



R.E.D. FACTS

THIODICARB

Pesticide Reregistration

All pesticides sold or distributed in the United States must be registered by EPA, based on scientific studies showing that they can be used without posing unreasonable risks to people or the environment. Because of advances in scientific knowledge, the law requires that pesticides which were first registered before November 1, 1984, be reregistered to ensure that they meet today's more stringent standards.

In evaluating pesticides for reregistration, EPA obtains and reviews a complete set of studies from pesticide producers, describing the human health and environmental effects of each pesticide. The Agency develops any mitigation measures or regulatory controls needed to effectively reduce each pesticide's risks. EPA then reregisters pesticides that can be used without posing unreasonable risks to human health or the environment.

When a pesticide is eligible for reregistration, EPA explains the basis for its decision in a Reregistration Eligibility Decision (RED) document. This fact sheet summarizes the information in the RED document for reregistration case 2675, thiodicarb, dimethyl N,N'-(thiobis((methylimino)carbonyloxy))bis(ethanimidothioate).

Use Profile

Thiodicarb acts as an insecticide against major Lepidopterous, and suppresses Coleopterous and some Hemipterous insect pests. Thiodicarb acts as an ovicide against cotton bollworms and budworms. Thiodicarb is used primarily on cotton, sweet corn, and soybeans. The remaining usage is spread among leafy vegetables, cole crops, ornamentals, and other minor use sites. There are currently 14 tolerances for thiodicarb. Application types for thiodicarb include aircraft (fixed-wing and helicopter), airblast sprayer, chemigation, groundboom, high- and low-pressure handwand, backpack sprayer, and belly-grinder spreader. Thiodicarb is formulated as a liquid, flowable concentrate, granular, pelleted/tableted, water dispersible granules, and wettable powder. There are no homeowner uses of thiodicarb.

**Regulatory
History**

Thiodicarb was first registered in the United States in 1984 for use as an insecticide. Rhone-Poulenc, Inc., is the current manufacturer of thiodicarb. A data call-in was issued in April 1991. There are 11 thiodicarb products registered, along with 19 Special Local Needs registrations (SLNs).

**Human Health
Assessment****Toxicity**

In acute toxicity testing, thiodicarb places in Toxicity Category I (the highest toxicity category out of four) via the oral route and Toxicity Category II via the inhalation route. For acute dermal effects and eye irritation thiodicarb is in Toxicity Category III. For acute skin irritation, thiodicarb produced no irritation (Category IV).

Thiodicarb has been classified as a Group B2 - probable human carcinogen. The B2 classification was based on statistically significant increases in tumors in both sexes of the mouse and statistically significant increases in testicular interstitial cell tumors in male rats. A linear methodology (Q_1^*) was applied for the estimation of human cancer risk and was calculated to be 1.88×10^{-2} .

In determining whether to retain, reduce, or remove the 10x FQPA safety factor for infants and children, EPA uses a weight of evidence approach taking into account the completeness and adequacy of the toxicity data base, the nature and severity of the effects observed in pre- and post-natal studies, and exposure. Although the data provided no indication of increased sensitivity of rats or rabbits to *in utero* and/or postnatal exposure to thiodicarb, data gaps exist for the acute and subchronic neurotoxicity studies. These studies would have yielded cholinesterase inhibition and field observation behavior data, as well as histopathology of the central and peripheral nervous system which are not presently available for evaluation. The Agency determined that the 10x safety factor to account for increased sensitivity of infants and children should be reduced from 10x to 3x.

The Agency has determined that thiodicarb has a metabolite, methomyl, which is also a registered pesticide. Therefore, methomyl residues resulting from applications of both thiodicarb and methomyl were considered in an aggregate dietary risk assessment and compared to appropriate toxicological endpoints for methomyl. In addition, for post application exposure to workers, the

methomyl short and intermediate-term dermal endpoints were used in the risk assessment because thiodicarb degrades rapidly to methomyl.

