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Memorandum

RE: EFED RED Chapter for 1,3-Dichloropropene (Telone)

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Included along with this memo is the Environmental Fate and Effects Division risk assessment and characterization for the reregistration of 1,3-dichloropropene (1,3-D).

Use Profile

Dichloropropene (1,3-D) is a contact nematicide that can also be used as an insecticide, fungicide, and herbicide. DowElanco has three formulations currently registered for nationwide use. These products -- Telone EC, Telone II, and Telone C-17 -- contain up to 94% active ingredient. Labels for Arizona, Oregon, and Washington are state specific. Telone C-17 is formulated with chloropicrin, a gas that may serve as a warning agent.

Telone is registered for use on at least 115 terrestrial food and feed crops including vegetables, tree nuts and fruits, and field crops. Terrestrial non-food and non-feed crop uses include nursery, ornamentals, and tobacco. 1,3-D can also be used as a herbicide to control bindweed and Canada thistle.

1,3-D is primarily applied via soil injection. Another method of application, drip irrigation, is used on melons at a rate of 91 pounds a.i./acre. Typical application rates range from 177 lbs. a.i./acre on field crops and tobacco to 350 lbs. a.i./acre on fruit crops. The application rate on ornamental crops is 550 lbs. a.i./acre.

Data Gaps

Environmental Fate

All environmental fate data requirements are complete.

Water Resources

Two small-scale prospective ground-water monitoring studies in Wisconsin and Florida (166-1) are ongoing. Additional ground-water monitoring may be requested following negotiations with DowElanco.

Limited surface-water monitoring information is available to the Agency. Surface-water monitoring may be requested following negotiations with DowElanco.

Ecological Effects

Five additional aquatic studies are required to fully assess 1,3-D's effect on nontarget organisms. Many of the crops on which 1,3-D is applied are located in coastal regions and are associated with estuarine habitats. The additional data would be of high value since the Agency lacks toxicity information for estuarine and marine assessments. These studies are:

- Two estuarine/marine invertebrate LC_{50} tests with the mysid shrimp and the eastern oyster,
- One estuarine/marine fish LC_{50} test with the Sheepshead minnow,

- One freshwater aquatic invertebrate life-cycle test with Daphnia magma,
- One freshwater fish early life-stage test with the Rainbow trout, and
- Tier I and Tier II aquatic and terrestrial plant studies.

Assessment Summary and Risk Characterization

Environmental Fate

The cis and trans isomers of 1,3-D are highly volatile and mobile depending upon environmental conditions. The major hydrolysis and aerobic soil metabolism degradates, 3-chloroallyl alcohol and 3-chloroacrylic acid, are both mobile and persistent. The manufacturing impurity 1,2-dichloropropane (1,2-D) found in all Telone formulations is also volatile, mobile, and persistent.

Water Resources

Ground Water. Monitoring data from a variety of studies have confirmed that 1,3-D; both of its major degradates; and 1,2-D leach to ground water as a result of normal agricultural use in some of its use area. Recent monitoring data also confirm that 1,3-D and its degradates have the potential to contaminate drinking water supplies derived from ground water. Ground-water monitoring information collected in different retrospective and prospective studies since 1983 demonstrates that 1,3-D has been detected in ground water in seven states in different regions of the U.S. These states include California, Florida, Nebraska, New York, Oregon, Washington, and Wisconsin. The highest values were detected in Florida and Wisconsin small-scale field monitoring studies conducted by DowElanco to support pesticide registration.

The results of these studies indicate that 1,3-D will leach to ground water in areas with shallow water tables (30 feet or less). Once in ground water, 1,3-D can persist for six months or more, even where the climate is warm. The 1,3-D degradates can persist for up to one year even in warm climates. In cooler climates, such as that seen in Nebraska, parent residues also persisted for more than one year. The results of the Wisconsin monitoring study will give a better idea of how long residues will persist in areas with cold ground water.

1,2-D is found in ground water at low levels as a result of applications of 1,3-D. These residues have been demonstrated to persist in ground water for long periods (probably several years) and accumulation of residues may occur after repeated applications.

Surface Water. 1,3-D has the potential to move to surface water via runoff, dissolution of the volatilized compound from the air (since 1,3-D is heavier than air), and from ground water discharge to surface water. However, extremely high application rates of several hundred pounds per acre coupled with low soil/water partitioning indicate some potential for runoff for at least several weeks post-application.

1,3-D will probably undergo rapid rates of dissipation in most surface waters due to volatilization and to a lesser extent by abiotic hydrolysis and possibly biodegradation. Volatilization rates will be highest for shallow turbulent water and decrease with increasing depth and decreasing turbulence. The low octanol/water partitioning of 1,3-D indicates that its bioaccumulation potential is probably low.

Limited surface-water monitoring information is available for 1,3-D. The only monitoring data are from four sampling sites along two perimeter ditches in a prospective ground-water monitoring study in Florida. 1,3-D; 3-chloroacrylic acid; and 3-chloroallyl alcohol were detected in the ditch water. The residues were short-lived; no 1,3-D was detected in samples collected from the ditches five days after application. However, this information indicates the potential for 1,3-D residues to move to surface water in some areas.

The screening model GENEEC (GENeric Estimated Environmental Concentration) was used by OPP to generate EECs for a field treated with 1,3-D at rates ranging from 177 to 556 lbs. ai/week. Concentrations generated by the model are similar to those measured in the shallow (4') wells from the Florida prospective study. More sophisticated modeling such as PRZM/EXAMS could not be used because the models cannot account for the 12" to 18" soil incorporation. The concentrations generated by GENEEC were used to develop the ecological risk assessment in this document. The GENEEC EECs are probably highly conservative for most surface waters and should only be used for screening purposes.

Ecological Effects

The available acute toxicity data on the TGAI indicate that 1,3-D is moderately toxic to birds (LD50 = 152 mg/kg), moderately toxic to small mammals (LD50 = 640 mg/kg, rat), moderately toxic to bees (LD50 = 6.6 μg/bee), moderately toxic to freshwater fish (LC50 = 1.1 <7.5 ppb), and moderately to highly toxic to freshwater invertebrates (LC50 = 0.09 - 6.2 ppb). Toxicity testing has not been required for estuarine or marine organisms. Chronic toxicity studies established the following LOEC value for small mammals: 75 ppm for slight physiological effects and >90 ppm for reproductive effects.

Because 1,3-D degradation appears to be strongly related to temperature, organisms living in cooler climates (where degradation is slower) would be at a risk for a longer time that those in warm climates. Applications to cool climate crops, such as flower bulbs in the Northwest, may pose the greatest acute and chronic risks. Alternatively, although use in Florida may present a substantial risk to freshwater organisms, the potential for chronic effects may be shortened because of the warm climate.

1,3-D application methods (soil injection and subsurface drip irrigation) greatly reduce the risk to terrestrial birds. Since application is primarily to bare fields prior to planting, terrestrial organisms could be at risk through three routes of exposure: ingestion of contaminated soil, ingestion of contaminated water or inhalation of 1,3-D vapors.

Birds. Actual residue levels found in field samples were used to estimate risk to birds. Acute risk quotients did not exceed any LOC even at the maximum application rates. No data are available to conduct a chronic risk assessment. However, given the relatively short field dissipation half-life, chronic exposure is not anticipated.

Mammals. Using under the same assumptions as the avian assessment, acute risk quotients did not exceed any LOC. A chronic risk assessment was not conducted.

Aquatic Organisms. Using GENEEC information, application rates equal to or above 354 lbs. ai/acre exceed the endangered species acute LOC for freshwater fish. Using measured residues found in ditch water adjacent to treated fields at 185 lbs. ai/acre, no LOCs were exceeded.

Using GENEEC concentrations, application rates equal to or above 177 lbs. ai/acre exceed the acute high risk LOC. Using mean measured residues found in ditch water adjacent to fields treated at 185 lbs. ai/acre, no LOCs are exceeded. However, if the EEC is extrapolated to the maximum application rate, the endangered species LOC is exceeded. Concentrations in four-foot deep ground water in Florida were nine times higher than the LD_{50} for aquatic invertebrates. No data were available to assess chronic risk.

It should be noted again that GENEEC is a screening model designed only to help determine if substantial risks are unlikely. It cannot be used to determine if substantial risks are likely. If an RQ based on a GENEEC-generated EEC is less than an LOC, a substantial risk of exceeding the LOC is unlikely. However if an RQ based on a GENEEC-generated EEC exceeds an LOC, it does not necessarily mean that risks exceeding the LOC are likely. It only means that EFED cannot say that risks exceeding the LOC are unlikely. In such cases, the determination of whether risks exceeding the LOC are likely depends upon additional, higher-tier exposure and risk assessment.

Estuarine and Marine Organisms. No estuarine or marine toxicity data are available. Consequently, no acute or chronic risk analysis could be conducted.

Plants. No toxicity information for nontarget plants has been submitted. Consequently, no risk analysis has been conducted. However, 1,3-D is registered as a herbicide and, therefore, is a candidate for both terrestrial and aquatic plant testing.

Endangered Species

The Endangered Species Protection Program is expected to become final in the future. Limitations in the use of 1,3-D will be required to protect endangered and threatened species but these limitations have not been defined and may be formulation specific. EPA anticipates that a consultation with the Fish and Wildlife Service will be conducted in accordance with the species-based priority approach described in the Program. After completion of consultation, registrants will be informed if any required label modifications are necessary. Such modifications would most likely consist of the generic label statement referring pesticide users to use limitations contained in county bulletins.

Recommended Mitigation Measures and Labeling Requirements

Mitigation options and future labeling requirements for 1,3-D use in the United States are currently being assessed by EPA/SRRD and DowElanco.

1. Use Profile

A. Type of Use

1,3-D (dichloropropene) is a contact nematicide applied as a soil fumigant. It is used primarily as a pre-plant nematicide. For some sites 1,3-D also serves as an insecticide, herbicide, and fungicide.

B. Use Group

(I) Terrestrial Food Crop

(a) Vegetables

Asparagus, beans, red beets, black-eyed peas, broccoli, cabbage, cantaloupe, Brussels sprouts, carrots, cauliflower, celery, collards, corn, cowpeas, cucumbers, egg plant, endive, garlic, horseradish, kale, kohlrabi, leeks, lettuce, melons, okra, onions, parsnips, mustard greens, peas, peppers, pimentos, potatoes, pumpkin, radishes, rutabaga, salsify, shallots, spinach, squash sweet potatoes, Swiss chard, tomatoes, turnips, watermelons

(b) Field Crops

Alfalfa, barley, birdsfoot trefoil, buckwheat, clover, corn, cotton, flax, grasses, hops, kenaf, lespedeza, millet, milo, mint, oars, pasture grass, peanuts, popcorn, rye, safflower, sorghum, soybeans, sugar beets, sugarcane, vetch, wheat

(c) Fruit and Nut Crops

Almonds, apples, apricots, bananas, blackberries, blueberries, boysenberries, cashew nuts, cherries, chestnuts, cranberries, currants, dates, dewberries, figs, gooseberries, grapefruit, grapes, hazelnuts (filberts), hickory nuts, huckleberries, kumquats, lemons, loganberries, nectarines, olives, peaches, pears, pecans, pears, pecans, persimmons, pineapple, plums, pomegranates, prunes, quince, raspberries, strawberries, tangerines, tangelos, youngberries, walnuts

(II) Terrestrial Non-Food and Non-Feed Crops

Floral plants, tobacco, ornamental shade trees, ornamental herbaceous plants, nonflowering plants and ornamental shrubs and vines

C. Target Pests

1,3-D is used primarily to control plant parasitic nematodes. However, it also has a variety of fungicide uses and can be used as a herbicide to control Canada thistle (*Cirsium arvense*) and bindweed (*Convovulus arvensis*).

D. Formulation Type

DowElanco has three formulations -- Telone C-17, Telone EC, and Telone II -- currently registered for nationwide use containing up to 94% active ingredient. In addition, there are three labels for state-specific uses (AZ, OR, and WA) that are formulated to contain 94% active ingredient.

Telone II and Telone C-17 are the main products containing 1,3-D. Telone C-17 is formulated with 1,3-D and chloropicrin, a gas that can serve as a warning agent to applicators.

E. Method and Rate of Application

Application methods approved for 1,3-D include soil fumigation, broadcast, soil band (row) and drip irrigation. It should be noted that all methods of application involve applying the chemical below the soil surface. As explained in DowElanco's "A Guide to Application" (1996), a row (or soil band) treatment is one where the chemical is injected into the soil directly under the planting bed. A broadcast treatment is still an injection procedure, however, 1,3-D is injected into the soil regardless of the placement of crops (not necessarily directly under the rows). Even when used as a herbicide for controlling bindweed or Canada thistle or as a fungicide, 1,3-D is injected into the soil and not used as an above surface spray treatment. Sub-surface drip irrigation is currently used on melon crops and the registrant is currently attempting to expand this application method to other crops. The advantage of this method is that lower application rates can be used.

Table 1. Maximum allowable single application rates and method of application for 1,3-D use on registered Food and Feed crops and Non-Food and Non-Feed crops. Only one application is allowed per year; consequently maximum seasonal and yearly rates are the same.

