



# ChemicalWatch Factsheet

## AMINOPYRALID

**A**minopyralid (4-amino-3,6-dichloro-2-pyridine carboxylic acid) is a new generation pyridine carboxylic acid herbicide used to provide systemic post-emergence broad-spectrum control of a number of key noxious and invasive weed species and broadleaf weeds. Older members of this class of herbicides include clopyralid, triclopyr, and picloram. Manufactured by Dow AgroSciences as the end-use product Milestone, it is also intended for use in rangeland, permanent grass pastures, non-cropland areas (rights-of-way, roadsides), natural areas (wildlife management areas, natural recreation areas), grazed areas, as well as wheat. Aminopyralid controls tropical soda apple, Canada thistle, knapweeds and other invasive species, and provides residual weed control at low application rates. Dow markets this herbicide as an alternative to picloram, clopyralid, 2,4-D, and dicamba. The U.S. Environmental Protection Agency (EPA) granted conditional registration to aminopyralid in 2005, which is still in effect, and categorized it as a “reduced risk” herbicide, but it has since been implicated in compost contamination across the U.S.

### Mode of Action

Aminopyralid is a plant growth regulator that possesses auxin-like qualities that can turn on and off vital plant processes. Once absorbed, aminopyralid moves systemically throughout the plant and deregulates plant growth metabolic pathways, affecting the growth process of the plant, through uneven cell division and growth. Aminopyralid binds at receptor sites normally used by the plant’s natural growth hormones, resulting in the death of susceptible plant species. The herbicide is rapidly absorbed by the leaves and roots.

### Acute Toxicity

According to EPA documents, acute toxicity data indicates that aminopyralid has low toxicity via oral, dermal, and inhalation routes of exposures. However, the free acid form of aminopyralid produces severe eye irritation. Thus, the technical product is classified in toxicity category I (DANGER), while the formulated end use product (Milestone) is classified as toxicity category IV (CAUTION).

### Chronic Toxicity

Since aminopyralid is a relatively new herbicide, little independent information is available in the published literature on the toxicity of aminopyralid to humans or other mammalian species. Aminopyralid has been classified as “not likely” to be carcinogenic to humans. No increases in tumors were found in carcinogenicity studies in rats and mice. The stomach, ileum, and cecum appear to be targets for this chemical. At mid- and high-level doses, ulcers and erosion of the mucosal lining are noted in the stomach.

In a two-generation reproduction study in rats, there is no evidence of parental, reproductive, or offspring toxicity observed after exposure to aminopyralid up to 1000 mg/kg/day. There were

no treatment-related effects, motor activity, or neuropathological observations in neurotoxicity studies. In a developmental toxicity study in rabbits with aminopyralid, maternal toxicity is observed at high doses in the form of decreased body weights and uncoordinated gait. Ulcers and erosions of the glandular mucosa of the stomach are also observed in these dose groups. In the rabbit developmental study with

the formulated product Milestone, developmental toxicity was demonstrated by a decrease in fetal body weights. Aminopyralid was also negative in all mutagenicity studies, except for an *in vitro* chromosome aberration assay utilizing rat lymphocytes. In this assay, aminopyralid induced chromosome aberrations, but only at cytotoxic concentrations.

### Metabolites

Aminopyralid metabolism data indicate that the compound is quickly eliminated following ingestion by animals with little biotransformation. In plants, sugar conjugates are the only significant metabolites found in association with the parent compound. In the environment, aminopyralid will degrade to a number of different metabolites via aqueous photolysis and two specific metabolites have been identified—oxamic acid and malonamic acid. Other unidentified metabolites include two or three carbon acid amides.

### ChemicalWatch Stats

**CAS Registry Number:** 150114-71-9

**Chemical Class:** pyridine carboxylic acid herbicide

**Use:** Non-cropland areas: forests, right-of-ways, rangelands

**Toxicity rating:** Toxic

**Signal Words:** Caution

**Health Effects:** Severe eye irritation, possible developmental effects

## Ecological Effects

Aminopyralid has been shown to be practically non-toxic to birds, fish, honeybees, earthworms, and aquatic invertebrates. Aminopyralid is slightly toxic to eastern oyster, algae and aquatic vascular plants. Aminopyralid is not expected to bioaccumulate in fish tissue. Survival, growth, and reproduction in bobwhite quail and mallard ducks were not affected by acute oral or by subacute or chronic dietary exposures to aminopyralid.

