



# TECHNICAL FACT SHEET

## Tough Name ... Easy on the Environment

ARSENAL is a new post-emergent and preemergent herbicides which is used by professional vegetation managers at a very low rate of only 3 L product/ha for season-long control of most annual and perennial broadleaf and grassy weeds on railways, roadsides, industrial sites, power substations or other non-crop areas where bare ground is desired.

ARSENAL contains 140 g/l of the active ingredient imazapyr formulated as an aqueous solution (water-based). ARSENAL works through both root and leaf uptake to interfere with an essential enzyme which is only found in plants. As a result, ARSENAL is easy on both the applicator and the environment because it does not pose a hazard to animals (or insects, worms, birds and fish) and it binds strongly to soil to resist leaching or lateral movement.

ARSENAL is also non-volatile and non-combustible and it is rain fast within 2 hours.

### Has ARESENAL Been Fully Tester?

ARSENAL has been registered for up to 10 years in over 20 countries worldwide. In 1994, a full Canadian registration was granted after intensive review by scientists at Health Canada, Environment Canada, Agriculture & Agri-Food Canada and the Department of Fisheries & Oceans. Tested performed since 1980 to satisfy criteria of safety, merit and value included efficacy testing (weed control), environmental persistence and leaching, short-term exposure, chronic exposure (long-term feeding studies), mutagenicity and cancer tests. Tests were performed on a wide range of target plants and non-target organisms including algae, fish, earthworms, birds, bees and mammals.

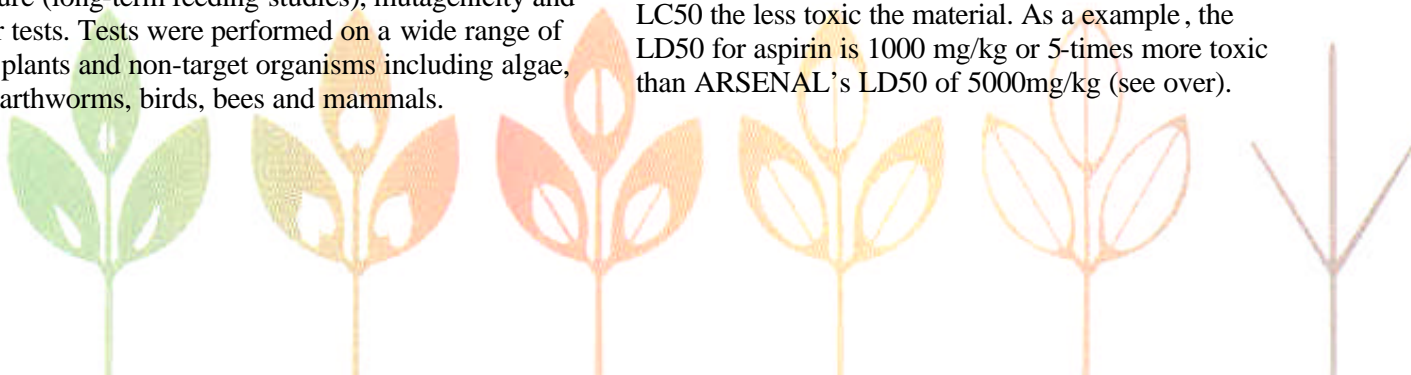
Results show that, uses as directed, ARSENAL poses no danger to non-target fauna while providing excellent control of target weeds which pose a hazard to industrial operations.

### How Does ARSENAL Work?

ARSENAL is applied when young weeds begin to grow. Once applied it is quickly absorbed through the leaves and roots (within 24 hours) and translocated in both the phloem and the xylem (vascular tissue) to the growing points of the roots and shoots. Once there, ARSENAL binds to an enzyme (AHAS) found only in plants and interferes with the plant's manufacture of three key amino acids – leucine, valine and isoleucine. Amino acids are the building blocks from which proteins are made so that without them the plant stops growing within several days and slowly expires after several weeks. Non-target fauna do not manufacture the amino acids affected by ARSENAL and do not possess the target enzyme so that ARSENAL is essentially non-toxic to organisms other than plants.

### Acute Toxicity to Non-Target Fauna.

Toxicities are measured in terms of dosages or concentrations which cause an affect on 50% of a test population. An LD50 is the dose which causes an effect on 50% of a test populations with the units of mg per kg of body weights (1 mg=1/1000gram;1 kg=1000grams). An LC50 is the concentration which causes an effect on 50% of a test populations measures in ppm (1 ppm = 1 part in 1 million parts water). The higher the LD50 or LC50 the less toxic the material. As a example, the LD50 for aspirin is 1000 mg/kg or 5-times more toxic than ARSENAL's LD50 of 5000mg/kg (see over).