USE	Preplant Soil Fumigation Plow sole or Chisel (lbs. ai/acre)	Preplant Soil Fumigation Drip Irrigation (lbs. ai/acre)	Preplant Broadcast Plowsole or Chisel (lbs. ai/acre)	Preplant Soil Band Chisel (lbs. ai/1000 linear feet)
FOOD AND FEED CROP				
Agricultural Crops (unspecified)	404	-	-	-
Field Crops (unspecified)	181.8	-	177.12	4.068
Fruits (unspecified)	353.5	-	344.4	7.912
Melons (unspecified)	-	90.9	-	-
Melons (Cantaloupe, Honeydew, Musk, Watermelon)	-	90.9	-	-
Mint	-	-	225.5	4.068
Onions	252.5	-	246	5.65
Peanuts (unspecified)	-	-	177.12	4.068
Potato, White/Irish	252	-	246	-
Sweet Potato	-	-	246	5.65
Tree nuts	353.5	-	344.4	7.912
Vegetables (unspecified)	252.5	-	246	5.65
NON-FOOD AND NON-FEED CROPS				
Tobacco				
Ornamental (Herbaceous Plants, Non-flowering plants, Woody shrubs and Vines)	555.5	-	541.2	12.43
Ornamental and/or Shade Trees	-	-	177.12	4.068

Note: If row spacing is assumed to be 12 inches:

4.07 lbs. ai/1000 linear feet = 177 lbs. ai/acre
5.65 lbs. ai/1000 linear feet = 246 lbs. ai/acre
7.91 lbs. ai/1000 linear feet = 345 lbs ai/acre
12.43 lbs. ai/1000 linear feed = 541 lbs. ai/acre

2. Environmental Fate and Ecological Integrated Risk Characterization

A. Environmental Fate Characterization

(I) Chemical and Physical Parameters

The cis and trans isomers of 1,3-dichloropropene (1,3-D) are highly volatile and mobile depending upon environmental conditions. The major hydrolysis degradates, 3-chloroallyl alcohol and 3-chloroacrylic acid, are both mobile and persistent. The manufacturing impurity 1,2-dichloropropane (1,2-D) found in all Telone formulations is also volatile, mobile, and persistent.

The primary routes of 1,3-D dissipation in the field appear to be volatilization, leaching, abiotic hydrolysis, and aerobic soil metabolism. In air, 1,3-D does not degrade through direct photolysis; however, there can be degradation through free-radical (OH and ozone) processes. In water, hydrolysis is temperature dependent with an increase in stability at lower temperatures. This seems to indicate that in warm climates, degradation will occur more rapidly than in cooler climates. According to laboratory mobility studies, 1,3-D is mobile in a variety of soils including loamy sand (K_d= 0.23) and sand (K_d= 0.32). 1,3-D is also mobile in clay soils (K_d= 0.42 and 1.09) which is highly unusual for most pesticides. These mobility data, in addition to ground-water monitoring information, have clearly demonstrated that 1,3-D is highly mobile in soil.

As mentioned above, 1,3-D is highly volatile. The factors influencing the volatility of 1,3-D from a field plot include but are not limited to: soil organic matter, wind speed, soil moisture content, depth of incorporation-injection, soil temperature and soil porosity. Studies indicate that approximately 25 percent of applied volatilizes within the first two weeks after application. Wind is a major factor in the dispersion of 1,3-D as higher concentrations are measured at night. During the day, an increase in wind velocity also increases vapor dispersion and lowers the measurable amount of material (Houtman et al., 1991).

In general, it is difficult to correlate soil moisture content with the rate and magnitude of volatilization but Glotfelty and Schomberg (1989) and Lyman et al. (1982) suggest that the extreme drying of soil during drought will greatly decrease volatilization. Addition of moisture to dry soils will generally increase volatilization rates to a point beyond which additional moisture may have little effect or may start to decrease volatilization. The effect of changes in soil moisture on the volatilization of organics from soils with intermediate moisture contents is difficult to predict and depends upon the chemical, soil type, and the initial soil moisture content. In general, soil chisel incorporation of 1,3-D is accompanied by capping off of the soil injection cores and/or by covering the field with plastic to minimize volatilization. Deeper injection minimizes the total amount of material that volatilizes and maximizes the amount of time from injection until volatiles are observed at the soil/air interface.

1,3-D has two major degradates: 3-chloroallyl alcohol and 3-chloroacrylic acid. The 3-chloroallyl alcohol is the major hydrolysis degradation product and formed at 72% of applied. The 3-chloroacrylic acid is produced through aerobic soil metabolism at lower and variable amounts depending on the soil type. In studies submitted to the Agency, 3-chloroacrylic acid formed at 1% - 6% of applied.

The formulated 1,3-D product contains as much as 0.1% to 0.06% 1,2-D. 1,2-D is stable to abiotic and biotic processes and, therefore, is highly persistent. Unlike 1,3-D, the degradation of 1,2-D is not temperature dependent. Laboratory studies also indicate that 1,2-D is very mobile and that mobility is inversely proportional to organic matter content.

(II) Effect on Ground Water Quality

In 1986, the Special Review for 1,3-D was initiated because of concerns for worker exposure. At the time the PD-1 was issued, there were also concerns about possible ground-water contamination but insufficient information was available. The Agency requested monitoring information to satisfy this data gap. **Monitoring data from a variety of studies have confirmed that 1,3-D; both of its degradates; and 1,2-D leach to ground water as a result of normal agricultural use in some of its use area.** Ground-water monitoring information collected in separate retrospective and prospective since 1983 demonstrates that 1,3-D has been detected in ground water in seven states in different regions of the U.S. These states include California, Florida, Nebraska, New York, Oregon, Washington, and Wisconsin. **The highest values were detected in Florida and Wisconsin small-scale field monitoring studies conducted by DowElanco to support pesticide registration.** 1,3-D has also been detected in ground water in The Netherlands in potato and flower bulb fields.

In 1992, the Agency requested that DowElanco conduct a small-scale prospective ground-water monitoring study in a northern climate because of the concern for 1,3-D persistence in cold climates. On September 9, 1996, Telone II was applied to a sugar beet field at 28 gallons per acre (266 lb ai/acre). Preliminary results from two months of sampling indicate that both 1,3-D and 1,2-D were detected in ground water on the site at concentrations ranging up to 278 ppb and 1.2 ppb, respectively. Results are not yet available for the degradates.

In 1993, DowElanco volunteered to conduct a small-scale prospective monitoring study in southern Florida. Because of concerns for potential ground-water contamination, EPA and the State of Florida agreed that the study should be conducted. On December 13, 1995, Telone C-17 was applied to a pepper field at approximately 22.5 gallons per acre (214 lb ai/acre). Study results through January 1997 show that 1,3-D; 1,2-D; and both the chloroacrylic acid and chloroallyl alcohol degradates were detected in ground water. **Ground-water temperatures near the test site at the four-foot depth are at ambient air temperature or approximately 80°F. Although the water is not "cold," 1,3-D residues persisted for 356 days in shallow ground water on the test site.** 1,3-D concentrations ranged from 0.10 to 833 ppb in this part of the aquifer (4 feet). These wells also contained 3-chloroallyl alcohol at concentrations ranging from trace levels to 360 ppb and 3-chloroacrylic acid at concentrations ranging from trace levels to 424 ppb.

At a depth of 12 feet in the aquifer, 1,3-D was detected at concentrations ranging from trace levels to 10.7 ppb. These wells also contained 3-chloroallyl alcohol at concentrations ranging from trace levels to 13.5 ppb and 3-chloroacrylic acid at concentrations ranging from trace levels to 6.16 ppb. Three of the offsite wells also contained trace amounts to 0.07 ppb of 1,3-D residues. The water temperature at this depth is approximately 75°F and 1,3-D residues persisted for up to one year in this part of the aquifer.

There are significant problems with interpretation of the 1,3-D data from the deep part of the aquifer (70') and it is not known whether these detections are real or the results of contamination. Water blanks from the bailers used to sample the deep wells contained 1,3-D concentrations similar to those found in the deep wells. Also, pump test data indicates that the deep wells are somewhat confined and bromide did not reach these deep wells during the study.

Ground-water monitoring for 1,3-D has also been conducted by other state agencies and researchers. The environments -- including soil, air, and water temperatures -- have been highly variable at these monitoring sites. In some states, such as California and Washington, 1,3-D was infrequently detected in a relatively small number of wells. In New York, 1,3-D was detected at high levels in a small-scale field study similar to those conducted in Wisconsin and Florida. In a retrospective study in Nebraska, 1,3-D was also detected at fairly high levels that persisted for eight months in a small but significant number of wells.

The results of these studies indicate that **1,3-D will leach to ground water in areas with shallow water tables (30 feet or less). Once in ground water, 1,3-D can persist for six months or more, even where the climate is warm (as seen in the above Florida study). The 1,3-D degradates can persist for up to one year, including in warm climates. In cooler climates, such as that seen in Nebraska, parent residues also persisted for more than one year.** The results of the Wisconsin monitoring study will give a better idea of how long residues will persist in areas with cold ground water.

The above studies also indicate that 1,3-D can leach to ground water at high concentrations in its use areas. These high concentrations will probably be seen in areas with shallow water tables. Soil type does not seem to have as much of an effect as earlier believed since in the above Florida monitoring study, 1,3-D residues moved below the spodic (high organic and clay) horizon.

1,2-D has been detected in ground water in California, Connecticut, Florida, Hawaii, Massachusetts, Maryland, Nebraska, New York, Oregon, Washington, and Wisconsin at concentrations ranging up to 440 ppb (EPA, 1992). 1,2-D monitoring is not required under the Safe Drinking Water Act. 1,2-D was also detected in the Florida monitoring study described above. Concentrations ranged up to 11.5 ppb, 1.28 ppb, and 0.07 ppb in the shallow, intermediate, and deep wells, respectively, and these residues have persisted for at least 419 days (the last date of sampling). 1,2-D was also detected in the deep (70-foot) offsite well at trace levels in all but one sampling event. The residues in this deep well probably result from former uses of 1,2-D because it is unlikely that they could have leached to 70 feet in this amount of time.

1,2-D is found in ground water at low levels as a result of applications of 1,3-D. These residues have been demonstrated to persist in ground water for long periods (probably several years) and accumulation of residues may occur after repeated applications.

(III) Effect on Surface Water Quality

1,3-D has the potential to move to surface water via runoff, dissolution of the compound from the air as it volatilizes (since 1,3-D is heavier than air), and from ground water discharge to surface water. 1,3-D undergoes fairly rapid dissipation in soil via volatilization and to a lesser extent degradation. Also, only chemical molecules that have diffused into the top 1 to 2 cm of soil at the time a runoff event occurs would probably be susceptible to runoff. Such factors should somewhat limit the runoff potential of 1,3-D. **However, extremely high application rates of several hundred pounds per acre coupled with low soil/water partitioning indicate some potential for runoff for at least several weeks post-application.**

Another route of 1,3-D transport to surface water could be by dissolution of volatilized compound from the air. That is a route proposed by DowElanco to explain 1,3-D residues in perimeter ditches of a treated field in Florida prior to any runoff events. During conditions of low wind, volatilized 1,3-D will move close to the ground due to its higher density than air. Some of the 1,3-D passing over surface water will be transported from the air to the water and dissolved. **Another possibility is that in Florida, ground water may be contributing to residues in surface water because of ground and surface water interactions.** The residues seen in shallow ground water in the small-scale prospective field study in Florida were high immediately for approximately one month after application. These residues could continue to move to surface water or recharge ground water depending on local conditions.

1,3-D will probably undergo rapid rates of dissipation in most surface waters due to volatilization and to a lesser extent by abiotic hydrolysis and possibly biodegradation. Volatilization rates will be highest for shallow turbulent water and decrease with increasing depth and decreasing turbulence. **The low octanol/water partitioning of 1,3-D indicates that its bioaccumulation potential is probably low.**

Limited surface-water monitoring information is available for 1,3-D. The only monitoring data are from four sampling sites along two perimeter ditches in a prospective ground-water monitoring study in Florida. 1,3-D was detected in the ditches at concentrations ranging from 0.07 to 1.8 ppb. The residues were short-lived; no 1,3-D was detected in samples collected from the ditches after 5 days post-application. The degradates 3-chloroacrylic acid and

3-chloroallyl alcohol were also detected at concentrations ranging up to 0.15 and 0.78 ppb, respectively. The degradates also did not persist beyond 5 and 9 days post-application, respectively, although irrigation was applied during the first month after application.

The screening model GENEEC (GENeric Estimated Environmental Concentration) was used by OPP to generate EECs for a 1-hectare by 2-meter deep pond draining an adjacent 10 hectare field treated with 1,3-D at rates ranging from 177 to 556 lbs ai/week. Despite an input of high dissipation rates, the relatively high magnitudes of the estimated EECs reflect extremely high application rates. However, the concentrations generated by the model are similar to those measured in the shallow (4') wells from the Florida prospective study. More sophisticated modeling such as PRZM/EXAMS could not be used because the models cannot account for the 12" to 18"soil incorporation. The concentrations generated by GENEEC were used to develop the ecological risk assessment in this document.

B. Risk to Terrestrial Organisms

The Agency has no standard protocol for conducting terrestrial risk assessments to terrestrial organisms when chemicals are applied via soil injection methods. To reduce root damage and phytotoxicity, 1,3-D is normally applied prior to planting (at plant for pineapples) when there is little to no ground cover or crop on the field. 1,3-D is a liquid that is injected 12 or more inches below the soil surface. It then becomes a gas and permeates the soil pore space. 1,3-D residues in treated fields are present on soil particles and in soil-pore water and because of its rapid volatilization, in the atmosphere above the field.

