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

OFFICE OF
PREVENTION, PESTICIDES AND
TOXIC SUBSTANCES

MEMORANDUM

SUBJECT: Transmittal of EFED's RED chapter for thiobencarb (Chemical # 108401, Case # 2665, DP Barcode # D214608, D214609, and D214610), associated data reviews (DP Barcodes # D182567, D199775, D200554, D200560, D204352, D205496, and D208936), and EFED's recommendations for thiobencarb

FROM: F. Nicholas Mastrota, Task Team Leader
Environmental Risk Characterization Branch
Environmental Fate and Effects Division (7507C)

F. Nicholas Mastrota
1-1-96

THRU: Elizabeth M. Leovey, Chief
Environmental Risk Characterization Branch
Environmental Fate and Effects Division (7507C)

TO: Jay Ellenberger, Chief
Accelerated Reregistration Branch
Special Review and Reregistration Division (7508W)

Attached to this memo is the EFED chapter for the Thiobencarb RED (Case # 2665). The attached product contains drop-in chapters for both the environmental fate assessment and the ecological risk assessment, as well as an integrated risk characterization. Also attached are Data Evaluation Reports for ~~eight~~ ten environmental fate studies and two ecological effects studies. The sponsor of these data is Valent USA Corporation.

Data Requirements

Environmental Fate DERs

DERs are attached for the following new environmental fate studies:

(1)

GLN	Study Type	MRID	Fulfills Guideline?
160-1	Hydrolysis	41609012	Yes
161-2	Photodegredation--water	42257801	Yes
162-1	Aerobic soil metabolism	43300401	Yes
162-3	Aerobic aquatic metabolism	43252001	Yes
163-1	Mobility	43150601	Yes
164-2	Aquatic field dissipation	42003404	Partial
164-2	Aquatic field dissipation	43404005	Partial
164-2	Aquatic field dissipation	Ross& Sava, 1986	Supplemental
165-3	Accumulation in crops	43148201	Yes
165-4	Bioaccumulation in fish	42460401	Yes

The requirement for aquatic field dissipation testing (GLN) is partially fulfilled by a combination of MRID 42003404, MRID 43404005, and Ross and Sava (1986). The study aquatic field dissipation performed in California (MRID 43404005) is currently partially acceptable because the study report lacked some vital information. The study report did not provide enough details on the water management practices used and did not provide information on the storage stability of thiobencarb. If this additional information is submitted and is judged to be acceptable by EFED, then GLN 164-2 will be fulfilled.

The registrant has submitted sufficient information on terrestrial field dissipation (164-1) to do an environmental fate assessment for the 40,000 acres of vegetables in Florida. Considering the small acreage of this use, the aquatic field dissipation study for rice in Louisiana (MRID 42003404) provided adequate information on the fate of thiobencarb under terrestrial conditions, in addition to aquatic conditions. The EFED reserves the right to request terrestrial field dissipation data for any future terrestrial uses of thiobencarb.

All of the other environmental fate studies were acceptable and fulfill their respective guideline requirements. DERs for these studies are attached. Since thiobencarb is used primarily on rice, with only minor uses on terrestrial crops, a terrestrial field dissipation study is not required. No additional environmental fate studies are required for thiobencarb.

Ecological Effects DERs

DERs are attached for the following new ecological effects studies:

GLN	Study Type	MRID	Fulfills Guideline?
72-3(c)	Acute shrimp	00079117	No, supplemental
72-4(b)	Shrimp life-cycle	00079117 & 43031701	No, supplemental
72-4(b)	Shrimp life-cycle	43976801	No, supplemental

MRID 00079117, a study submitted by the registrant, included both an acute and chronic tests with the mysid. The acute test was classified supplemental because primarily because the test organisms were too old. However, this guideline has already been fulfilled by other studies.

The chronic test was classified as supplemental because the experiment design lacked proper replication, measured concentrations were highly variable, and dry weights of mysids were not measured at the end of the test. This study is not repairable. The cover memo for these DERs (D197655) provide additional information on these tests.

MRID 43976801 was a paper from the open literature that was reviewed in attempt to fulfill the data gap. Although this paper provided useful information on the chronic toxicity of thiobencarb to shrimp, the study design was inappropriate for fulfilling the guideline requirement. A new chronic toxicity test with a shrimp or mysid [GLN 72-4(b)] is thus required.

Requirements for Additional Studies

Four additional toxicity studies are required to complete EFED's data base. The risk assessment has been performed without these studies. This risk assessment is adequate for completing the RED; the additional studies are confirmatory.