## Environmental Fate

Aminopyralid persists in soils with a half-life ranging from 32 to 533 days, with a typical time of 103 days. It is soluble in water and has moderate to high mobility with the ability to leach through soils and possibly contaminate groundwater. Aminopyralid is stable in water but in sunlight breaks down quickly with an estimated half-life of 0.6 days. This is therefore an important route of degradation for shallow water bodies with little to no suspended sediment. Aminopyralid is only moderately broken down in soil. The main mode of degradation in the environment is expected to be microbial metabolism in soils however microbial metabolism can be slow in some soils, especially at lower soil depths and appears generally to be very slow (half-lives well above a year) in aquatic systems.

## Compost Contamination

Like Dow Agrosiences' related active ingredients picloram and clopyralid that were linked to compost contamination in the early 2000s, aminopyralid has also been found to contaminate compost, which was responsible for several crop kills across many states. In 2009, organic farmers and gardeners across a Washington state county suspected that herbicide-contaminated manure and compost obtained from non-organic farms and dairies were responsible for severe crop and economic losses reported throughout the region. Tests of soil and tissue samples of local dairy manure that is used in soil and compost mixtures revealed small amounts of aminopyralid.

The herbicide found its way into compost after application to plant matter on dairy farms or other grass cuttings. As aminopyralid passes relatively unchanged through mammals after ingestion and breaks down slowly in organic matter, manure from these farms became contaminated. Residues of aminopyralid in manure, composts or soils can cause damage to sensitive plants, such as tomato, beans and peas at levels as low as one part per billion. Some plant species are more sensitive than others, but all broadleaf plants are considered



sensitive to this chemical. Damage includes cupped leaves, twisted stems, distorted apical growing points, and reduced fruit set.

Compost contamination was also reported in Britain in 2008 where domestic gardens and allotments were contaminated by manure originating from farms where the herbicide was sprayed on fields. During that time, Dow launched a campaign to reassure farmers and acknowledge that they were aware of how the products should be used. However, since the chemical has entered the food chain via compost, many demanded a ban of the product. Dow voluntarily pulled aminopyralid off the market in Britain in 2008, but reintroduced the product in 2010.

## Regulatory Status

Aminopyralid was issued a conditional registration by EPA in 2005 and is not scheduled to be reviewed until 2020. Aminopyralid is structurally similar to its cousins picloram and clopyralid. Despite this, in EPA's 2005 Environmental Fate and Ecological Risk assessment document, the agency stated that whether issues with clopyralid (persistence in grass clippings) and picloram (groundwater contamination) will occur with aminopyralid is "uncertain." Levels of concern (LOCs) were exceeded for both acute risk and listed plants and therefore all federally threatened and endangered species are considered to be potentially at risk from the uses of aminopyralid (from drift, runoff, etc.).

In 2008, garden crops were damaged with contaminated manure across the United Kingdom resulting in a temporary ban. Dow amended label precautions for Milestone and other similar products containing the active ingredient aminopyralid, which stated that treated plant residues or manure from animals that have grazed on treated forage should not be used in compost or mulch to be used in growing susceptible broadleaf plants.

Milestone's revised product labels state: "Do not use aminopyralid-treated plant residues, including hay or straw from treated areas, or manure from animals that have grazed forage or eaten hay harvested from treated areas within the previous 3 days, in compost or mulch that will be applied to areas where commercially grown mushrooms or susceptible broadleaf plants may be grown." Additionally, already contaminated manure should not be replanted with for at least a year.

After Washington State encountered contaminated manure with aminopyralid residues in 2009 and 2010, advisories went out to dairy farmers warning them not export the manure to compost facilities or farms growing sensitive crops.