1,3-D is approved for use on millions of acres of cropland and can be applied at rates as high as 556 lbs ai/acre. **However, due to the application method which reduces terrestrial exposure and the relatively low toxicity to birds and mammals, its use is not expected to result in large incidents of mortality. One reason 1,3-D was placed in Special Review was the oncogenic effect observed in rats and mice. However, given the rapid dissipation in terrestrial habitats, deleterious chronic exposure to terrestrial wildlife is expected to be minimal.**

Telone C-17 contains chloropicrin which is a contact irritant to humans and serves as a warning to applicators. It is assumed this product would affect birds and wild mammals in the same manner, resulting in avoidance, and thereby reducing the risk of exposure.

(I) Birds, Acute and Chronic

The available toxicity information was used to determine acute risk through dietary routes for birds consuming contaminated soil particles. Birds can intentionally ingest soil to provide missing minerals or unintentionally through preening and grooming activities. They can also ingest particles adhering to food items such as roots, tuber or foliage. Many species of birds inadvertently ingest soil when probing soft soils for food. Additionally, birds on the treated fields could also be at risk via inhalation of 1,3-D vapors. **Currently, no information is available on acute inhalation toxicity to birds, but as shown in the mammalian risk assessment, the acute risk associated with this type of exposure is probably insignificant.**

Risk quotients were determined for birds consuming a range of soil quantities in their diet from less than 2% to 30% (Beyer, 1994). At an application rate of 342 lbs ai/acre, 1,3-D concentrations in soil peaked at 130,000 ppb. At this concentration, no LOCs were exceeded. Even if the concentration of 1,3-D in soil was extrapolated to the maximum application rate (556 lbs ai/acre = 208 ppm), no LOCs were exceeded. At this maximum soil concentration, a 100-gm bird with an LD_{50} of 152 mg/kg would need to consume 72 gm of soil to attain this equivalent dose. These results indicate that the use of **1,3-D should not result in significant acute mortality to avian species under any application scenario.**

No avian chronic test data has been submitted to support reregistration. Consequently, no assessment of chronic exposure has been conducted. Chronic toxicity is normally assessed through dietary routes of exposure. **1,3-D, being applied only once and having a relatively short field dissipation half-life, is not expected to result in long-term exposure and consequent chronic effects.**

(II) Mammals, Acute and Chronic

The available toxicity information was used to determine acute risk through dietary routes for mammals consuming contaminated soil particles. It has been shown mammals may ingest soil intentionally to provide missing minerals or unintentionally through grooming activities or by ingesting particles adhering to food items such as roots, tubers or foliage. Additionally, mammals on the treated fields could also be at risk via inhalation of 1,3-D vapors.

Risk quotients were determined for mammals consuming a range of soil quantities from less than 2% to 17% in their diet (Beyer, 1994). At the application rate of 342 lbs ai/acre, no LOCs were exceeded. Even if the concentration of 1,3-D in soil was extrapolated to the maximum application rate, no LOCs were exceeded. At this maximum soil concentration, a 20-gram mouse with an LD_{50} of 640 mg/kg would need to consume 61 gm of soil (three times its body weight) to attain this equivalent dose. **This result indicates the use of 1,3-D should not result in significant acute mortality to mammalian species via dietary exposure under any application scenario.**

Acute inhalation toxicity was assessed by comparing mammalian inhalation data to the amount of volatilized chemical found above the treated fields. Using an application rate of 346 lbs ai/acre, 1,3-D concentrations at a height of 6 inches above the soil surface never exceeded 4.4 ppm. This value is less than 0.01% of the mammalian inhalation LD_{50} of 713 mg/kg. Even if the 1,3-D concentration in the air is directly proportional to the application rate, atmospheric concentrations are not expected to reach toxic levels. **This result indicates**

that under standard applications, inhalation of 1,3-D should not result in significant acute mortality to mammalian species.

No assessment of chronic exposure to mammals has been conducted. Chronic toxicity is normally assessed through dietary routes of exposure. **1,3-D is applied only once per growing season and has a relatively short dissipation half-life. It is not expected to result in long-term exposure and consequent chronic effects observed in the laboratory rat tests.**

C. Risk to Aquatic Organisms

Exposure of aquatic nontarget organisms to toxic concentrations of 1,3-D is possible through surface-water runoff, soil erosion, off-target drift, and movement from ground water in to surface water. Peak and various time-series average concentrations were generated using GENEEC at application rates up to 556 lbs ai/acre. In addition to the usual inputs to GENEEC, the model was slightly modified to include an estimate of the aerobic aquatic metabolism half-life which was based upon a hydrolysis rate constant and a volatilization rate constant for a two-meter deep pond.

In addition to predicted EECs, actual measured environmental concentrations were available. Surface-water samples were obtained from drainage ditches located 130 feet from a treated field in Florida (see discussion on Florida small-scale prospective monitoring). After an application of 184.5 lbs ai/acre (three times less than the maximum allowable rate), initial concentrations ranged from 0.34 ppb to 1.8 ppb. As discussed in the Exposure Assessment section of this document, 1,3-D concentrations found in the ditch water may be the result of drift and the sampling locations may not have received any input from surface runoff. Based on aquatic EECs generated by GENEEC, measured concentrations in shallow (4') ground water, and measured concentrations found in ditch water, risk quotients were calculated for freshwater fish and invertebrates.

The highest risk quotients are calculated for ornamental crops and could occur in cooler states like Oregon and Washington where flower bulbs are grown or Maine where potatoes are grown. Potatoes and cole crops receive lower application rates than ornamentals, but because of the cooler climates, may present longer periods of risk to aquatic organisms than warmer climate crops with the same application rate. Application rates and corresponding initial peak concentrations will be equal in the two climates but the time when toxic levels of 1,3-D are present may be much longer in cooler climates. The effect of long-term chronic exposure -- which may be more prevalent in cold climates -- is unknown since no chronic toxicity information has been submitted in support of reregistration. Further characterization of the potential risk is difficult given the uncertainty associated with the lack of toxicity data.

(I) Freshwater Fish, Acute and Chronic

Using GENEEC values, freshwater fish acute aquatic risk quotients range from 0.63 at the lowest application rate (177 lbs ai/acre) to 2.0 at the highest application rate (556 lbs ai/acre). This indicates that for all modeled application rates, acute high risk, restricted use, and endangered species LOCs are exceeded. The degree to which this translates into fish kills may depend on the crop being treated.

When the ditch water concentrations are used, acute aquatic risk quotients do not exceed 0.002 or any LOC. If the concentrations in the ditch water are assumed to be directly proportional to the application rate, expected ditch water concentrations at the maximum application rate could reach 5.4 ppb. At this concentration, risk quotients reach 0.005 which still does not exceed any LOC.

The values obtained from ditch water were used instead of the concentrations predicted from GENEEC runoff models. However, the results must be viewed with caution since the collection site may not represent the GENEEC assumptions and GENEEC is meant only to be used as a screening tool. If a precipitation event occurs following an application, concentrations are expected to be higher and LOCs for fish could be exceeded.

No freshwater fish chronic toxicity information has been submitted in support of reregistration. 1,3-D has a hydrolysis half-life of 13.5 days at 20ºC and cooler temperatures could lengthen degradation and exposure time. As indicated by the range of species tested for acute toxicity, with some exceptions, coldwater fish appear to be more sensitive. The high application rates, high predicted surface-water concentrations, exceedence of acute high risk quotients, temperature-dependent degradation, and high toxicity to aquatic invertebrates indicate the possibility of chronic effects. **However, the lack of chronic information on any class of organism other than laboratory mammals makes the uncertainty high when discussing direct chronic effects to aquatic organisms.**

While acute effects of 1,3-D on fish are not expected to be severe, there could be indirect effects caused by a temporary decline in aquatic invertebrates as a food source. These effects may not be of sufficient duration to cause decreased fish survival or reproduction. However, the effect or lack of effect of such an occurrence has not been proven.

(II) Freshwater Invertebrates, Acute and Chronic

The same uncertainties exist for aquatic invertebrates as for fish. However, it is certain that 1,3-D is substantially more acutely toxic to aquatic invertebrates than any other class of organism tested. Acute aquatic risk quotients for freshwater invertebrates indicate that aquatic acute high risk, restricted use, and endangered species levels of concern are exceeded for freshwater invertebrates at registered maximum application rates equal to or above 177 lbs ai/acre.

The LC_{50} of 0.09 ppm was compared to actual residues detected in ditches adjacent to treated fields. Fields were treated at an application rate of 182 lbs ai/acre and concentrations ranged from 1.8 ppb to 0.34 ppb. The resulting risk quotients range from 0.02 to 0.004 which exceed the endangered species LOC. If residues in ditch water are assumed to be directly proportional to the application rate, then at 556 lbs ai/acre, concentrations in ditch water could reach concentrations above 4.5 ppb which exceed the endangered species LOC.

Concentrations of 1,3-D in ground water four feet below the surface in Florida reached a maximum of 833 ppb. At this concentration, the acute high risk LOC for invertebrates would be exceeded by more than 15 times. This does not account for the additional toxicity presented by the two degradates that were also found in this ground water. Additionally, concentrations remained at potentially toxic levels for approximately 60 days.

No freshwater invertebrate chronic toxicity information has been submitted in support of reregistration. However, the argument used for fish can also be used here. Only one acute toxicity test has been submitted for invertebrates so generalizations cannot be made as to the sensitivity differences between cold and warm water invertebrates. However, the high application rates, high predicted surface-water concentrations, exceedence of acute high risk quotients, temperature dependent degradation, and high toxicity to aquatic invertebrates indicate the possibility of chronic effects.

D. Risk to Estuarine and Marine Organisms

1,3-D is registered for use on crops that are associated with estuarine systems. The potential for 1,3-D to enter estuarine systems is similar to that in freshwater. However, the dilution and rapid flushing effect of an estuarine system may lessen the hazard to organisms.

No estuarine or marine toxicity data has been submitted in support of 1,3-D reregistration. Therefore, it is not known if estuarine species are more or less sensitive to 1,3-D than freshwater species. Because of 1,3-D's use pattern, environmental conditions exist that require the submission of estuarine/marine toxicity information. Acute toxicity tests with estuarine/marine invertebrate and fish species are required. Receipt of this information will allow a more accurate assessment of the risks in these environments.

3. Ecological Assessment

A. Ecological Toxicity Data

Additional acute and chronic studies are required and would be of high value because no information is available on the toxicity to estuarine organisms or aquatic and terrestrial plants. The following studies using the TGAI are needed to complete a thorough risk assessment:

- a freshwater fish early life-stage test with the rainbow trout (72-4a),
- a freshwater aquatic invertebrate life-cycle with *Daphnia magna* (72-4b),
- an estuarine/marine fish LC_{50} test with the sheepshead minnow (72-3a),
- two estuarine/marine invertebrate LC_{50} tests with the mysid shrimp and eastern oyster (72-3b and 72-3c), and
- both Tier I and Tier II aquatic and terrestrial plant studies.

(I) Toxicity to Terrestrial Animals

(a) Birds and Reptiles, Acute and Subacute

An acute oral (LD_{50}) study (preferably with the Mallard or Northern bobwhite) using the technical grade of the active ingredient (TGAI) is required to establish the toxicity of 1,3-D to birds and reptiles. The result of the Northern bobwhite test is presented in Table 2.

Table 2. Avian Acute Oral Toxicity

Species	% ai	LD_{50} (mg/kg)	Toxicity Category	MRID No. Author/Year	Study Classification[1]
Northern bobwhite *(Colinus virginianus)*	92	152	moderately toxic	261149/ Wildlife International /1982	Core

[1] Core (study satisfies guideline). Supplemental (study is scientifically sound, but does not satisfy guideline)

Since the LD_{50} falls in the range of 51 to 500 mg/kg, 1,3-D is moderately toxic to avian species on an acute oral basis. The guideline (71-1) is fulfilled (MRID #261149).

Two subacute dietary studies using the TGAI are required to establish the toxicity of 1,3-D to birds and reptiles. The preferred test species are Mallard duck and Northern bobwhite. The avian acute dietary LC_{50} test is a subacute, eight-day dietary laboratory study designed to determine the dietary concentration of toxicant that is likely to cause 50% mortality in a test population of birds. The TGAI is administered to juvenile birds' diets for five days, followed by three days of "clean" diet. Results of these tests are presented in Table 3.

Table 3. Avian Subacute Dietary Toxicity

Species	% ai	LC_{50} (ppm)	Toxicity Category	MRID No. Author/Year	Study Classification
Northern bobwhite *(Colinus virginianus)*	92	>10,000	Practically Nontoxic	STEODI03 Fink, 1975	Core
Mallard duck *(Anas platyrhynchos)*	92	>10,000	Practically Nontoxic	00120908 Fink, 1975	Core

The LC_{50} is higher than 2,000 ppm. This toxicity value indicates that 1,3-D is practically nontoxic to birds and reptiles on a subacute dietary basis; however, this result is inconsistent with the acute oral test. The subacute dietary results could be explained by the fact that the length of time to perform the test is long and because 1,3-D is highly volatile, it may not remain in the food. Therefore, the birds may have received an inadequate dose resulting in a poor dose response. Field study data indicate that volatility is the primary route of 1,3-D dissipation with dispersal increasing to 35.1 $mg/m^2/hour$ by three days. Therefore, the weight of evidence indicates that 1,3-D is moderately toxic to birds (LD_{50} = 157 mg/kg). The guideline (71-2) is fulfilled (MRID #STEODI03 and 00120908).