Dietary Exposure and Risk

The RfD for thiodicarb was calculated to be 0.03 mg/kg/day from a chronic rat toxicity study. The RfD was based on an increased incidence of extramedullary hemopoiesis in males and decreased RBC cholinesterase in females at the LOEL. An uncertainty factor of 100 was used for deriving the RfD and includes 10x for inter-species extrapolation and 10x for intra-species variation. An FQPA safety factor of 3x (due to data gaps) was applied to derive an FQPA adjusted RfD of 0.01 mg/kg/day. Chronic dietary exposure to thiodicarb alone must be less than 100% of the FQPA adjusted RfD to be considered below EPA's level of concern.

For acute dietary risk assessment for thiodicarb alone, a MOE of 1000 is required for women 13 years and older, as well as for the general population including infants and children. This MOE includes the conventional MOE of 100 for inter- and intra-species variation, 3x for FQPA, and another 3x for the use of a LOEL, instead of a NOEL, in the rat developmental study. The FQPA Safety Factor (3x) is required because of data gaps (acute and subchronic neurotoxicity studies). The acute Monte Carlo dietary analysis for thiodicarb alone indicates that there are adequate margins of exposure for the U.S. population, women 13 years and older, children 1 to 6 years old and infants.

The results of the chronic dietary risk evaluation system (DRES) analyses, for thiodicarb alone, indicate that the anticipated residue contribution for the U.S. Population occupies 68% of the FQPA adjusted RfD. For females (13 years and older) 67% of the FQPA adjusted RfD is occupied. For children (1 to 6 years old) and infants, 104% and 43%, respectively, of the FQPA adjusted RfD is occupied. Although for children (1 to 6 years old), the FQPA adjusted RfD is slightly exceeded, if more refined estimates of dietary exposure were made (e.g. residues from field trials) significantly lower chronic risk would be estimated. Therefore, the chronic risk from exposure to thiodicarb from food sources is not of concern.

For the acute aggregate dietary risk assessment for food, for thiodicarb and methomyl combined, the endpoint for methomyl was used in the risk

assessment and compared to residues of methomyl from thiodicarb application plus residues of methomyl from methomyl application. The results of the acute aggregate exposure analyses for food, for thiodicarb and methomyl show that there are adequate margins of exposure for the general U.S. population, children 1 to 6 years of age, and infants.

For the chronic aggregate dietary risk assessment for food, for thiodicarb and methomyl combined, the RfD for methomyl was used in the risk assessment and compared to residues of methomyl from thiodicarb application plus residues of methomyl from methomyl application. The results of the chronic aggregate exposure analysis indicate that there are no chronic concerns associated with potential residues of methomyl on foods as the result of application of thiodicarb and methomyl.

Thiodicarb degrades rapidly to methomyl in the environment. Therefore, the Agency has calculated drinking water levels of concern (DWLOCs) for methomyl. The maximum estimated concentrations of methomyl in surface and ground water are less than the Agency's levels of concern for methomyl in drinking water as a contribution to acute aggregate exposure. The estimated average concentrations of methomyl in surface and ground water are less than OPP's levels of concern for methomyl in drinking water as a contribution to chronic aggregate exposure.

A linear methodology (Q_1^*) was applied for the estimation of human cancer risk and was calculated to be 1.88×10^{-2} . The assessment was conducted for the total U.S. Population only. The upper bound cancer risk was calculated to be 3.76×10^{-7} . This upper bound risk is below the range the Agency considers negligible for excess lifetime cancer risk and is not cause for concern.

Occupational Exposure and Risk

Handlers (mixers, loaders, and applicators) of thiodicarb may be exposed to thiodicarb during and after normal use of liquid and wettable powder formulations. For dermal exposure, no short- and intermediate-term dermal risk was seen for thiodicarb. For inhalation exposure, the Agency is requiring the use of personal protective equipment and/or the use of engineering controls (water soluble bags). The handler information for thiodicarb has been

integrated with other considerations, including the toxicity concerns pertaining to methomyl, a degradate of thiodicarb, in determining the required PPE.

