

Imazapyr is a broad-spectrum herbicide manufactured by American Cyanamid Co. under the product names Arsenal, Chopper, and Assault. It has been registered in the United States since 1984. Imazapyr is toxic to almost every plant it comes in contact with, as it kills by inhibiting the enzyme plants use to synthesize amino acids. Within hours of treatment, the ability to synthesize DNA is obliterated and soon afterward all growth ceases. The complete death of the plant, however, can take as long as a month. The fact that imazapyr is so universally toxic to plants makes it uniquely dangerous to non-target plants: as little as 1/50 of a typical application can damage crop plants.

Information Unavailable to the Public

One of the reasons that there is little specific information about direct results of imazapyr-containing herbicides on humans, animals, and ecosystems when compared to unadulterated imazapyr is that there are so few studies readily available to public researchers. **There are no publicly available studies on the distance that imazapyr can drift, or the general chronic toxicity, chronic effects on humans, reproductive hazards, carcinogenicity, and chronic effects on fish and birds of imazapyr-containing herbicides.** This is important, as studies have shown that many chemicals become more potent in toxicity when combined with other ingredients, as herbicides are. **47% of Arsenal Applicators Concentrate, the most common imazapyr-containing herbicide, is comprised of ingredients whose identities are not available to the public,** as it is not required under law to identify "inert" ingredients. Most of the United States Environmental Protection Agency's assessment of the health hazards posed by Arsenal are based on tests of pure imazapyr, not of all ingredients contained in the herbicide.

Health Hazards

One of the primary breakdown products of imazapyr is quinolinic acid, which is irritating the eyes, skin, and respiratory system. In addition, it is a neurotoxin, and causes nerve lesions and symptoms similar to Huntington's disease. Although there is limited information on imazapyr herbicides, there have been several studies on the effects of pure imazapyr on animals that can be correlated to the chemical's potential for affecting human health.

- Rabbits dermally exposed to imazapyr and rats inhaling Arsenal both showed bleeding and congested lungs. Congestion of the liver, intestine, and kidneys was also observed.
- Rabbits given imazapyr orally exhibited stomach ulcers and intestinal lesions at most doses tested.
- There is no information on the hazards imazapyr and imazapyr herbicides pose to fish. However, a closely related herbicide (imazamethabenz-methyl) has high chronic toxicity to fish, with effects occurring at concentrations less than one part per million.
- Mice and rats fed sublethal doses of imazapyr over two years showed fluid accumulation in the air sacs of the lungs, brain congestion, kidney cysts, abnormal blood formation in the spleen, blood pooling in the liver, thyroid cysts, tumors, and cancers, brain tumors, adrenal gland tumors and cancers, and decreased food efficiency.
- Rabbits dermally exposed to imazapyr herbicides for 21 days showed reddened, scaly, crusted skin. A single exposure showed swelling and redness.

High Persistence

Field studies have shown that imazapyr persists for 60 to 436 days in soil, with most tests showing persistence longer than a year. These are minimum estimates, however, because in almost all studies imazapyr still persisted on the last day.

The length of time a given chemical remains viable in an environment is dependant not only on its own properties but on climate, weather, soil

type, and other variables. In the case of imazapyr, it seems that another key aspect of our understanding of its persistence is the method by which we measure its presence in that environment. Studies have given widely varying conclusions on the persistency of imazapyr: half-lives (the time it takes for half the amount of herbicide applied to break down or move away) have been measured ranging from 21

days to 49 months in field studies. The cause of this discrepancy seems to be whether the researchers were testing for the presence of imazapyr by looking for residue identifiable by lab techniques, or for imazapyr-caused damage to plant life. All studies testing for damage to plants show longer persistence, suggesting that imazapyr can cause damage to plants at concentrations too low to detect in laboratories.

Contamination of Water

Although studies of the effects of imazapyr on water quality are few, research suggests that imazapyr readily causes contamination problems.

- Imazapyr is highly mobile in soil, and thus easily contaminates groundwater. Alabama studies showed that imazapyr was more mobile in soil even than widespread water contaminant atrazine.
- Imazapyr was found in surface water in the Southeastern United States following aerial applications at both of the two forestry sites for which data are available to the public.
- Imazapyr was found in surface water in the Pacific Northwest following aerial forestry application.
- One field study showed that 40-70% of imazapyr applied in a given area leached to the lowest water depth tested.
- Another study found "significant" residues of imazapyr leached to depths of 4.9 to 9.9 feet.
- Ozone degradation (a treatment to remove pesticides from drinking water) does not work on imazapyr, removing only half of the chemical present in samples.

Dangers Posed to Non-Target Plants

Imazapyr is deadly to almost all plants in several ways. However, there are documented examples of weeds worldwide developing resistance to imazapyr herbicides. These plants, which include different ryegrass varieties, Russian thistle, and common chickweed, as well as some algae species, have developed resistance caused in at least one case by the single-point mutation of an enzyme. The fact that these plants can absorb normally lethal doses of the chemical without apparent harm does not mean the herbicides are less toxic, but that the plants are now carriers of the residue as they reproduce, move into new geographical locations and decompose.

- Imazapyr increases the susceptibility of plants to disease.
- Imazapyr poses specific risks to endangered plant species, because in such populations the loss of a few plants can have significant consequences. The Fish and Wildlife Service has identified 100 counties in 24 states where endangered species could be at risk from forestry use of Arsenal (no such analysis is publicly available for Western states).
- Imazapyr can disrupt the ability of soil to decompose plant material by inhibiting the ability of enzymes to break down cellulose.

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ACAT researcher Katie Bryson based this report on a scientific article written by Caroline Cox and published by the Northwest Coalition for Alternatives to Pesticides in the *Journal of Pesticide Reform* vol.16, no.3, fall 1996. You may request a copy of the full article and further information by contacting Alaska Community Action on Toxics at (907) 222-7714.

ACAT e-mail: info@akaction.net ACAT website: www.akaction.net