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MEMORANDUM

SUBJECT: Isoxaben Leaching Potential Assessment for the Registration Standard

FROM: Patrick Holden, Team Leader C.E. for
Ground-Water Team

TO: Emil Regelman, Chief
Review Section # 3

The chemical appears to fall into a gray area, neither clearly mobile and persistent nor clearly immobile and non-persistent. Isoxaben is persistent based on hydrolysis, field dissipation and aerobic soil metabolism study data. To complete the assessment of the chemical's persistence, anaerobic soil metabolism data are necessary. These data were neither required for isoxaben previously nor in the current Registration Standard.

Isoxaben does not appear to be mobile based on column leaching study data, its low solubility, and limited adsorption/desorption data.

A degradate, (N-[3-(2-hydroxybut-2-yl)isoxazol-5-yl]-2,6-dimethoxybenzamide) is slightly mobile in column studies and appears to be more mobile than the parent. This is only a qualitative assessment and should be supported with more data.

As a preliminary assessment, under worst-case conditions, water tables within 1-2 feet of the ground surface coupled with high irrigation/rainfall, could produce conditions where isoxaben residues might reach ground water. However, these are conditions under which most chemicals would leach and the statement does not flag isoxaben as a "leacher". (See the section on Field Dissipation studies).

Other data are required for a full leaching assessment. They are: anaerobic, adsorption/desorption, and field dissipation data. Anaerobic soil metabolism data would indicate to what extent the parent persists under these conditions. Further, it would indicate to what extent the degradates form and persist under anaerobic soil conditions. Although there is limited data on the adsorption/desorption of isoxaben (1 Kd value for

a sandy loam soil) more data are required under the Subdivision N Guidelines. Adsorption/desorption data should be required for the parent and degradates on several soils types. Adsorption/desorption data on the degradate would allow a more quantitative assessment of its mobility. Field dissipation data are useful, but must be reported in ppm or ppb before a judgment as to the validity of the analytical method's minimum detection limit (MDL)

can be made.

The Ground-Water Team does not recommend a ground-water monitoring study for isoxaben at this time as the data for the leaching assessment are incomplete and do not raise an immediate concern regarding isoxaben's leaching potential.

The environmental fate of isoxaben is outlined below:

° Hydrolysis

Isoxaben is stable to hydrolysis. The chemical was recovered from sterile aqueous solutions buffered at pHs 5, 7, and 9 at 87-102%. These data were taken from an acceptable hydrolysis study. Hydrolysis is not an important pathway of degradation for isoxaben.

° Photolysis

Isoxaben in sterile aqueous solutions buffered at pH 7 when irradiated with natural sunlight had a half-life of 7-15 days. (The dark controls run with this study confirm the hydrolysis data indicating isoxaben is stable to hydrolysis). The degradates formed are a group of compounds that differ from the parent by substitution of hyroxyl groups for alkyl groups. The maximum amounts in percentages of the originally applied material of these degradates were $\leq$ 25%, each at the end of the study period (30 days). The hydroxyl groups may increase the solubility of the degradates above the parent slightly. The parent compound comprised 21.6% of the original material applied. Photolysis is an important pathway of degradation for isoxaben.

° Aerobic Soil Metabolism

Data were reviewed and considered acceptable by EAB.

An EAB review dated 12/31/85 on isoxaben describes the results of an aerobic soil metabolism study for isoxaben. Half-lives were 4.3, 5.6, and 10.6 months, respectively, for clay loam, loam and sandy loam soils.

A follow-up study was conducted to account for the percentage of volatiles evolved from aerobic incubation. The study indicated that isoxaben degrades through microbial action with subsequent mineralization and $CO_2$ evolution.

The main degradate reached a maximum of 20.3% of the applied parent compound. This degradate differs from the parent by one hydroxyl group replacing a methyl group. This is expected to make the degradate slightly more soluble than the parent. The Ground-Water Team awaits the raw data from this study to assess the pattern of formation and decline of this degradate under conditions of aerobic soil metabolism.

This brief assessment of the aerobic soil metabolism data was made from summarized data taken from past reviews in EAB's files. The actual study has been recalled from the RD for a more thorough assessment. However, in the interest of timeliness, EAB's Ground-Water Team has prepared this overview. The Ground-Water Team will contact Margaret Jones, the SIS coordinator on isoxaben, if a review of the raw data causes any change in EAB's opinion of isoxaben's leaching potential.

° Anaerobic Soil Metabolism

These data were not required for isoxaben, but would be necessary for a leaching assessment. It is recommended that anaerobic soil metabolism data be required as part of the Registration Standard.

° Leaching and Adsorption/Desorption

Column Leaching:

Isoxaben is not mobile in column leaching studies using worst-case conditions (20 inches of water for leaching over 10 days). The degradate (N-(3-(2-hydroxybut-2-yl)isoxazol-5-yl]-2,6-dimethoxybenzamide) is slightly mobile. The column studies appear to be acceptable according to the Subdivision N Guidelines. Isoxaben was present in the leachate from four soil columns, sand, sand loam, clay, and clay loam, at $\leq$ 0.31% of the original material applied. Aged leaching column studies using soil-aged isoxaben (aged for 30 days aerobically) were conducted with 20 inches of water. The degradate was present at $\leq$ 3.61% of the applied. There was no mention of pre-wetted columns.

