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NATIONAL INDUSTRIAL CHEMICALS NOTIFICATION AND ASSESSMENT SCHEME

FULL PUBLIC REPORT

1,1,1- TRIFLUOROETHANE

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For Enquiries please contact the Administration Coordinator at:

Street Address: 92 Parramatta Rd Camperdown, NSW 2050, AUSTRALIA
Postal Address: GPO Box 58, Sydney 2001, AUSTRALIA
Telephone: (61) (02) 565-9466 **FAX (61) (02) 565-9465**

Director
Chemicals Notification and Assessment

ASSESSMENT REPORT

1,1,1-TRIFLUOROETHANE

1. APPLICANT

Elf Atochem (Australia) Pty Ltd of Level 6, 65 Berry Street, North Sydney, NSW 2060, have submitted a standard notification for assessment of 1,1,1-trifluoroethane.

2. IDENTITY OF THE CHEMICAL

Chemical name: 1,1,1-Trifluoroethane

Chemical Abstracts Service (CAS) Registry No.: 420-46-2

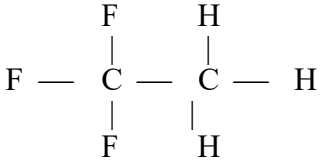
Trade names:

Forane Fx70(blend)
Contains: 46% Trifluoroethane
7% Pentafluoroethane
47% Chlorodifluoromethane

Forane Fx10(blend)
Contains: 44% Pentafluoroethane
4% Tetrafluoroethane
52% Trifluoroethane

Molecular formula: CF_3-CH_3

Structural formula:



Molecular weight: 84

Method of detection and determination:
Infrared spectroscopy

Spectral data:
Infrared spectrum: Major peaks were observed at: 1454, 1439, 1421, 1391, 1231, 966 and 829 cm^{-1}

3. PHYSICAL AND CHEMICAL PROPERTIES

Appearance at 20°C and 101.3 kPa:	Colourless, odourless gas
Boiling Point:	-47.6°C
Vapour Pressure:	1105 kPa at 20°C 1260 kPa at 25°C
Water Solubility:	0.05%(wt) at 25°C and 101.3 kPa
Partition Co-efficient:	Not applicable. The substance is a gas and will partition into the atmosphere.
Hydrolysis as a function of pH:	The notified substance contains no hydrolysable funtionalities.
Soil Adsorption/Desorption:	Not measured. Significant sorption to soil is not expected as the notified substance is a gas.
Dissociation Constant:	The notified substance contains no dissociable groups.
Flash Point:	-90°C
Flammability Limits:	Lower Flammability Limit 7.4% by volume in air Upper Flammability Limit 16.1% by volume in air
Decomposition Products:	Hydrogen fluoride and carbonyl halides
Autoignition Temperature:	750°C
Explosive Properties:	The notified substance is stable, but is extremely flammable.
Reactivity/Stability:	Extremely flammable gas; reacts with strong oxidising agents.

4. PURITY OF THE CHEMICAL

Degree of purity : ≥99%

Toxic impurities:

None

Non-toxic impurities (> 1% by weight):

None

Additive/Adjuvant:

None

5. INDUSTRIAL USE

HFC-143a will be imported in refrigerant gas blends to be used in commercial applications only, such as supermarkets, fish markets and cold stores. These blends will replace the current chlorofluorocarbon refrigerants.

6. OCCUPATIONAL EXPOSURE

The refrigerant blends containing 1,1,1- trifluoroethane will be imported in 1 tonne tanks or ISO containers approved for international shipping.

The number and category of workers potentially exposed to the notified chemical are shown in the following table.

Table 1: Number and Category of workers exposed to 1,1,1-trifluoroethane

Stage of Use	Category of worker	Number exposed	Exposure Source
Import	Dock/Waterside workers	2-5	Cylinder leakage
Transport from dock to Elf Atochem Warehouse	Transport drivers	2-5	Cylinder leakage
Storage at Elf Atochem Warehouse	Warehouse workers Repackaging technicians	6-10 5	Cylinder leakage
Transport to end users	Transport drivers	5-10	Cylinder leakage
Charging and maintenance of refrigeration systems	Refrigeration mechanics Service personnel	50-500 50-1000	Cylinder leakage, emissions from coupling/uncoupling charging hoses leakage from refrigeration plant during operation.

