this chemical was completely absorbed and largely eliminated in urine, while at 500 mg/kg, this chemical was incompletely absorbed and largely eliminated in feces. The elimination half-life was 30 to 60 min in rats and 1.5 to 2 hr in dogs after oral or intravenous administration. In dogs, sodium isocyanurate distributed into an apparent volume of distribution of 0.7 L/kg, which is somewhat greater than total body water volume. Rats and dogs were also administered unlabeled sodium isocyanurate orally at 5 mg/kg/day followed by the single exposure of 5 mg/kg radiolabeled sodium isocyanurate on day 15. In rats, the remainder of radioactivity in most tissues was below the level of detection 7 days after treatment for repeated dose administration and for all sampling times for both single and repeated dose administration in dogs. As results of repeated dose study, it was shown that isocyanurate did not bioaccumulate in tissues. There was no evidence that isocyanurate was biodegraded, as only unchanged isocyanurate was found in excreta. (Barbee *et al.*: 1983)

Toxicokinetics study by dermal route was performed, in which species was not indicated. After dermal application, the ¹⁴C-labelled substance is not detectable in the blood and < 0.01 % of the administered dose is found in the urine. This result showed that isocyanuric acid was absorbed only in very small quantities. (Toxikologische Bewertung: 1993)

i) Experience with human exposure

Toxicokinetics of isocyanuric acid was investigated in 5 volunteers, who soaked in a swimming pool for 120 minutes. As a result, the cumulative excretion of isocyanuric acid was 0.03-2.8 mg, equivalent to 3.0-3.6 ml of pool water and the elimination half-life is calculated as 3 hr. On the other hand, recovery of ingested isocyanuric acid was 98 % in urine. There was no correlation between toxicokinetics and gamma glutamyl transpeptidase activity. (Allen *et al.*: 1982)

4.3 Initial Assessment for Human Health

Isocyanuric acid is lowly toxic in acute toxicity studies. This chemical is considered to be slightly irritating to eyes, but not to the skin. Several subchronic oral toxicity studies demonstrated renal damages, such as dilatation of the renal tubules, necrosis or hyperplasia of the tubular epithelium, increased basophilic tubules, neutrophilic infiltration, mineralization and fibrosis. These changes were probably caused by crystal of this chemical in renal tubules. The mechanism of this renal toxicity is supported by the toxicokinetics studies in animals and humans, showing that this chemical is quickly absorbed and excreted to urine within a few hours as an unchanged form. NOAEL is considered to be 150 mg/kg/day. In a developmental toxicity study, reduction of fetal body weights and crown/rump lengths was observed and NOAEL was 200 mg/kg/day, but this most

likely reflects toxicity to the dams. No reproductive toxicity was observed (NOAEL: 600 mg/kg/day). A variety of *in vitro* and *in vivo* genotoxicity studies show this chemical is not genotoxic. Two years studies of rats and mice indicate this chemical has no carcinogenic potential.

Occupational exposure

Isocyanuric acid is used in a closed system at industries and workers wear protective gloves and respiratory protective equipment during the operation. Although the occupational exposure route is expected as an inhalation in limited workers, there is no available data of the atmosphere concentration. Based on the predicted high concentration and the possibility of exposure period, the daily intake is calculated as 0.23 mg/kg/day as the worst case. Occupational risk is presumably low because the margin of safety is 652.

Consumer exposure

Isocyanuric acid is used in the form of chlorides in sterilizing water tank, swimming pool, bathing water, and kitchen. In Japan, trichloroisocyanurate is mainly used in swimming pool and the average concentration of isocyanuric acid is estimated as 50 to 100 µg/ml. The exposure of high performance athletes in training is expected through a swallow and skin absorption. The combined daily intake is calculated as 0.34 mg/kg/day as the worst case. Consumer risk is presumably low because the margin of safety is 441.

Indirect exposure via environment

As for indirect exposure via environment, PEC_{local} of 0.186 mg/l from local exposure scenario was used for the estimation. The daily intakes through drinking water and fish were calculated as 6.20×10^{-3} mg/kg/day and 1.40×10^{-4} mg/kg/day, respectively. Since the margin of safety is very large, such as 2.42×10^4 for drinking water and 1.08×10^6 for fish, health risk via environment is presumably low.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Isocyanuric acid is not readily biodegradable (OECD 301C: 0 % after 14-d) and stable in water. Bioaccumulation factor of this chemical is low (BCF < 0.5, Carp). PEC/PNEC ratio ($0.186/0.32 = 0.58$) is less than 1 based on the local exposure scenario in the Sponsor country. It is currently considered of low potential risk to environments and low priority for further work. However, relatively high PEC/PNEC value suggests necessity for assessment of this chemical to the river ecosystem contaminated with this chemical.

Isocyanuric acid is moderately toxic in a repeated dose study (i.e. kidney) but not toxic in reproductive toxicity study. In a developmental toxicity study, this chemical is toxic to dams, which resulted in slight fetal toxicity (reduction of body weights and crown/rump lengths). This chemical is neither genotoxic nor carcinogenic but slightly irritating to eyes. Occupational and consumer risks are expected to be low because the margin of safety is 652 and 441, respectively. As the margin of safety via indirect exposure is more than 10,000, it is currently considered of low potential human risk and low priority for further work.

5.2 Recommendations

Environment:	Relatively high PEC (0.18 mg/l) and PEC/PNEC ratio (0.58) in the river receiving the effluents from the production site.
Human health:	No recommendation

6. REFERENCES

- Allen, M.L. *et al.*, *Drug Metab.Rev.*, 13, 499 (1982)
- Babayan, A.A. and Aleksandryan, A.V., *Zh.Eksp.Klin.Med.*, 25(4), 345 (1985)
- Barbee, S.J. *et al.*, *Toxicologist*, 3, 80 (1983)
- Cascieri, T. *et al.*, *Toxicologist*, 5, 58 (1985)
- D'Auria, F.D. *et al.*, *Ann.Ig.*, 1, 1445-1458 (1989)
- Datta, P.R., *Hazard Evaluation Division Report prepared for Special Pesticide Review Division*, p1 (1979)
- FMC Corporation, Industrial Bio Test, Report E 756 (1972)
- Gigiena i Sanitariya. For English translation, see HYSAAV. (V/O Mezhdunarodnaya Kniga, 113095 Moscow, USSR) 27(12), 13 (1962)
- Golaszewski, G. and Seux, R., *Water Res.*, 28, 207 (1994)
- Hammond, B.G. *et al.*, *Environ.Health Perspect.*, 69, 287 (1986)
- Hammond, B.G. *et al.*, *Fundam.Appl.Toxicol.*, 5(4), 655 (1985)
- Hayworth, S. *et al.*, *Environmental Mutagenesis*, 5(1), 3 (1983)
- Hazleton, U.S. (Vienna), Thirteen week toxicity study in mice - Sodium monocyaurate, Report 2169-100 (1982)
- Hodge, H.C. *et al.*, *Toxicol.Appl.Pharmacol.*, 7, 667 (1965)
- Industry Ad hoc Committee for Isocyanurates, Hazleton laboratories, Report 2169-100 (1986)
- Industry ad hoc Committee for Isocyanurates, Research Institute Int., Project 013-312-582-7 (1981a)
- Industry ad hoc committee for Isocyanurates, SRI International, Project LSC 2923, Task 1 (1981b)
- *Journal of Pharmacology and Experimental Therapeutics*, 103, 420 (1951)
- Marhold, J.V., Institut Pro Vychovu Vedoucicn Pracovniku Chemickeho Prumyclu Praha, Czechoslovakia, 152 (1972)
- Ministry of Health and Welfare: Japan, *Toxicity Testing Reports of Environmental Chemicals* 5, 429-442 (1997)
- Moody, R.P., *J. Toxicol., Cutaneous Ocul. Toxicol.*, 12, 197 (1993)
- NORSOLOR/APC, Inductest performed by Institut Pasteur de Paris (M. Hofnung), Contract 133 (1977)
- Sobti, R.C. *et al.*, Cytogenetic monitoring of environmental pollutants in South Florida, AACR Abstracts, 435 (1981)
- Toxicity Information (Monsanto Industrial Chemicals Co., Bancroft Bldg., Suite 204, 3411 Silverside Rd., Wilmington, DE 19810) (1972)
- Toxikologische Bewertung. Heidelberg, Berufsgenossenschaft der chemischen Industrie, 103, 28 p (1993)
- Wheeler, A.G. *et al.*, *Toxicologist*, 5, 189 (1985)

Appendix 1

Method for Prediction of Environmental Concentration of Pollutant in Surface Water

1. Predicted environmental concentration in the local environment (PEC_{local}) with effluent release into river

When decomposition, precipitation and vaporization of pollutant can be ignored, it is used that simplified equation by complete mixing model shown with equation (1) to calculate predicted environmental concentration in the local environment (PEC_{local}) as for release effluent into river.

$$PEC_{local} \text{ (mg/L)} = \frac{C_o Q + C_s Q_s}{Q + Q_s} \quad (1)$$

Where

C_o : Concentration of pollutant in upper stream of release point (mg/L)

C_s : Concentration of pollutant in effluent (mg/L)

Q : Flow rate of river (m^3/day)

Q_s : Flow rate of effluent released into river (m^3/day)

At the equation (1), when C_o can be considered as 0, dilution factor of pollutant in the river (R) can be shown with following equation.

$$R = C_s/C = (Q + Q_s) / Q_s \quad (2)$$

As the worst case, it is used to employ a flow rate at dry season as flow rate of river (Q). When flow rate at dry season is indistinct, it is estimated using the following equation in Japan.

$$\text{Flow rate at dry season} = \text{mean flow rate} / 2.5 \quad (3)$$

2. Predicted environmental concentration in the local environment (PEC_{local}) with effluent release into sea

For prediction of concentration of pollutant in the sea water with effluent, it is employed generally Joseph-Sendner's equation (4). This equation is one of analytic solution led under the following conditions from diffusion equation.

