

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
WASHINGTON, D.C. 20460

OFFICE  
PREVENTION, PESTICIDES

TOXIC SUBSTANCES

PC Code No: 128821,  
128829  
DP Barcode: D313607

September 30, 2005

MEMORANDUM

SUBJECT: EFED Ecological Risk Assessment Supporting the Reregistration Eligibility Decision for the Use of the Herbicide, Imazapyr, in Previously Registered Non-Agricultural and Horticultural Settings, and on Clearfield Corn

CAS Registry Number: 81510-83-0  
Company: BASF Corporation

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This memorandum transmits the ecological and environmental risk conclusions for the herbicide, imazapyr, and the Environmental Fate and Ecotoxicity Assessments for its proposed uses on: Clearfield corn, forestry uses, aquatic and terrestrial non-cropland uses including manufacturing sites and right-of-ways, pasture and rangeland, residential non-food use, and non-residential turf. Imazapyr is applied as a foliar spray or pellet product for the control of unwanted vegetation. In general, the labeled uses for different products containing imazapyr have single maximum annual application rates between 0.9 and 1.5 pounds ae/acre for terrestrial and aquatic sites and 0.5 to 1.5 lb ae/acre with 1-2 applications per 10 years (brush) for granular uses. While labels for the

registered products allow application with backpack sprayers, which would minimize the treated area, in many cases aerial application is also permissible. Maximum annual application rates for uses of imazapyr on Clear Field<sup>1</sup> corn is much lower at 0.014 pounds ae/acre.

## **Environmental Fate**

Imazapyr is an anionic, organic acid that is non-volatile, degrades through photolysis in clear shallow waters, and is both persistent and mobile in soil. Imazapyr is mainly present in anionic form at typical environmental pHs, and the behavior of the acid and salt forms are expected to be similar. Soil to water partitioning coefficients ( $K_d$ ) for imazapyr are low (ranging from 0.04 to 3.4), indicating that imazapyr will be mobile in surface waters. Imazapyr is soluble in water and has the potential to leach into ground water. For anionic compounds, sorption would tend to diminish with increasing environmental pH. Since imazapyr is not expected to sorb strongly to either soils or sediments, it is not expected to accumulate in benthic systems or bioconcentrate in fish. Imazapyr is not volatile and is stable to aerobic and anaerobic degradation. Imazapyr is also stable to hydrolysis, but is susceptible to aqueous photolysis with reported half-lives of 2.5 to 5.3 days. The two major photodegradates are 2,3-pyridinecarboxylic acid (CL 9140, 22.7%) and 7-hydroxy-furo[3,4-b]pyridin-5(7H)-one (CL 119060, 9.7%). These transformation products are less persistent than the parent, imazapyr, under aerobic aquatic conditions (half-lives 2.5 to 5.3 days). There are no toxic residues of concern identified for the imazapyr transformation products, and none were considered in this ecological risk assessment.

## **Risk Conclusions**

The use of imazapyr in accordance with the label (total annual application rate, 0.014 lbs ae/acre for agricultural uses and 0.5 to 1.5 lbs ae/acre for non-food crops) results in adverse effects for listed and non-listed aquatic vascular plants from the high non-food rate, but not for aquatic non-vascular plants. Adverse effects are expected for listed and non-listed terrestrial monocots and dicots in dry and semi-aquatic areas. Non-listed species are not expected to be adversely effected from ground application spray drift alone.

## **Risks to Aquatic Organisms**

### *Fish and Invertebrates*

This screening risk assessment indicates that there is minimal risk of direct acute effects to fish and aquatic invertebrates at maximum application rates. In addition, there are no chronic risks to fish and invertebrates; however, there is an uncertainty for estuarine/marine fish and invertebrates, since no toxicity data were available to observe the prolonged effects of imazapyr to estuarine/marine fish and invertebrates. Consequently, fish and invertebrates inhabiting surface waters adjacent to an imazapyr treated field would not be at risk for adverse acute and/or

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<sup>1</sup>Clear Field is a variety of corn that has been developed to be resistant to the herbicidal effects of imazapyr.

chronic effects on reproduction, growth and survival when exposed to imazapyr directly or in residues in surface runoff and spray drift as a result of ground and/or aerial spray application. Risk to benthic organisms is also not likely based on the available toxicity data and that imazapyr is not expected to accumulate in benthic systems.

### Plants

Toxicity studies indicate that imazapyr acid is highly toxic to plants, and expected to exert detrimental effects to aquatic vascular plants. Imazapyr acid, and its salt, are not expected to exert detrimental effects to listed and non-listed non-vascular plants, even at the maximum application rate. Both non-listed and listed aquatic vascular plants are at risk for the terrestrial non-cropped spray and granular uses, and for the aquatic non-cropped uses, at the highest allowable application rate. Both non-listed and listed aquatic vascular plants are not at risk for use of imazapyr on Clearfield corn. Aquatic vascular plants inhabiting surface waters adjacent to a treated field, and those exposed via direct application to water, would be at risk for adverse effects to growth and development as a result of the labeled uses of the pesticide.