The nature of work done by various categories of worker and the likely duration of exposure are as follows:

Table 2: Nature of work done and duration of exposure to 1,1,1-trifluoroethane

Category of worker	Nature of work done	Maximum duration(hrs/day, days/yr)	Form of chemical during exposure
Waterside wokers	Unload pressurised tanks and ISO containers and load onto trucks	10 times/yr 2-3 hr/day	Liquefied compressed gas
Repackaging technicians	Gases are decanted into smaller cylinders for tansport to their sites	10 times/yr 6-8 hr/day	Liquefied compressed gas
Service personnel /refrigeration mechanics	Carry cylinders between jobs/vehicles, connect and disconnect charging hoses to cylinders, service refrigeration plant	Not available	Liquefied compressed gas or vapour.

Exposure to 1,1,1-trifluoroethane is expected to be minimal in view of the methods employed to minimise release of ozone depleting gases to the atmosphere (1). During charging of refrigeration units with refrigerant closed piping is employed. Release of about 0.1 g of refrigerant can normally occur when the flexible hose connectors between the refrigeration system and the cylinder are disconnected at the end of charging. The hoses are fitted with automatic shut-off valves which prevent release of the contents of the hose.

7. PUBLIC EXPOSURE

There will be low potential for public exposure to the notified chemical during shipment and transportation.

Following transport to end users such as supermarkets, cold stores and the fishing industry, gas blends containing the notified chemical will then be loaded into low temperature refrigeration units via closed piping. Under normal conditions, there is negligible potential for public exposure to 1,1,1-trifluoroethane.

Disposal practices for this refrigerant will be to recover, reclaim and recycle gas for continued use. Any additional disposal/destruction, if required, will be by high temperature incineration or plasma arc.

Therefore, public exposure to 1,1,1-trifluoroethane will be minimal.

8. ENVIRONMENTAL EXPOSURE

. Release

Use

The blends containing the notified chemical will be used to replace CFC based refrigerants in commercial applications only, such as supermarkets, fish markets and cold stores.

The notified substance will not enter the environment intentionally, but any releases during filling or use of cooling systems, or following disposal of obsolete equipment or recovery of refrigerants therefrom, will rapidly volatilise to the atmosphere. It is difficult to estimate the likely extent of releases, but commercial systems generally lose less than 10% of working charge per annum. Releases during recharge when hoses are disconnected are estimated at about 0.1 g per operation. The new blends are expensive, providing a financial incentive to minimise losses and install area monitors around large installations.

The Australian Refrigeration and Air Conditioning Code of Good Practice (1) requires that releases of ozone depleting refrigerants to the atmosphere during manufacturing, installation or servicing operations be reduced to the minimum level by re-use of refrigerant recovered. Recovery of refrigerant is required from performance testing during development and production. Refrigerant must be recovered in dedicated cylinders, identified by valving, labelling and colour coding. Where contaminated refrigerants are stored, they must be labelled to indicate the contents.

Formulation, handling and disposal

The blends will be decanted into 22 or 65 kg cylinders at the notifier's warehouse in Sydney. Some losses are likely during this operation. The notifer estimates that cumulative losses from an import volume of 50 tonnes would remain below 100 g.

Recovery, reclamation and recycling of refrigerants is preferred to disposal. For disposal, the Code(1) requires that unusable or surplus refrigerant not be discharged to the atmosphere, but be returned to the supplier or stored in a cool shaded place pending disposal. Reprocessing will not occur in Australia as such activities require a production facility. Local disposal will also not occur as acceptable disposal facilities do not exist currently in Australia.

. Fate

Given its high volatility, any 1,1,1-trifluoroethane released to the environment will partition almost entirely to the atmosphere. The main degradation pathway in the environment is reaction with tropospheric hydroxyl radicals, which abstract hydrogen. Atmospheric lifetimes of refrigerant gases are compiled under the Alternative Fluorocarbons Environmental Acceptability Study (AFEAS). Recent AFEAS data sheets indicate an atmospheric lifetime of 64.2 years for the notified substance. A lifetime of about 40 years has been reported elsewhere (2).