- 1 It is adopted large area of sea or lake.
- 2 The flow rate of effluent and concentration of pollutant in the effluent are constant, and distribution of concentration is able to regard as equilibrium state.
- 3 Effluent is distributed uniformly to vertical direction, and it spreads in a semicircle or segment to horizontal direction.
- 4 Diffusion coefficient of pollutant at the sea is in proportion to distance from release point of effluent.
- 5 There is not any effect of tidal current.
- 6 Decomposition of pollutant can be ignored.

$$C(x) = (C_s - C(r)) \left(1 - \exp\left(-\frac{Q_s}{d p} \left(\frac{1}{x} - \frac{1}{r}\right)\right)\right) + C(r) \quad (4)$$

Where

$C(x)$: Concentration of pollutant at distance x (m) from release point

C_s : Concentration of pollutant in effluent

$C(r)$: Concentration of pollutant at distance r (m) from release point

Q_s : Flow rate of effluent (m^3/day)

θ : Opening angle of seacoast (rad.)

d : Thickness of diffusion layer (m)

P : Diffusion velocity (m/day) (1.0 0.5 cm/sec)

When $C(x)$ is 0 at $r = \infty$ and density stratification is ignored for simplification, Joseph-Sendner's symbol 146 θ "Times New Roman" θ 11's equation (4) is simplified to equation (5)

$$C(x) = C_s \left(1 - \exp\left(-\frac{Q_s}{d p x}\right)\right) \quad (5)$$

Because of $Q_s / d p x \ll 1$ except vicinity of release point, dilution factor in distance x from release point $R(x)$ can be shown with equation (6).

$$R(x) = C_s / C(x) = d p x / Q_s \quad (6)$$

When it is employed following parameters in equation (6) as default, dilution factor R can be shown with equation (7).

$$P = 1 \text{ cm/sec (860 m/day)}$$

$$= 3.14$$

$$d = 10 \text{ m}$$

$$x = 1000 \text{ m}$$

$$R = 2.7 \cdot 10^7 / Q_s \quad (7)$$

Q_s : volume of effluent (m^3/day)

REVISED OECD HPV FORM 1

SIDS DOSSIER ON THE HPV PHASE 5 CHEMICAL

Isocyanuric acid

CAS No. 108-80-5

Sponsor Country: Japan

DATE: March 15, 1999

CONTENTS**Sids Profile****Sids Summary****1. General Information**

- 1.01 Substance Information
 - * A. Cas-Number
 - B. Name (Iupac-Name)
 - * C. Name (Oecd Name)
 - † D. Cas Descriptor
 - E. Eines-Number
 - F. Molecular Formula
 - * G. Structural Formula
 - H. Substance Group
 - I. Substance Remark
 - J. Molecular Weight
- 1.02 Oecd Information
 - A. Sponsor Country
 - B. Lead Organisation
 - C. Name Of Responder (Company)
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 - B. Physical State
 - C. Purity
- 1.2 Synonyms
- 1.3 Impurities
- 1.4 Additives
- 1.5 * Quantity
- 1.6 Labelling And Classification (Use And/Or Transportation)
- 1.7 * Use Pattern
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 - B. Uses In Consumer Products
- 1.8 Occupational Exposure Limit Value
- 1.9 * Sources Of Exposure
- 1.10 Additional Remarks
 - A. Options Of Disposal
 - B. Other Remarks.

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- 2.1 * Melting Point
- 2.2 * Boiling Point
- 2.3 † Density (Relative Density)
- 2.4 * Vapour Pressure
- 2.5 * Partition Coefficient N-Octanol/Water
- 2.6 * Water Solubility
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- B. Ph Value, Pka Value
- 2.7 Flash Point (Liquids)
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 - 3.1.2 * Stability In Water
 - 3.1.3 Stability In Soil
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- 3.4 Mode Of Degradation In Actual Use
- 3.5 * Biodegradation
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- 3.8 Additional Remarks
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 - B. Other

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 - * A. Daphnia
 - B. Other Aquatic Organisms
- 4.3 * Toxicity To Aquatic Plants E.G., Algae
- 4.4 Toxicity To Bacteria
- 4.5 Chronic Toxicity To Aquatic Organisms
 - 4.5.1 Chronic Toxicity To Fish
 - 4.5.2 (*) Chronic Toxicity To Aquatic Invertebrates (E.G., Daphnia Reproduction)
- 4.6 Toxicity To Terrestrial Organisms
 - 4.6.1 Toxicity To Soil Dwelling Organisms
 - 4.6.2 Toxicity To Terrestrial Plants
 - 4.6.3 Toxicity To Other Non-Mammalian Terrestrial Species (Including Birds)
- 4.7 Biological Effects Monitoring (Including Biomagnification)
- 4.8 Biotransformation And Kinetics
- 4.9 Additional Remarks

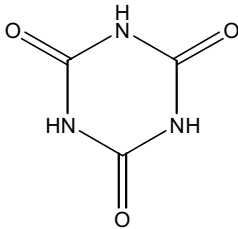
5. Toxicity

- 5.1 * Acute Toxicity
 - 5.1.1 Acute Oral Toxicity
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 - 5.1.4 Acute Toxicity By Other Routes Of Administration
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 - A. Specific Toxicities (Neurotoxicity, Immunotoxicity Etc.)
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6. References**Appendix-1**

Note: *; Data Elements In The Sids
†; Data Elements Specially Required For Inorganic Chemicals

SIDS PROFILE

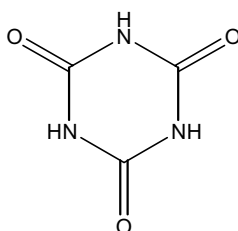
1.01 A.	CAS No.	108-80-5
1.01 C.	CHEMICAL NAME (OECD Name)	Isocyanuric acid
1.01 D.	CAS DESCRIPTOR	
1.01 G.	STRUCTURAL FORMULA	
	OTHER CHEMICAL IDENTITY INFORMATION	
1.5	QUANTITY	20,000 tonnes/year in Japan
1.7	USE PATTERN	Intermediate in closed system.
1.9	SOURCES AND LEVELS OF EXPOSURE	407.7 tonnes/year Release into river
ISSUES FOR DISCUSSION (IDENTIFY, IF ANY)	SIDS testing required: Water solubility, Vapour pressure, Octanol/water partition coefficient, Stability in water, Biodegradation, Chronic toxicity to daphnia, Combined repeat dose and reproductive toxicity, Chromosomal aberration test in vitro	

SIDS SUMMARY

CAS NO: 108-80-5		Information	OECD Study	GLP	Other Study	Estimation Method	Acceptable	SIDS Testing Required
STUDY		Y/N	Y/N	Y/N	Y/N	Y/N	Y/N	Y/N
PHYSICAL-CHEMICAL DATA								
2.1	Melting Point	Y	N	N	Y	N	Y	N
2.2	Boiling Point	Y	N	N	Y	N	Y	N
2.3	Density	N						N
2.4	Vapour Pressure	N						Y
2.5	Partition Coefficient	N						Y
2.6	Water Solubility	N						Y
	pH and pKa values	N						N
2.12	Oxidation: Reduction potential	N						N
OTHER P/C STUDIES RECEIVED								
ENVIRONMENTAL FATE and PATHWAY								
3.1.1	Photodegradation	N						N
3.1.2	Stability in water	N						Y
3.2	Monitoring data	N						N
3.3	Transport and Distribution	N						N
3.5	Biodegradation	N						Y
OTHER ENV FATE STUDIES RECEIVED								
ECOTOXICITY								
4.1	Acute toxicity to Fish	Y	N	N	Y	N	N	Y
4.2	Acute toxicity to Daphnia	Y	N	N	Y	N	N	Y
4.3	Toxicity to Algae	N						Y
4.5.2	Chronic toxicity to Daphnia	N						Y
4.6.1	Toxicity to Soil dwelling organisms	N						N
4.6.2	Toxicity to Terrestrial plants	N						N
4.6.3	Toxicity to Birds	N						N
OTHER ECOTOXICITY STUDIES RECEIVED								
TOXICITY								
5.1.1	Acute Oral	Y	N	N	Y	N	Y	N
5.1.2	Acute Inhalation	Y	N	N	Y	N	Y	N
5.1.3	Acute Dermal	Y	N	N	Y	N	Y	N
5.4	Repeated Dose	Y	N	Y	Y	N	Y	Y
5.5	Genetic Toxicity <i>in vitro</i>							
	. Gene mutation	Y	N	N	Y	N	Y	N
	. Chromosomal aberration	N						Y
5.6	Genetic Toxicity <i>in vivo</i>	Y	N	N	Y	N	Y	N
5.8	Reproduction Toxicity	Y	N	Y	Y	N	Y	Y
5.9	Development / Teratogenicity	Y	N	Y	Y	N	Y	N
5.11	Human experience	Y	N	N	Y	N	Y	N
OTHER TOXICITY STUDIES RECEIVED		Y	N	N	Y	N	Y	N

1. GENERAL INFORMATION**1.01 SUBSTANCE INFORMATION**

- *A. CAS number** 108-80-5
- B. Name (IUPAC name)**
- *C. Name (OECD name)** Isocyanuric acid

†D. CAS Descriptor**E. EINECS-Number** 203-618-0**F. Molecular Formula** C₃H₃N₃O₃***G. Structural Formula****H. Substance Group****I. Substance Remark****J. Molecular Weight** 129.08**1.02 OECD INFORMATION****A. Sponsor Country:** Japan**B. Lead Organisation:**

Name of Lead Organisation: Ministry of Health and Welfare (MHW)
 Ministry of International Trade and Industry (MITI)
 Environmental Agency (EA)
 Ministry of Labour (MOL)

Contact person: Mr. Kazuhide Ishikawa
 Second International Organization Division
 Economic International Bureau
 Ministry of Foreign Affairs