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## Mammals

### Oral LD50

Rats, male and female ->5000 mg/kg

Mice, female ->2000 mg/kg

Rabbits, male and female ->4800 mg/kg

### Dermal LD50

Rabbits, male and female ->2000 mg/kg

Rats, male and female -> 5000 mg/kg

### Intraperitoneal LD50

Rats, male and female ->2500 mg/kg

Rats, male and female ->2500 mg/kg but <3200 mg/kg

### Inhalation LC50

Rats, male and female ->1.3 mg/litre actual concentration

### Primary Irritation

Rabbits, eye - irritating with full recovery in 7 days

Rabbits, skin - mildly irritating

### Dermal Sensitization

Guinea pig - negative

## Birds

### Oral LD50

Bobwhite quail and mallard duck ->2150 mg/kg

### 8-Day Dietary LC50

Bobwhite quail and mallard duck ->5000 mg/kg

## Fish

### 96-Hour LC50

Rainbow trout, bluegill sunfish, channel catfish - >100 mg/litre

## Arthropods (Insects)

### 48-Hour LC50

Water fleas (*Daphnia magna*) ->100 mg/litre

### Dermal LD50

Honey bee ->100 ug/bee

## Annelids (Worms)

### 14-Day LC50

Earthworm (*Lumbricus terrestris*) - 132.5 ppm (240 g/L formulation used in test)

## Algae

### 7-Day EC50

Freshwater blue-green alga (*Anabaena flos-aquae*) - 11.7 mg/litre

Freshwater green alga (*Selenastrum capricornatum*) - 71 mg/litre

Freshwater diatom (*Navicula pelliculosa*) - 55.8 mg/litre

Marine diatom (*Skeletonema costatum*)->85.5 mg/litre

### 14-Day EC50

Duckweed (*Lemna gibba*) ->0.024 mg/litre

## Chronic Toxicity to Non-Target Fauna

### 21-Day Dermal

Rabbits - no systemic toxicity at 400 mg/kg/day

### 13-Week Dietary

Rats - no-effect level of 10,000 ppm (highest dose tested)

Dogs - no-effect level of 10,000 ppm (highest dose tested)

1-Year Dietary Dogs - no-effect level of 10,000 ppm (highest dose tested)

### 18-Month Dietary & Oncogenicity

Mice - no-effect level of 10,000 ppm (highest dose tested)

### 2-Year Dietary & Oncogenicity

Rate - no-effect level of 10,000 ppm (highest dose tested)

## Reproduction Studies

### 2-Generation Reproduction

Rats - no treatment-related signs of systemic toxicity and no adverse effects upon reproductive performance or pup development at dietary levels up to 10,000 ppm (highest dose tested)

### 18-Week Toxicity & Reproduction

Mallard ducks and bobwhite quail - no treatment-related signs of systemic toxicity and no adverse effects upon reproductive performance and egg production, thickness, quality, and hatchability at dietary levels up to 2000 ppm (highest dose tested)

## Mutagenicity and Teratogenicity

No mutagenic effects were observed at doses tested in the Ames, Dominant Lethal, Unscheduled KDNA Synthesis, in vitro Chromosomal Aberrations in Chinese Hamster Ovary Cells, and CHO.HGPRT tests, No teratogenic or foetotoxic effects were observed at doses up to 1000 mg/kg body weight in rats of up to 400 mg/kg in rabbits (highest doses tested).

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## Rat Metabolism

In rats dosed by gavage with imazapyr approximately 87% of the dose was excreted in the urine and faeces within 24 hours. Residual levels in liver and kidney tissues were 0.03 and 0.02 ppm, respectively, at 24 hours and <0.01 ppm in both tissues at 192 hours after dosing. In muscle and fat tissue and blood, residue levels were <0.01 ppm at both 24 and 192 hours.

## Bioaccumulation

Results of a bioconcentration study with bluegill

sunfish indicate that imazapyr does not accumulate in fish tissues and that the bioconcentration factor is less than 1.

## Effect on Soil Microorganisms

Studies to determine the effects of ARSENAL treatments on soil microorganisms show that ARSENAL herbicide has no adverse effect on numbers of soil organisms, growth rates of microbial populations, soil enzymes, nitrogen cycling, sulphur oxidation, mineralization of organic substrates, or normal soil respiration.

## A COMPARISON OF ARSENAL TO ROUNDUP™, DYCLEER™ AND GARLON™ (Source: Herbicide Handbook of the WSSA, 6th Edition, 1989)


It is often helpful with a new product to compare its toxicity to substances which are already familiar. The following table provides this comparison of ARSENAL to several other industrial vegetation management tools.

	ARSENAL	ROUNDUP	DYCLEER	GARLON
Oral LD50 (mg/kg)	>5000	5400	2629	2830
Dermal LD50 (mg/kg)	>2000	5000	>2000	3980
Inhalation (mg/L)	non-toxic	non-toxic	non-toxic	non-toxic
Eye Irritation	none	none	yes	yes
Skin Irritation	none	moderate	mild	yes
Rainbow Trout LD50 (mg/L)	>100	110	>1000	>320
Mallard Duck LFD50 (mg/L)	>5000	>4640	>4640	>10,000

## Summary

ARSENAL Herbicide provides today's vegetation managers with an effective new tool which poses no risk to the environment based on extensive laboratory and field tests conducted over 10 years in Canada and in over 50 other countries worldwide.

For more information on ARSENAL, call

 BASF AgSolutions at 1-877-371-BASF (2273)

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