A generic scheme has been developed for predicting the fate of HFCs and HCFCs (2). According to this scheme, hydrogen abstraction from 1,1,1-trifluoroethane would generate the trifluoroethyl radical, which would react rapidly with oxygen to form the trifluoroperoxyethyl radical. Such radicals decay by various mechanisms with estimated lifetimes less than 10 minutes to generate trifluoroethoxy radicals or carbonyl products (in this case, trifluoroacetaldehyde). Further breakdown of these products leads via trifluoromethoxy radical to carbonyl fluoride, which is thought to be removed from the atmosphere by dry or wet deposition.

Possible alternative breakdown pathways for trifluoroacetaldehyde include photolysis to fluoroform or oxidation to trifluoroacetic acid. Fluoroform would degrade via reaction with hydroxyl radicals to carbonyl fluoride, but is more persistent in the atmosphere than the original HFC-143a. Trifluoroacetic acid would precipitate in rain. Recent studies (3) indicate that trifluoroacetate is biodegradable in aerobic and anaerobic sediments.

9. EVALUATION OF TOXICOLOGICAL DATA

9.1 Acute Toxicity

Studies on acute oral toxicity, acute dermal toxicity, skin irritation, eye irritation and skin sensitisation were not conducted. This is acceptable since 1,1,1-trifluoroethane is a gas.

9.1.1 Acute Inhalation Toxicity (4)

Groups of 6 male Crl:CD BR rats were exposed nose-only for a single 4 hour period to 0, 97,000 or 540,000 ppm 1,1,1-trifluoroethane. Following termination of treatment, the rats were observed for 14 days.

Rats exposed to 1,1,1-trifluoroethane exhibited dry, red ocular and nasal discharges but this was said to be the result of being held in restrainers.

Three rats exposed to 97,000 ppm 1,1,1-trifluoroethane showed slight weight loss on the day following exposure and 4 rats in the high dose group showed moderate to severe weight loss on the same day.

No mortality was observed during the observation period and no clinical signs of toxicity were observed in either of the exposure groups.

It can be concluded that the 4 hour acute inhalation LC_{50} is greater than 540,000 ppm.

9.2 Repeated Dose Inhalation Toxicity

9.2.1 Four-Week Repeated Dose Inhalation Study (5)

Charles River rats (10/sex/dose) were exposed nose-only by inhalation to 1,1,1-trifluoroethane at concentrations of 0, 2000, 10000 or 39000 ppm for 6 hours per day for 20 days over a 31 day period. There was no recovery period.

All treated males had statistically significant decreased body weight and body weight gain compared to controls at various intervals during the exposure period but the decreases were not dose-dependent.

A number of functional observations were made to determine an effect on the nervous system. No compound-related neurotoxic effects were observed.

No compound-related effects on haemotology or clinical chemistry were observed.

One male animal in each of the 2000 or 10000 ppm dose groups and one female animal in the 39,000 ppm dose group were found dead on test days 8, 9 and 15 respectively. The cause of death was not determined.

There were no statistically significant changes in final body or organ weights in treated groups relative to controls.

Regarding gross organ changes, small testes were noted in 1/10 and 2/10 male rats in the 10,000 and 39,000 ppm dose groups respectively.

Significant pathological changes were noted in the testes of exposed male rats. Degenerative changes were present at all exposure concentrations. Microscopically, these changes were characterised by minimal to mild accumulation of eosinophilic debris within the lumen of seminiferous tubules. Tubular architecture was generally intact and germ cell necrosis was not prominent. In the epididymes of affected animals, decreased sperm density and increased exfoliated germ cell debris were correlated to the testicular changes. The changes were minimal to mild in both the 39000 and 10000 ppm dose groups and less severe in the 2,000 ppm dose group where testicular changes were generally very slight and epididymal sperm density was affected in 3/10 animals.