Avian Acute Toxicity

The guideline requirement for avian single-dose oral testing [GLN 71-1(a)] has been fulfilled, but the requirement for avian dietary testing [GLN 71-2(a) and 71-2(b)] have not been fulfilled. The guidelines specify that both an upland game species and a waterfowl species be tests. Only one supplemental study has been submitted with the bobwhite quail, an upland game species. Based on the low acute toxicity determined in this supplemental study as well as the core acute oral study, EFED has sufficient information to conclude that thiobencarb is not an acute risk to avian species. The guideline requirement for avian dietary testing with an upland game species [GLN 71-2(a)] is waived. However, no acute toxicity data are available for a waterfowl species. Therefore, an additional study must be submitted testing the avian dietary toxicity of technical thiobencarb to a waterfowl species, preferable the mallard [GLN 71-2(b)].

The value added of these data is moderate. There is a chance that the mallard may be more sensitive to thiobencarb than the bobwhite, and this could change the conclusion of the risk assessment. In general, however, the acute toxicity of thiobencarb is not a major concern.

Avian Chronic Toxicity

A core avian reproduction study has been submitted for an upland game species (the bobwhite), but only a supplemental study is available for a waterfowl species (the mallard). This supplemental data for the mallard indicates that it is the more sensitive species and was thus used in the risk assessment. The data requirement for an avian reproduction study with a waterfowl is still outstanding. The value added of this information is low since the results of a new study likely would not be very different from those of the supplemental study. Also, the conclusion of the risk assessment is not dependent on these data since high risk could be concluded based on the results of the core study with the bobwhite.

Chronic Fish Toxicity

Guideline requirements have not been fulfilled for a fish early life-stage test [GLN 72-4(a)]. EFED does not require a new study for this guideline, but instead requires that the registrant submit a fish life-cycle test (GLN 72-5) with technical thiobencarb. The Agency is justified in requiring a fish life-cycle test because the end-use product is intended to be applied directly to water or is expected to transport to water from the intended use site (rice), and because the EEC is greater than one-tenth of the NOEC in the invertebrate life-cycle test. This test should be conducted with a freshwater fish, preferably the fathead minnow or rainbow trout. The value added of this information is high because thiobencarb appears to have high chronic toxicity in aquatic organisms, yet just how toxic it is to fish cannot be known until an NOEC is determined. The Agency reserves the right to require a second fish life-cycle study using a saltwater species at a later time.

Chronic Marine/Estuarine Shrimp Toxicity

The guideline requirement for a life-cycle toxicity study with a marine/estuarine shrimp or mysid [72-4(b)] has not been fulfilled. A new life-cycle study is required. The value added by this study would be low to moderate since a high chronic risk has already been established based on the supplemental information. The benefits of a new study would be for establishing a definitive toxicity value that would improve the quality of the risk assessment and enable comparative analysis with other chemicals.

Seedling Emergence

The guideline requirement for seedling emergence testing [123-1(a)] is only partially fulfilled. The test was classified supplemental for the two most sensitive species, lettuce and ryegrass, because there was significant mortality of plants at the lowest test concentration. The EFED requests that additional testing be done for these two sensitive species using lower test concentrations that do not result in mortality of plants. The value added of this information is moderate. It would increase the confidence of the risk assessment on terrestrial plants. Also, this information would be required for comparative analysis of thiobencarb with other herbicides.

Thiobencarb Use Patterns Addressed in Risk Assessment

Thiobencarb is an herbicide used to control grasses and broadleaved weeds. It is applied to soil or water (in rice fields) to kill weeds before they emerge. Being a carbamothioate, its mode of action is inhibition of cell growth.

The primary use of thiobencarb is to control terrestrial and aquatic weeds in rice production. Over 95% of the use of thiobencarb is on rice. The maximum label use rate on rice is 4 lb/A, and the average rate is approximately 3 lb/A. Application may be by aircraft or ground equipment. For rice grown in the Gulf Coast and Mississippi River Valley, thiobencarb

is usually applied as a liquid (EC formulation) to nonflooded fields. "Dry-seeded" rice is frequently grown in this area, in which seeds are sowed and grown in dry seed beds for several weeks before flooding. If there is no rainfall, fields are irrigated with a small volume of water (i.e. flushed) to promote seed germination. Some rice in this area is "water-seeded", meaning that seeds are applied to water in flooded fields. In this part of the country, thiobencarb is usually applied to fields before they are flooded. Fields are then flooded for seeding with rice. These floods are normally dropped temporarily after seeding to allow rice seedlings to grow, resulting in a discharge of water. In California, the majority of rice grown is water-seeded with a continuous flood. Unlike the southern region, thiobencarb in California is almost always applied as a granule to water in flooded fields. A small percentage of rice farmers in California use "pin-point flood" culture, in which case thiobencarb may be applied as a liquid to dry-ground before fields are flooded. California state regulations prevent rice farmers from discharging tailwater from rice fields for 4 to 30 days after application.

