

Health and Safety Guide No. 47

10

ATRAZINE HEALTH AND SAFETY GUIDE



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ENVIRONMENT PROGRAMME



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Health and Safety Guide No. 47

**ATRAZINE
HEALTH AND
SAFETY GUIDE**

Published by the World Health Organization for the International
Programme on Chemical Safety
(a collaborative programme of the United Nations Environment
Programme, the International Labour Organisation, and the World
Health Organization)

WORLD HEALTH ORGANIZATION, GENEVA 1990

This report contains the collective views of an international group of experts and does not necessarily represent the decisions or the stated policy of the United Nations Environment Programme, the International Labour Organisation, or the World Health Organization

WHO Library Cataloguing in Publication Data

Atrazine : health and safety guide.

(Health and safety guide ; no. 47)

1.Atrazine - standards I.Series

ISBN 92 4 151047 1 (NLM Classification: WA 240)
ISSN 0259-7268

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Computer typesetting by HEADS, Oxford OX7 2NY, England
Printed by Wissenschaftliche Verlagsgesellschaft mbH · D-7000 Stuttgart 10

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INTRODUCTION

This Health and Safety Guide is not based on an existing Environmental Health Criteria document, but on critical national reviews. The hazard evaluation in the Health and Safety Guide was made on the basis of carefully selected studies, after scrutiny of the original publications.

In order to assist the peer-review process of the present Health and Safety Guide, a background companion document was prepared by the IPCS and can be obtained from the Manager on request; the IPCS does not intend that the background document should be published.

The first three sections of this Health and Safety Guide present essential technical information and the hazard evaluation. Section 4 includes advice on preventive and protective measures and emergency action; health workers should be thoroughly familiar with the medical information to ensure that they can act efficiently in an emergency. The section on regulatory information has been extracted from the legal file of the International Register of Potentially Toxic Chemicals (IRPTC) and from other United Nations sources.

The target readership includes occupational health services, those in ministries, governmental agencies, industry, and trade unions who are involved in the safe use of chemicals and the avoidance of environmental health hazards, and those wanting more information on this topic. An attempt has been made to use only terms that will be familiar to the intended user. However, sections 1 and 2 inevitably contain some technical terms.

Revision of the information in this Guide will take place in due course, and the eventual aim is to use standardized terminology. Comments on any difficulties encountered in using the Guide would be very helpful and should be addressed to:

The Manager
International Programme on Chemical Safety
Division of Environmental Health
World Health Organization
1211 Geneva 27
Switzerland

**THE INFORMATION IN THIS GUIDE
SHOULD BE CONSIDERED AS A
STARTING POINT TO A COMPREHENSIVE
HEALTH AND SAFETY PROGRAMME**

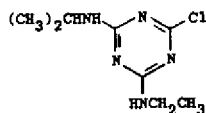
1. PRODUCT IDENTITY AND USES

1.1 Identity

Common name: atrazine

Chemical formula: $C_8H_{14}ClN_5$

Chemical structure:



Relative molecular mass: 215.7

Common trade names (including formulations): A 361; Aatrex; Aatrex 4L; Aatrex 80W; Aatrex Nine-O; Aktikon; Aktikon PK; Aktinit A; Aktinit PK Argezin; Atazinax; Atranex; Atrasine; Atratol A; Atrazin; Atred; Atrex; Candex; Cekuzina-T; Crisatrina; Crisazine; Cyazin; Farmco Atrazine; Fenamin; Fenamine; Fenatrol; G 30027; Geigy 30,027; Gesaprim; Gesoprim; Griffex; Hungazin; Hungazin PK; Inakor; Oleogesaprim; Primatol; Primatol A; Primaze; Radazin; Radizine; Strazine; Triazine A 1294; Vectal; Vectal SC; Weedex A; Wonuk; Zeazin; Zeazine