Address: Street: 2-2-1 Kasumigaseki, Chiyoda-ku, Tokyo 100 Japan
 Tel: 81-3-3581-0018
 Fax: 81-3-3503-3136

C. Name of responder

Same as above contact person

1.1 GENERAL SUBSTANCE INFORMATION**A. Type of Substance**

element []; inorganic[]; natural substance []; organic[X];
organometallic []; petroleum product []

B. Physical State (at 20°C and 1.013 hPa)

gaseous []; liquid []; solid [X]

C. Purity

99.7 %

1.2 SYNONYMS

sym-Triazine-2,4,6-triol; sym-Triazinetriol; normal Cyanuric acid; 2,4,6-Trihydroxy-1,3,5-triazine; Trihydroxycyanidine; Tricyanic acid; Pseudocyanuric acid; 1,3,5-Triazine-2,4,6(1H,3H,5H)-trione; 1,3,5-Triazine-2,4,6-triol; 1,3,5-Triazinetriol; 1,3,5-Triazinetrione; Tricarbimide; Trihydroxy-1,3,5-triazine

1.3 IMPURITIES

None

1.4 ADDITIVES

None

***1.5 QUANTITY**

Remarks: 20,000 tonnes/year
Reference: MITI, Japan

1.6 LABELLING AND CLASSIFICATION

None

1.7 USE PATTERN*A. General****Type of Use:****Category:**

main	Intermediate
industrial	Intermediate in closed system
use	Intermediate for various chemicals

Remarks: None
Reference: MITI, Japan

1.8 OCCUPATIONAL EXPOSURE LIMIT

None

*** 1.9 SOURCES OF EXPOSURE**

In Japan, isocyanuric acid is produced in 2 companies.

Source:	Media of release:	River
	Quantities per media:	407.7 tonnes/year
Remarks:		
Reference:	MITI, Japan	

2. PHYSICAL-CHEMICAL DATA***2.1 MELTING POINT**

Value:	330 °C
Decomposition:	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Ambiguous <input type="checkbox"/>
Sublimation:	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Ambiguous <input type="checkbox"/>
Method:	
GLP:	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> ? <input type="checkbox"/>
Remarks:	
Reference:	Organic Chemical Dictionary

***2.2 BOILING POINT**

Value:	not measurable
Pressure:	
Decomposition:	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Ambiguous <input type="checkbox"/>
Method:	
GLP:	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> ? <input type="checkbox"/>
Remarks:	
Reference:	MITI, Japan

***2.4 VAPOUR PRESSURE**

Value:	$< 5.0 \times 10^{-3}$ Pa
Temperature:	25 °C
Method:	calculated <input type="checkbox"/> ; measured <input checked="" type="checkbox"/> OECD TG 104
GLP:	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> ? <input type="checkbox"/>
Test substance:	purity: 99.9 %
Remarks:	
Reference:	MITI, Japan

***2.5 PARTITION COEFFICIENT $\log_{10} P_{ow}$**

Log Pow:	< 0.3
Temperature:	25 °C

Method: calculated []; measured [X]
 OECD TG 107 HPLC method
 GLP: Yes [X] No [] ? []
 Test substance: purity: 99.9 %
 Remarks:
 Reference: MITI, Japan

*2.6 WATER SOLUBILITY

A. Solubility

Value: 2.7 g/l
 Temperature: 25 °C
 Description: Miscible []; Of very high solubility [X]; Soluble []; Slightly soluble []; Of low solubility []; Of very low solubility []; Not soluble []
 Method: OECD TG 105
 GLP: Yes [X] No [] ? []
 Test substance: purity: 99.9 %
 Remarks:
 Reference: MITI, Japan

B. pH Value, pKa Value

Value: pK₁ = 6.88
 pK₂ = 11.40
 pK₃ = 13.50
 Reference: Merck Index

3. ENVIRONMENTAL FATE AND PATHWAYS

3.1 STABILITY

*3.1.2 STABILITY IN WATER

Type: Abiotic (hydrolysis) [X]; biotic (sediment)[]
 Half life: Stable in pH 4, 7, 9 at 25 °C
 Method: OECD TG 111
 GLP: Yes [X] No [] ? []
 Test substance: purity: 99.9 %
 Remarks:
 Reference: MITI, Japan

*3.2 MONITORING DATA (ENVIRONMENTAL)

(a)
 Type of Measurement: Background []; At contaminated site []; Other [X]
 Media: Surface water (lake)
 Results: ND (Detection limits: 0.002 mg/l) in 3 areas in Japan as of 1983

Remarks:	ND: Not detected
Reference:	Chemicals in the environment, EA, Japan (1984)
(b)	
Type of Measurement:	Background []; At contaminated site []; Other [X]
Media:	Surface water (estuary)
Results:	ND (Detection limits: 0.004 mg/l) in 1 area in Japan as of 1983
Remarks:	ND: Not detected
Reference:	Chemicals in the environment, EA, Japan (1984)
(c)	
Type of Measurement:	Background []; At contaminated site []; Other [X]
Media:	Surface water (sea)
Results:	ND (Detection limits: 0.002 - 0.004 mg/l) in 6 areas in Japan as of 1983
Remarks:	ND: Not detected
Reference:	Chemicals in the environment, EA, Japan (1984)
(d)	
Type of Measurement:	Background []; At contaminated site []; Other [X]
Media:	Sediment (lake)
Results:	ND (Detection limits: 0.12 - 0.24 mg/kg-dry) in 3 areas in Japan as of 1983
Remarks:	ND: Not detected
Reference:	Chemicals in the environment, EA, Japan (1984)
(e)	
Type of Measurement:	Background []; At contaminated site []; Other [X]
Media:	Sediment (estuary)
Results:	ND (Detection limit: 0.09 mg/kg-dry) in 1 area in Japan as of 1983
Remarks:	ND: Not detected
Reference:	Chemicals in the environment, EA, Japan (1984)
(f)	
Type of Measurement:	Background []; At contaminated site []; Other [X]
Media:	Sediment (sea)
Results:	ND (Detection limit: 0.025 - 0.15 mg/kg-dry) in 6 areas in Japan as of 1983
Remarks:	ND: Not detected
Reference:	Chemicals in the environment, EA, Japan (1984)

3.3 TRANSPORT AND DISTRIBUTION BETWEEN ENVIRONMENTAL COMPARTMENTS INCLUDING ESTIMATED ENVIRONMENTAL CONCENTRATIONS AND DISTRIBUTION

***3.3.2 THEORETICAL DISTRIBUTION (FUGACITY CALCULATION)**

Media:	Air-biota []; Air-biota-sediment-soil-water [X]; Soil-biota []; Water-air []; Water-biota []; Water-soil []; Other []
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Method: Fugacity level I ; Fugacity level II ; Fugacity level III ; Fugacity level IV ; Other (calculation) ; Other (measurement)

Results:

Compartment	Release 100% to air	Release 100% to water	Release 100% to soil
Air	0.1 %	0.0 %	0.0 %
Water	46.5 %	99.6 %	40.5 %
Soil	53.3 %	0.0 %	59.3 %
Sediment	0.2 %	0.4 %	0.2 %

Remarks: Appendix 1
Reference: MITI, Japan

*3.5 BIODEGRADATION

Type: aerobic ; anaerobic
Inoculum: adapted ; non-adapted
Concentration of the chemical: related to COD ; DOC ; test substance
Medium: water ; water-sediment ; soil ; sewage treatment
Degradation: 0 % by BOD after 14 days
7.8 % by TOC after 14 days
5.3 % by HPLC after 14 days
Results: readily biodeg. ; inherently biodeg. ; under test condition no biodegradation observed , other
Method: OECD TG 301C
GLP: Yes No ?
Test substance: purity: 99.9 %
Reference: MITI, Japan

3.7 BIOACCUMULATION

Species: Carp (*Cyprinus carpio*)
Exposure period: 6 weeks
Temperature: 25 °C
Concentration: (1) 10 mg/L
(2) 1 mg/L
BCF: (1) < 0.1
(2) < 0.5
Method: OECD TG 305C
Type of test: calculated ; measured
static ; semi-static ; flow-through ; other (*e.g. field test*)
GLP: Yes No ?
Test substance: purity: 99.9 %
Remarks:
Reference: MITI, Japan

4. ECOTOXICITY

*4.1 ACUTE/PROLONGED TOXICITY TO FISH

- (a) Type of test: static ; semi-static ; flow-through ; other (*e.g. field test*)
 open-system ; closed-system
- Species: *Oryzias latipes* (Himedaka)
- Exposure period: 96 h
- Results: LC₅₀ (96h) > 100 mg/l
- Analytical monitoring: Yes No ?
- Method: OECD TG 203 (1992)
- GLP: Yes No ?
- Test substance: As prescribed by 1.1 - 1.4, purity: 99.7 %
- Remarks: Groups of 10 Himedaka were exposed to the nominal concentrations of 6.25, 12.5, 25, 50 and 100 mg/l and laboratory water control. Solubilizer was not used. Concentrations of the test substance were kept close to the nominal concentrations (99.5 to 103 %).
- Reference: Environment Agency of Japan (1996)
- (b) Type of test: static ; semi-static ; flow-through ; other (*e.g. field test*)
 open-system ; closed-system
- Species: *Oryzias latipes* (Himedaka)
- Exposure period: 14 d
- Results: LC₅₀ (14d) > 100 mg/l
- Analytical monitoring: Yes No ?
- Method: OECD TG 203 (1992)
- GLP: Yes No ?
- Test substance: As prescribed by 1.1 - 1.4, purity: 99.7 %
- Remarks: Groups of 10 Himedaka were exposed to the nominal concentrations of 10, 32 and 100 mg/l and laboratory water control. Solubilizer was not used. Concentrations of the test substance were kept close to the nominal concentrations throughout the 14-d test (99 to 102 %).
- Reference: Environment Agency of Japan (1996)

4.2 ACUTE TOXICITY TO AQUATIC INVERTEBRATES

*A. **Daphnia**

- Type of test: static ; semi-static ; flow-through ; other (*e.g. field test*)
 open-system ; closed-system
- Species: *Daphnia magna*.
- Exposure period: 48 h
- Results: EC₅₀ (48h) = 1000 mg/l
- Analytical monitoring: Yes No ?
- Method: OECD TG 202
- GLP: Yes No ?
- Test substance: As prescribed by 1.1 - 1.4, purity: 99.7 %

Remarks: 20 daphnids (4 replicates; 5 organisms per replicate) were exposed to measured concentrations of 100, 180, 320, 580 and 1000 mg/l and laboratory water control. Solubilizer was not used. Concentrations of the test substance were kept close to the nominal concentrations throughout the 48-h test (99.2 to 103.0 %).