There are no short- or intermediate-term dermal endpoints of concern for thiodicarb, and a post-application inhalation risk assessment is not warranted. However, thiodicarb rapidly degrades to methomyl. Therefore, the toxicity concerns pertaining to methomyl are considered in the post-application risk assessment. Based on the results of this assessment, the Agency believes an REI of 48 hours is sufficiently protective of workers following applications of thiodicarb for the currently registered uses.

Environmental Assessment

Environmental Fate

Available environmental fate studies show that thiodicarb degrades rapidly into methomyl under most conditions. While the parent chemical does not appear to be very persistent or highly mobile, the degradate methomyl is more persistent, more mobile, and more toxic. Thiodicarb rapidly degrades (half-lives on the order of a few days) primarily by metabolism and hydrolysis in alkaline conditions. It may be more persistent under drier conditions. Methomyl appears to be moderately persistent and highly mobile in the environment. The dominant routes of dissipation are metabolism (biologically-mediated degradation), leaching, and photolysis in clear waters.

While thiodicarb is not expected to have a high potential to contaminate ground water because of its short persistence, methomyl has fate characteristics that favor leaching, and it has been detected in ground water in a prospective ground water monitoring study and in other reported incidences. While it may reach ground water under certain conditions, methomyl may not persist under many conditions. Both thiodicarb and methomyl may run off to surface waters for a few days to several weeks after application. Neither chemical is likely to persist in clear, shallow waters or in waters with substantial microbiological populations. However, methomyl may persist in waters where sunlight penetration is limited (such as in deeper waters or waters with a significant sediment load or populations of organisms such as algae). Neither chemical is expected to persist in anaerobic sediments.

Ecological Effects

Laboratory studies show that thiodicarb is practically non-toxic to birds but moderately to highly toxic to small mammals on an acute oral basis. Methomyl is highly toxic to birds and mammals on an acute oral basis but only slightly toxic to birds on a subacute dietary basis. Thiodicarb may result in chronic risks to certain species that frequent short grass (e.g, ducks, geese and swans). Methomyl, as a degradate, poses acute risks to birds and mammals that feed on short and tall grasses, broadleaf plants, and small insects.

Acute toxicity studies show that thiodicarb is moderately to highly toxic to freshwater and estuarine/marine fish, respectively, and very highly toxic to freshwater and estuarine/marine invertebrates. The degradate methomyl is moderately to highly toxic to freshwater fish and moderately toxic to estuarine fish. In a chronic early life-stage study, methomyl significantly reduced fish larvae survival under flow through conditions. Toxicity data suggest that aquatic invertebrates are much more sensitive to methomyl contamination than either fresh or salt water fish species. Accumulation of methomyl from repeated applications contributes to the chronic risks.

Ecological Effects Risk Assessment

EPA is generally concerned about the ecological effects to terrestrial wildlife and aquatic organisms posed by exposure to thiodicarb. The risk assessment for thiodicarb and its degradate methomyl shows various levels of concern regarding avian risk and mammalian risk from multiple applications of thiodicarb at short intervals. In addition, most agricultural uses present acute and chronic risks of varying levels to endangered and nonendangered aquatic organisms. The major concerns for non-target organisms are the chronic risks posed by the use of thiodicarb to non-target mammalian and freshwater invertebrate organisms. With risk mitigation measures in place, the Agency considers these risks acceptable.

Risk Mitigation

To lessen ecological and potential water risks posed by thiodicarb and its degradate methomyl, the Agency is requiring the following mitigation for thiodicarb containing products.

- Thiodicarb will be reclassified as a Restricted Use Pesticide. (Thiodicarb degrades rapidly to methomyl which is already a restricted use chemical.)