CAS chemical name: 2-chloro-4-ethylamine-6-isopropylamino-*S*-triazine

PRODUCT IDENTITY AND USES

Synonyms: *S*-triazine, 2-chloro-4-ethylamino-6-isopropylamino-; 1,3,5-triazine-2,4-diamine, 6-chloro-*N*-ethyl-*N'*-(1-methylethyl)-; 2-aethylamino-4-isopropylamino-6-chlor-1,3,5-triazin; 2-chloro-4-ethylamineiso-propylamine-*S*-triazine; 1-Chloro-3-ethylamino-5-isopropylamino-2,4,6-triazine; 1-chloro-3-ethylamino-5-isopropylamino-*S*-triazine; 2-chloro-4-ethylamino-6-isopropylamino-1,3,5-triazine; 2-chloro-4-ethylamino-6-isopropylamino-*S*-triazine 6-chloro-*N*-ethyl-*N'*-(1-methylethyl)-1,3,5-triazine-2,4-diamine; 2-chloro-4-(2-propylamino)-6-ethylamino-*S*-triazine

CAS registry number: 1912-24-9
RTECS registry number: XY5600000

According to FAO specifications, commercial atrazine should be at least 92% pure, and most products are about 95% pure. Common impurities are sodium chloride and other symmetric triazines, such as simazine and propazine. It is often formulated as wettable powders, granules, and as flowable suspensions.

Wettable powder formulations contain 450–800 g atrazine/kg (less if mixed with other pesticides), and liquid formulations (including suspension concentrate), 40–650 g/litre.

PRODUCT IDENTITY AND USES

1.2 Physical and Chemical Properties

Technical atrazine is a colourless crystalline powder with low vapour pressure (40 nPa at 20 °C). A melting point range of 175–177 °C has been reported for the technical product. It is readily soluble in dimethyl sulfoxide (183 g/litre), moderately soluble in methanol (18 g/litre), diethyl ether (12 g/litre), chloroform (52 g/litre), and ethyl acetate (28 g/litre), and very slightly soluble in water (30 mg/litre). It is stable in the dry state, but is hydrolysed to the herbicidally inactive 2-hydroxy analogue in acid or in alkaline solutions and more slowly in neutral aqueous solutions, even at elevated temperatures.

1.3 Analytical Methods

Gas chromatography with a nitrogen-phosphorus detector (NPD) is used for the determination of residues and the analysis of environmental samples. The minimum detection limit varies according to the substrate.

1.4 Production and Uses

Atrazine was introduced in 1958. In 1987, total worldwide production was estimated to be 70 000 tonnes.

Atrazine is a selective pre- and post-emergence herbicide used for the control of weeds in crops, such as asparagus, corn, sorghum, sugar cane, and pineapple. It is also used in forestry and, at higher application rates, for non-selective weed control in non-crop areas.

2. SUMMARY AND EVALUATION

2.1 Human Exposure to Atrazine

Highest human exposure to atrazine is associated with its production and its use in agriculture. Widespread, low-level exposure of the general population may occur through contaminated drinking-water.

2.2 Uptake, Metabolism, and Excretion

Atrazine is readily absorbed from the gastrointestinal tract, but only penetrates the skin to a very limited extent. The absorbed herbicide is rapidly eliminated. In the rat, the whole-body half-life is about 1.3 days, and 95% of the dose is eliminated within 7 days. The highest concentration of atrazine and/or its metabolites is found in the red blood cells, to which the triazines bind effectively. In rats given low, oral doses, daily, levels were found in the tissues in the following decreasing order: erythrocytes, liver, spleen, kidney. The primary route of elimination in rodents is via the urine (about 75%); approximately 20% is eliminated in the faeces.

Dealkylation at the C-4 and C-6 positions of the atrazine molecule are the principal metabolic degradation reactions. Dechlorination at the C-2 position also occurs, to some extent. In the rat, the major urinary metabolites include the two mono-*N*-dealkylated metabolites and the fully dealkylated derivative, 2-chloro-4,6-diamino-*S*-triazine.

2.3 Effects on Animals

The acute oral toxicity and the dermal toxicity of atrazine in rodents are both low. Acute oral studies conducted on different rodent species have indicated LD₅₀ values in the range of 1700–4000 mg/kg. Young rats are much less sensitive to atrazine than adults. Ruminants seem to be much more sensitive to the acute toxic action of atrazine than rodents. In one study, 2 doses of 250 mg/kg caused death in both sheep and cattle.

