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OFFICE OF
PREVENTION, PESTICIDES AND
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MEMORANDUM

SUBJECT: Memorandum Describing the Environmental Fate and Effect Division's Ecological Risk Assessment on Aliphatic Oils (PC Codes 063502 and 063503) in Support of Reregistration Eligibility Decision

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Attached is EFED's ecological risk assessment on aliphatic oils. Although there is much uncertainty in this assessment, the results suggest that there are potential acute risks to aquatic invertebrates and risks to eggs of egg-laying animals in or adjacent to the treated field. The high application rates do not allow for a definitive conclusion with respect to potential risks to terrestrial animals because the estimated concentrations on food items for some application rates is higher than levels tested in submitted studies in birds and mammals. In addition, no chronic or reproduction toxicity data in terrestrial or aquatic animals have been submitted, and no plant toxicity data have been submitted; therefore, definitive risk conclusions cannot be made at this time with respect to these surrogate species.

One issue EFED faced in trying to assess runoff with these products is that they are oils, and as such are not single molecule active ingredients like other pesticides. As a first tier approach,

EFED made conservative assumptions about how much might move off with runoff and modeled the products as a whole in a water body using GENEEC in this assessment. This is a relatively conservative approach that assumes the products move as a unit with runoff. However, because mineral oil and other similar petroleum products used as pesticides are composed of mixtures of various length carbon chain molecules, it is recognized that once applied the product will not behave as one molecule. As soon as the product reaches the environment, it will be begin to undergo differential degradation, and each chemical within the mixture will behave independently. To simulate this behavior, a method presented by Foster et al, 2003 was explored called the block method. Generally this approach allows for the assessment of individual components and considers the risk each block represents in a receiving water body separately. The method further explored the potential to add the risks from the various components together once each has moved into the receiving water body.

The basis for the block approach was that representative chemicals within a given block would be expected to behave similarly to other chemicals in that block in the environment because of the similarity in structure and number of carbon atoms. The chemical properties and characteristics (log Kow, Koc, halftimes, acute toxicity and chronic toxicity) for each chemical in a given block could be derived using structural activity relationship (SAR). The environmental fate of the **block** can then be based on the fate of the chemicals in that group. The likely components and their proportions for each mixture were determined by analyzing the petroleum refinement process by which each would have been produced, and identifying the various chemicals that were likely to form.

This method was not used in this chapter to assess these products because of the uncertainties inherent in it. The uncertainties with this method are:

1) Not knowing the constituents of the products that are applied and their relative proportions.

2) Basing all fate and effects on structural activity relationship analysis without corroboration of actual testing.

This assessment could be refined if this information was available.

I. Problem Formulation Summary

This assessment summarizes potential risks to non-target surrogate aquatic and terrestrial organisms identified for the currently labeled uses of aliphatic oils (PC Codes 063502 and 063503) using screening level methodologies. The available toxicity and environmental fate data are limited; therefore, assumptions were necessary to allow for a completion of an ecological risk assessment as outlined in Table I-1 below. Based on the limitations in the available data, a finding with respect to the likelihood of adverse effects to endangered species may not be possible for some of the assessed surrogate species.

Table I-1. Effects of data limitations on the screening level risk assessment of aliphatic oils.

Problem Formulation Issue	Effect of Issue on Risk Assessment.
Twelve CAS RNs representing numerous formulated products are included in this assessment. However, toxicity data were only available for a small subset of substances included in these PC Codes	Based on the broad descriptions of the CAS RNs outlined in Table I-2 below, it appears that the composition of the oils are similar across the two PC Codes. Therefore, the toxicological and fate properties may be similar. However, the data are insufficient to definitively support this conclusion.
Aquatic toxicity data are limited and have previously been considered invalid.	Limitations in the aquatic toxicity data exist. However, EFED believes that the data provides a weight of evidence regarding the toxicity of aliphatic oils and approximate drift and direct application to water exposures.
Composition of aliphatic oils is uncertain	Composition of six aliphatic oils was estimated based on the best available information. Composition information is particularly important to allow for an estimation of the relative risks of the various aliphatic oils and potential aquatic exposures and risks from runoff scenarios. Also, EFED notes that these oils may have polycyclic aromatic hydrocarbons (PAH) present, which could be persistent, bioaccumulative, and toxic, and may pose different additional risks than the aliphatic constituents. Therefore, clarification of the PAH content for all of the aliphatic oils included in this analysis is critical to ecological risk assessment.
Toxicity studies in aquatic and terrestrial plants, reproduction toxicity data in birds and mammals, and chronic studies in aquatic organisms have not been submitted.	These endpoints cannot be fully evaluated.
Submitted environmental fate data are not available	Aquatic EECs from runoff are uncertain and are not used to calculate risk quotients.