(b) Birds and Reptiles, Chronic

Avian reproduction studies using the TGAI have not been required for 1,3-D. Since the field dissipation half-life is roughly one week and only one application is made per year, birds are not expected to be exposed to repeated or continuous residues of 1,3-D.

(c) Mammals, Acute and Chronic

Wild mammal testing is required on a case-by-case basis, depending on the results of lower tier laboratory mammalian studies, intended use pattern, and pertinent environmental fate characteristics. In most cases, rat or mouse toxicity values generated for the Agency substitute for wild mammal testing. The toxicity values for mammals are presented in Table 4 (USEPA, 1997). In addition, 1,3-D was placed in Special Review in 1986 because of its oncogenic properties in rats and mice and potential worker exposure issues. Results indicate that 1,3-D is slightly toxic to small mammals on an acute oral basis (640 mg/kg). The guideline is fulfilled (MRID #0039693).

Table 4. Mammalian Toxicity

Species	Test Material	Test Type	Toxicity Value	Affected Endpoints	MRID No.
Laboratory mouse *(Mus musculus)*	Telone II	Acute Oral	LD_{50} 640 mg/kg (M&F)	Mortality	00039683
Laboratory rat *(Rattus norvegicus)*	1,3-dichloropropene	Acute Inhalation	LC_{50} 729 ppm/4 hours	Mortality	235350
Laboratory mouse *(Rattus norvegicus)*	1,3-dichlorpropene	Chronic Inhalation	NOEL Systemic 730 ppm	No systemic effects observed at 730 ppm	00039685
Laboratory rat *(Rattus norvegicus)*	90% ai cis + trans	Developmental - Inhalation	NOEL Maternal 20 ppm NOEL Developmental 60 ppm	Maternal - body weight loss and reduced food consumption Developmental - delayed ossification of vertebral centra	00144715 00152848
Laboratory rat *(Rattus norvegicus)*	96% ai cis + trans	13 Week Feeding	NOEL 5 mg/kg/day LOEL 15 mg/kg/day	Body weight, hyperkeratosis and/or basal cell hyperplasia of the non-glandular portion of the stomach	42954802

(d) Insects

A honeybee acute contact study using the typical end-use product is not required. The registered application method via soil injection prior to planting should not result in honeybee exposure. However, exposure in adjacent habitats could occur because of the 1,3-D's volatility and the probability of the chemical drifting offsite.

Atkins (1969, 1972) conducted two acute studies on honeybees. The results, presented in Table 5, indicate that 1,3-D is moderately toxic to bees on an acute contact basis. The guidelines (141-1 and 141-2) are fulfilled (MRID #00028772 and 00018842).

Table 5. Nontarget Insect Acute Contact Toxicity

Species	% ai	LD_{50} (μg/bee)	Toxicity Category	MRID No. Author/Year	Study Classification
Honey bee *(Apis mellifera)*	TGAI	6.6	Moderately toxic	00028772/ Atkins/1972	Core
Honey bee *(Apis mellifera)*	Formulation	6.6	Moderately toxic	00018842/ Atkins/1969	Core

(e) Terrestrial Field Testing

Terrestrial field testing of 1,3-D has not been requested or submitted to support reregistration.

(II) Toxicity to Freshwater Aquatic Animals

(a) Freshwater Fish and Amphibians, Acute

Two freshwater fish toxicity studies using the TGAI are required to establish the toxicity of 1,3-D to fish and amphibians. The preferred test species are the Rainbow trout (a coldwater fish) and Bluegill sunfish (a warm-water fish). Results of these tests are presented in Table 6.

Since the LC_{50} falls in the range of 1 to 10 ppm, 1,3-D is moderately toxic to freshwater fish on an acute basis. The guideline (72-1) is fulfilled (MRID #00039692 and STE0DI02).

Table 6. Freshwater Fish Acute Toxicity

Species/ (Flow-through or Static)	% ai	96-hour LC_{50} (ppm) (measured/nominal)	Toxicity Category	MRID No. Author/Year	Study Classification
Walleye *(Stizostedion vitreum)* static	100	1.08 (measured)	Moderately Toxic	40098001/ Mayer & Ellersieck/ 1986	Core
Largemouth Bass *(Micropterus salmoides)* static	100	3.65 (measured)	Moderately Toxic	40098001/ Mayer & Ellersieck/ 1986	Core
Rainbow Trout *(Salmo gairdneri)* static	92	3.9 (measured)	Moderately Toxic	00039692/ Bentley/ 1975	Core
Fathead Minnow *(Pimephales promelas)* static	100	4.1 (measured)	Moderately Toxic	40098001/ Meyer & Ellersieck/ 1986	Core
Rainbow Trout *(Salmo gairdneri)* static	92	5.9 (unknown)	Moderately Toxic	STE0DI01 USEPA 1977	Core
Bluegill Sunfish *(Lepomis macrochirius)* static	≥80	6.1 (nominal)	Moderately Toxic	00117043/ Buccafusco/ 1981	Supplemental [1]
Bluegill Sunfish *(Lepomis macrochirus)* static	92	6.7 (unknown)	Moderately Toxic	STE0DI02 USEPA 1977	Core
Bluegill Sunfish *(Lepomis macrochirus)* static	92	7.1 (measured)	Moderately Toxic	00039692/ Bentley/ 1975	Core

[1] Rated supplemental because the dose levels were not high enough to calculate an LD_{50}.

(b) Freshwater Fish, Chronic

A freshwater fish early life-stage test using the TGAI is required for 1,3-D because the end-use product may be transported to water from the intended use site. Also, the following conditions are met: (1) the pesticide is intended for use such that its presence in water is likely to be continuous or recurrent regardless of toxicity, (2) any aquatic acute LC50 or EC50 is less than 1 ppm, (3) the EEC in water is equal to or greater than 0.01 of any acute LC50 or EC50 value or (4) the actual or estimated environmental concentration in water resulting from use is less than 0.01 of any acute LC50 or EC50 value and any one of the following conditions exist: studies of other organisms indicate the reproductive physiology of fish may be affected, physicochemical properties indicate cumulative effects, or the pesticide is persistent in water (*i.e.*, half-life greater than 4 days). The preferred test species is Rainbow trout.

Chronic testing of freshwater fish using the TGAI is still required for 1,3-D. Soil fumigation occurs only once per growing season and recurrent exposure is not expected. However, in relation to the triggers listed in the previous paragraph, the following conditions warrant chronic testing. Initial and 21-day surface-water EECs, as calculated by GENEEC, are less than 1% of the lowest LC_{50} for freshwater fish at all registered application rates. At rates equal to or above 354 lbs a.i./acre, 90-day EECs are less than 1% of the lowest LC_{50} for freshwater fish. Although the LC_{50} for freshwater fish (1.08 ppm) is not less than 1 ppm, it is sufficiently close to suspect chronic effects. However, the LC_{50} for aquatic invertebrates (0.09 ppm) is less than 1 ppm and the hydrolysis half-life is 13.5 days at 20°C.

The guideline (72-4a) is not fulfilled.

(c) Freshwater Invertebrates, Acute

A freshwater aquatic invertebrate toxicity test using the TGAI is required to establish the toxicity of 1,3-D to aquatic invertebrates. The preferred test species is *Daphnia magna*. Results of this test are presented in Table 7.

Table 7. Freshwater Invertebrate Acute Toxicity

Species/(Static or Flow-through)	% ai	48-hour LC50/ EC50 (ppm) (measured/nominal)	Toxicity Category	MRID No. Author/Year	Study Classification
Waterflea *(Daphnia magna)*	100	0.09	Highly Toxic	40098001/ Mayer & Ellersieck/ 1986	Core

Since the LC50/EC50 falls in the range of 0.1 to 10 ppm, 1,3-D is considered moderately to highly toxic to aquatic invertebrates on an acute basis. The guideline (72-2) is fulfilled (MRID # 40098001).

(d) Freshwater Invertebrate, Chronic

A freshwater aquatic invertebrate life-cycle test using the TGAI is required for 1,3-D since the end-use product may be transported to water from the intended use site and the following conditions are met: (1) the pesticide is intended for use such that its presence in water is likely to be continuous or recurrent regardless of toxicity, (2) any aquatic acute LC50 or EC50 is less than 1 ppm, or, (3) the EEC in water is equal to or greater than 0.01 of any acute EC50 or LC50 value, or, (4) the actual or estimated environmental concentration in water resulting from use is less than 0.01 of any aquatic acute EC50 or LC50 value and any of the following conditions exist: studies of other organisms indicate the reproductive physiology of invertebrates may be affected, physicochemical properties indicate cumulative effects, or the pesticide is persistent in water (*i.e.*, half-life greater than 4 days). The preferred test species is *Daphnia magna*.

Chronic testing of freshwater invertebrates using the TGAI is required for 1,3-D. Soil fumigation occurs only once per growing season and recurrent exposure is not expected. However, the LC_{50} for aquatic invertebrates (0.09 ppm) is less than 1 ppm. Also, at all registered application rates, initial, 21-day, and 90-day surface-water EECs, as calculated by GENEEC, are less than 1% of the lowest LC_{50} for freshwater invertebrates. Additionally, the hydrolysis half-life for 1,3-D is 13.5 days at 20°C.

The guideline (72-4b) is not fulfilled.

(e) Freshwater Field Studies

A freshwater field study using the TGAI is not required for 1,3-D.

(III) Toxicity to Estuarine and Marine Animals

(a) Estuarine and Marine Fish, Acute

Acute toxicity testing with estuarine/marine fish using the TGAI is required for 1,3-D. 1,3-D is used on crops associated with coastal counties and GENEEC modeling predicts concentrations of 1,3-D in surface water that exceed LOCs for freshwater fish. The preferred species is the sheepshead minnow.

The guideline (72-3a) is not fulfilled.

(b) Estuarine and Marine Fish, Chronic

Chronic tests of estuarine/marine fish test using the TGAI are not required for 1,3-D at this time. This requirement will be re-evaluated after reviewing the freshwater fish toxicity information.

(c) Estuarine and Marine Invertebrates, Acute

Acute toxicity testing with estuarine/marine invertebrates using the TGAI is required because the end-use product is intended for direct application to the marine environment or the active ingredient is expected to reach this environment because of its use in coastal counties. GENEEC modeling predicts significant concentrations of 1,3-D in surface water that exceed LOCs for freshwater invertebrates. The preferred test species are the mysid shrimp and Eastern oyster.

This guideline (72-3b and 72-3c) is not fulfilled.

(d) Estuarine and Marine Invertebrate, Chronic

Chronic tests of estuarine and marine fish using the TGAI are not required for 1,3-D at this time. This requirement will be re-evaluated after examining the freshwater fish toxicity information.

(e) Estuarine and Marine Field Studies

A field study in estuarine/marine environments using the TGAI has not been required for 1,3-D.

(IV) Toxicity to Aquatic and Terrestrial Plants

Currently, aquatic and terrestrial plant testing is only required for herbicides with some exceptions on a case-by-case basis (e.g., label contains phytotoxicity warnings, incident data are available or literature demonstrates phytotoxicity). 1,3-D is a candidate for both terrestrial and aquatic plant testing since it is also registered as a herbicide. Because of its environmental fate parameters, 1,3-D is expected to move offsite. To date, no data have been submitted demonstrating toxicity to plants. Consequently, a full battery of Tier I and Tier II aquatic and terrestrial vegetation testing is required to complete the risk assessment.

Tier I tests measure the response of plants, relative to a control, at a test level that is equal to the highest use rate (expressed as lbs a.i./acre). Tier II tests measure the response of plants, relative to a control, at five or more test concentrations. Tier II test results allow the determination of dose-response relationships and will further refine the ecological assessment.

For terrestrial seedling emergence and vegetative vigor testing the following plant species and groups should be tested: (1) six species of at least four dicotyledonous families, one species of which is soybean (*Glycine max*), and the second of which is a root crop, and four species of at least two monocotyledonous families, one of which is corn (*Zea mays*).

The following aquatic plant species should be tested at Tier I: *Kirchneria subcapitata* and *Lemna gibba*. At Tier II, the following species should be tested: *Kirchneria subcapitata, Lemna gibba, Skeletonema costatum, Anabaena flos-aquae* and a freshwater diatom.

(V) Toxicity of Degradation Products and Manufacturing Impurities

No data were available to conduct an ecological assessment for either 1,2-D; 3-chloroallyl alcohol or 3-chloroacrylic acid. All of these chemicals are considered at least as toxic as the parent.

B. Environmental Fate

The environmental fate database is largely complete. The cis and trans isomers of 1,3-dichloropropene (1,3-D) are highly volatile and mobile depending upon environmental conditions. The major degradation products, 3-chloroallyl alcohol and 3-chloroacrylic acid, are mobile and persistent. The manufacturing impurity 1,2-dichloropropane (1,2-D) found in all Telone formulations is also volatile, mobile, and persistent.