The irritant action of atrazine is only slight on rabbit skin, but is moderate for the rabbit eye.

SUMMARY AND EVALUATION

Atrazine has been subjected to extensive long-term testing on rats, mice, and dogs. Significant cardiac toxicity was observed in dogs after long-term oral administration of atrazine at doses of 5 mg/kg per day or more. In rats and mice, reduced food intake, decreased weight gain, and toxic effects on other organs were detected after long-term administration of atrazine at high dose levels (>25 mg/kg per day). These effects included muscle degeneration, retinal degeneration, necrosis of the liver, and haematological effects in rats and in mice. An increase in mammary tumours was observed in rats, but not in mice. Taking into account the very high background level of mammary tumours in untreated animals, the compound's apparent lack of genotoxicity, and the fact that the maximum tolerated dose was exceeded, these findings do not represent convincing evidence of carcinogenicity.

Atrazine exerts a fetotoxic action at, or close to, dose levels that have a deleterious action on the mothers, but does not seem to have any significant teratogenic action in rats, mice, or rabbits.

2.4 Effects on Human Beings

There are no substantiated indications that atrazine causes any health or safety hazards for the general population or for exposed workers.

2.5 Effects on the Environment

On the basis of acute and short-term dietary studies, the toxicity of atrazine for birds is low, with no mortality at 10 000 mg/kg diet. Atrazine is virtually non-toxic for bees, but is moderately toxic for aquatic organisms (96-h LC₅₀ range from 0.5 to 15 mg/litre). The herbicide is degradable and has little tendency to bioaccumulate, thereby limiting possible long-term adverse effects on wildlife and fish. As it is an effective herbicide, its phytotoxicity may constitute a problem in the case of uncontrolled applications. However, the main concern is its relative persistence (half-life of 125 days in sandy soils) and mobility in some types of soils (related to rainfall), resulting in contamination of surface and ground waters.

3. CONCLUSIONS AND RECOMMENDATIONS

The acute oral and dermal toxicities of atrazine for most mammalian species are low. Atrazine has no significant teratogenic action in rats, mice, or rabbits. There is no convincing evidence of carcinogenicity in rats or mice. Toxic effects, including ocular, cardiac, haematological, and hepatic effects, have been observed in both rats and mice after long-term administration.

On the basis of acute and short-term dietary studies, the toxicity of atrazine is low for birds and moderate for aquatic organisms. It has a low capacity for bioconcentration.

The relative persistence and mobility of atrazine in some types of soils can result in contamination of ground and surface waters. It is recommended that adequate precautions should be taken to prevent this contamination.

A few gaps in data have been identified that indicate a need for further mutagenicity testing and studies of the mechanism of tumour induction in rats.

Atrazine is moderately irritating to the eye. No significant health effects on either the general population or exposed workers are expected.

4. HUMAN HEALTH HAZARDS, PREVENTION AND PROTECTION, EMERGENCY ACTION

4.1 Main Human Health Hazards, Prevention and Protection, First Aid

The acute toxicity of technical atrazine for human beings is thought to be low, and no adverse health effects from exposure to this herbicide have been reported. In view of the toxicity induced in experimental animals on repeated exposure, proper care should be taken during occupational use to avoid excessive inhalation of dust or spray particles, and to prevent accidental contamination of food products and water.

4.1.1 Prevention and Protection

In order to reduce the risk of accidental contamination, the following precautions should be observed during handling and use:

- (a) Avoid contact with the skin and eyes.
- (b) Do not smoke, drink, or eat in the work-place. Wash hands and any exposed skin before eating, drinking, or smoking, and after work.
- (c) Avoid raising a dust cloud when handling wettable powder formulations.
- (d) Avoid breathing dust from powder products.
- (e) When unloading and handling containers, wear protective PVC or neoprene gloves.
- (f) When handling leaking containers, or when dealing with leaks and spills, wear overalls and PVC or neoprene gloves and boots. If overalls become contaminated, change and wash them thoroughly before re-use.
- (g) Store products in closed original containers, out of reach of children, and away from food, drink, and animal feed.