A. Chemicals Included in the Aliphatic Oils PC Codes

Aliphatic oils are complex mixtures of hydrocarbons obtained from refinement of crude oil. Twelve CAS numbers are included under “Aliphatic Oils” (PC Codes 063502 and 063503). These substances are described in Table I-2.

Table I-2. Description of Aliphatic Oils Included in PC Codes 063502 and 063503		
Name	**CAS No.**	**Description**
PC Code 063502		
Mineral oil, and paraffin liquid	8012-95-1* 8020-83-5	In general, mineral oil and paraffin liquid are considered synonymous and can be characterized as containing primarily (>60%) paraffinic hydrocarbons with low volatility (>C12) and low melting points (<C30 and liquid at ambient temperatures) (TPH Criteria Working Group 1998b; CONCAWE 1997).
White mineral oil, petroleum	8042-47-5	A highly refined petroleum mineral oil consisting of a complex combination of hydrocarbons obtained from the intensive treatment of a petroleum fraction with sulfuric acid and oleum, or by hydrogenation, or by a combination of hydrogenation and acid treatment. Additional washing and treating steps may be included in the processing operation. It consists of saturated hydrocarbons having carbon numbers predominantly in the range of **C15 through C50**.
Lubricating oils, petroleum, C15-30	72623-84-8	A complex combination of hydrocarbons obtained by treating light vacuum gas oil, heavy vacuum gas oil, and solvent deasphalted residual oil with hydrogen in the presence of a catalyst in a two stage process with dewaxing being carried out between the two stages. It consists predominantly of saturated hydrocarbons having carbon numbers predominantly in the range of **C15 through C30.**
Lubricating oils, petroleum, C15-30, hydrotreated neutral oil-based	72623-86-0	A complex combination of hydrocarbons obtained by treating light vacuum gas oil and heavy vacuum gas oil with hydrogen in the presence of a catalyst in a two stage process with dewaxing being carried out between the two stages. It consists predominantly of saturated hydrocarbons having carbon numbers predominantly in the range of **C15 through C30**.
Lubricating oils, petroleum, C20-50, hydrotreated neutral oil-based	72623-87-1	A complex combination of hydrocarbons obtained by treating light vacuum gas oil, heavy vacuum gas oil and solvent deasphalted residual oil with hydrogen in the presence of a catalyst in a two stage process with dewaxing being carried out between the two stages. It consists predominantly of saturated hydrocarbons having carbon numbers predominantly in the range of **C20 through C50**.
PC Code 063503		
Solvent-refined heavy paraffinic distillate	64741-88-4	Primarily saturated hydrocarbons from **C20 to C50;** Solvent refining indicates a lower concentration of polyaromatic and unsaturated hydrocarbons when compared to mineral oil (which is true for all solvent refined substances in this assessment). This mixture includes a higher composition of high molecular weight **(>C30)** hydrocarbons than the solvent-refined light paraffinic petroleum distillates (TPH Criteria Working Group 1998b; CONCAWE 1997).
Solvent-refined light paraffinic distillate	64741-89-5	The EPA substance registry system definition for the CAS number is primarily saturated hydrocarbons from **C15 to C30.** This mixture includes a higher composition of low molecular weight **(<C15)** hydrocarbons than the solvent-refined heavy paraffinic petroleum distillates (TPH Criteria Working Group 1998b; CONCAWE 1995, 1997).
Hydro-treated heavy paraffinic distillate	64742-54-7*	Primarily saturated hydrocarbons from **C20 to C50;** The primary difference in this mixture as compared to mineral oil is the reduced proportion of elemental sulfur. Furthermore, hydro-treated distillates can be distinguished from other mixtures based on the slightly higher concentration of polyaromatic hydrocarbons versus solvent-refined products. Finally, this mixture includes a higher composition of high molecular weight hydrocarbons than the hydro-treated light paraffinic petroleum distillates (TPH Criteria Working Group 1998b; CONCAWE 1995).