The following study requirements were waived:

- **Aqueous Photolysis** (soil injected), Registration Standard, Sept. 1986 (161-2)
- **Soil Photolysis** (soil injected), Registration Standard, Sept. 1986 (161-3)

(I) Environmental Fate Assessment of 1,3-D

The primary routes of dissipation of 1,3-D appear to be volatilization, leaching, abiotic hydrolysis, and aerobic soil metabolism. Field volatility studies have shown that approximately 25% of the applied 1,3-D volatilizes during the two weeks after an application. In laboratory hydrolysis studies, 1,3-D degraded fairly rapidly with a half-life of 13.5 days in buffered solutions at pH's 5, 7, and 9 (20°C). Hydrolysis is temperature dependent and there is an increase in stability at lower temperatures. At 2°C, for both pH 5.5 and 7.5, the half-life of the parent was 90 to 100 days. Under aerobic conditions, half-lives ranging from 12 to 54 days were reported for the parent. The 3-chloroallyl alcohol is expected to be the main hydrolytic degradation product. The 3-chloroacrylic acid is the major aerobic metabolite. Laboratory mobility data, in addition to ground-water monitoring information, has clearly demonstrated that 1,3-D is highly mobile in soil. The Freundlich adsorption coefficients for 1,3-D were: K_d= 0.23 in loamy sand, K_d= 0.32 in sand; and in clay, K_d= 0.42 and 1.09.

(II) Environmental Fate Assessment of 1,2-D

The formulated 1,3-D product contains as much as 0.1% to 0.06% 1,2-D. 1,2-D has a vapor pressure of 42 mm Hg at 20°C, a water solubility of 2700 ppm at 20°C, is fairly stable to hydrolysis with a half-life of 77 days at pH 5.5, and has variable aerobic soil half-lives (41 to 69 days on four soils but stable in a sandy loam and a loam). Photoreactions are also minimal with a half-life of 313 days with respect to the (OH) radical and stable with respect to ozone. Mobility studies give a strong indication of the extreme mobility of 1,2-D. Freundlich adsorption coefficients for 1,2-D were K_d=0.12, K_d=0.16, K_d=0.05, K_d=0.87 for the Fuquay loamy sand, Metz sandy loam, Hanford loam, and the Wahiawa sandy clay loam soils, respectively. In column leaching experiments using a Fuquay loamy sand with 0.64% organic carbon, a total of 85.8% of the applied 1,2-D leached from the soil column. For the Wahiawa sandy clay loam column with 2.32% organic carbon, a total of 73.2% of the applied was found in the leachate. Mobility was inversely proportional to organic matter content.

(III) Environmental Fate and Transport

(a) Degradation

Hydrolysis. In buffered solutions at pH 5, 7, 9, the half-life of 1,3-D was 13.5 days at 20°C (Acc #262484, #2627301, 1986). A supplemental study at pH's 5.5 and 7.5 showed that the half-life of 1,3-D was 90 to 100 days at 2°C; 11 to 13 days at 15°C; and 2 days at 29°C. The chloroallyl alcohol is expected to be the main hydrolytic product (Acc #00158442, 1986).

Another supplemental study gave these results: at pH 5, 7, and 9, the half-life of 1,2-D was 51 days at 10°C; 10 to 13 days at 20°C and 3 to 5 days at 30°C. The chloroallyl alcohol reached maximum concentrations of 32%, 72%, and 78% at 10°, 20°, and 30°C and appeared to be stable to further hydrolysis. Hydrolysis of 1,3-D is pH independent and temperature dependent (Acc No. 262730, 1986).

Photodegradation in Air. Both cis and trans 1,3-D (purity $\geq$ 94.8%) at 0.035 to 0.050 ug/ml did not degrade in borosilicate glass vials irradiated continuously for 30 days with a xenon arc lamp at 25°C and ambient humidity. After 30 days of irradiation, 95% to 98% of the applied radioactivity was recovered as 1,3-D and no degradates were detected. In the dark control at 30 days post-treatment, 86% to 92% of the applied was recovered as 1,3-D and no degradates were observed. The study indicates that under these conditions, direct photolysis in air is not an important degradative mode for 1,3-D (MRID #40390101, 1987).

Reactions of 1,3-D and 1,2-D with O_3 and OH radicals were studied. The half-lives of 1,3-D with respect to the OH radical were 7 and 12 hours for the trans and cis isomers, respectively. The observed degradation products were formyl chloride and chloroacetaldehyde. The half-life of 1,3-D with respect to ozone was 12 and 52 days for the trans and cis isomers, respectively. The observed products were formyl chloride and chloroacetaldehyde, chloroacetic acid, HCL, CO, CO_2 and formic acid. The rate of photolysis alone seems insignificant (as was shown in the above 161-4 experiment) relative to the reactions of 1,3-D with ozone and the OH radicals. For 1,2-D the experiments also indicated that the only significant loss in the atmosphere would be a reaction with the OH radical. The half-life with respect to the OH radical was 313 days. A half-life of 313 days for 1,2-D would indicate the compound is stable enough for worldwide long-distance transport (Tuazon, 1984).

Aerobic Soil Metabolism. The reported half-lives were 12 days in Catlin silt loam soil and 54 days in Fuquay loamy sand soil. These major nonvolatile degradates were isolated from the soils: cis/trans-3-chloroprop-2-en-1-ol and cis/trans-3-chloroprop-2-enoic acid (3-chloroacrylic acid). Numerous naturally-occurring carboxylic acids were also identified as degradates (MRID #42642301, 1993).

Anaerobic Soil Metabolism. In a silty clay loam at 15°C, the half-life of 1,3-D was reported to be 9.1 days. In a sandy loam soil at 15°C, the half-life was 7.7 days. In both a silty clay loam and sandy loam soil at 25°C, the half-life was 2.4 days. The observed degradates were chloroacrylic acid, propionic acid, and an unknown (MRID #40025901, 1986).

(IV) Mobility

Column Leaching. The calculated Freundlich adsorption coefficients for 1,3-D were: loamy sand K_d= 0.23; sand K_d= 0.32; clay K_d= 0.42 and 1.09. The average maximum K_{oc} values were 20 for sand, 25 for loamy sand, and 41 and 42 for two clay soils. In 30-cm columns of sand, loamy sand, and Florida clay, 1-3-D leached when greater than 25 inches of water were applied. A total of 1.9% to 4.6% of the applied (unaged) radioactivity remained in the soils and 70% to 84% was found in the leachate (MRID #40538901, 1988).

Aged Column Leaching. Aged (31 days) 1,3-D residues were very mobile with 25.6% to 32.0% of the applied radioactivity in the leachates of 30-cm columns of loamy sand soil. 1,3-D and the degradates 3-chloroallyl alcohol, 3-chloroacrylic acid, and composite carboxylic acids (including acetic acid, oxalic acid, and propionic acid) were detected in both the leachates and the upper 2-cm soil segment extracts.

Batch Equilibrium (1,2-D). Freundlich adsorption coefficients for 1,2-D were 0.12 (n=1.13), 0.16 (n=1.13), 0.05 (n=1.63), and 0.87 (n=1.07) with corresponding K_{oc}s of 18.8, 23.5, 10.4, 37.5 for the Fuquay loamy sand, Metz sandy loam, Hanford loam, and the Wahiawa sandy clay loam, respectively. The Freundlich desorption coefficients were 1.54 (n=0.99), 0.93 (n=1.22), 0.45 (n=1.52), and 3.45 (n=1.13) with corresponding Koc's of 241, 137, 93.8 and 149 for the Fuquay loamy sand, Metz sandy loam, Hanford loam, and Wahiawa sandy clay loam (MRID #42868501, 1994).

Column Leaching (1,2-D). The column leaching experiments indicated that for the Fuquay loamy sand, a total of 85.8% of the applied 1,2-D leached from the soil column. 1,2-D was distributed evenly throughout the column. For the Wahiawa sandy clay loam column, a total of 73.2% of the applied was found in the leachate. 1,2-D was not evenly distributed throughout the column and concentrations were highest near the final soil segment. Sorption coefficients estimated from the column leaching studies were 0.09 and 0.43 for the Fuquay and Wahiawa soils with corresponding Koc's of 14.1 and 18.5 (MRID #42868501, 1994).

Field Volatility. The factors influencing the volatility of 1,3-D from a field plot include but are not limited to: soil organic matter, wind speed, soil moisture content, depth of incorporation-injection, soil temperature and soil porosity. Approximately 25% of the applied 1,3-D had volatilized by 14 days post-treatment (the final sampling interval). The volatilization of 1,3-D increased to 35.1 $mg/m^2 \cdot hour$ by 3 days post-treatment using the aerodynamic flux method with 33- and 90-cm sampling levels at the plot center. Volatilization ranged from 8.13 to 22.3 $mg/m^2 \cdot hour$ at 4-6 days, 4.6 to 17.5 $mg/m^2 \cdot hour$ at 7-9 days, 3.31 to 7.78 $mg/m^2 \cdot hour$ at 10-12 days, and 1.28 to 4.93 $mg/m^2 \cdot hour$ at 12-14 days (MRID #42545101, 1992).

1,3-D was soil injected at 12-14 inches at 346 lb/ai/A into fields of sandy loam, loamy sand, and muck soils. At 6 to 12 hours post-treatment, 1,3-D reached a maximum concentration of 0.09 to 4.4 ppm at the 0.5-foot height. 1,3-D concentrations decreased to $\leq$ 0.03 ppm in all air samples from all locations by 7 days post-treatment. It was not detected above the loamy sand and sandy loam soils by 14 days or above the muck soil by 21 days. Volatilization rates appeared to be inversely proportional to the amount of soil organic matter and proportional to soil porosity (MRID #41057701, 1989).

Telone II was applied at approximately 12.8 gallons per acre (121 lbs ai/acre) to a fallow plot in Nevada and monitored over 7 days for airborne concentrations directly above the field and at locations up to 1/2 mile away (no MRID#, reviewed 11/5/91, EFGWB #91-0910). The average value of 1,3-D at a 6-inch height above the field during 7 days was 465.31 ug/m^3; at a 5-foot height at the edge of the field it was 94.81 ug/m^3; at a 5-foot height 100 feet from the field it was 39.39 ug/m^3; at a 5-foot height 1/4 mile from the field it was 5.17 ug/m^3; and at a 5-foot height 1/2 mile from the field it was 3.88 ug/m^3. Wind was a major factor in the dispersion of 1,3-D as higher concentrations were measured at night. During the day, the increase in wind velocity also increased vapor dispersion and lowered the measurable amount of material (Houtman et al., 1991).

In general, it is difficult to correlate soil moisture content with volatilization but Glotfelty and Schomberg (1989) and Lyman et al. (1982) suggest that the extreme drying of soil during drought will greatly decrease volatilization. Addition of moisture to dry soils will generally increase volatilization rates to a point beyond which additional moisture may have little effect or may start to decrease volatilization. The effect of changes in soil moisture on the volatilization of organics from soils with intermediate moisture contents is difficult to predict and depends upon the chemical, soil type, and the initial soil moisture content. In general, soil chisel incorporation of 1,3-D is accompanied by capping off of the soil injection cores and/or by covering the field with plastic to minimize volatilization. Deeper injection minimizes the total amount of material that volatilizes. It also maximizes the amount of time from injection until volatiles are observed at the soil/air interface because of the increased soil distance through which the pesticide must diffuse.

(5) Field Dissipation

Terrestrial Field Dissipation. Cis and trans 1,3-D applied at 345 lb ai/A dissipated with an observed initial half-life of approximately 1 day and a second half-life of approximately 7 days in the surface 24-inches of a bare-ground loamy sand soil (MRID #40855501, 1988).

1,3-D was applied at 342 lb ai/A to a sand soil field plot in California. 1,3-D residues declined from a maximum of 130,000 ppb in the 0.3- to 0.45-m layer of soil immediately after treatment to less than 10 ppb (detection limit) in any soil layer at 71 days. The degradate 3-chloroallyl alcohol declined from a maximum of 410 ppb in the 0.66 to 0.81 m layer of soil at 7 days posttreatment to less than 10 ppb in any soil layer at 71 days (MRID #40403301, 1987; additional data 3/24/89). The half-life is approximately 7 days assuming a linear dissipation rate.

C. Water Resources

(I) Ground Water

High-quality data indicate that 1,3-D leaches to ground water as a result of normal agricultural use. Monitoring information collected since 1983 indicates that 1,3-D has been detected in ground water in 7 states in different regions of the U.S. with concentrations exceeding 800 ppb. These states include California, Florida, Nebraska, New York, Oregon, Washington, and Wisconsin. The highest values were detected in Florida and Wisconsin small-scale field monitoring studies conducted for EPA. These small-scale field studies were required in 1992 to provide information on the magnitude of residues found as a result of normal agricultural use. Because these data are high quality, our confidence in the results is also high.

In 1986, retrospective ground-water monitoring studies were also requested by the Agency to evaluate the impact of years of 1,3-D use on ground-water quality. During one retrospective study, 1,3-D was detected in ground water in Nebraska at concentrations up to 3.86 ppb. 1,3-D residues in Nebraska persisted for approximately eight months and were detected again at 14 months. 1,3-D was also detected at trace concentrations in the Washington state retrospective study.

(II) Occurrence of 1,3-D in Ground Water.

1,3-D has been detected in ground water at concentrations ranging from trace levels to 833 ppb. The highest levels were detected in Florida and Wisconsin small-scale field monitoring studies conducted for EPA. These studies, conducted in vulnerable areas at maximum label rates, were still ongoing as of June 1997. Total 1,3-D residues (parent plus two degradates) in Florida water that could be used for drinking ranged up to 39.51 ppb. In Wisconsin, preliminary results show that 1,3-D was detected in an aquifer used for drinking water at concentrations ranging up to 278 ppb.

1,3-D has also been detected in ground water in The Netherlands in potato and flower bulb fields. Because an MCL has not been established for 1,3-D, no monitoring for this chemical is required under the Safe Drinking Water Act.