Reference: Environment Agency of Japan (1996)

*4.3 TOXICITY TO AQUATIC PLANTS, e.g. algae

Species: *Selenastrum capricornutum* ATCC 22662
 Endpoint: Biomass [X]; Growth rate []; Other []
 Exposure period: 72 h
 Results: Biomass EC₅₀ (72h) = 620 mg/l
 (Endpoint) NOEC = 62.5 mg/l
 Analytical monitoring: Yes [X] No [] ? []
 Method: OECD TG 201 (1984)
 open-system []; closed-system [X]
 GLP: Yes [X] No [] ? []
 Test substance: As prescribed by 1.1 - 1.4, purity: 99.7 %
 Remarks: Static test. The EC₅₀ value for biomass was calculated based on the measured concentrations of the nominal concentrations 62.5, 125, 250, 500 and 1000 mg/l. No solubilizer was used. Concentrations of the test substance were kept close to the nominal concentrations throughout the 72-h test (98 to 105 %).

Reference: Environment Agency of Japan (1996)

4.4 TOXICITY TO BACTERIA

No data

4.5 CHRONIC TOXICITY TO AQUATIC ORGANISMS

4.5.1 CHRONIC TOXICITY TO FISH

(*4.5.2 CHRONIC TOXICITY TO AQUATIC INVERTEBRATES

Type of test: static []; semi-static [X]; flow-through []; other (e.g. field test) []
 ; open-system [X]; closed-system []
 Species: *Daphnia magna*
 Endpoint: Mortality []; Reproduction rate [X]; Other [X]
 Exposure period: 21 d
 Results: Reproduction rate: EC₅₀ (21 d) = 65.9 mg/l
 (Endpoint) NOEC = 32.0 mg/l
 Analytical monitoring: Yes [X] No [] ? []
 Method: OECD TG 202(1984)
 GLP: Yes [X] No [] ? []
 Test substance: As prescribed by 1.1 - 1.4, purity: 99.7 %
 Remarks: 40 daphnids (4 replicate; 10 daphnids per replicate) were exposed to the nominal concentrations of 1.0, 3.2, 10, 32 and 100 mg/l and laboratory water control (dechlorinated tap water).

Concentrations of the test substance were kept close to the nominal concentrations throughout the 21-d test (95 to 103 %). The test water was renewed every 2 or 3 days.
 Reference: Environment Agency of Japan (1996)

4.6 TOXICITY TO TERRESTRIAL ORGANISMS

4.6.1 TOXICITY TO SOIL DWELLING ORGANISMS

No data

4.6.2 TOXICITY TO TERRESTRIAL PLANTS

No data

4.6.3 TOXICITY TO OTHER NON MAMMALIAN TERRESTRIAL SPECIES (INCLUDING AVIAN)

No data

4.7 BIOLOGICAL EFFECTS MONITORING (INCLUDING BIOMAGNIFICATION)

No data

4.8 BIOTRANSFORMATION AND KINETICS

No data

4.9 ADDITIONAL REMARKS

None

5. TOXICITY

*5.1 ACUTE TOXICITY

5.1.1 ACUTE ORAL TOXICITY

(a) Type: LD₀ []; LD₁₀₀ []; LD₅₀ [X]; LD_{L0} []; Other []
 Species/strain: Rats/albino
 Value: 7,700 mg/kg b.w.
 Method: Other
 GLP: Yes [] No [X] ? []
 Test substance: purity: unknown
 Remarks:
 Reference: Babayan & Aleksandryan: 1985

(b) Type: LD₀ []; LD₁₀₀ []; LD₅₀ [X]; LD_{L0} []; Other []
 Species/strain: Rats
 Value: > 7,500 mg/kg b.w.

- Method: Other
 GLP: Yes [] No [X] ? []
 Test substance: Sodium isocyanurate, purity: unknown
 Remarks:
 Reference: *Gigiiena i Sanitariya*: 1962
- (c) Type: LD₀ []; LD₁₀₀ []; LD₅₀ [X]; LD_{L0} []; Other []
 Species/strain: Mice
 Value: 3,400 mg/kg b.w.
 Method: Other
 GLP: Yes [] No [X] ? []
 Test substance: purity: unknown
 Remarks:
 Reference: Babayan & Aleksandryan: 1985
- (d) Type: LD₀ []; LD₁₀₀ []; LD₅₀ []; LD_{L0} [X]; Other []
 Species/strain: Rabbits
 Value: > 10 g/kg b.w.
 Method: Other
 GLP: Yes [] No [X] ? []
 Test substance: purity: unknown
 Remarks:
 Reference: Toxicity Information: 1972

5.1.2 ACUTE INHALATION TOXICITY

Type: LC₀ []; LC₁₀₀ []; LC₅₀ []; LCL₀ []; Other [X]
 Species/strain: Rats
 Exposure time: not indicated
 Value: 612 mg/m³
 Method: Other
 GLP: Yes [] No [X] ? []
 Test substance: As an aerosol, purity: unknown
 Remarks: Minimum toxic concentration
 Reference: Babayan & Aleksandryan: 1985

5.1.3 ACUTE DERMAL TOXICITY

Type: LD₀ []; LD₁₀₀ []; LD₅₀ [X]; LD_{L0} []; Other []
 Species/strain: Rabbits
 Value: > 7,940 mg/kg b.w.
 Method: Other
 GLP: Yes [] No [X] ? []
 Test substance: purity: unknown
 Remarks:
 Reference: Toxikologische Bewertung: 1993

5.1.4 ACUTE TOXICITY, OTHER ROUTES OF ADMINISTRATION

Type: LD₀ []; LD₁₀₀ []; LD₅₀ [X]; LD_{L0} []; Other []
 Species/strain: Rats

Route of Administration: i.m. []; i.p. []; i.v. [X]; infusion []; s.c. []; other []
 Exposure time:
 Value: > 100 mg/kg b.w.
 Method: Other
 GLP: Yes [] No [X] ? []
 Test substance: purity: unknown
 Remarks:
 Reference: *Gigiiena i Sanitariya*: 1962

Type: LD₀ []; LD₁₀₀ []; LD₅₀ [X]; LD_{L0} []; Other []
 Species/strain: Mice
 Route of Administration: i.m. []; i.p. []; i.v. [X]; infusion []; s.c. []; other []
 Exposure time:
 Value: > 500 mg/kg b.w.
 Method: Other
 GLP: Yes [] No [X] ? []
 Test substance: purity: unknown
 Remarks:
 Reference: *Gigiiena i Sanitariya*: 1962

Type: LD₀ []; LD₁₀₀ []; LD₅₀ [X]; LD_{L0} []; Other []
 Species/strain: Cats
 Route of Administration: i.m. []; i.p. []; i.v. [X]; infusion []; s.c. []; other []
 Exposure time:
 Value: 2,144 mg/kg b.w.
 Method: Other
 GLP: Yes [] No [X] ? []
 Test substance: Sodium isocyanurate, purity: unknown
 Remarks:
 Reference: *J. Pharmacol. Exp. Ther.*: 1951

5.2 CORROSIVENESS/IRRITATION

5.2.1 SKIN IRRITATION/CORROSION

Species/strain: Rabbits
 Results: Highly corrosive []; Corrosive []; Highly irritating []; Irritating []; Moderate irritating []; Slightly irritating []; Not irritating [X]
 Classification: Highly corrosive (causes severe burns) []; Corrosive (causes burns)[]; Irritating []; Not irritating []
 Method: Federal Hazardous Substances Act (FHSA) tests
 GLP: Yes [] No [X] ? []
 Test substance: purity: unknown
 Remarks:
 Reference: Hammond *et al.*: 1986

5.2.2 EYE IRRITATION/CORROSION

(a) Species/strain: Rabbits

- Results: Highly corrosive []; Corrosive []; Highly irritating []; Irritating []; Moderate irritating []; Slightly irritating [X]; Not irritating []
- Classification: Irritating []; Not irritating []; Risk of serious damage to eyes []
- Method: Federal Hazardous Substances Act (FHSA) tests
- GLP: Yes [] No [X] ? []
- Test substance: purity: unknown
- Remarks:
- Reference: Hammond *et al.*: 1986
- (b) Species/strain: Rabbits
- Results: Highly corrosive []; Corrosive []; Highly irritating []; Irritating []; Moderate irritating [X]; Slightly irritating []; Not irritating []
- Classification: Irritating []; Not irritating []; Risk of serious damage to eyes []
- Method: Rinsed with water
- GLP: Yes [] No [X] ? []
- Test substance: purity: unknown
- Remarks: Administration into the eye at 20 mg/24 hr
- Reference: Toxicity Information: 1972
- (c) Species/strain: Rabbits
- Results: Highly corrosive []; Corrosive []; Highly irritating []; Irritating []; Moderate irritating [X]; Slightly irritating []; Not irritating []
- Classification: Irritating []; Not irritating []; Risk of serious damage to eyes []
- Method: Standard Draize test
- GLP: Yes [] No [X] ? []
- Test substance: purity: unknown
- Remarks: Administration into the eye at 500 mg/24 hr
- Reference: Marhold: 1972