All other microscopic findings noted were considered incidental occurrences of spontaneous lesions common to rats of this strain and age.

A possible explanation of the testicular changes advanced was that the rats were inadvertently exposed to excessive heat leading to increased body temperatures during the nose-only exposures.

9.2.2 Four-Week Repeated Dose Inhalation Study (6)

A second four-week repeated dose study was conducted to discover if the testicular changes observed in a previous study (see section 9.2.1 above) could be confirmed. Toxicity evaluations were limited to body weights, clinical signs and anatomic and/or histopathological evaluations of the testes and epididymes.

Charles River rats (10 males/dose) were exposed whole-body to 1,1,1-trifluoroethane at concentrations of 0, 2,000, 10,000 or 40,000 ppm for 6 hours per day, for 20 days over a 28-day period. On day 21 all rats were killed for pathological examination.

Exposed rats did not exhibit any statistically significant changes in body weight or body weight gain compared to controls.

All rats survived to scheduled termination and no compound-related clinical signs were observed in any of the exposed groups.

No effect of exposure to 1,1,1-trifluoroethane was observed on testes weights and there were no compound-related changes in gross or microscopic findings.

9.2.3 90-Day Repeated Dose Study (7)

Charles River rats (20/sex/dose) were exposed whole-body to 0, 2020, 10141 or 40072 ppm 1,1,1-trifluoroethane , 6 hours per day, 5 days per week for 90 days.

At the conclusion of the 90 day exposure approximately 10 rats per dose group were allowed to recover for approximately one month.

There were no compound-related effects on body weight or body weight gain or food consumption at any exposure concentration during either the exposure period or the recovery period.

During the exposure and recovery periods there were no compound-related effects on clinical signs.

No compound-related deaths were observed. Three rats died or were killed *in extremis*.

No compound-related effects on ocular tissue were observed.

Isolated statistically significant differences in haemotology and clinical chemistry values were within normal ranges and were not considered to be biologically significant.

There were no statistically significant or biologically significant differences in organ weights at any exposure concentration at either 90 days or at the end of the one month recovery period.

There were no compound-related gross or microscopic morphological changes to any organ at any exposure concentration after 90 days. In particular, there was no evidence of pathological changes in the testes.

9.3 Developmental Toxicity

9.3.1 Inhalation Developmental Toxicity Study in Rabbits (8)

Artificially inseminated New Zealand White rabbits were exposed to 0, 2,000, 10,000 or 40,000 ppm 1,1,1-trifluoroethane by inhalation for 6 hours (24/dose) on each of 13 consecutive days (gestational days 6-18). The control group was exposed to air. All surviving females were killed on day 29 of gestation for a scheduled laparohysterectomy.

One animal in the 2,000 ppm dose group spontaneously aborted on day 17 but was not considered compound-related in view of the fact that spontaneous abortions are not uncommon in this species and strain.

No compound-related clinical signs were noted during the study.

No compound-related changes in mean body weight, body weight gain, gravid uterine weight, net body weight or net body weight change were observed. No compound-related changes in food consumption were observed.

At the scheduled necropsy on day 29, a number of gross organ changes including a white precipitate in the amniotic fluid at one implantation site for one 2000 ppm animal were noted but these were not attributable to 1,1,1-trifluoroethane.

Organ weights (kidney, liver and lung) were comparable in the control and exposed groups.

No adverse effects on intrauterine growth or survival were observed at any exposure level. An increased mean number of implantation sites in the 10,000 ppm dose group compared to the control was statistically significant but within the historical control data. One animal in the 2,000 ppm dose group had a completely resorbed litter.

Regarding the foetal morphology, external, soft tissue and skeletal malformations were observed in 4, 14, 5 and 5 foetuses in the control, 2,000, 10,000 and 40,000 ppm dose groups, respectively. The total malformation rate (expressed as per cent per litter) was 3.1%, 8.2%, 3.4% and 7.1% for these same groups, respectively, which is within the historical control range for total malformations (0.0 - 12.9%).