1,2-D has been detected in ground water in California, Connecticut, Florida, Hawaii, Massachusetts, Maryland, Nebraska, New York, Oregon, Washington, and Wisconsin. The MCL for 1,2-D is 5 ppb. However, DowElanco's Q* information indicates an estimated HAL of 1.2 ppb. 1,2-D monitoring is not required under the Safe Drinking Water Act.

(A) Small-Scale Prospective Monitoring

(i) Wisconsin.

The Agency requested that DowElanco conduct a small-scale prospective ground-water monitoring study in a northern climate because of the concern for 1,3-D persistence in cold climates. On September 9, 1997, Telone II was applied to a sugar beet field at 28 gallons per acre (266 lb ai/acre). Preliminary results from two months of sampling indicate that 1,3-D and 1,2-D were detected in ground water on the site; no results are yet available for the degradates. 1,3-D was detected in all of the onsite shallow and deep wells (16 wells) at concentrations ranging from 0.001 to 278 ppb using a quantitation limit of 0.05 ppb. Concentrations of 1,3-D were increasing during the last sampling round.

1,2-D was detected in all eight of the onsite shallow wells and four of the onsite deep wells at concentrations ranging from trace levels to 1.2 ppb using a quantitation limit of 0.05 ppb. For 1,2-D also, residue concentrations were increasing during the last sampling round.

Neither 1,3-D or 1,2-D were detected in the offsite wells located 75 feet downgradient of the site (these wells were installed two months after the 1,3-D application). However, 1,3-D was detected in one of the deep wells located upgradient of the test plot at concentrations up to 0.761 ppb.

(ii) Florida.

In 1993, DowElanco volunteered to conduct a small-scale prospective monitoring study in southern Florida. Because of concerns for potential ground-water contamination, EPA and the State of Florida agreed that the study should be conducted. On December 13, 1995, Telone C-17 was applied to a pepper field at approximately 22.5 gallons per acre. Study results through January 1997 show that 1,3-D; 1,2-D; and both the chloroacrylic acid and chloroallyl alcohol degradates were detected in ground water.

In the uppermost part of the aquifer (4'), 1,3-D was detected in all eight of the onsite wells. Detections peaked at 833 ppb and declined to 0.19 ppb by 110 days after application. These wells also contained 3-chloroallyl alcohol at concentrations ranging from trace levels to 360 ppb and 3-chloroacrylic acid at concentrations ranging from trace levels to 424 ppb. 1,2-D was detected at concentrations ranging from trace levels to 11.5 ppb. Five offsite wells also contained 1,3-D residues at concentrations ranging from trace levels to 0.23 ppb.

At a depth of 12' in the aquifer, 1,3-D was detected in all eight of the onsite wells. Concentrations ranged from trace levels (0.05 ppb) to 10.7 ppb. These wells also contained 3-chloroallyl alcohol at concentrations ranging from trace levels to 13.5 ppb and 3-chloroacrylic acid at concentrations ranging from trace levels to 6.16 ppb. 1,2-D was detected at concentrations ranging from trace levels to 1.28 ppb. Three of the offsite wells also contained trace amounts to 0.07 ppb of 1,3-D residues.

There are significant problems with interpretation of the data from the deep part of the aquifer (70') and it is not known whether these detections are real or the results of contamination. Water blanks from the bailers used to sample the deep wells contained 1,3-D concentrations similar to those found in the deep wells. Also, pump test data indicates that the deep wells are somewhat confined and bromide did not reach these deep wells during the study. However, the information submitted is as follows: 1,3-D was detected in two of the three onsite wells in the Lower Tamiami Aquifer with concentrations ranging from 0.05 to 1.03 ppb. These wells also contained 3-chloroallyl alcohol at concentrations ranging from trace levels to 7.85 ppb and 3-chloroacrylic acid at trace concentrations. 1,2-D was detected at concentrations ranging from trace levels to 0.07 ppb. No 1,3-D residues were found in the offsite deep well; 1,2-D was detected in this well at trace levels in all but one sampling event.

(B) Small-Scale Retrospective Monitoring.

In 1986, the Agency requested that the registrant evaluate the impact of 1,3-D on ground water in varied environments with different use patterns. From 1989 to 1992, DowElanco conducted retrospective ground-water monitoring studies in Grant County, Washington; Merced County, California; Monterey County, California; Wayne County, North Carolina; and Scotts Bluff County, Nebraska. Although there were significant problems with the study designs and sampling, results indicated that 1,3-D can leach to ground water in some environments.

Nebraska. 1,3-D concentrations in ground water ranged from 0.23 ppb to 3.86 ppb using a detection limit of 0.05 ppb. In this sugar beet study, maximum residues were seen in ground water eight months after application. The cis isomer was again detected fourteen months after the 1,3-D application.

Washington. In the Washington potato study, the cis isomer of 1,3-D was detected at 0.03 ppb in two ground-water samples from two of the 50-foot wells on the site approximately one month after application.

North Carolina, California. No residues of 1,2-D; 1,3-D or its degradates were detected in ground water in the North Carolina tobacco study, the Merced County, California sweet potato study or the Monterey County, California carrot study.

(C) State Ground-Water Monitoring Studies.

The Pesticides in Ground Water Database (EPA, 1992) indicates detections of 1,3-D in three states -- Florida, New York, and Washington -- because of normal field use. The database also reports detections of 1,3-D in California because of point source problems. Additional monitoring in Hawaii, Massachusetts, Mississippi, and Oregon has not yielded any detections of 1,3-D.

California. In 1987, 1988, and 1991, 1,3-D was detected in six wells in Del Norte, Fresno, and Santa Clara counties. Using a method detection limit of 0.5 ppb, concentrations ranged from 0.89 to 1.9 ppb. No information is available about the source of the detections. 1,3-D was not detected in 9,915 wells sampled from May 1979 to June 1996 using detection limits ranging from 0.02 to 100 ppb (Bartkowiak, 1997).

In Riverside, California, illegal use of 1,3-D in 1986 and 1987 resulted in six detections in one irrigation well ranging from 6.8 to 31 ppb (EPA, 1992).

Florida. From 1987 to 1996, a total of 9,505 wells were monitored for 1,3-D residues. The present detection limit is 0.0850 ppb but it has varied in the past (Fisher, 1997). Although 1,3-D was recorded in three wells at concentrations ranging from 0.2790 to 8.0000 ppb, these are probably most likely 1,2-D detections (Riotte, 1997).

Hawaii. The Hawaii Department of Health monitors for 1,3-D in ground water because of its use as a soil fumigant in the pineapple industry. From 1979 to 1987, samples were analyzed from 54 wells and no residues were found (Giambelluca, 1988?).

Massachusetts. In the summer and fall of 1985, several Massachusetts agencies analyzed samples from 239 wells in tobacco-growing areas. Using a detection limit of 1.0 ppb, no 1,3-D was found. No degradates were analyzed (Massachusetts Interagency Task Force, 1986).

Mississippi. In Mississippi, a statewide drinking-water ambient monitoring survey was designed to sample for pesticides. 1,3-D is not widely used in Mississippi (Landreth, 1997) and the reported monitoring may not have been conducted in areas where 1,3-D has been used. To date, 348 deep wells have been sampled and analyzed for cis and trans 1,3-D. No residues have been detected using a detection limit of 0.10 ppb for the parent.

New York. Although monitoring for 1,3-D is not usually done by the State, several studies have been done by researchers to determine the leaching potential of 1,3-D in Suffolk County, New York. In one of the studies done in 1983, 1,3-D was detected in ground water at concentrations ranging from 37 to 270 ppb in one well over a period of three months. The detection limit used in this study was 2 ppb (Loria et al., 1986). In another study, no 1,3-D was detected in nine wells located near fields where 1,3-D was applied. The detection limit used here was also 2 ppb (Kotcon and Loria, 1987).

Oregon. In Oregon, a standard analytical screen that includes 1,3-D is done for every well that is sampled. Many of these wells are not in agricultural areas or 1,3-D use areas. Some 1,3-D has been found using a detection limit of 0.5 ppb. However, problems with data retrieval make it impossible to determine how much or how many times 1,3-D has been detected (McLaughlin, 1997).

Washington. From 1990 through 1996, the Washington State Department of Ecology analyzed 196 wells for cis and trans 1,3-D. The trans isomer was found on April 30, 1991 in three wells at concentrations of 0.10, 0.11, and 0.11 ppb. The same three wells were resampled in February 1992 (10 months later) and no 1,3-D was detected (Larsen, 1997).

(III) Modeling and Occurrence of 1,3-D in Surface Water

A mixture of the cis and trans isomers of 1,3-D is typically applied at several hundred pounds per acre at a depth of approximately 1 foot below the soil surface. It then volatilizes up through the soil profile and subsequently to the atmosphere. The 1,3-D isomers undergo fairly rapid dissipation in soil via volatilization and to a lesser extent degradation. Also, only chemical molecules that have diffused into the top 1 to 2 cm of soil at the time a runoff event occurs would probably be susceptible to runoff. Such factors should somewhat limit the runoff potential of the 1,3-D isomers. However, extremely high application rates of several hundred pounds per acre coupled with low soil/water partitioning indicate some potential for runoff for at least several weeks post-application.

In addition to runoff, another route of 1,3-D transport to surface water could be by dissolution of volatilized compound from the air. That is a route proposed by DowElanco to explain 1,3-D residues in perimeter ditches of a treated field in Florida (see above discussion on the Florida prospective ground-water monitoring study) prior to any runoff events. DowElanco postulates that during conditions of low wind, volatilized 1,3-D will move close to the ground due to its higher density than air, and that some of the 1,3-D passing over surface water will be transported from the air to the water and dissolved. Another possibility is that in Florida, ground water may be contributing to residues in surface water because of ground and surface water interactions. Both the 3-chloroallyl alcohol and 3-chloroacrylic acid were detected in surface water along with 1,3-D this prospective ground-water monitoring study in Florida.

1,3-D will probably undergo rapid rates of dissipation in most surface waters due to volatilization and to a lesser extent by abiotic hydrolysis and possibly biodegradation. Volatilization rates will be highest for shallow turbulent water and decrease with increasing depth and decreasing turbulence. Isomer mixture soil/water partition coefficients of 0.23 in a loamy sand, 0.32 in a sand, 0.42 and 1.09 in two clays indicate that the concentration of 1,3-D in sediment pore water will be comparable to that adsorbed to suspended and bottom sediment. Concentrations in the water column will be less than in the sediment pore water, but should still be somewhat comparable to concentrations adsorbed to sediment. The low octanol/water partitioning of 1,3-D indicates that its bioaccumulation potential is probably low.

(IV) Drinking Water Exposure Assessment

(a) Ground Water

The following concentrations are believed to be representative of ground water that is currently or could reasonably be expected to be a source of drinking water. Because there are differences in 1,3-D use across the U.S., we have broken the data down by region and by whether the water is currently used as a drinking water source. Because of the high data quality, we are confident in the concentrations stated in this document. Also, because the concentrations vary regionally, we believe a regional risk assessment is appropriate.

In Florida, acute high values of 39.51 ppb for total 1,3-D and 11.5 ppb for 1,2-D were seen in the 10-foot wells on the site. These wells could be used for drinking water in parts of Florida. In the 70-foot wells on the site, concentrations are suspect at this time. However, a total of 7.85 ppb total 1,3-D residues and 0.24 ppb 1,2-D residues were seen. These wells were installed in the Lower Tamiami aquifer which is a regional source of drinking water. In Florida, chronic values calculated for one year in the 10-foot wells were 1.11 ppb for total 1,3-D residues and 3.97 ppb for 1,2-D. In the 70-foot wells, the data are suspect at this time. Values were calculated as 0.28 ppb for total 1,3-D residues and 0.86 ppb for 1,2-D.

In Wisconsin, all data are taken from wells installed in a drinking water aquifer. Only parent 1,3-D information was available when this report was written. Acute concentrations were 278.348 ppb and 1.187 ppb for 1,3-D and 1,2-D, respectively. The two months of available data yielded a chronic 1,3-D concentration of 16.02 ppb. To be conservative, in all chronic calculations, the Limit of Detection was used when the chemical was "not detected."

(b) Surface Water

Using the screening model GENEEC (GENeric Estimated Environmental Concentration), the following EECs (Estimated Environmental Concentrations) were generated for a 1-hectare by 2-meter deep pond draining an adjacent 10 hectare field treated with 1,3-D at rates ranging from 177 to 556 lbs ai/week. Results of the GENEEC modeling are presented in Table 8. Parameters used in the modeling exercise are listed in Appendix 1.

Table 8. Expected environmental concentrations (EECs) in surface water as modeled by GENEEC.

Lbs ai/acre	Peak (ppb)	4-day avg. (ppb)	21-day avg. (ppb)	90-day avg. (ppb)	Ann. avg. (ppb)
177	685	130	21	6	1.4
253	980	185	35	8	2
354	1380	260	50	12	2.9
404	1570	300	55	13	3.3
556	2160	410	80	18	4.5

Despite substantial rates of dissipation input to GENEEC (see below), the relatively high magnitudes of the estimated EECs reflect extremely high application rates. The EECs were generated assuming that 1,3-D is incorporated uniformly to a depth of 12 inches. Of course, that does not completely reflect reality since the entire compound is applied at a depth of 12 inches. However, assuming that it rapidly diffuses throughout the soil profile, the assumption may not be entirely unrealistic. The degradation rate constant entered into GENEEC for the pond was a combination of the hydrolysis rate constant and a volatilization rate constant estimated from the compound's Henry's Law constant and its molecular weight. The EECs are probably highly conservative for most surface waters (possibly even more so than usual due to the uniform incorporation assumption). The GENEEC EECs should only be used for screening purposes (see additional reservations below).