Relatively minor uses of thiobencarb are on lettuce, endive, and celery. These registrations are restricted to Florida. The maximum label rate is 6 lb ai/A for lettuce and endive and 8 lb ai/A for celery. Application is by boom sprayers.

Summary of Risks

Thiobencarb is exceptional as an herbicide in that it poses a risk not only to nontarget plants (as do most herbicides) but also substantial risk to virtually all aquatic and terrestrial wildlife. The ecological risks of the various uses are summarized below.

Summary of Risk Conclusions and RQ Values

Use Site	Birds	Mammals	Honey Bees	Freshwater Fish[1]	Aquatic Inverts.	Estuarine Fish	Estuarine Inverts.	Terrestrial Plants	Aquatic Plants
Rice in CA (granules)	High (chronic)	High (chronic)	Minimal	Moderate[3] (chronic)	Moderate[3] (chronic)	Minimal	Minimal	Minimal	Moderate
Rice in CA (liquid)[2]	High (chronic 0.6-9.6)	High (chronic 3.48 acute <0.1-0.6)	Minimal	Moderate[3] (chronic)	Moderate[3] (chronic)	Minimal	Minimal	High (terrestrial plant only)	Moderate
Rice in SE US	High (chronic 0.6-9.6)	High (chronic 3.48 acute <0.1-0.6)	Minimal	Moderate (acute) High (chronic)	High (chronic)	High (chronic)	High (acute and chronic)	High (terrestrial plant only)	High
Lettuce and endive	High (chronic 0.9-14.4)	High (chronic 19.5 acute <0.1-0.8)	Minimal	High (chronic)	High (chronic 76, acute 1.4)	High (chronic >0.8)	High (chronic 4.29 acute 0.9)	High	High (a)
Celery	High (chronic 1.2-19.2)	High (chronic 22.57 acute 0.02-0.5)	Minimal	High (chronic)	High (chronic 102 acute 1.9)	High (chronic >5)	High (chronic 5.38 acute 1.23)	High	High (a)

1 The chronic risk assessment for freshwater fish is tentatively based on chronic effects observed in a supplemental study with an estuarine fish (MRID 00079117). These risk conclusions will need to be reevaluated if additional data on chronic effects to fish are submitted.
2 Liquid formulations account for a small percentage of thiobencarb use in California.
3 In this table, "moderate risk" indicates that some risk exists, but it is likely limited to small areas and/or infrequent events that are associated with unusually high exposures.

- All uses of thiobencarb pose a high chronic risk to birds and mammals.
- Use of liquid formulations also pose some acute risk to mammals. The acute risk to birds is minimal.
- Use of thiobencarb on celery, lettuce, and endive in Florida poses a very high risk of causing chronic effects to fish and freshwater invertebrates. It likely contributes to the degradation of water quality in the northern sections of the Everglades, including Loxahatchee National Wildlife Refuge. Additionally, this use poses a high risk of causing acute effects to freshwater and estuarine invertebrates.
- Use of thiobencarb on celery, lettuce, and endive in Florida poses a high risk to terrestrial plants, semiaquatic plants, and algae. It may also pose a risk to seeds and emerging seedlings of vascular aquatic plants.

- Use of thiobencarb on rice in the southeast US poses a high risk of chronic effects to freshwater and estuarine invertebrates, including shrimp and mollusks. The risk characterization concluded that thiobencarb could cause significant harm to populations of juvenile shrimp. The risk of chronic effects to fish is assumed to be high as well, but additional data are needed to confirm this. This use of thiobencarb may also poses a high risk of acute effects to fish and aquatic invertebrates in certain high-exposure situations.

- Use of thiobencarb on rice in California poses a risk of causing chronic effects to fish and aquatic invertebrates in the smaller drains and waterways, but not in the larger rivers. The EFED does not consider this to be a serious threat to the environment. This use poses minimal risk of acute effects to fish and aquatic invertebrates.

- Minimal risk of both acute and chronic effects is expected for all estuarine organisms in California due to minimal exposure.

- All uses of thiobencarb on rice may pose a risk of killing emerging seedlings of aquatic plants, especially aquatic grasses.

- Use of thiobencarb on rice may harm aquatic algae in the southeast US and in smaller drains and waterways in California.

- Spray drift from aerial application of liquid thiobencarb on rice poses a high risk to nontarget terrestrial and semiaquatic plants. Drift from applying granular thiobencarb (primarily in California) and spraying liquid thiobencarb with ground equipment pose minimal risk to these plants.

Recommendations for Risk Mitigation

The EFED is not able to propose specific recommendations for risk mitigation at this time. Possible actions that would likely reduce ecological risks are discussed below. These are meant to be options for consideration. The EFED recognizes that some of these actions may not be feasible. Also, other measures not discussed may be effective in mitigating risk. The EFED recommends that risk mitigation actions be negotiated with the registrant and other interested parties.