5.3 SKIN SENSITISATION

No data

*5.4 REPEATED DOSE TOXICITY

- (a) Species/strain: Rats/Crj: CD (SD)
- Sex: Female []; Male []; Male/Female [X]; No data []
- Route of Administration: Oral (by gavage)
- Exposure period: Male: 44 days
Female: From 14 days before mating to day 3 of lactation
- Frequency of treatment: Daily
- Post exposure observation period:
- Dose: 0, 10, 40, 150, 600 mg/kg/day
- Control group: Yes [X]; No []; No data []; Sesame oil
Concurrent no treatment []; Concurrent vehicle [X]; Historical []
- NOAEL: 150 mg/kg/day
- LOAEL: 600 mg/kg/day

Results:	Isocyanuric acid indicated toxic effects at 600 mg/kg in both sexes. Excretion of reddish urine was evident. In addition, depression of body weight gain was observed in males. Urinalyses of males revealed appearance of crystals, which is considered this chemical precipitated from urine, and increases of erythrocytes and leukocytes. In hematological examination of males, significant decreases in erythrocyte counts, hemoglobin concentrations and hematocrit values were observed. In blood chemical examination of males, increases in urea nitrogen and creatinine, and a decrease of sodium were revealed. In histopathological examination, dilatation of the renal tubules, necrosis or hyperplasia of the tubular epithelium, increased basophilic tubules, neutrophilic infiltration, mineralization and fibrosis in the kidney, hyperplasia of the mucosal epithelium in the urinary bladder and vacuolization of the zona fasciculata in the adrenals were observed in both sexes. In addition, the incidence of atrophic thymus also showed a tendency for increase in females. Absolute and relative kidney weights and relative adrenal weights were increased in both sexes.
Method:	OECD Combined Repeat Dose and Reproductive/Developmental Toxicity Screening Test
GLP:	Yes [X] No [] ? []
Test substance:	purity: 99.8 %
Reference:	MHW, Japan: 1997
(b) Species/strain:	Rats/Rochester strain (Wistar-derived)
Sex:	Female []; Male []; Male/Female [X]; No data []
Route of Administration:	Oral (in diet)
Exposure period:	20 weeks
Frequency of treatment:	Daily
Post exposure observation period:	
Dose:	0, 0.8, 8 % (calculated daily dose: 0, 56, 560 mg/kg)
Control group:	Yes [X]; No []; No data []; Concurrent no treatment[]; Concurrent vehicle[X]; Historical[]
NOAEL:	0.8 % (56 mg/kg/day)
LOAEL:	8 % (560 mg/kg/day)
Results:	14/20 males and 4/20 females died at 8 %, but no died at 0.8 %. Considerable decrease in body weight gain was observed at 8 %. Urine samples taken prior to the start of feeding and again near termination of the study showed normal concentrations of protein and sugar. In hematological examination no change was observed. There were no changes in organ weights (thyroid, liver, brain, lungs, heart, etc.), expect for kidney weight, which increased at 8 % in females. In histologic study, dilatation of distal collecting tubules and dusts of Bellini, with focal areas of epithelial proliferation were observed at 8 % in both sexes.
Method:	Other
GLP:	Yes [] No [X] ? []
Test substance:	Sodium isocyanurate, purity: unknown
Reference:	Hodge <i>et al.</i> : 1965

- (c) Species/strain: Mice/B6C3F1
 Sex: Female []; Male []; Male/Female [X]; No data []
 Route of Administration: Oral (in drinking water)
 Exposure period: 90 days
 Frequency of treatment: Daily
 Post exposure observation period:
 Dose: 896, 1,792, 5,375 ppm
 Control group: Yes [X]; No []; No data [];
 Concurrent no treatment[X]; Concurrent vehicle[X]; Historical[]
 NOAEL: 5,375 ppm (male: 1,994 mg/kg/day, female:
 2,200mg/kg/day)
 LOAEL:
 Results: Although increase in water consumption in both sexes and absolute and relative weights of ovaries in females were observed, these changes were considered due to the high sodium content. No adverse effect was observed.
 Method: Other
 GLP: Yes [X] No [] ? []
 Test substance: Sodium isocyanurate, purity: unknown
 Remarks: Sodium hippurate was used as a second control in order to have the sodium burden as the top concentration.
 Reference: Hazleton U.S.: 1982
- (d) Species/strain: Dogs/Beagle
 Sex: Female []; Male []; Male/Female [X]; No data []
 Route of Administration: Oral (in diet)
 Exposure period: 6 months
 Frequency of treatment: Daily
 Post exposure observation period:
 Dose: 0 (vehicle), 0.8 % (calculated daily dose: 291 mg/kg)
 Control group: Yes []; No [X]; No data [];
 Concurrent no treatment[]; Concurrent vehicle[]; Historical[]
 NOAEL: 0.8 % (291 mg/kg/day)
 LOAEL:
 Results: There were no changes in body weight gain, organ weight, and sugar and protein in urine. In addition, hematological and histological changes were not observed.
 Method: Other
 GLP: Yes [] No [X] ? []
 Test substance: Sodium isocyanurate, purity: unknown
 Reference: Hodge *et al.*: 1965
- (e) Species/strain: Dogs/Beagle
 Sex: Female []; Male []; Male/Female [X]; No data []
 Route of Administration: Oral (in diet)
 Exposure period: 2 years
 Frequency of treatment: Daily
 Post exposure observation period:
 Dose: 8 % (calculated daily dose: 2,912 mg/kg)
 Control group: Yes []; No [X]; No data []

	Concurrent no treatment[<input type="checkbox"/>]; Concurrent vehicle[<input type="checkbox"/>]; Historical[<input type="checkbox"/>]
NOAEL:	
LOAEL:	8 % (2912 mg/kg/day)
Results:	Two of three dogs died after 16 and 21 months on the regimen, respectively. No change or slight increase in body weights was observed. Periodic urinalyses gave normal trace values for sugar and protein. In hematologic study, only a survival dog showed changes, which are low red blood cell counts, hemoglobin values, and hematocrits. There was no change in organ weights (thyroid, liver, brain, lungs, heart, etc.), expect for decrease in kidney weight of two dogs surviving more than 20 months. In these dogs, there was gross evidence of kidney fibrosis. Sections revealed numerous linear streaks of gray fibrous tissue extending from the papillary tip to the cortical surface. Microscopically, similar changes were observed in the kidneys of all three dogs. The collecting tubules were more uniformly and severely involved, but all portions of the nephron were compressed by fibrosis. There were slight focal dilatation and epithelial proliferation in the ducts of Bellini. In survival dog, focal areas of thyroid atrophy were found with lymphocytic infiltration, but without evidence of hyperplasia.
Method:	Other
GLP:	Yes [<input type="checkbox"/>] No [X] ? [<input type="checkbox"/>]
Test substance:	Sodium isocyanurate, purity: unknown
Reference:	Hodge <i>et al.</i> : 1965
(f) Species/strain:	Rabbits/Albino
Sex:	Female [<input type="checkbox"/>]; Male [<input type="checkbox"/>]; Male/Female [X]; No data [<input type="checkbox"/>]
Route of Administration:	Dermal
Exposure period:	Approx. 3 months
Frequency of treatment:	5 days/week
Post exposure observation period:	
Dose:	5 ml of 0.8 % or 8 % aqueous suspension
Control group:	Yes [<input type="checkbox"/>]; No [X]; No data [<input type="checkbox"/>]
	Concurrent no treatment[<input type="checkbox"/>]; Concurrent vehicle[<input type="checkbox"/>]; Historical[<input type="checkbox"/>]
NOAEL:	0.8 %
LOAEL:	8 %
Results:	Urinalyses (sugar and protein) and hematological study showed no change. There were no irritation or other adverse effects on the skin. In histological findings of liver and skin from treated and untreated area, no change was observed at the termination of the study. In the kidneys of the rabbits treated with the 8 % isocyanurate suspension, slight dilatation of the ducts of Bellini and mild tubular changes were found.
Method:	Other
GLP:	Yes [<input type="checkbox"/>] No [X] ? [<input type="checkbox"/>]
Test substance:	Sodium isocyanurate, purity: unknown
Reference:	Hodge <i>et al.</i> : 1965
(g) Species/strain:	Rabbits/Albino
Sex:	Female [<input type="checkbox"/>]; Male [<input type="checkbox"/>]; Male/Female [X]; No data [<input type="checkbox"/>]

Route of Administration: Eye application
 Exposure period: Approx. 3 months
 Frequency of treatment: 5 days/week
 Post exposure observation period:
 Dose: 0.1 ml of 0.8 % or 8 % aqueous suspension
 Control group: Yes [X]; No []; No data [];
 Concurrent no treatment[X]; Concurrent vehicle[]; Historical[]
 NOAEL: 0.8 %
 LOAEL: 8 %
 Results: Increase in body weight was observed during the period of the study in all treated groups. No eye injury was caused and no eye irritation was observed in rabbits treated with an 8 % aqueous suspension of the sodium salt.
 Method: Other
 GLP: Yes [] No [X] ? []
 Test substance: Sodium isocyanurate, purity: unknown
 Reference: Hodge *et al.*: 1965

*5.5 GENETIC TOXICITY IN VITRO

A. BACTERIAL TEST

Type: Ames test
 System of testing: *Salmonella typhimurium* TA1535, TA1537, TA98, TA100
 Concentration: 100 to 1000 µg/plate
 Metabolic activation: With []; Without []; With and Without [X]; No data []
 S9: Hamster liver - Arochlor 1254
 Results:
 Cytotoxicity conc: With metabolic activation:
 Without metabolic activation:
 Precipitation conc:
 Genotoxic effects: + ? -
 With metabolic activation: [] [] [X]
 Without metabolic activation: [] [] [X]
 Method: Other
 GLP: Yes [] No [X] ? []
 Test substance: purity: unknown
 Remarks:
 Reference: Hayworth *et al.*: 1983

Type: Other: Inductest Pasteur
 System of testing: Induction of bacteriophage Lambda in *Escherichia Coli* K12 en VA UVRB
 Concentration: 0.2 to 2000 µg/plate
 Metabolic activation: With []; Without []; With and Without [X]; No data []
 Results:
 Cytotoxicity conc: With metabolic activation:
 Without metabolic activation:
 Precipitation conc:
 Genotoxic effects: + ? -
 With metabolic activation: [] [] [X]

Without metabolic activation:

Method: Other

GLP: Yes No ?