9.3.2 Inhalation Developmental Toxicity Study in Rats (9)

1,1,1-Trifluoroethane was admininstered by inhalation to groups of 25 female Crl:CD BR rats 6hrs/day for 10 consecutive days on days 7-16 of gestation (the day copulation was confirmed was termed day 1 of gestation). The target dose levels chosen were 0, 2,000, 10,000 and 40,000 ppm. All animals survived to scheduled termination on day 22 of gestation. No adverse effects on body weight or body weight gain were observed. No clinical signs were noted and no compound-related effects were observed during gross postmortem examinations.
No significant dose-related effects on reproductive parameters (early deliveries, incidence of dams with total resorptions, litter means for live, dead or resorbed foetuses or mean corpora lutea) were detected. Regarding effects on the foetus, no significant effects on mean foetal weights were observed. No compound-related effects on the incidence of foetal malformations were detected.
The mean percent of affected foetuses examined for variations due to retarded development during the visceral examination was significantly increased for all test groups. The incidences were 1.6%, 10.5%, 8.7% and 10.0 % for the 0, 2,000, 10,000 and 40,000 ppm dose groups, respectively. Retarded renal papillary development was the primary and most frequently recorded observation for this category. However, it was concluded that these effects were not biologically significant because the control value was abnormally low, the increases were not dose-dependent and there was no other evidence of developmental toxicity.

9.4 Genotoxicity

9.4.1 Bacterial Reverse Mutation Assay (10)

The effect of the notified chemical on back mutation to prototrophy was tested in *Salmonella typhimurium* strains TA 98, TA 100, TA 1535, TA 1537 and TA 1538 and in *Escherichia coli* strain WP2 *uvrA* both in the presence and the absence of metabolic activation provided by rat liver S9.

Agar plates seeded with the tester strains were exposed to the notified chemical in the vapour phase at nominal concentrations up to 100% v/v.

Negative controls were within acceptable limits. Positive controls of dichloromethane (in vapour phase), benzo[a]pyrene (BaP), 2-nitrofluorene, 2-aminoanthracene (2AA), 9-aminoacridine (9AA), N-ethyl-N'-nitro-N-nitrosoguanidine (ENNG) and sodium azide gave the expected increases in mutant yields. In the absence of S9, dichloromethane was tested on all strains, sodium azide on TA 1535 and TA 100, 9AA on TA 1537, 2-nitrofluorene on TA 1538 and TA 98 and ENNG on WP2 *uvrA*. In the presence and absence of S9, 2AA was tested on TA 1535 and WP2 *uvrA* and BaP on TA 1537, TA 1538 and TA 100.

1,1,1-Trifluoroethane did not increase the level of back mutation in any strain at any dose level.

It can be concluded that 1,1,1-trifluoroethane is not genotoxic as measured by this assay.

9.4.2 Micronucleus Assay in the Bone Marrow Cells of the Mouse (11)

Groups of 10 male and 10 female CD-1(ICR)BR mice were exposed to target concentrations of 0, 2,000, 10,000 or 40,000 ppm 1,1,1-trifluoroethane for approximately 6 hours/day on 2 consecutive days. Groups of 5 males and 5 females from each negative control and treated group were killed approximately 24 and 48 hours after the final exposure. The positive control group, consisting of 5 male and 5 female mice were treated with 20 mg/kg cyclophosphamide (CP) 2 consecutive days (during which time they were sham-exposed to air) and killed approximately 24 hours after the second exposure.

No significant clinical signs were observed as a result of treatment.

One thousand polychromatic erythrocytes (PCEs) per animal were scored for the presence of micronuclei. No statistically significant increases in micronucleated PCEs were observed in male or female mice at either the 24 or 48 hour time points. As expected, CP-treated males and females showed significant increases in micronucleated PCEs compared to controls. Treatment did not change the ratio of PCEs to normochromatic erythrocytes.

It can be concluded that 1,1,1-trifluoroethane is not genotoxic as measured by this assay.

9.5 Cardiac Sensitisation in Dogs (12)

The effect of intravenous injection of beagle dogs with adrenaline before and during inhalation of 1,1,1-trifluoroethane on the electrocardiogram was studied.

Optimal doses of adrenaline were chosen on the basis of the number of ectopic beats and ranged from 2 - 12μg/kg.