Risk Mitigation for Use Granular Thiobencarb on Rice in California

Almost all granular thiobencarb is used on rice in California. Granular thiobencarb poses a high risk of causing chronic effects to all types of terrestrial vertebrates, as well as possible acute effects to mammals. The following measures are options that could be used reduce these risks:

1. Allow application only by ground equipment and require that granules be applied only to areas of the field that will be flooded (excluding levees). Require flooding of fields with at least 4 inches of water immediately after application.

2. Require the use of global positioning system (GPS) technology when applying granules by air to make the placement of the granules more precise. Also, the applicator could be required to use a set-back from the edge of flooded areas when applying granules. This set-back would account for the swath width of granular application to minimize the number of granules falling on dry ground on levees and field edges.

3. Granules possibly could be made aversive or less attractive to wildlife by altering the size, shape, or carrier, or by adding a taste repellent. To be acceptable, the effectiveness of any such modification of granules at deterring consumption by wildlife would have to be well established by published literature studies or new field or pen studies approved by the EFED.

The EFED believes that the water-holding requirements already required by the state government of California are adequate for minimizing risk to aquatic habitats from granular thiobencarb in that state. Any strengthening of these measures, such as lengthening water holding periods, would further mitigate this risk. Requiring that mixing/loading/handling be carried out some distance from surface water habitats would also be beneficial in reducing risks.

For any granular thiobencarb sold for use in the southeastern US, the mitigation measures for reducing aquatic risks from liquid formulations, discussed below, should be applied.

Risk Mitigation for Use of Thiobencarb on Rice in the Southeast

1. Reduction of the maximum label use rate would reduce risk.

2. Risk to shrimp and estuarine ecosystems could be mitigated by allowing use of thiobencarb within 1 mile of tidal waters only on farms that have a pond or other facility that temporarily retains tailwater discharged from the field before it is released in the environment. This would reduce the amount of thiobencarb entering estuaries by allowing time for dissolved residues to dissipate and for suspended sediment with absorbed thiobencarb residues to settle out before the water is released.

3. Movement of the chemical in runoff is significantly reduced if thiobencarb is allowed time to bind to the soil before it is flooded or flush. Therefore, risk could be reduced by prohibiting flooding or flushing with irrigation water for several days following application.
4. The highest levels of contamination to aquatic habitats probably occurs when there is heavy rain immediately following application. A statement such as the following may reduce this risk:

Avoid application when heavy rainfall (>0.5 inch) is expected to occur within 48 hours.

5. Restrict discharging of water from the field for several days after application. Flood gates on the outer levees would have to remain closed during this period, releasing only enough rain or irrigation water from the field needed to prevent the levees from rupturing.

6. Require a set-back of mixing/loading/handling areas from surface water habitats (streams rivers, lakes, wetlands, etc.).

Risk Mitigation for Uses in Florida

Over ten years ago, the EFED concluded that the use of thiobencarb in Florida on lettuce and endive would result in high acute and chronic risks to aquatic organisms (Section 18 review, Registration No. 83-FL-05) or on celery (Section 18 review, Registration No. 83-FL-26). The 1983 Section 18 review for celery also stated that the adverse effects of thiobencarb "could materialize on the Loxahatchee National Wildlife Refuge". The EFED still agrees with this conclusion. Most of the use of thiobencarb in Florida on vegetables is concentrated in the Palm Beach County, as well as some additional use on rice in this county. Since the agricultural areas in this county flow directly into the Loxahatchee National Wildlife Refuge, adverse effects from thiobencarb may be occurring. Also, the current risk assessment indicate that these uses pose additional chronic risks to birds and mammals, and a high risk of harming nontarget terrestrial and aquatic plants. The EFED therefore concludes that the reregistration of the use of thiobencarb on lettuce, endive, and celery in Florida result in continued high risks to many types of organisms in nearby habitats.

With chronic aquatic risk quotients of 102 for celery and 76 for lettuce and endive, the EFED doubts that practical risk mitigation could be imposed that would remove the characterization of "high risk". Actions that could reduce the risk somewhat include reducing the use rate, requiring soil incorporation, and establishing buffer zones or vegetative filter strips between fields and bodies of water. However, the EFED recommends eliminating this use as the best way to mitigate risk.

cc (by cc:Mail): Denise Keehner
Kathleen Knox
Anthony Maciorowski
Henry Jacoby
Kathy Monk
Daniel Rieder
Mary (Betsy) Grim
James Breithaupt
Robert Hitch
David Wells
William Effland
Ronald Kendall
Renee Costello
Stephanie Syslo

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