Test substance: purity: unknown

Remarks:

Reference: NORSOLOR/APC: 1977

B. NON-BACTERIAL IN VITRO TEST

Type: Chromosomal aberration test

System of testing: Chinese hamster lung (CHL/IU) cells

Concentration: +S9 (short-term treatment): 0, 0.33, 0.65, 1.3 mg/ml
-S9 (continuous treatment): 0, 0.33, 0.65, 1.3 mg/ml
-S9 (short-term treatment): 0, 0.33, 0.65, 1.3 mg/ml

Metabolic activation: With ; Without ; With and Without ; No data

S9: Rat liver, induced with phenobarbital and 5,6-benzoflavone

Results:

Cytotoxicity conc: Not observed

Precipitation conc:

Genotoxic effects: clastogenicity polyplody
+ ? - + ? -

With metabolic activation:

Without metabolic activation:

Method: Guidelines for Screening Mutagenicity Testing of Chemicals (Japan), and OECD TG (473).

GLP: Yes No ?

Test substance: purity: 99.5 %

Remarks: Exposure period: short-term treatment: 6 hr
continuous treatment: 24, or 48 hr

Reference: Positive control: -S9: Mitomycin, +S9: Cyclophosphamide
MHW, Japan: 1997

Type: Mouse lymphoma assay

System of testing: L 5178 TK +/-

Concentration: 50 to 2000 µg/plate

Metabolic activation: With ; Without ; With and Without ; No data

Results:

Cytotoxicity conc: With metabolic activation:
Without metabolic activation:

Precipitation conc:

Genotoxic effects: + ? -

With metabolic activation:

Without metabolic activation:

Method: Other

GLP: Yes No ?

Test substance: purity: unknown

Remarks:

Reference: Industry ad hoc Committee for Isocyanurates: 1981a

Type: Sister chromatid exchange assay

System of testing: CHO cells

Concentration: 93 to 1500 µg/plate
 Metabolic activation: With []; Without []; With and Without [X]; No data []
 Results: Cytotoxicity conc: With metabolic activation:
 Without metabolic activation:
 Precipitation conc:
 Genotoxic effects: + ? -
 With metabolic activation: [] [] [X]
 Without metabolic activation: [] [] [X]
 Method: Other
 GLP: Yes [X] No [] ? []
 Test substance: purity: unknown
 Remarks:
 Reference: Industry ad hoc committee for Isocyanurates: 1981b

* 5.6 GENETIC TOXICITY IN VIVO

Type: Chromosomal aberration test
 Species/strain: Rats
 Sex: Female []; Male []; Male/Female []; No data [X]
 Route of Administration: Oral (single gavage administration)
 Exposure period:
 Doses: Up to 5000 mg/kg
 Results: Effect on mitotic
 index or P/N ratio:
 Genotoxic effects: + ? -
 [] [] [X]
 Method: Other
 GLP: Yes [] No [X] ? []
 Test substance: Sodium isocyanurate, purity: unknown
 Remarks: Rats were killed 24 and 48 hr after dosing, and bone
 marrow cells were collected and examined for
 chromosomal aberrations.
 Reference: Hammond *et al.*: 1985

5.7 CARCINOGENICITY

- (a) Species/strain: Rats/CD
 Sex: Female []; Male []; Male/Female [X]; No data []
 Route of Administration: Oral (in drinking water)
 Exposure period: 2 years
 Frequency of treatment: Daily
 Postexposure observation period:
 Doses: 0 (vehicle), 400, 1,200, 2,400, 5,375 ppm
 (Estimated daily doses were indicated only for 2,400 and 5,375
 ppm (male: 154 and 371 mg/kg/day, female: 266 and 634
 mg/kg/day))
 Control group: Yes [X]; No []; No data []; tap water
 Concurrent no treatment[]; Concurrent vehicle[X]; Historical[]
 Results: No test article related carcinogenesis.

- Method: Other
 GLP: Yes [] No [X] ? []
 Test substance: Sodium isocyanurate, purity: unknown
 Remarks: Sodium hippurate was administered at the equivalent amount of sodium to the highest dose group as a second control. Treatment-related mortality was observed in some males of highest dose group, which died during the first 12 months of the study. This mortality was due to the development of calculi in the urinary tract. In some males that died on test and in some that were sacrificed at 12 months, there were pathologic changes, including hyperplasia, bleeding, and inflamed ureters, and renal tubular nephrosis. Although slight tubular nephrosis was also observed in a few females of highest dose group during the first 12 months, these animals did not exhibit bladder calculi. Inflammatory lesions in the heart were also apparent in some of the highest dose males that died early.
 Reference: Cascieri *et al.*: 1985
- (b) Species/strain: Mice/B6C3F1
 Sex: Female []; Male []; Male/Female [X]; No data []
 Route of Administration: Oral (in drinking water)
 Exposure period: 2 years
 Frequency of treatment: Daily
 Postexposure observation period:
 Doses: 0 (vehicle), 100, 400, 1,200, 5,375 ppm
 Control group: Yes [X]; No []; No data [];
 Concurrent no treatment[]; Concurrent vehicle[X]; Historical[]
 Results: There was no evidence of test article related carcinogenesis.
 Method: Other
 GLP: Yes [X] No [] ? []
 Test substance: Sodium isocyanurate, purity: unknown
 Remarks: Sodium hippurate was administered at the equivalent amount of sodium to the highest dose group as a second control. Apparent swollen enlarged abdomen was observed at the highest dose groups (both isocyanurate and hippurate). There were no effects on survival, clinical pathology (except for urinary sodium), organ weight, gross and histopathology.
 Reference: Industry Ad hoc Committee for Isocyanurates, Hazleton laboratories, Report 2169-100 (1986)
- (c) Species/strain: Rats
 Sex: Female []; Male []; Male/Female []; No data [X]
 Route of Administration: Subcutaneous
 Exposure period: 2 years
 Frequency of treatment: Once a week
 Postexposure observation period:
 Doses: Total dose: 6.06 g (approx. daily dose: 8.3 mg/day)
 Control group: Yes []; No []; No data [X];
 Concurrent no treatment[]; Concurrent vehicle[]; Historical[]

Results: A lymphosarcoma in lungs has been observed in 1 of the 5 surviving rats after 28 months, and a subdermal lipoma in 1 of the other rats after 30.5 months.

Method: Other

GLP: Yes [] No [X] ? []

Test substance: purity: unknown

Remarks:

Reference: Toxikologische Bewertung.: 1993

(d) Species/strain: Mice

Sex: Female []; Male []; Male/Female []; No data [X]

Route of Administration: Subcutaneous

Exposure period: 2 years

Frequency of treatment: Once a week

Postexposure observation period:

Doses: Total dose: 0.6 g (estimated daily dose: 0.82 mg/day)

Control group: Yes []; No []; No data [X];
Concurrent no treatment[]; Concurrent vehicle[]; Historical []

Results: No tumours were observed.

Method: Other

GLP: Yes [] No [X] ? []

Test substance: purity: unknown

Remarks:

Reference: Toxikologische Bewertung.: 1993

*5.8 TOXICITY TO REPRODUCTION

(a) Type: Fertility []; One-generation study []; Two-generation study []; Other [X]

Species/strain: Rats/Crj: CD (SD)

Sex: Female []; Male []; Male/Female [X]; No data []

Route of Administration: Oral (by gavage)

Exposure period: Male: 14 days before mating
Female: 14 days before mating to day 3 of lactation

Frequency of treatment: Daily

Post exposure observation period:

Premating exposure period: 14 days

Duration of the test:

Dose: 0, 10, 40, 150, 600 mg/kg/day

Control group: Yes [X]; No []; No data []; Sesame oil
Concurrent no treatment[]; Concurrent vehicle[X]; Historical[]

NOEL Parental: Male: 600 mg/kg/day, Female: 600 mg/kg/day

NOEL F1 Offspring: 600 mg/kg/day

NOEL F2 Offspring:

Results: General parental toxicity:
Isocyanuric acid indicated no alteration in reproductive parameters including the copulation index, fertility index, gestation length, numbers of corpora lutea or implantations, implantation index, gestation index, delivery index, and behavior at delivery and lactation.