### **Risks to Terrestrial Organisms**

#### Birds

Imazapyr acid is categorized as practically non-toxic to avian species. Neither mortality nor clinical signs of toxicity were observed in any of the acute oral and dietary toxicity studies. The acute risk to birds following either broadcast granular application or spray application is expected to be low because the highest dose-based environmental exposure concentrations (EECs) are one quarter (broadcast spray) to one-half (granular application) of the highest concentration tested in the acute studies which produced no mortalities and no clinical signs of toxicity. The difference between the highest dietary EEC and the highest concentration tested in the acute dietary studies is even greater. Chronic avian reproduction studies indicated no evidence of adverse reproductive effects. The chronic LOC for birds was not exceeded for any of the registered uses. Therefore, the chronic risk for birds is also expected to be low following exposure to imazapyr acid at maximum application rates.

#### Mammals

Imazapyr acid is categorized as practically non-toxic to small mammals. Again, neither mortality nor clinical signs of toxicity were observed in the acute oral study. The acute risk to mammals following either broadcast granular application or spray application is expected to be low because the highest dose-based EECs are 0.03 (broadcast spray) to 0.1 (granular application) of the highest concentration tested in the acute study which produced no mortalities and no clinical signs of toxicity.

The chronic mammalian reproduction study indicated no evidence of adverse reproductive effects. The chronic LOC for mammals was not exceeded for any of the registered uses. Therefore, the chronic risk for mammals is expected to be low following exposure to imazapyr

acid at maximum application rates.

### Terrestrial Non-target Insects

The available terrestrial toxicity data on honey bees suggests that imazapyr is practically non-toxic to bees. It is unlikely that there will be significant risk to terrestrial insects in the direct treatment area. The potential for imazapyr to have adverse effects on pollinators and other beneficial insects is low.

### Plants

The results of this screening risk assessment indicate that imazapyr use on non-cropped areas and on Clearfield corn applied at the labeled concentration rates as a liquid spray for ground or aerial applications presents a risk to non-target plants for some distance from the application site. Imazapyr is readily absorbed through the foliage and roots of plants. Consequently, it could be injurious to non-target plant species by drift, runoff, or leaching to roots. Damage to non-target plants may be sufficient to prevent the plant from competing successfully with other plants for resources and water. Low-level exposure to non-target crops can cause severe reductions in yield. Imazapyr increases a plant's susceptibility to disease and can disrupt nutrient cycling in soil by inhibiting the ability of enzymes to break down cellulose and thereby, decompose plant material. Listed plant species may be especially impacted by exposure to imazapyr because of the impact of the loss of a few individuals to the population.

For the high and low application rates by ground and aerial spray for non-food uses, the listed and non-listed monocots and dicots (with the exception of monocots receiving only spray drift from ground application at the low application rate) located adjacent to treated areas, and inhabiting semi-aquatic areas are at risk.

The use of imazapyr on Clearfield corn present a risk to non-listed terrestrial plants located in semi-aquatic areas, but does not present a risk for terrestrial plants in dry areas. Listed dicot plants inhabiting adjacent treated areas are at risk from the use of imazapyr on Clearfield corn by both ground and aerial application. In dry areas, monocots are not at risk from spray drift alone.

When imazapyr is applied directly to surface waters for the control of aquatic plants, both non-listed and listed species of monocots and dicots inhabiting semi-aquatic areas are at risk.

For granular, non-cropped terrestrial uses, both non-listed and listed species of monocots and dicots located adjacent to treated areas, or inhabiting semi-aquatic areas, are at risk.

### **Listed Species**

Both acute and chronic risk are considered in the screening-level assessment of pesticide for listed species. Imazapyr is expected to pose a direct risk to listed plant species. Indirect risks are expected for all other listed animal species that are dependent upon plants for survival and other reproductive factors.

## Outstanding Data Requirements

The set of data available for imazapyr is adequate to conduct a Tier I screening-level risk assessment for purposes of reregistration. However, not all guidelines are completely fulfilled. See Appendix I for guideline numbers.

In order to reduce uncertainties associated with the toxicity of imazapyr's degradates, toxicity studies with aquatic and terrestrial animals would be useful.

Summary of Major Uncertainties and Data Gaps in Imazapyr Assessment		
Selected Uncertainty	Value of Additional Testing	Comment
<i>Aquatic Assessment</i>		
Biotic metabolism in soil and water	Low	Only one half-life value is available for both aerobic and anaerobic soil metabolism, and for anaerobic aquatic metabolism. Normally, aquatic modeling inputs would be adjusted by an appropriate factor in order to account for natural soil variability not captured by only one data point. However, imazapyr was reported to be stable in the one soil system tested, so little added value is expected by requesting data from the additional two test systems.
<i>Terrestrial Assessment</i>		
Terrestrial plant Seedling Emergence - Tier II	High	Guidelines only partially fulfilled. Problems with overcrowding and inadequate reporting. Tier II Seedling Emergence Studies needed with 10 species using the TEP (salt plus identified adjuvant). Guideline 123-1(a)
Terrestrial plant Vegetative Vigor - Tier II	High	Guidelines only partially fulfilled. Problems with overcrowding and inadequate reporting. Tier II Vegetative Vigor Studies needed with 10 species using the TEP (salt plus identified adjuvant). Guideline 123-1(b)