



AquaMaster™ Technical Fact Sheet

January 2002

Introduction

AquaMaster™ herbicide – which consists of glyphosate isopropylamine salt (the active ingredient) and water – is a non-selective aquatic herbicide that controls emerged vegetation in and around bodies of fresh and salt water. AquaMaster herbicide is effective in lakes, rivers, streams, ponds, seeps, irrigation and drainage ditches, canals, reservoirs, wastewater treatment facilities, wildlife habitat restoration and management areas, and similar sites. When applied according to label directions, AquaMaster herbicide can be used without unreasonable adverse effects to human health or the environment.

Health and Safety

AquaMaster herbicide has been evaluated in numerous studies with laboratory animals and wildlife species using exposure levels far greater than the levels that might occur from labeled use of the herbicide. Mammalian toxicity data and irritation scores from laboratory studies conducted with AquaMaster herbicide are summarized in Tables 1 and 2.

Table 1. AquaMaster Herbicide Mammalian Acute Toxicity

Exposure Route	Animal	LD ₅₀ ¹	EPA Category ²
Oral	rat	>5,000 mg/kg	IV
Dermal	rabbit	>5,000 mg/kg	IV

Table 2. AquaMaster Herbicide Irritation Scores

Exposure Route	Animal	Irritation Score
Eye	rabbit	0.0 on a scale of 110.0 (non-irritating)
Skin	rabbit	0.1 on a scale of 8.0 (practically non-irritating)

¹ The LD₅₀ is the dose that causes death in 50% of the test animals.

² The U.S. Environmental Protection Agency has established acute toxicity categories ranging from slight to moderate to severe, with Category I being severe and Category IV being slight.

The U.S. Environmental Protection Agency classifies herbicides for acute toxicity into one of four categories, where “I” is the most toxic and “IV” is the least toxic. Glyphosate, the active ingredient in AquaMaster herbicide, is rated in the U.S. as Category IV for acute oral toxicity based on tests conducted on rats.

The results from extensive, chronic toxicology tests resulted in an EPA cancer classification of glyphosate as a “Category E,” or “evidence of non-carcinogenicity for humans,” the most favorable rating granted.

Studies have also shown that glyphosate does not cause birth defects or reproductive problems in laboratory animals, and no adverse effects have been observed in mutagenicity and genotoxicity tests.

In 2000, three internationally recognized toxicologists published a safety evaluation and risk assessment of glyphosate. They concluded that glyphosate has low acute toxicity, is not a carcinogen, does not adversely affect reproduction and development, and does not bioaccumulate in mammals.³

No Water Restrictions

When AquaMaster herbicide is used according to label directions, there are no restrictions on the use of water from treated areas for irrigation, recreation, or domestic purposes. Studies have demonstrated that crops irrigated with water from areas treated with AquaMaster herbicide will not be adversely affected. Residue levels of glyphosate in water have been found to be significantly below the acceptable level established by the EPA.

³ Williams GM, Kroes R, Munro IC (2000) Safety evaluation and risk assessment of the herbicide Roundup and its active ingredient, glyphosate, for humans. Reg Toxicol Pharmacol 31(2):117-165.

Environmental Fate

Glyphosate, the active ingredient in AquaMaster herbicide, has favorable environmental fate characteristics. Over time, glyphosate undergoes microbial degradation in soil, sediment and natural waters, under both aerobic and anaerobic conditions. The major metabolite formed is aminomethylphosphonic acid, which undergoes further microbial degradation. Glyphosate is ultimately metabolized to carbon dioxide, inorganic phosphate, and other naturally occurring compounds.

Glyphosate binds tightly to most types of soil and sediment until it is degraded, and is not absorbed by roots from soil or sediment. This tight binding results in an extremely low potential for glyphosate to move into groundwater.

Glyphosate readily dissipates from surface water by two primary mechanisms. It quickly partitions from water into sediment, and then is microbially degraded over time in both water and the sediment. In flowing waters, factors such as tributary dilution and dispersion contribute to the dissipation of glyphosate.

The dissipation of glyphosate in sterile and non-sterile water has been extensively studied. A review of the available dissipation field studies concluded that 50% of the concentration of glyphosate initially found in water dissipates within time periods ranging from a few days to two weeks.⁴

Thermal Degradation Studies

Some vegetation management practices involve the burning of weeds and brush following herbicide application. An assessment of the thermal decomposition products of glyphosate clearly shows that they will not cause adverse effects to individuals exposed to the smoke and gases formed as a result of burning treated vegetation. This assessment is based on the maximum application rate of 7½ pints of AquaMaster herbicide per acre, and assumes that no decomposition of glyphosate occurs prior to burning.

Extremely Low Volatility

Glyphosate, the active ingredient in AquaMaster herbicide, has extremely low volatility. That means that AquaMaster will not produce vapors that could move through air after application and damage non-target vegetation.

Bioaccumulation

In laboratory studies conducted with glyphosate, bioconcentration factors were less than 1.0, indicating that glyphosate does not accumulate in fish. The low bioaccumulation factor is a result of glyphosate being readily soluble in water, and therefore subject to rapid elimination from organisms in water. Other animal species studied include marine mollusks and crustaceans, and also showed low potential for bioaccumulation.