	<p>Toxicity to offspring: There were no significant differences in offspring parameters including number of offspring or live offspring, the sex ratio, live birth and viability indices, and body weight. No external or visceral abnormalities related to the test substance were detected in any of the offspring.</p>
Method:	OECD Combined Repeat Dose and Reproductive/Developmental Toxicity Screening Test
GLP:	Yes [X] No [] ? []
Test substance:	purity: 99.8 %
Remarks:	
Reference:	MHW, Japan: 1997
(b) Type:	Fertility []; One-generation study []; Two-generation study []; Other [X] *Three generation study
Species/strain:	Rats/CD
Sex:	Female []; Male []; Male/Female [X]; No data []
Route of Administration:	Oral (in drinking water)
Exposure period:	P0: A minimum of 100 days from 36 days of age to mating F1 and F2: 120 days after weaning F3: 4 weeks
Frequency of treatment:	Daily
Post exposure observation period:	
Premating exposure period:	A minimum of 100 days
Duration of the test:	
Dose:	0 (vehicle), 400, 1,200, 5,375 ppm
Control group:	Yes [X]; No []; No data []; tap water Concurrent no treatment[]; Concurrent vehicle[X]; Historical[]
NOAEL Parental:	5,375 ppm (Approx. 370 mg/kg/day for male, 634 mg/kg/day for female)
NOAEL F1 Offspring:	5,375 ppm
NOAEL F2 Offspring:	5,375 ppm
NOAEL F3 Offspring:	5,375 ppm
Results:	<p>General parental toxicity: No compound related changes were observed in mortality, body weight, food consumption, and gestation length. In pathological and histological findings, there were also no changes.</p> <p>Toxicity to offspring: No compound-related changes were observed in mortality, body weights, food consumption litter size, pup survival to weaning, sex ratio, and pup weight. In pathological and histological findings, epithelial hyperplasia with chronic cystitis was observed in a few of high-dose treated males in F2 offsprings, which were attributed to chronic irritation by the calculi in the urinary bladder. In other treated groups, there were no changes.</p>
Method:	Other
GLP:	Yes [X] No [] ? []
Test substance:	Sodium isocyanurate, purity: unknown

Remarks:	Sodium hippurate was provided an equivalent amount of sodium administered to high-dose sodium isocyanurate animals as second control. Weanlings from the F1 and F2 litters were randomly selected as parents for the next generation and continued on treatment. Related litters and F3 offsprings were sacrificed 4 weeks after weaning and organ weight measurements and microscopic examination of tissues were carried out.
Reference:	Wheeler <i>et al.</i> : 1985
(c) Type:	Fertility []; One-generation study []; Two-generation study []; Other [X]
Species/strain:	Mice/CD-1
Sex:	Female []; Male [X]; Male/Female []; No data []
Route of Administration:	i.p.
Exposure period:	6 weeks
Frequency of treatment:	
Post exposure observation period:	
Premating exposure period:	
Duration of the test:	6 weeks
Doses:	0 (vehicle), 125 and 250 mg/kg/day
Control group:	Yes [X]; No []; No data []; Concurrent no treatment[]; Concurrent vehicle[X]; Historical[]
NOAEL Parental:	250 mg/kg/day
NOAEL Foetal:	250 mg/kg/day
Results:	General parental toxicity: Any treatment related effects were not observed in females, mated with sodium isocyanurate treated males. Toxicity to fetus: Any toxicity was not observed.
Method:	Other
GLP:	Yes [] No [X] ? []
Test substance:	Sodium isocyanurate, purity: unknown
Remarks:	As positive control, methyl methane sulfonate was used at dose of 50 mg/kg/day. Non-treated females are mated with the treated males every week. As a result, early resorptions were observed in females mated with males treated with methyl methane sulfonate.
Reference:	FMC Corporation: 1972

*5.9 DEVELOPMENTAL TOXICITY/ TERATOGENICITY

Species/strain:	Rabbits/Dutch belted
Sex:	Female [X]; Male []; Male/Female []; No data []
Route of Administration:	Oral (by gavage)
Duration of the test:	22 days
Exposure period:	Days 6-18 of gestation
Frequency of treatment:	Daily
Doses:	0 (vehicle), 50, 200, 500 mg/kg/day

Control group:	Yes [X]; No []; No data []; 20 mL/kg water Concurrent no treatment[]; Concurrent vehicle[X]; Historical[]
NOAEL Maternal Toxicity:	50 mg/kg/day
NOAEL teratogenicity:	200 mg/kg/day
Results:	
Maternal general toxicity:	Although slight decrease in body weight were observed in mid- and high-dose groups during the treatment period, compensatory weight gains occurred after termination of treatment on day 18. There were no compound related mortality or other adverse reactions.
Pregnancy/litter data:	
Foetal data:	The mean number of live fetus/dam and the sex ratio were essentially comparable for all groups. Body weights and crown/rump lengths were reduced slightly in high-dose groups, compared to control. There was no evidence of external or internal malformations or skeletal anomalies.
Method:	Other
GLP:	Yes [] No [X] ? []
Test substance:	Sodium isocyanurate, purity: unknown
Remarks:	
Reference:	FMC Corporation, unpublished observations
Species/strain:	Rats/Sprague-Dawley
Sex:	Female [X]; Male []; Male/Female []; No data []
Route of Administration:	Oral (by gavage)
Duration of the test:	20 days
Exposure period:	Days 6-15 of gestation
Frequency of treatment:	Daily
Doses:	0 (vehicle), 200, 1,000, 5,000 mg/kg/day
Control group:	Yes [X]; No []; No data []; Concurrent no treatment[]; Concurrent vehicle[X]; Historical[]
NOAEL Maternal Toxicity:	5,000 mg/kg/day
NOAEL teratogenicity:	5,000 mg/kg/day
Results:	
Maternal general toxicity:	There were no treatment-related effects on maternal appearance, behavior and body weight gain in all groups treated with sodium isocyanurate.
Pregnancy/litter data:	
Foetal data:	No teratogenic effects were observed in all groups treated with sodium isocyanurate.
Method:	Other
GLP:	Yes [X] No [] ? []
Test substance:	Sodium isocyanurate, purity: unknown
Remarks:	Sodium control groups received sodium hippurate at doses of 1,118 and 5,590 mg/kg/day.

In sodium control group, decrease in body weight and crown/rum length, and increase in post-implantation loss and incidence of incomplete ossification were observed.

Reference: Industry ad hoc Committee for Isocyanurates: 1982

5.10 OTHER RELEVANT INFORMATION

A. Specific toxicities

There is no available data.

B. Toxicodynamics, toxicokinetics

Type: Toxicokinetics

Results: Toxicokinetics study of sodium isocyanurate was performed in rats, using [¹⁴C] sodium isocyanurate. The elimination half-life was 30 to 60 min after oral or intravenous administration at 5 mg/kg and 2.5 hr after oral administration at 500 mg/kg. At 5 mg/kg, this chemical was completely absorbed and largely eliminated in urine, while at 500 mg/kg, this chemical was incompletely absorbed and largely eliminated in feces. The remainder of radioactivity in most tissues was below the level of detection (0.1-1.0 µg/g) 7 days after treatment. In second study, rats were administered unlabeled sodium isocyanurate orally at 5 mg/kg/day for 14 days followed by the single exposure on day 15. As results of second study, no bioaccumulation and no significant changes in disposition or metabolism were observed, compared to the single exposure. In excreta, only unchanged isocyanurate was found.

Remarks:

References: Barbee *et al.*: 1983

Type: Toxicokinetics

Results: Toxicokinetics study of sodium isocyanurate was conducted in dogs, using [¹⁴C] sodium isocyanurate. Administration was performed at 5 mg/kg by oral or intravenous route and at 500 mg/kg by oral route. At 5 mg/kg, this chemical was completely absorbed and largely eliminated in urine, while at 500 mg/kg, this chemical was only partially absorbed and largely eliminated in feces. Sodium isocyanurate distributed into an apparent volume of distribution of 0.7 L/kg, which is somewhat greater than total body water volume. The elimination half-life was from 1.5 to 2 hr after administration. Dogs were also administered unlabeled sodium isocyanurate orally at 5 mg/kg/day followed by the single exposure of 5 mg/kg radiolabeled sodium isocyanurate on day 15. The remainder of radioactivity in most tissues was below the level of detection (0.1-3.3 µg/g) for all sampling times for both single and repeated dose administration. In excreta, only unchanged isocyanurate was found.

Remarks:

References:	Barbee <i>et al.</i> : 1984
Type:	Toxicokinetics
Results:	Toxicokinetics study by dermal route was performed, in which species was not indicated. After dermal application, the ¹⁴ C-labelled substance is not detectable in the blood and < 0.01% of the administered dose is found in the urine.
Remarks:	
References:	Toxikologische Bewertung: 1993

* 5.11 EXPERIENCE WITH HUMAN EXPOSURE

Results:	Toxicokinetics of isocyanuric acid was investigated in 5 volunteers, who soaked in a swimming pool for 120 minutes. As a result, the cumulative excretion of isocyanuric acid was 0.03-2.8 mg, equivalent to 3.0-3.6 ml of pool water and the elimination half-life is calculated as 3 hr. On the other hand, recovery of ingested isocyanuric acid is 98 % in urine. No correlation observed between toxicokinetics and gamma glutamyl transpeptidase activity. Distribution 1 compartment open model.
Remarks:	
Reference:	Allen <i>et al.</i> : 1982

6. REFERENCES

- Allen, M.L. *et al.*, *Drug Metab.Rev.*, 13(3), 499-516 (1982)
- Babayan, A.A. and Aleksandryan, A.V., *Zh.Eksp.Klin.Med.*, 25(4), 345 (1985)
- Barbee, S.J. *et al.*, *Toxicologist*, 3, 80 (1983)
- Barbee, S.J. *et al.*, *Toxicologist*, 4, 92 (1984)
- Cascieri, T. *et al.*, *Toxicologist*, 5, 58 (1985)
- FMC Corporation, Industrial Bio Test, Report E 756 (1972)
- Gigiena i Sanitariya. For English translation, see HYSAAV. 27(12), 13, (1962)
- Hammond, B.G. *et al.*, *Environ.Health Perspect.*, 69, 287 (1986)
- Hammond, B.G. *et al.*, *Fundam.Appl.Toxicol.*, 5(4), 655 (1985)
- Hayworth, S. *et al.*, *Environ Mutagenesis*, 5(1), 3 (1983)
- Hazleton, U.S. (Vienna), Thirteen week toxicity study in mice - Sodium monocyanurate, Report 2169-100 (1982)
- Hodge, H.C., *et al.*, *Toxicol.Appl.Pharmacol.*, 7, 667 (1965)
- Industry ad hoc Committee for Isocyanurates, I.R.D.C. Mattawan, Report 167-159 (1982)
- Industry ad hoc Committee for Isocyanurates, Research Institute Int., Project 013-312-582-7 (1981a)
- Industry ad hoc committee for Isocyanurates, SRI International, Project LSC 2923, Task 1 (1981b)
- *J. Pharmacol. Exp. Ther.*, 103, 420 (1951)
- Marhold, J.V., Institut Pro Vychovu Vedoucien Pracovniku Chemickeho Prumyclu Praha, Czechoslovakia, 152 (1972)