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- Based on the environmental risk assessment for methomyl, the following advisories are required for thiodicarb: a labeling statement for potential ground water contamination, a labeling statement to minimize the potential for surface water contamination and labeling statements on manufacturing use products and end use products based on the toxicity to nontarget organisms. A bee hazard statement is also required.
 - The maximum number of applications on cole groups will be reduced from 6 to 4 per season, at the maximum rate of 1.0 pounds ai/A. The number of applications on cotton will be limited to 6.
 - A statement supporting the use of an Integrated Pest Management (IPM) plan must be added to the labels.
 - Buffer zones have been imposed that will reduce the potential risk to non-target aquatic organisms from spray drift during aerial or ground applications.

Additionally, there are risk mitigation measures required in the RED to protect mixers, loaders, applicators and workers, including water soluble bags, additional PPE and appropriate REIs. For a detailed list, refer to Chapter V. of the thiodicarb RED document.

Additional Data Required

The generic data base supporting the reregistration of thiodicarb for the above eligible uses has been reviewed and determined to be substantially complete. For thiodicarb, the following information is being required:

81-8 Acute neurotoxicity study - rat
 82-7 Subchronic neurotoxicity study - rat
 72-4(a) Estuarine/marine fish early life stage test
 72-4(b) Estuarine/marine invertebrate life-cycle tests
 164-1 Field Dissipation Study (cotton and corn)
 860.1500 Magnitude of residue in cotton (formerly 171-4k)
 860.1900 Field Accumulation in Rotational Crops (formerly 165-2)
 830.7050 UV/Visible Absorption
 Thiodicarb Cooking Study

Product Labeling

All thiodicarb end-use products must comply with EPA's current

Changes Required

pesticide product labeling requirements and with those labeling requirements imposed in the Thiodicarb RED. For a comprehensive list of labeling requirements, please see Section V. of the Thiodicarb RED document.

**Regulatory
Conclusion**

Based on the reviews of the generic data for the active ingredient thiodicarb, the Agency has sufficient information on the health effects of thiodicarb and on its potential for causing adverse effects in fish and wildlife and the environment. The Agency has determined that thiodicarb products, labeled and used as specified in the Reregistration Eligibility Decision, will not pose unreasonable risks to humans or the environment. Therefore, the Agency concludes that products containing thiodicarb for all uses are eligible for reregistration.

**For More
Information**

EPA is requesting public comments on the Reregistration Eligibility Decision (RED) document for thiodicarb during a 60-day time period, as announced in a Notice of Availability published in the Federal Register. To obtain a copy of the RED document or to submit written comments, please contact the Pesticide Docket, Public Response and Program Resources Branch, Field Operations Division (7506C), Office of Pesticide Programs (OPP), US EPA, Washington, DC 20460, telephone 703-305-5805.

Electronic copies of the RED and this fact sheet are available on the Internet. See <http://www.epa.gov/REDs>.

Printed copies of the RED and fact sheet can be obtained from EPA's National Center for Environmental Publications and Information (EPA/NCEPI), PO Box 42419, Cincinnati, OH 45242-0419, telephone 513-489-8190, fax 513-489-8695.

Following the comment period, the Thiodicarb RED document also will be available from the National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, VA 22161, telephone 703-605-6000.

For more information about EPA's pesticide reregistration program, the Thiodicarb RED, or reregistration of individual products containing thiodicarb, please contact the Special Review and Reregistration Division (7508C), OPP, US EPA, Washington, DC 20460, telephone 703-308-8000. For information about the health effects of pesticides, or for assistance in recognizing and managing pesticide poisoning symptoms, please contact the National Pesticide Telecommunications Network (NPTN). Call toll-free 1-

800-858-7378, between 9:30 am and 7:30 pm Eastern Standard Time, seven days a week. Their internet address is ace.orst.edu/info/nptn.