In both of these studies, parent and aged leaching, worst-case conditions were used. In conclusion, these data do not indicate that isoxaben nor the degradate identified are mobile.

Adsorption/Desorption:

A study reviewed in EAB dated 9/29/83 reported a Kd value of 5.7 ml/gm for a sandy loam soil (the percentage organic matter was 1.6) indicating that isoxaben is not a mobile chemical. Because this study used only one soil type and no duplicates, a new adsorption/desorption study should

be required for both the parent and the degradates.

The adsorption/desorption data reported in the EAB Science Chapter for Registration on Isoxaben dated 12/17/87 under the study entitled, "Saunders, D.G., Smith, S.K., and Mosier, J.W. Mobility of EL-107 and a Soil Metabolite in Soil. Report No. EWD8442. Prepared and submitted by Eli Lilly and Co. Greenfield, IN. Reference 1," should be considered invalid and unacceptable. No conclusions as to the mobility of isoxaben should be drawn from these data for the following reasons. The batch equilibrium experiment was described as using 1 data point to generate the necessary isotherm. This cannot be done. By definition, the isotherm is composed of a series of points, generating a line, from which a Kd value is taken as the ratio of the (ug of pesticide adsorbed/g of soil) at the equilibrium concentration of 1 ppm. Such an isotherm cannot be generated with 1 data point unless assumptions are made as to the slope of the line reflected in the Freundlich 1/n factor. Any such assumption is likely to be incorrect and misleading.

These data as presented in the EAB science chapter for isoxaben should be considered unacceptable and invalid. They lead to the conclusion that isoxaben and its degradate are mobile, which at this time does not appear to be the case.

° Field Dissipation

The data reviewed from the EAB fate chapter of the Registration Standard were reported in lb. ai/acre instead of ppm or ppb. Because of this peculiarity, it is difficult to determine at what concentration residues of isoxaben are appearing in soil. The detection limits on the analytical methods were also reported in lb. ai/acre. It is therefore impossible to determine if the limits are adequate.

Given these drawbacks in the data presentation, soils sampled in 6 inch increments down to the 24 inch depth in 2 vulnerable Florida sand soils with water tables fluctuating between 10-30 inches from the surface and high rainfall/irrigation (73.7 inches annually) indicate only 1 detection of isoxaben residues past the 12 inch depth. Residues were detected in the 0-6 and 6-12 inch depths sampled at or above the 0.01 lb. ai/acre MDL at all sampling times. The degradate (N-(3-(2-hydroxybut-2-yl)isoxazol-5-yl]-2,6-dimethoxybenzamide) was not detected below the 12 inch depth. It was detectable throughout the study at the MDL.

Both parent and degradate were detected in the 0-6 and 6-12 inch depths throughout the year of sampling. The half-life for isoxaben was 30-41 days in 1 of these worst-case Florida sites and 60-182 days at the second Florida site. Whether or not sampling followed irrigation was unclear.

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Field studies conducted in less vulnerable sites in Indiana clay-clay loam soils indicate detectable residues

in the 0-6 inch depth throughout the sampling period (127 days) and non-detectable residues in the 6-12 inch depth. Deeper sampling was not conducted. The same pattern applied to the degradate (n-(3-(2-hydroxybut-2-yl)isoxazol--5-yl]-2,6-dimethoxybenzamide). This site had a cumulative rainfall/irrigation of 13.2 inches. The half-life for isoxaben was 30-41 days.

A sandy loam soil in Texas indicate detectable residues in the 0-6 inch depth throughout the sampling period. One sample showed detectable residues in the 6-12 inch depth. This site had a cumulative rainfall/irrigation of 20.75 inches. The half-life was 60-182 days.

These data indicate that in the worst-case sites in Florida with shallow water tables within a foot of ground surface and high irrigation/rainfall, isoxaben residues will reach ground water. As indicated in the data residues down to 12 inches were detected; the water table is within 10 inches of the surface during the year.

Summary

Isoxaben is persistent; it does not appear to be mobile based on limited data. It would not be flagged under the ground water data call-in at this point. However, anaerobic soil metabolism and adsorption/desorption data are necessary to finalize the assessment.

The Ground-Water Team recommends the following additions to the Registration Standard regarding ground-water issues:

° Require anaerobic soil metabolism data.

° Require adsorption/desorption data on both parent and degradates, particularly N-[3-(2-hydroxybut-2-yl)isoxazol-5-yl] -2,6-dimethoxybenzamide.

° Require information from the field dissipation study necessary to convert the units of lb a.i./acre to ppm for the minimum detection limit of the analytical method used for this study.

° The State of Florida could be notified of the findings in the field dissipation studies conducted in Florida with isoxaben. Based on these data, the State of Florida may want to consider precautions in the use of isoxaben.

The Ground-Water Team recommends the following changes to the Registration Standard regarding ground-water issues:

° The adsorption/desorption data reported in the Registration Standard from the study entitled, "Saunders, D.G., Smith, S.K., and Mosier, J.W. Mobility of EL-107 and a Soil Metabolite in Soil. Report No. EWD8442. Prepared and submitted by Eli Lilly and Co. Greenfield, IN. Reference 1," should be considered invalid and unacceptable. No conclusions should be drawn from these data.

cc: Bob Holst
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