HUMAN HEALTH HAZARDS, PREVENTION AND PROTECTION, EMERGENCY ACTION

4.1.2 *First Aid*

Poisoning by atrazine is unlikely, unless large amounts have been ingested. In case of over-exposure, apply routine first-aid measures. If material has been spilled on the skin, immediately remove the patient from the source of contamination, remove all contaminated clothing, and wash affected areas with soap and running water. If the material is in the eyes, flush with clean water for at least 15 minutes. In case of ingestion of significant quantities, and, if the patient is conscious, give a glass of water and subsequently administer activated charcoal. Do not induce vomiting. In serious cases, medical attention should be sought.

4.2 **Advice to Physicians**

The acute toxicity of atrazine for human beings is believed to be low. There is no specific antidote. Treat symptomatically when required. When large amounts have been ingested, gastric lavage may be indicated.

4.3 **Explosion and Fire Hazards**

Technical atrazine is not flammable but, on heating, it decomposes to form toxic fumes containing oxides of nitrogen (NO_x) and hydrogen chloride (HCl). Extinguish small fires with carbon dioxide, dry powder, or alcohol-resistant foam. Water spray can be used for larger fires and the cooling of unaffected stock, but avoid the accumulation of polluted run-off from the site.

Beware: Some liquid formulations may be highly flammable and require alcohol-resistant foam as an extinguishing agent.

4.4 **Storage and Transport**

All products should be stored in secure buildings, out of reach of children and animals, and local regulations should be complied with. Containers should be sound and adequately labelled.

HUMAN HEALTH HAZARDS, PREVENTION AND PROTECTION, EMERGENCY ACTION

4.5 Spillage and Disposal

Keep spectators away from any leakage. Prevent contamination of other goods or cargo, or nearby vegetation and waterways.

Absorb spilled liquid products with sawdust or sand, sweep up and place in separate container.

Empty any product remaining in damaged or leaking containers into a clean empty container, which should be suitably labelled.

Sweep up any spilled powder with damp earth or sand or other suitable absorbent, such as sawdust, taking care not to raise a dust cloud (use a vacuum cleaner). Place in separate container for subsequent disposal. Contaminated absorbents, used containers, surplus product, etc., should be burnt in an incinerator, preferably designed for pesticide disposal. Hydrolysis under alkaline conditions (10% w/v sodium hydroxide) is a suitable method to dispose of small quantities of atrazine. Heating speeds the process. After hydrolysis, dilute and dispose of via the sewage system. Atrazine is relatively stable and characterized by high mobility in some soils and should not be buried in dump sites, etc. Comply with any local legislation applying to waste disposal.

5. HAZARDS FOR THE ENVIRONMENT AND THEIR PREVENTION

Triazines may be ingested by domestic animals. In view of the relatively high toxicity of atrazine for ruminants, exposure to atrazine of sheep and cows should be avoided. Because of its relative persistence and mobility in some types of soils, atrazine has a significant potential for contamination of ground and surface waters. The contamination of ponds, waterways, and ditches should be avoided.

6. CURRENT REGULATIONS, GUIDELINES, AND STANDARDS

The information given in this section has been extracted from the International Register of Potentially Toxic Chemicals (IRPTC) legal file. A full reference to the original national document from which the information was extracted can be obtained from IRPTC. When no effective date appears in the IRPTC legal file, the year of the reference from which the data are taken is indicated by (r).

The reader should be aware that regulatory decisions about chemicals, taken in a certain country, can only be fully understood in the framework of the legislation of that country. Furthermore, the regulations and guidelines of all countries are subject to change and should always be verified with the appropriate regulatory authorities before application.

6.1 Exposure Limit Values

Exposure limit values for atrazine are given in the table on pages 18–20.

