November 18, 1980

11-18-80

Request by Union Carbide for a full registration of their new insecticide product Larvin-(Dimethyl N,N'-[thiobis [(methylimino) carbonyloxy]] bis,-dimethylester-44% a.i.-to be used on cotton and soybeans - EPA File No. 264

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The Ecological Effects Branch (EEB) of HED has reviewed Union Carbide's request for the registration of their new insecticide LARVIN (active ingredient Thiodicarb-TD-44% a.i) to be used on cotton and soybeans.- For chemical name see above heading). The maximum application rate would be 0.9 lbs. a.i/A.

A previous EEB review by R.W. Matheny (12/15/78) for a cotton and soybean Larvin EUP pointed out (see section 104.1.1.): "A complete hazard assessment cannot be made at this time in the absence of an evaluation by the Environmental Fate Branch (EFB)". At the time of Matheny's review no Daphnia toxicological data was available either. He requested a Daphnia LC50.

Since Matheny's review the following facts about TD have came to light:

1. The Daphnia sp. test requested by Matheny was presented by the applicant. The result for the 48-hour LC50 was 5.3 ppb (or 0.0053 ppm).

2. EFB review of 3/1/79 by Ney and Nawar indicate that the halflife (t 1/2) for TD in water and when subjected to light is 80.91 days. This means that the outdoor t 1/2 under the same conditions is likely to be substantially longer since solar radiation is only present about 1/3 of the day. In the lab. 24 hour artificial light is applied.

3. Methomyl (M) which is a registered pesticide with EPA (Reg. No. 353-342, 370) is the immediate major degradate of TD (one TD molecule gives two of M). The fish and wildlife toxicity of M and TD were compared by this reviewer and found to be very similar with their toxicity to aquatic invertebrates being the highest (range 0.0053 ppm for Daphnia to 0.056 ppm for grass shrimp) followed by more moderate levels of ichthyotoxicity (1.21 ppm for Bluegill sunfish to 3.4 ppm for the Rainbow trout test).

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It is readily apparent that from the aquatic toxicity point of view TD presents a much greater hazard than M because of TD's much longer t 1/2.

4. On 11/4/80, J.C. Reinert of the EFB calculated the estimated environmental concentrations (EEC) of TD and M. The following is an almost verbatim text of EEB's report to EEB:

The following assumptions were made. Thiodicarb was applied 10 times at the maximum rate of 0.9 lb ai/A/appl. at 14 day intervals. Soon after the final application a severe runoff event occured, draining 100 A of treated fields into the aquatic matrices. Both spray drift and runoff were considered in the calculations. The pond and stream hydrosoils were assumed to contain 2% organic matter. Calculations were made both for parent thiodicarb (TD) and for the principal degradate methomyl (M). The following first order degradation rate constants were used in the calculations:

	K (day^{-1})
TD (terrestrial)	0.14
TD (aquatic)	0.0028
M (foliage)	5.54
M (soil)	0.023
M (aquatic)	0.1

Soil-water partition coefficients, accumulated residues, lake EECs, and input for the stream calculations from the Exposure Analysis Modeling System (exams) developed by Larry Burns of the EPA Environmental Research Laboratory in Athens, GA. were all calculated using an EFB program called HR59-EEC. The results were as follows:

	max. EECs in a 3A x 4 ft. lake (ppm)	
	water	hydrosoil
TD	0.03	0.5
M	0.008	0.001

	max. EECs in a small (10CFS) stream (ppm)	
	water	hydrosoil
TD	0.001	0.02
M	0.0005	0.00007

The March 2, 1980 proposed "EPA Guidelines for Registering Pesticides, Draft Subpart E, Hazard Evaluation: Wildlife and Aquatic Organisms", Section 163.72-4(a)(1) states:

Section 163.72-4 Fish Embryolarvae and Aquatic Invertebrate Life-Cycle Studies

(a) When required. (1) End-use formulated products. Data from fish embryolarvae tests or life-cycle tests with aquatic invertabrates or both are required to support the registration of any end-use formulated product intended for use in water or expected to be transported to water from the intended use site, and when any of the following conditions apply:

(i) If the pesticide is intended for use such that its presence in water is likely to be continous or recurrent regardless of toxicity; or

(ii) If any LC50 or LC50 value determined in testing required by 163.72-1, -2, or -3 is less than 1 mg/l; or

(iii) If the estimated concentration in water is equal to or greater than 0.01 of any EC50 or LC50 determined in testing required by 163.72-1, -2, or -3; or

(iv) If the actual or estimated concentration is water resulting from use is less than 0.01 of any LC50 or LC50 determined in testing required by 163.72-1, -2, or -3 and any of the following conditions exists:

(A) Studies of other organisms indicate the reproductive physiology of fish and/or invertebrates may be affected; or

(B) Physiochemical properties indicate cumulative effects; or

(C) The pesticide is persistent in water (i.a., half-life in water greater than 4 days).