Limited surface-water monitoring data are available to the Agency. The only surface-water data are from four sampling sites along two perimeter ditches in a prospective ground-water monitoring study in Florida (see above). 1,3-D was detected above the detection limit of 0.05 ppb in 14 of 20 samples collected from the 2 ditches in the first five days post-application (prior to the first runoff event). Concentrations ranged from 0.07 to 1.8 ppb. No 1,3-D was detected in samples collected from the ditches after 5 days post-application. The degradate 3-chloroacrylic acid was detected in 4 of the 20 samples collected from the 2 ditches in the first five days post-application at concentrations ranging from 0.09 to 0.15 ppb. The degradate 3-chloroallyl alcohol was detected at a concentration of 0.78 ppb in one sample collected from the north ditch 9 days post-application.

The maximum reported concentrations in the ditches are three orders of magnitude less than the maximum concentrations estimated in an edge-of-the-field pond using GENEEC. In addition to obvious differences between computer estimated screening concentrations and actual data, one possibility for the discrepancy is that the two sets of numbers may represent different transport pathways to surface water. While the concentrations in the ditch represent the possible dissolution of 1,3-D from the air (as proposed by DowElanco since the concentrations appeared before the first runoff event), the GENEEC estimated concentrations represent runoff at two days post-application. However, it should be pointed out that no 1,3-D was detected in any samples collected from the ditches after runoff events did occur starting 6 days post-application. Actual runoff events occurred several days later than the 2 days assumed in GENEEC and some chemical removal from the ditches by flow during storms was likely. However, the lack of detections in samples collected from the ditches after the runoff events casts some doubt on the usefulness of GENEEC (runoff based) estimated concentrations even for crude screening purposes for this chemical. GENEEC and the more refined models it is based upon are not well suited for modeling fumigants.

4. Ecological Exposure Assessment

A. Explanation of the Risk Quotient (RQ) and the Level of Concern (LOC)

Risk characterization integrates the results of the exposure and ecotoxicity data to evaluate the likelihood of adverse ecological effects. The quotient method is used to integrate the results of exposure and ecotoxicity data. In this method, risk quotients (RQs) are calculated by dividing exposure estimates by both acute and chronic ecotoxicity values.

RQ = EXPOSURE/TOXICITY

RQs are then compared to OPP's levels of concern (LOCs). These LOCs are criteria used by OPP to indicate potential risk to nontarget organisms and the need to consider regulatory action. The criteria indicate that a pesticide used as directed has the potential to cause adverse effects on nontarget organisms. LOCs currently address the following risk presumption categories: (1) **acute high** - potential for acute risk is high and regulatory action may be warranted in addition to restricted use classification; (2) **acute restricted use** - the potential for acute risk is high but this may be mitigated through restricted use classification; (3) **acute endangered species** - the potential for acute risk to endangered species is high and regulatory action may be warranted; and (4) **chronic risk** - the potential for chronic risk is high and regulatory action may be warranted. Currently, the Agency does not conduct assessments for chronic risk to plants, acute or chronic risks to nontarget insects, or chronic risk from granular/bait formulations to mammalian or avian species.

The ecotoxicity test values (i.e., measurement endpoints) used in the acute and chronic risk quotients are derived from the results of required studies. Examples of ecotoxicity values derived from the results of short-term laboratory studies that assess acute effects are: LC50 (fish and birds), LD50 (birds and mammals), EC50 (aquatic plants and aquatic invertebrates) and EC25 (terrestrial plants). Examples of toxicity test effect levels derived from the results of long-term laboratory studies assessing chronic effects are: LOEC (birds, fish, and aquatic invertebrates), NOEC (birds, fish and aquatic invertebrates) and MATC (fish and aquatic invertebrates). For birds and mammals, the NOEC value is used as the ecotoxicity test value in assessing chronic effects. Other values may be used when justified. Generally, the MATC (defined as the geometric mean of the NOEC and LOEC) is used as the ecotoxicity test value in assessing chronic effects to fish and aquatic invertebrates. However, the NOEC is used if the measurement endpoint is reproduction or survival. Risk presumptions, along with the corresponding RQs and LOCs listed in Table 9.

Table 9. Risk Presumptions for Terrestrial Animals

Risk Presumption	RQ	LOC
Birds		
Acute High Risk	EEC[1]/LC50 or LD50/sqft[2] or LD50/day[3]	0.5
Acute Restricted Use	EEC/LC50 or LD50/sqft or LD50/day (or LD50 < 50 mg/kg)	0.2
Acute Endangered Species	EEC/LC50 or LD50/sqft or LD50/day	0.1
Chronic Risk	EEC/NOEC	1
Wild Mammals		
Acute High Risk	EEC/LC50 or LD50/sqft or LD50/day	0.5
Acute Restricted Use	EEC/LC50 or LD50/sqft or LD50/day (or LD50 < 50 mg/kg)	0.2
Acute Endangered Species	EEC/LC50 or LD50/sqft or LD50/day	0.1
Chronic Risk	EEC/NOEC	1

[1] abbreviation for Estimated Environmental Concentration (ppm) on avian/mammalian food items

[2] $\frac{\text{mg/ft}^2}{\text{LD50 * wt. of bird}}$ [3] $\frac{\text{mg of toxicant consumed/day}}{\text{LD50 * wt. of bird}}$

Table 9 (cont.). Risk Presumptions for Aquatic Animals

Risk Presumption	RQ	LOC
Acute High Risk	EEC[1]/LC50 or EC50	0.5
Acute Restricted Use	EEC/LC50 or EC50	0.1
Acute Endangered Species	EEC/LC50 or EC50	0.05
Chronic Risk	EEC/MATC or NOEC	1

[1] EEC = (ppm or ppb) in water

Talbe 9 (cont.). Risk Presumptions for Plants

Risk Presumption	RQ	LOC
	Terrestrial and Semi-Aquatic Plants	
Acute High Risk	EEC[1]/EC25	1
Acute Endangered Species	EEC/EC05 or NOEC	1
	Aquatic Plants	
Acute High Risk	EEC[2]/EC50	1
Acute Endangered Species	EEC/EC05 or NOEC	1

[1] EEC = lbs ai/A

[2] EEC = (ppb/ppm) in water

For pesticides applied as nongranular products (e.g., liquids, dusts applied via broadcast methods, etc.), the EECs on food items following product application are compared to toxicity values to assess risk (Fletcher et al., 1994). However, the Agency currently does not have routinely used methods for predicting EECs for soil fumigants. When available, risk determinations can be made when actual concentrations have been reported in terrestrial field dissipation studies or other studies submitted in support of reregistration.

B. Field Data Used for Risk Assessment

In this assessment, residues detected in soil, water, and air samples following application are compared to toxicity values. It should be noted that this risk assessment relies on very little data, measured or predicted. It should also be noted that the reported field studies were conducted with lower application rates than allowed on some crops. 1,3-D concentrations in soil, water, and air will be higher with corresponding higher application rates. However, the risk quotients calculated from the environmental data do provide information about the potential risk of 1,3-D application to nontarget species. In some instances, extrapolations were made to higher application rates.

Two terrestrial field dissipation studies (MRID # 40403301 and 40855501) provided 1,3-D residue concentrations in treated soil and subsequent dissipation rates. A prospective ground-water monitoring study in Florida yielded 1,3-D concentrations in water collected from ditches adjacent to treated fields (MRID # 44005201). Three field volatility studies evaluated atmospheric concentrations of 1,3-D under field conditions (MRID # 4245101, 41057701 and EFGWB # 91-0910).

C. Exposure and Risk to Nontarget Terrestrial Animals

1,3-D is approved for use on millions of acres of cropland and can be applied at rates as high as 556 lbs ai/acre. However, because the application method reduces terrestrial exposure and because of the relatively low toxicity to and mammals, its use is not expected to result in large incidents of mortality. No avian mortality incidents have been reported in relation to 1,3-D applications. Telone C-17 contains chloropicrin which is a contact irritant to humans and serves as a warning to applicators. It is assumed this product could affect birds and wild mammals in the same manner, resulting in avoidance and thereby reducing the risk of exposure.

1,3-D was placed in Special Review in 1993 because of its oncogenic properties in rats and mice. However, deleterious chronic exposure to terrestrial wildlife is expected to be minimal.

The Agency does not have a standard protocol for conducting terrestrial risk assessments on terrestrial organisms when chemicals are applied via soil injection methods. Instead, in this risk assessment, animals were assumed to be exposed through dietary intake of contaminated soil. Beyer et al. (1994) analyzed scat samples from a variety of vertebrate species to determine the percent of soil in the diet. His work showed that the quantity of soil in animal diets can range from less than 2% up to 30%. Animals can ingest soil intentionally to provide missing minerals or unintentionally through preening and grooming activities or by particles adhering to food items such as roots, tuber or foliage. Many species of birds also inadvertently ingest soil when probing soft soils for food. For the purpose of calculating risk quotients, it was assumed that 100% of the soil in an animal's diet comes from the treated field.

(I) Birds

Because of the application method, 1,3-D use in chemical soil sterilization operations is not expected to present a significant hazard to avian species. However, birds could be exposed through both dietary and inhalation routes. The available toxicity information allowed an acute risk determination through dietary routes. However, no information is available on acute inhalation toxicity to birds but the acute risk associated with this type of exposure is probably insignificant.

Risk quotients were calculated from the field dissipation residue data submitted to the Agency in support of reregistration. The Northern bobwhite LD_{50} was chosen to calculate the following risk quotients because of the wide range between the avian LD_{50} and the two avian LC_{50}s determined for this chemical. The discrepancy between the two endpoints is believed to be the result of the difficulty of keeping 1,3-D concentrations constant on the test diets considering 1,3-D's volatility. The following equation was used to determine the avian acute risk quotients:

$$LD_{50}\text{s/day} = \frac{\text{EEC} * (\%\ \text{daily food consumption} * \%\ \text{soil in diet})}{LD_{50}}$$

The results of these calculations are presented in Table 10.

Table 10. Risk quotients for acute exposure based upon an Avian LD_{50} of 152 mg/kg and a mean and range of soil consumption rates[1] of 10.6% (>2% to 30%) of the total daily food intake and a daily food consumption rate of 18% of total body weight. EECs are taken from a field dissipation study submitted to the Agency (MRID #40403301).

Application Rate and Injection Depth (MRID #)	EEC (ppm)	Avian LD_{50} (mg/kg)	Daily Soil Ingestion Rate[1]	RQ
342 lbs ai/acre (13-15 inches) (404033-01)	130	152	Mean = 10.6% Range = >2 to 30%	Mean =0.02 Range = <0.003 to 0.05

[1] Soil consumption values are taken from Beyer et al. 1995.

An evaluation of the above risk quotients shows that no LOCs are exceeded for avian species. If it assumed that the concentration in soil is directly proportional to the application rate, the EEC would be 208 ppm at the highest rate of 556 lbs ai/acre. At this concentration, no LOCs were exceeded. Even if the concentration of 1,3-D in soil was extrapolated to the maximum application rate (556 lbs ai/acre = 208 ppm), no LOCs were exceeded. At this soil concentration, a 100-gm bird with an LD_{50} of 152 mg/kg would need to consume 72 gm of soil to attain this equivalent dose. This indicates that 1,3-D use should not result in significant acute mortality to avian species under any application scenario.

No avian chronic test data has been submitted to support reregistration. Consequently, no assessment of chronic exposure has been conducted. Chronic toxicity is normally assessed through dietary routes of exposure. Since 1,3-D is applied only once per growing season and because it has a relatively short field dissipation half-life, it is not expected to result in long-term exposure or subsequent chronic effects.

(II) Mammals

Because of the application method, the use of 1,3-D in chemical soil sterilization operations is not expected to present a significant hazard to mammals. However, exposure could occur through both dietary and inhalation routes. No incidents of mammalian mortality have been reported due to the application of 1,3-D.

Risk quotients were calculated from field dissipation data and laboratory mouse LD_{50} data using the following equation:

$$LD_{50}\text{s/day} = \frac{\text{EEC} * (\text{\% daily food consumption} * \text{\% soil in diet})}{LD_{50}}$$

The results of these calculations are presented in Table 11.

Table 11. Risk quotients for acute exposure based upon a mammalian LD_{50} of 640 mg/kg and a mean and range of soil consumption rates[1] of 4.4% (>2% to 17%) of the total daily intake and a daily food consumption rate of 95% of total body weight. EECs are from a field dissipation study submitted to the Agency (MRID # 40403301).

Application Rate and Injection Depth (MRID #)	EEC (ppm)	Mammalian LD_{50} (mg/kg)	Daily Soil Ingestion Rate[1]	RQ
342 lbs ai/acre (13-15 inches) (404033-01)	130	640	Mean = 4.4% Range = >2 to 17%	Mean =0.008 Range = <0.003 to 0.03

[1] Soil consumption values are taken from Beyer et al. 1995.

Evaluation of the above risk quotients show that no LOCs are exceeded for mammalian species. If it assumed that the concentration in soil is directly proportional to the application rate, the EEC would be 208 ppm at the highest rate of 556 lbs ai/acre. At this soil concentration, a 20-gram mouse with an LD_{50} of 640 mg/kg would need to consume 61 gm of soil (three times its body weight) to attain this equivalent dose. Therefore, 1,3-D use should not result in significant acute mortality to mammalian species via dietary exposure under any application scenario.