6.2 Specific Restrictions

The National Swedish Chemicals Inspectorate has recently announced its intention to prohibit the use of atrazine and other triazine herbicides for weed elimination on gravel roads and similar surfaces.

Atrazine constitutes a contaminant required to be regulated by the US Safe Water Drinking Act of 1986, including the promulgation of a MCLG (Maximum Concentration Limit Goal).

CURRENT REGULATIONS, GUIDELINES, AND STANDARDS

EXPOSURE LIMIT VALUES^a

Medium	Specification	Country/ organization	Exposure limit description	Value	Effective date
AIR	Occupational	Australia	Time-weighted average (TWA)	5 mg/m ³	1983
		Belgium	Time-weighted average (TWA)	5 mg/m ³	1988
		Germany, Federal Republic of,	Time-weighted average (TWA) - Maximum worksite concentration	2 mg/m ³ 2 mg/m ³	1988
		Switzerland	Time-weighted average (TWA)	10 mg/m ³	1987
		United Kingdom	Maximum allowable concentration	2 mg/m ³	1977
		USSR	(Ceiling value)		
WATER	Drinking-	Canada	Interim maximum acceptable concentration	0.06 mg/litre	1987
		EEC	Maximum allowable concentration	0.1 µg/litre	-
		Switzerland	Maximum residue limit	0.1 µg/litre	1980
		WHO/EURO	Guideline value	2.0 µg/litre	1987

WATER	Oral intake	WHO/EURO	Acceptable daily intake (ADI)	0.7 mg/kg body weight	1987
FOOD	Plant (general)	EEC	Maximum residue limit	0.1 mg/kg	-
FOOD	Plant (specified)	Brazil	Acceptable limit	0.1-0.2 mg/kg	1984
FOOD	Plant (general)	Germany, Federal Republic of,	Maximum residue limit	0.1 mg/kg	1984
	Plant (specified)	Germany, Federal Republic of,	Maximum residue limit	0.5-10 mg/kg	1984
FOOD	Specified food products	Kenya	Maximum limit	0.02-0.25 mg/kg	
FOOD	Raw agricultural products (specified plant and animal products)	USA	Tolerance (Acceptable residue limit)	0.02-15 mg/kg	1982
	Oral intake	USA	Reference dose	0.005 mg/kg body weight	
FOOD	Specified food products	USSR	Acceptable daily intake (ADI)	0.004 mg/kg	1983

CURRENT REGULATIONS, GUIDELINES, AND STANDARDS

EXPOSURE LIMIT VALUES *(continued)*

Medium	Specification	Country/ organization	Exposure limit description	Value	Effective date
FOOD	Oral intake	USA	Tolerance	0.005 mg/kg	
GOODS		Brazil	Use in domestic sanitation not authorized		

^a For other regulatory data see complete legal file of IRPTC data profile.

CURRENT REGULATIONS, GUIDELINES, AND STANDARDS

6.3 Transport and Labelling

The United Nations Committee of Experts on Transportation of Dangerous Goods classifies atrazine in:

- Hazard Class 6.1: poisonous substances;
- Packing group III: substance presenting a relatively low risk of poisoning in transport.

The label should be as follows:



Division 6.1

Poisonous (toxic) substances

Packing Group: III

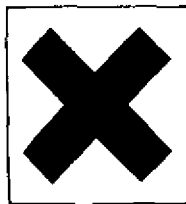
The bottom half of the label should bear the inscriptions:

HARMFUL

Stow away from foodstuffs

Symbol (St Andrew's Cross over an ear of wheat): black; Background: white

The European Economic Community legislation requires labelling as a dangerous substance, using the symbol:



Sundhedsskadelig
Mindergiftig
(Gesundheitsschädlich)
Επιβλαβές
Harmful
Nocif
Nocivo
Schadelijk

CURRENT REGULATIONS, GUIDELINES, AND STANDARDS

The label must read:

Harmful by inhalation, in contact with the skin, and if swallowed; keep out of reach of children; keep away from food, drink, and animal feed.

Price: Sw. fr. 5.-
Price in developing countries: Sw. fr. 3.50

ISBN 92 4 151047 1