The concentration of 1,1,1-trifluoroethane in the air supply ranged from 5 - 30% (v/v). Postive responses were observed only at 30% 1,1,1-trifluoroethane in 2/5 dogs.

9.6 Overall Assessment of Toxicological Data

1,1,1-Trifluoroethane exhibits low acute inhalation toxicity in rats.

Repeated dose studies suggest that 1,1,1-trifluoroethane does not exhibit toxic effects in rats exposed by inhalation for up to 90 days.

Developmental toxicological studies with dosing of females did not reveal any effects on foetal development in either rats or rabbits.

1,1,1-Trifluoroethane was found not to be genotoxic in the bacterial reverse mutation and mouse micronucleus assays.

1,1,1-Trifluoroethane was found to induce cardiac sensitisation in dogs at a dose of 30% v/v . Therefore, it can be concluded that 1,1,1-trifluoroethane is a cardiac sensitiser at high concentrations.

10. ASSESSMENT OF ENVIRONMENTAL EFFECTS

Testing was conducted on rainbow trout (13) and *Daphnia magna* (14). The former used flow-through conditions, with end-points expressed as mean daily measured concentrations. A single fish died in one replicate at 2.5 mg/L, and in each replicate at 40 mg/L (the highest concentration tested). The daphnid test used static, unaerated conditions, with results expressed as mean measured concentrations at 0 and 48 h. The EC_{50} was 300 mg/L. Results indicate that 1,1,1-trifluoroethane is practically non-toxic to aquatic fauna.

Chronic effects on aquatic fauna and acute effects on algae are not anticipated in view of the limited aquatic persistence and absence of significant toxic effects in the tests described above.

Halocarbon refrigerants can affect the atmosphere. 1,1,1-Trifluoroethane contains neither chlorine nor bromine, and thus will not act as a source of ozone depleting halogen radicals in the stratosphere. Scientists from the US National Oceanic and Atmospheric Administration concluded recently that hydrofluorocarbons have negligible potential to destroy ozone (15).

Like other halocarbons, 1,1,1-trifluoroethane makes a positive contribution to the global warming potential of the atmosphere. AFEAS data provided in the submission indicate that the global warming potential of the notified substance is smaller than those for the CFC refrigerants (CFC-12 and CFC-115) that it will replace.

11. ASSESSMENT OF ENVIRONMENTAL HAZARD

1,1,1-Trifluoroethane is not expected to exert a direct effect on living organisms as it has negligible biological activity, as evidenced by results from aquatic toxicity testing. The high volatility should ensure minimal exposure of aquatic and terrestrial compartments, and therefore minimal hazard to organisms inhabiting them.

Hazard to the atmosphere will be reduced following the proposed transition as the replacement refrigerant will not carry chlorine or bromine to the stratosphere. 1,1,1-Trifluoroethane retains significant global warming potential, but less than those of the ozone depleting CFC based refrigerants that are currently used.

12. ASSESSMENT OCCUPATIONAL HEALTH AND SAFETY EFFECTS

Animal tests suggest that 1,1,1-trifluoroethane is unlikely to exhibit toxic effects to individuals exposed by inhalation either acutely or to repeated doses. The acute inhalation studies described above extend data previously published (16) in which no mortality was observed in mice exposed for 2 hours to 500,000 ppm.

Based on developmental toxicity studies, 1,1,1-trifluoroethane is not expected to have effects on the developing foetus.

The data on genotoxicity suggest that 1,1,1-trifluoroethane is not genotoxic. However, there is evidence in the literature that 1,1,1-trifluoroethane may be mutagenic in *Salmonella typhimurium* strains TA 1535 and TA 100 (17). In the same paper 1,1,1-trifluoroethane was reported to be negative for transformation of hamster kidney cells and was not carcinogenic in Wistar rats dosed at 300 mg/kg for 52 weeks by gavage.

1,1,1-Trifluoroethane induces cardiac sensitisation in dogs though at higher doses than refrigerants it is designed to replace. For example, the lowest dose at which 1,1,1-trifluoroethane induces cardiac sensitisation is 60 times higher than for CFC-11 (trichlorofluoromethane).