Acute inhalation toxicity was assessed by comparing mammalian inhalation data to the amount of volatilized chemical found above the treated fields. Using an application rate of 346 lbs ai/acre, 1,3-D concentrations at a height of 6 inches above the soil surface never exceeded 4.4 ppm. This value is less than 0.01% of the mammalian inhalation LD_{50} of 713 mg/kg. Even if 1,3-D concentrations in the air are directly proportional to the application rate, atmospheric concentrations are not expected to reach toxic levels. This result also indicates that 1,3-D use should not result in significant acute mortality to mammalian species via inhalation exposure under any application scenario.

No assessment of chronic exposure to mammals was conducted. Chronic toxicity is normally assessed through dietary routes of exposure. Since 1,3-D is applied only once per growing season and because it has a relatively short dissipation half-life, it is not expected to result in long-term exposure and subsequent chronic effects observed in laboratory rat tests.

(III) Terrestrial Insects

The Agency currently does not assess risk to nontarget insects. Results of acceptable studies are used for recommending appropriate label precautions.

D. Exposure and Risk to Nontarget Freshwater Aquatic Animals

Exposure of pesticides to aquatic nontarget organisms is possible through surface water runoff, soil erosion, off-target drift, and movement from ground water to surface water. Risk via exposure to 1,3-D concentrations in surface-water was assessed by using aquatic EECs predicted using the program GENEEC (see Table 8) and from actual residues in ditch water found during a ground-water study. These estimates of environmental levels were then compared to known toxicity reference values.

(I) Freshwater Fish

Acute and chronic risk quotients are presented in Table 12.

Table 12. Risk Quotients for Freshwater Fish Based on a (Walleye) LC50 of 1.08 ppm. Chronic risk quotients could not be evaluated due to the lack of chronic toxicity information.

Site/ Application Method/ Rate in lbs ai/A (No. of Apps.)	LC50 (ppm)	NOEC/ MATC (ppm)	EEC Initial/Peak (ppm)	EEC 90-Day Ave.[1] (ppm)	Acute RQ (EEC/LC50)	Chronic RQ (EEC/NOEC or MATC)
177	1.08	nd	0.685	0.006	0.63 ***	nc
253	1.08	nd	0.980	0.008	0.91 ***	nc
354	1.08	nd	1.380	0.012	1.27 ***	nc
404	1.08	nd	1.570	0.013	1.45 ***	nc
556	1.08	nd	2.160	0.018	2.00 ***	nc

[1] 56 day concentration was not modeled.
nd = no data
nc = not calculated
* = Exceeds the endangered species LOC
** = Exceeds the endangered species LOC
*** = Exceeds the acute high risk LOC

The results indicate that aquatic acute high risk, restricted use, and endangered species levels of concern are exceeded for freshwater fish at maximum application rates equal to or above 177 lbs ai/acre. Chronic risk could not be determined because of the lack of chronic toxicity data.

The freshwater fish LC_{50} (1.08 ppm) was compared to actual residues detected in borrow ditches adjacent to fields treated at an application rate of 182 lbs ai/acre (MRID #44005201). Concentrations ranged from 1.8 ppb to 0.34 ppb. The resulting risk quotient ranges from 0.002 to 0.0003 which does not exceed any LOC. If residues in ditch water are assumed to be directly proportional to the application rate, then at 556 lbs ai/acre, concentrations in ditch water would reach 5.5 ppb. At this concentration no LOCs are exceeded.

Concentrations of 1,3-D in ground water four feet below the surface in Florida reached a maximum of 833 ppb. At this concentration, the acute high risk LOC for fish would be exceeded by 1.5 times. This does not account for the additional toxicity presented by the two degradates that were also found in ground water in Florida.

(II) Freshwater Invertebrates

The acute and chronic risk quotients are presented in Table 13.

Table 13. Risk Quotients for Freshwater Invertebrates Based on a Daphnia LC50 of 0.09 ppm. Chronic risk quotients could not be evaluated due to the lack of chronic toxicity information.

Site/ Application Method/ Rate in lbs ai/A (No. of Apps.)	LC50 (ppm)	NOEC/ MATC (ppm)	EEC Initial/Peak (ppm)	EEC 21-Day Ave. (ppm)	Acute RQ (EEC/LC50)	Chronic RQ (EEC/NOEC or MATC)
177	0.09	nd	0.685	0.025	7.61 ***	nc
253	0.09	nd	0.980	0.035	10.89 ***	nc
354	0.09	nd	1.380	0.05	15.33 ***	nc
404	0.09	nd	1.570	0.055	17.44 ***	nc
556	0.09	nd	2.160	0.080	24.00 ***	nc

nd = no data
nc = not calculated
* = Exceeds the endangered species LOC
** = Exceeds the endangered species LOC
*** = Exceeds Acute High Risk LOCs

The results indicate that aquatic acute high risk, restricted use, and endangered species levels of concern are exceeded for freshwater invertebrates at maximum application rates equal to or above 177 lbs ai/acre. Chronic toxicity could not be determined due to a lack of toxicity information.

When the LC_{50} (0.09 ppm) is compared to actual residues (MRID #44005201) detected in borrow ditches adjacent to fields treated at an application rate of 182 lbs ai/acre ranged from 1.8 ppb to 0.34 ppb. The resulting risk quotients range from ranges from 0.02 to 0.004, which do exceed the endangered species LOC. If residues in ditch water are assumed to be directly proportional to the application rate, then at 556 lbs ai/acre, concentrations in ditch water would reach 1.04 to 5.5 ppb. At concentrations above 4.5 ppb, endangered species LOCs are exceeded.

Concentrations of 1,3-D in ground water four feet below the surface in Florida reached a maximum of 838 ppb. At this concentration, the acute high risk LOC for invertebrates would be exceeded by more than 15 times. This does not account for the additional toxicity presented by the two degradates that were also found in this ground water. Additionally, concentrations remained at potentially toxic levels for approximately 60 days.

D. Exposure and Risk to Estuarine and Marine Animals

No toxicity information for estuarine and marine animals has been submitted in support of registration. Consequently, no risk analysis could be conducted for these types of organisms.

Two acute toxicity tests are required for estuarine/marine invertebrates, preferably with the mysid shrimp and the Eastern oyster. One acute toxicity test is required for estuarine/marine fish, preferably using the Sheepshead minnow.

E. Exposure and Risk to Nontarget Plants

No toxicity information for nontarget plants has been submitted in support of registration. Consequently, no risk analysis could be conducted for these types of organisms.

5. Endangered Species

The Endangered Species Protection Program is expected to become final in the future. Limitations in the use of 1,3-D will be required to protect endangered and threatened species, but these limitations have not been defined and may be formulation specific. EPA anticipates that a consultation with the Fish and Wildlife Service will be conducted in accordance with the species-based priority approach described in the Program. After completion of consultation, registrants will be informed if any required label modifications are necessary. Such modifications would most likely consist of the generic label statement referring pesticide users to use limitations contained in county bulletins.

6. Labeling Requirements

A. End-use Products. Mitigation options for 1,3-D use in the United States are currently being assessed by EPA/SRRD and DowElanco.

APPENDIX 1

Environmental Fate information used in aquatic EEC determination:

1) Aerobic soil metabolism half-life = 18.5 days = average of 2 aerobic soil metabolism half-lives (12 days and 54 days) and 2 terrestrial field dissipation half-lives (1 day and 7 days).

2) K_{oc} = average of 4 K_{oc} values (20, 25, 41, and 42).

3) Estimated aerobic aquatic metabolism half-life = 0.53 days. The estimated value = $\ln 2/(k_{hydr} + k_{volat})$ where

k_{hydr} = hydrolysis rate constant = 0.05 day^{-1} = ln2/hydrolysis half-life of 13.5 days.

k_{volat} = volatilization rate constant for a 2-meter deep pond = 1.27 day^{-1}

The volatilization rate constant in day^{-1} is given by

$$k_{volat} = 24Hk_gk_l/z(Hk_g + k_lRT)$$

where

24 = constant to convert hr^{-1} to day^{-1}

k_g = gas transfer constant = $3000(18/111)^{1/2}$ cm/hr where 3000 is the value for water with a molecular weight of 18 and 111 is the molecular weight of 1,3-D.

k_l = water transfer constant = $20(44/M)^{1/2}$ cm/hr where 20 is the value for carbon dioxide with a molecular weight of 44 and 111 is the molecular weight of 1,3-D.

H = average of Henry's Law constants for the cis- and trans isomers = 1.43 X 10-3 $atm*m^3/mol$

R = gas constant = 8.2 X 10^{-5} $atm*m^3/mol*{}^\circ K$
T = temperature in degrees Kelvin = 298°K
z = depth of pond = 2 m = 200 cm

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Date:
Case No:
Chemical No:

PHASE IV
DATA REQUIREMENTS FOR ECOLOGICAL EFFECTS BRANCH

Data Requirements	Composition[1]	Use Pattern[2]	Does EPA Have Data To Satisfy This Requirement? (Yes, No)	Bibliographic Citation	Must Additional Data Be Submitted under FIFRA3(c)(2)(B)?
6 Basic Studies in Bold					
71-1(a) Acute Avian Oral, Quail/Duck	TGAI	1,2,3,4	Yes	MRID #261149 Wildlife International, 1982	No
71-1(b) Acute Avian Oral, Quail/Duck	(TEP)				
71-2(a) Acute Avian Diet, Quail	TGAI	1,2,3,4	Yes	MRID #STEODI03 Fink,1975	No
71-2(b) Acute Avian Diet, Duck	TGAI	1,2,3,4	Yes	MRID #00120908 Fink, 1975	No
71-3 Wild Mammal Toxicity					
71-4(a) Avian Reproduction Quail					
71-4(b) Avian Reproduction Duck					
71-5(a) Simulated Terrestrial Field Study					
71-5(b) Actual Terrestrial Field Study					
72-1(a) Acute Fish Toxicity Bluegill	TGAI	1,2,3,4	Yes	MRID #STODI02 USEPA, 1977	No
72-1(b) Acute Fish Toxicity Bluegill	(TEP)				
72-1(c) Acute Fish Toxicity Rainbow Trout	TGAI	1,2,3,4	Yes	MRID #00039692 Bentley,1975	No
72-1(d) Acute Fish Toxicity Rainbow Trout	(TEP)				
72-2(a) Acute Aquatic Invertebrate Toxicity	TGAI	1,2,3,4,	Yes	MRID # 40098001 Mayer & Ellersieck, 1986	No
72-2(b) Acute Aquatic Invertebrate Toxicity	(TEP)				
72-3(a) Acute Estu/Mari Tox Fish	TGAI	1,2,3,4	No		Yes
72-3(b) Acute Estu/Mari Tox Mollusk	TGAI	1,2,3,4	No		Yes
72-3(c) Acute Estu.Mari Tox Shrimp	TGAI	1,2,3,4	No		Yes

* In Bibliographic Citation column indicates study may be upgradeable

Date:
Case No:
Chemical No:

PHASE IV
DATA REQUIREMENTS FOR
ECOLOGICAL EFFECTS BRANCH

Data Requirements	Composition[1]	Use Pattern[2]	Does EPA Have Data To Satisfy This Requirement? (Yes, No)	Bibliographic Citation	Must Additional Data Be Submitted under FIFRA3(c)(2)(B)?
72-3(d) Acute Estu/Mari Tox Fish	(TEP)				
72-3(e) Acute Estu/Mari Tox Mollusk	(TEP)				
72-3(f) Acute Estu/Mari Tox Shrimp	(TEP)				
72-4(a) Early Life-Stage Fish	TGAI	1,2,3,4	No		Yes
72-4(b) Live-Cycle Aquatic Invertebrate	TGAI	1,2,3,4	No		Yes
72-5 Life-Cycle Fish					
72-6 Aquatic Org. Accumulation					
72-7(a) Simulated Aquatic Field Study					
72-7(b) Actual Aquatic Field Study					
122-1(a) Seed Germ./Seedling Emerg.	TGAI	1,2,3,4	No		Yes
122-1(b) Vegetative Vigor	TGAI	1,2,3,4	No		Yes
122-2 Aquatic Plant Growth	TGAI	1,2,3,4	No		Yes
123-1(a) Seed Germ./Seedling Emerg.	TGAI	1,2,3,4	No		Yes
123-1(b) Vegetative Vigor					
123-2 Aquatic Plant Growth					
124-1 Terrestrial Field Study					
124-2 Aquatic Field Study					
141-1 Honey Bee Acute Contact	TGAI	1,2,3,4	Yes	MRID #00028772 Atkins, 1972	No
141-2 Honey Bee Residue on Foliage	TEP	1,2,3,4	Yes	MRID #00018842 Atkins, 1969	No
141-5 Field Test for Pollinators					

* In Bibliographic Citation column indicates study may be upgradeable

[1] Composition: TGAI = Technical grade of the active ingredient; PAIRA = Pure active ingredient, radiolabeled; TEP = Typical end-use product

[2] Use Patterns: 1 = Terrestrial/Food; 2 = Terrestrial/Feed; 3 = Terrestrial Non-Food; 4 = Aquatic Food; 5 = Aquatic Non-Food (Outdoor); 6 = Aquatic Non-Food (Industrial); 7 = Aquatic Non-Food (Residential); 8 = Greenhouse Food; 9 = Greenhouse Non-Food; 10 = Forestry; 11 = Residential Outdoor; 12 = Indoor Food; 13 = Indoor Non-Food; 14 = Indoor Medical; 15 = Indoor Residential