Further, 40 CFR 162.11 (a)(B)(3) clearly states that there will be an RPAR when "... a maximum calculated concentration following direct application to a 6 wide layer of water more than 1/2 the acute LC50 for aquatic organisms likely to be exposed as measured on test animals specified in the Registration Guidelines".

A comparison between EFB's calculated EEC and each of the two lowest acute aquatic LC50 values for TD gives the following results:

	TD Lowest LC50 Values (ppm)	Highest Lentic EEC (ppm)	EEC/LC50 Ratio
-Daphnia 48 hours	0.0053	0.03	5.66
-Grass shrimp 96 hours	0.056	0.03	0.54

In the absence of actual field data, both EEB and EFB have had to evaluate the applicant's request for registration through computer modeling and analysis of the applicant's environmental fate and fish and wildlife toxicological data. From said analysis, we at EEB conclude that the proposed use of TD major crops such as cotton and soybeans would constitute an unreasonable adverse environmental risk to the aquatic environment.

Because we at EEB recognize the limitations of laboratory and computer simulation of the real world we believe that in this particular case it would be in the public interest as well as in the interest of the applicant to bring to the attention of EPA actual field data which could demonstrate possible adverse effects attenuation by the combination of various natural biological, chemical and physical factors, should this be the case.

These same studies would have to be conducted for the main degradate of TD-namely Methomyl because:

1. Methomyl's aquatic toxicity is very similar to that of TD:

	LC50 for TD (ppm)	LC50 for M (ppm)
Grass shrimp	0.056	0.049
Rainbow trout (Conducted by EPA*)	2.55	2.4*
Bluegill sunfish	1.21	1.88
Daphnia sp	0.0053	0.031

2. In 1979 EPA's Beltsville, MD. laboratory conducted a series of tests on Methomyl and concluded that the halflife of this compound is likely to be over 60 days (another implication could be that Methomyl degradates were also toxic to aquatic invertebrates - See memorandum and corresponding attached studies - 6/27/79 from John A. McAnn of Beltsville's EPA Lab. to Participants in the Methomyl Deactivation Study Discussion).

Further, a 5/12/80 EEB review of Methomyl by J.J. Bascietto discusses the apparent problem of Methomyl's halflife and concluded (Sec. 107.4 of review) that the data was not adequate to assess chronic hazards. Bascietto in his review (sec. 107.5-c) requested clarification on the issue of methomyl's halflife.

Conclusions:

1. The aquatic halflives of both Thiodicarb and methomyl, its main degradate, have not been clearly established but there are strong indications that both of these materials may be significantly persistant.

2. Both thiodicarb and methomyl are very toxic to aquatic invertebrates and use patterns as those proposed here on major crops such as cotton and soybeans appear to present serious adverse environmental risks.

3. Given all the above facts a responsible and well informed hazard evaluation by EEB is only possible if the applicant submits the following additional data:

   - A complete invertebrate life cycle study (Daphnia sp.).

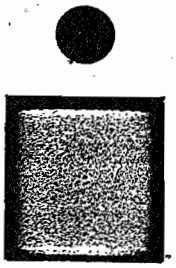
   - A fish embryolarvae study (Brood trout). P. 29736 Guidl. sec. 163.72-4

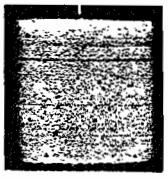
   - Field studies that would demonstrate the actual aquatic concentrations and t 1/2 of TD and M under natural conditions similar to those expected to occur under actual agricultural use practices.

EEB will be glad to assist on this matter should you consider it necessary. Our telephone number is (703)557-0320.

Alvaro A. Yamhure

cc: EEB file.





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