- Ministry of Health and Welfare: Japan, *Toxicity Testing Reports of Environmental Chemicals* 5, 429-442 (1997)
- NORSOLOR/APC, Inductest performed by Institut Pasteur de Paris (M. Hofnung), Contract 133 (1977)
- Toxicity Information (Monsanto Industrial Chemicals Co., Bancroft Bldg., Suite 204, 3411 Silverside Rd., Wilmington, DE 19810) (1972)
- Toxikologische Bewertung. Heidelberg, Berufsgenossenschaft der chemischen Industrie, 103, 28 p (1993)
- Wheeler, A.G. *et al.*, *Toxicologist*, 5, 189 (1985)

Appendix 1

scenario 1

	emission rate	conc.	amount	percent	transformation rate [kg/h]	
	[kg/h]	[g/m ³]	[kg]	[%]	reaction	advection
air	1,000	9.5.E-08	9.5.E+02	0.1	2.4E+00	9.5.E+00
water	0	4.2.E-02	8.4.E+05	46.5	6.8E+01	8.4.E+02
soil	0	6.0.E-01	9.7.E+05	53.3	7.7E+01	
sediment		3.3.E-02	3.3.E+03	0.2	2.7E-01	6.7.E-02
		total amount	1.8.E+06			

scenario 2

	emission rate	conc.	amount	percent	transformation rate [kg/h]	
	[kg/h]	[g/m ³]	[kg]	[%]	reaction	advection
air	0	4.3.E-12	4.3.E+02	0.0	1.1.E-04	4.3.E-04
water	1000	4.6.E-02	9.3.E+05	99.6	7.4.E+01	9.3.E+02
soil	0	2.7.E-05	4.3.E+01	0.0	3.5.E-03	
sediment		3.7.E-02	3.7.E+03	0.4	2.9.E-01	7.3.E-02
		total amount	9.3.E+05			

scenario 3

	emission rate	conc.	amount	percent	transformation rate [kg/h]	
	[kg/h]	[g/m ³]	[kg]	[%]	reaction	advection
air	0	7.9.E-10	7.9.E+00	0.0	2.0.E-02	7.9.E-02
water	0	4.2.E-02	8.3.E+05	40.5	6.7.E+01	8.3.E+02
soil	1000	7.6.E-01	1.2.E+06	59.3	9.8.E+01	
sediment		3.3.E-02	3.3.E+03	0.2	2.6.E-01	6.6.E-02
		total amount	2.1.E+06			

scenario 4

	emission rate	conc.	amount	percent	transformation rate [kg/h]	
	[kg/h]	[g/m ³]	[kg]	[%]	reaction	advection
air	600	5.7.E-08	5.7.E+02	0.0	1.5.E+00	5.7.E+00
water	300	4.3.E-02	8.7.E+05	55.1	7.0.E+01	8.7.E+02
soil	100	4.4.E-01	7.0.E+05	44.6	5.6.E+01	
sediment		3.4.E-02	3.4.E+03	0.2	2.7.E-01	6.9.E-02
		total amount	1.6.E+06			

Physico-chemical parameter

molecular weight	129.08	Measured	Temp. [°C]	25
melting point	330	Measured		
vapor pressure [Pa]	5.00E-03	Measured		
water solubility [g/m ³]	2700	Measured		
log Kow	0.3	Measured		
half life [h]	in air	272	Estimated	
	in water	8640	Estimated	
	in soil	8640	Estimated	
	in sediment	8640	Estimated	

Environmental parameter

		volume	dept h	area	organic	lipid content	density	residence
		[m ³]	[m]	[m ²]	carbon [°]	[°]	[kg/m ³]	time [h]
bulk air	air	1.0E+13					1.2	100
	particles	2.0E+03						
	total	1.0E+13	1000	1E+10				
bulk water	water	2.0E+10					1000	1000
	particles	1.0E+06			0.04		1500	
	fish	2.0E+05				0.05	1000	
	total	2.0E+10	10	2E+09				
bulk soil	air	3.2E+08					1.2	
	water	4.8E+08					1000	
	solid	8.0E+08			0.04		2400	
	total	1.6E+09	0.2	8E+09				
bulk sediment	water	8.0E+07					1000	
	solid	2.0E+07			0.06		2400	50000
	total	1.0E+08	0.05	2E+09				

Intermedia Transport Parameters

m/h

air side air-water MTC	5	soil air boundary layer MTC	5
water side air water MTC	0.05	sediment-water MTC	1E-04
rain rate	1E-04	sediment deposition	5E-07
aerosol deposition	6E-10	sediment resuspension	2E-07
soil air phase diffusion MTC	0.02	soil water runoff	5E-05
soil water phase diffusion MTC	1E-05	soil solid runoff	1E-08

EXTRACT FROM IRPTC LEGAL FILES

File: 17.01 LEGAL

rn : 303375

systematic name:1,3,5-Triazine-2,4,6(1H,3H,5H)-trione
 common name :cyanuric acid
 reported name :ISOCYANURIC ACID
 cas no :108-80-5
 area : CAN type : REG

subject	specification	descriptor
USE	OCC	RQR
STORE		
LABEL		

INGREDIENT DISCLOSURE LIST CONCENTRATION 1% WEIGHT/WEIGHT. THE WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM (WHMIS) IS A NATIONAL SYSTEM TO PROVIDE INFORMATION ON HAZARDOUS MATERIALS USED IN THE WORKPLACE. WHMIS IS IMPLEMENTED BY THE HAZARDOUS PRODUCTS ACT AND THE CONTROLLED PRODUCTS REGULATIONS (ADMINISTERED BY THE DEPARTMENT OF CONSUMER AND CORPORATE AFFAIRS). THE REGULATIONS IMPOSE STANDARDS ON EMPLOYERS FOR THE USE, STORAGE AND HANDLING OF CONTROLLED PRODUCTS AND ADDRESS LABELLING AND IDENTIFICATION, EMPLOYEE INSTRUCTION AND TRAINING, AS WELL AS THE UPKEEP OF A MATERIALS SAFETY DATA SHEET (MSDS). THE PRESENCE IN A CONTROLLED PRODUCT OF AN INGREDIENT IN A CONCENTRATION EQUAL TO OR GREATER THAN SPECIFIED IN THE INGREDIENT DISCLOSURE LIST MUST BE DISCLOSED IN THE SAFETY DATA SHEET.

entry date: APR 1991

effective date: 31DEC1987

amendment: CAGAAK, Canada Gazette Part II, 122 , 2 , 551 ,

File: 17.01 LEGAL

rn : 1122611

systematic name:1,3,5-Triazine-2,4,6(1H,3H,5H)-trione
 common name :cyanuric acid
 reported name :cyanuric acid
 cas no :108-80-5
 area : RUS type : REG

subject	specification	descriptor
AIR	OCC	MAC
		CLASS

CLV : 0.5 MG/M3 (AEROSOL) HAZARD CLASS: II

entry date: MAY 1990

effective date: 01JAN1989

amendment: GOSTS*, GOSUDARSTVENNYI STANDART SSSR (STATE STANDARD OF USSR), 12.1.005 , , , 1988

File: 17.01 LEGAL

rn : 1123035

systematic name:1,3,5-Triazine-2,4,6(1H,3H,5H)-trione
 common name :cyanuric acid
 reported name :cyanuric acid
 cas no :108-80-5
 area : RUS type : REG

subject	specification	descriptor
AQ	SURF	MAC CLASS

6.0 MG/L HAZARD CLASS: III

entry date: JUL 1990

effective date: 1JAN1989

amendment: SPNPV*, SANITARNYE PRAVILA I NORMY OKHRANY POVERKHNOSTNYKH
VOD OT ZAGRIAZNENIA (HEALTH REGULATION AND STANDARDS OF
SURFACE WATER PROTECTION FROM CONTAMINATION), 4630-88 , , ,
1988

File: 17.01 LEGAL

rn : 1320069

systematic name:1,3,5-Triazine-2,4,6(1H,3H,5H)-trione

common name :cyanuric acid

reported name :cyanuric acid

cas no :108-80-5

area : USA type : REG

subject	specification	descriptor
CLASS		RQR
MANUF		PRMT

REGISTRATION STANDARD, CHLORINATED ISOCYANURATES, 1987.; Summary - THIS
SUBSTANCE IS INCLUDED ON A LIST OF ACTIVE INGREDIENTS FOR WHICH
REGISTRATION STANDARDS HAVE BEEN ISSUED AS OF DECEMBER 24, 1988. A
REGISTRATION STANDARD IS A DOCUMENT DESCRIBING THE AGENCY'S SCIENTIFIC
CONCLUSIONS AND REGULATORY FINDINGS ABOUT CHEMICALS THAT ARE
INGREDIENTS IN PESTICIDE PRODUCTS. REGISTRANTS OF THESE PESTICIDES MUST
SUBMIT DATA ON THOSE SUBSTANCES FOR WHICH THEY ARE RESPONSIBLE.
INFORMATION WILL BE INCLUDED INTO A DATABASE WHICH WILL ALLOW EPA TO
EVALUATE HEALTH AND ENVIRONMENTAL EFFECTS AND DETERMINE APPROPRIATE
REREGISTRATION STANDARDS. THIS LIST STATES THE REGISTRATION STANDARD
TITLE AND THE YEAR OF THE ISSUANCE OF THE REGISTRATION STANDARD.

entry date: JAN 1992

effective date: 1988

title: FEDERAL INSECTICIDE, FUNGICIDE, AND RODENTICIDE ACT: PESTICIDES
FOR WHICH REGISTRATION STANDARDS HAVE BEEN ISSUED. LIST A.

original : FEREAC, Federal Register, 54 , 34 , 7740 , 1989

amendment: FEREAC, Federal Register, 54 , 34 , 7740 , 1989