Exposure to 1,1,1-trifluoroethane during charging or recharging refrigeration equipment is expected to be minimal in view of the well established procedures to minimise release of ozone-depleting gases to the atmosphere (1).

From the above considerations, the risk of adverse health effects resulting from the use of 1,1,1-trifluoroethane is low.

Although pure 1,1,1-trifluoroethane is highly flammable, the mixtures (FORANE FX10 and FORANE FX70) that are used to charge refrigeration equipment are not. Nevertheless, contact of the refrigerant with hot surfaces or open flames should be avoided because of the potential for release of hydrogen fluoride and carbonyl halides.

A possible hazard from spills of liquid FORANE FX10 OR FORANE FX70 contained in gas cylinders is their potential to cause frostbite.

13. RECOMMENDATIONS

To minimise the occupational health risk of and environmental exposure to 1,1,1-trifluoroethane the following guidelines and precautions should be observed:

- those taking sympathomimetics, bronchodilators or cough and cold medications should have their medication evaluated by their medical adviser, if exposure to the notified chemical is likely;

- physicians treating a patient after exposure to high concentrations of notified chemical should not administer adrenalin or other sympathomimetic amine stimulants.

- manufacturers, distributors and users must minimise atmospheric emissions of 1,1,1-trifluoroethane by adhering to the Australia Refrigeration and Air Conditioning Code of Good Practice.

- charging and recharging of refrigeration equipment should be conducted in well ventilated areas;

- 1,1,1-trifluoroethane is heavier than air and may displace oxygen. Care should be taken not to allow concentrations to accumulate in confined areas. Floor level ventilation should be used and pits and drains avoided.

- if engineering controls and work practices are insufficient to reduce exposure to 1,1,1-trifluoroethane to a safe level, then personal protective devices which conform to and are used in accordance with Australian Standards (AS) for eye protection (in this case a face shield) (AS 1336, AS 1337) (18,19), respiratory protection (20), thermal gloves (AS 2161) (21) and protective overalls and shoes should be worn;

- It is recommended that leak testing be conducted quarterly on equipment containing in excess of 50 kg of refrigerant.

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

14. MATERIAL SAFETY DATA SHEET

The attached MSDS for Forane FX 70 and Forane FX 10 were provided in Worksafe Australia format (22).

These MSDS were provided by ELF ATOCHEM (Australia) Pty Ltd as part of their notification statement. It is reproduced here as a matter of public record. The accuracy of this information remains the responsibility of ELF ATOCHEM (Australia) Pty Ltd.

15. REQUIREMENTS FOR SECONDARY NOTIFICATION

Under the *Industrial Chemicals (Notification and Assessment) Act 1989*, secondary notification of 1,1,1-trifluoroethane shall be required if any of the circumstances stipulated under subsection 64(2) of the Act arise. No other specific conditions are prescribed.

16. REFERENCES

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4. *Four-Hour Acute Inhalation Toxicity Study with FC-143a in Rats,* Data on File, E I du Pont de Nemours and Company, Delaware, USA, Project No.: HLR 283-90, 1990.

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6. *Four-Week Inhalation Toxicity Study with HFC-143a in Rats,* Data on File, E I du Pont de Nemours and Company, Delaware, USA, Project No.: HLR 6-92, 1992.

7. *Subchronic Inhalation Toxicity: 90-Day Study with HFC-143a in Rats,* Data on File, E I du Pont de Nemours and Company, Delaware, USA, Project No.: HLR 690-92, 1992.

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10. *Forane 143a in Vapour Phase: Assessment of Mutagenic Potential in Amino acid Auxotrophs of Salmonella typhimurium and Escherichia coli (the Ames Test),* Data on File, Pharmaco-LSR, Paris, France, Schedule No.: ATH/008, Report No.: 93/ATH/008/0209, 1993.

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13. D G Hutton, "Flow-Through Acute 96-Hour LC50 of FC-143a to Rainbow Trout (Oncorhynchus mykiss)", Haskell Laboratory Report 540-89, September 1989.

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