Moreover, tissue analyses showed that of the trace amounts of glyphosate residue found, more than 75 percent was contained in non-edible portions of the fish. When exposed fish were transferred to glyphosate-free water, virtually all of the glyphosate was eliminated from their tissues.

Wildlife Safety

The acute toxicity of glyphosate and AquaMaster herbicide to terrestrial and aquatic wildlife has been extensively evaluated, with laboratory and field results indicating low acute toxicity and low risk from direct exposure. The scientific literature contains hundreds of articles addressing this topic.⁵

Laboratory studies indicate that AquaMaster herbicide will not cause adverse effects to earthworms and honeybees (following acute exposure) or avian species, such as Mallard ducks or Bobwhite quail (following oral and dietary exposure). In 2000, a comprehensive ecotoxicological risk assessment was published for glyphosate.⁴ The authors concluded that the use of glyphosate poses minimal risk to non-target species.

AquaMaster herbicide and glyphosate have low acute toxicity to aquatic organisms. Surfactants that might be mixed with AquaMaster herbicide can have low to moderate acute toxicity to aquatic organisms. However, the toxicity and exposure are sufficiently low that no unreasonable adverse effects to aquatic organisms are expected to occur under normal use conditions.

⁴ Giesy JP, Dobson S, Solomon KR (2000) Ecotoxicological risk assessment for Roundup herbicide. *Reviews of Environmental Contamination and Toxicology* 167: 35-120.

⁵ Sullivan DS, Sullivan TP (2000) Non-target impacts of the herbicide glyphosate: A compendium of references and abstracts. 5th Edition. Applied Mammal Research Institute, Summerland, British Columbia, Canada.

Table 3 summarizes the results of laboratory testing with AquaMaster herbicide and glyphosate for fish, algae, and aquatic invertebrates.

Table 3: Aquatic Acute Toxicity Data

Species, Endpoint	LC ₅₀ or EC ₅₀ (mg/L) ⁶	EPA Classification
AquaMaster herbicide		
Bluegill sunfish, 96-hr LC ₅₀	> 1,000	Practically non-toxic
Rainbow trout, 96-hr LC ₅₀	> 1,000	"
<i>Daphnia magna</i> , 48-hr EC ₅₀	930	"
Green algae, 72-hr EC ₅₀ (growth)	166	"
Glyphosate		
Sheepshead minnow, 96-hr LC ₅₀	>1000	"
Grass shrimp, 96-hr LC ₅₀	281	"
Mysid shrimp, 96-hr LC ₅₀	> 1,000	"
Sea urchin, 96-hr LC ₅₀	> 1,000	"
Fiddler crab, 96-hr LC ₅₀	934	"

The maximum glyphosate concentration following AquaMaster herbicide application to a shallow pond can be calculated. For the maximum application rate of 7½ pints/acre, the maximum glyphosate concentration immediately after application to a 1-foot deep waterbody would be 1.4 mg/L. This assumes no interception by foliage being treated, which would reduce the amount of glyphosate reaching the water surface. A comparison of this concentration with the toxicity data in Table 3 demonstrates that when AquaMaster herbicide is used at labeled rates, it is highly unlikely that glyphosate concentrations would reach levels harmful to aquatic species.

In a study conducted to assess the effect of various herbicides on submerged aquatic vegetation, the authors concluded that “glyphosate would appear to pose no threat to non-target, submersed aquatic plants.”

⁶ The LC₅₀ is the concentration that produces 50% mortality in the test. The EC₅₀ is the concentration that produces effects (inhibition of growth or immobilization) in 50% of the test organisms.

Ecosystem Studies

Because glyphosate-based herbicides are widely used throughout the world, ecosystem studies have been conducted to assess what effect, if any, the use of glyphosate has on an ecosystem. Results from two comprehensive ecosystem studies – the Canadian Carnation Creek Study⁷ and the Oregon State University⁸ study – indicate the following:

When used according to directions, glyphosate, the active ingredient in AquaMaster herbicide:

- readily degrades over time in soil;
- is essentially immobile in soil and is not likely to contaminate ground water;
- does not cause significant adverse health or migrational changes in fish; and
- has no significant adverse effects on aquatic or terrestrial invertebrates or waterfowl.

Habitat Restoration & Enhancement

AquaMaster herbicide can be used for the restoration and/or maintenance of native habitat and in wildlife management areas, including riparian and estuarine areas and wildlife refuges. Applications of Aquamaster herbicide can be made to allow recovery of native plant species, as well as prior to planting desirable native species.

SUMMARY

AquaMaster herbicide offers favorable toxicological and environmental characteristics. When applied according to label directions, AquaMaster herbicide can be used without unreasonable adverse effects to human health or the environment.

⁷ Forest Pest Management Institute. (1989) Proceedings of the Carnation Creek Herbicide Workshop (Sault Ste. Marie, Ontario). Ministry of Forests, Research Branch.

⁸ Newton M et al. (1984) Fate of glyphosate in an Oregon Forest Ecosystem. Journal of Agricultural and Food Chemistry 32: 1144.