Table I-2. Description of Aliphatic Oils Included in PC Codes 063502 and 063503		
Name	**CAS No.**	**Description**
Hydro-treated light paraffinic distillate	64742-55-8*	This mixture is similar to the description under hydro-treated heavy paraffinic distillates except that the composition of these mixtures is **C15 to C30 hydrocarbons.** Also, this mixture includes a higher composition of low molecular weight (<C15) hydrocarbons than the hydro-treated heavy paraffinic petroleum distillates (TPH Criteria Working Group 1998b; CONCAWE 1995, 1997). This mixture contains a higher composition of low molecular weight hydrocarbons than the hydro-treated heavy paraffinic petroleum distillates
Distillates, petroleum, solvent-dewaxed light paraffinic	64742-56-9	A complex combination of hydrocarbons obtained by removal of normal paraffins from a petroleum fraction by solvent crystallization. It consists predominantly of hydrocarbons having carbon numbers predominantly in the range **of C15 through C30** and produces a finished oil with a viscosity of less than 100 SUS at 100 degrees F (19cSt at 40 degrees C).
Distillates, petroleum, solvent-dewaxed heavy paraffinic	64742-65-0	A complex combination of hydrocarbons obtained by removal of normal paraffins from a petroleum fraction by solvent crystallization. It consists predominantly of hydrocarbons having carbon numbers predominantly in the range **of C20 through C50** and produces a finished oil with a viscosity not less than 100 SUS at 100.degree.F.
Definitions and descriptions were obtained from ChemID Plus (http://chem.sis.nlm.nih.gov/chemidplus/) * Denotes substances for which toxicity data are available		

B. Use Patterns Modeled in this Assessment

Aliphatic oils may be applied at extremely variable rates using diverse methods including foliar spray (ground or aerial), air blast, and direct application to water. Terrestrial applications rates are as high 477 lbs a.i./Acre. Additional description of the use patterns is in Appendix C. Based on the high variability in the application rates and methods, EFED estimated exposure concentrations of aliphatic oils to nontarget terrestrial and aquatic organisms using a range of labeled application rates (i.e., single applications of 10, 50, 150, and 477 lb/A using airblast applications). Potential risks to aquatic organisms from direct application to water were also evaluated. Single applications were modeled. However, if multiple applications are used at high application rates such that the total amount of aliphatic oils applied exceeds 477 lbs a.i./Acre, then risk may be underestimated in this assessment. In addition, use of multiple applications would likely result in higher longer-term (chronic) average exposure concentrations. Therefore, when chronic toxicity data are obtained by EFED, modeling of multiple application rates may be needed.

The Biological and Economic Analysis Division (BEAD) provided data indicating that most applications are less than 60 lbs a.i./Acre; 0.1% of the applications were >100 lbs a.i./Acre.

II. Effects Characterization Summary

This effects characterization discusses studies that have been submitted to the Agency in support of pesticide registration. EFED acknowledges that data have been submitted to U.S. EPA's High

Production Volume Challenge Program. These data were not included in this assessment for reasons outlined in Appendix A.

Twelve petroleum mixtures are included in the aliphatic oils category. However, toxicity data were not available on all of the mixtures to allow for an adequate assessment of risk. If the composition of the aliphatic oils with fate or toxicity data is not representative of the 12 oils included in PC Codes 063502 and 063503, then the risks presented in this assessment may not be representative of the aliphatic oils category as a whole. However, based on the broad descriptions of aliphatic oils in Table I-2, it appears that the composition of the oils that have been tested in toxicity studies may be representative of the aliphatic oils group. Table II-1 below summarizes the substances for which toxicity data has been submitted, and Table II-2 summarized the toxicity data used in risk estimation.

No chronic toxicity studies in any species have been submitted to EFED for use in this risk assessment, and no aquatic plant toxicity studies have been submitted to the Agency.

Table II-1. Summary of aliphatic oils with toxicity data

Aliphatic Oil CAS No.	Effects Data						
	Fish, acute	Daphnids, acute	Mysid shrimp	Oyster	Aquatic Plants	Birds	Mammals
						Acute or subacute	Acute
PC Code 063502							
8012-95-1; 90 Neutral Oil	S	S				A	A
N65DW	S					A	
VHVI-4	S	S					
8020-83-5	No data						
8242-47-5	No data						
72623-84-8	No data						
72623-86-0	No data						
72623-87-1	No data						
PC Code 063503							
64741-97-5							A
64742-54-7; 100 Paraffin Oil	S	S					A
64742-55-8; 70-Orchard spray		S					A
GB-1111	S	S		S		A	

Table II-1. Summary of aliphatic oils with toxicity data							
Aliphatic Oil CAS No.	**Effects Data**						
	Fish, acute	**Daphnids, acute**	**Mysid shrimp**	**Oyster**	**Aquatic Plants**	**Birds**	**Mammals**
						Acute or subacute	**Acute**
64741-88-4	No data						
64741-89-5	No data						
A = Acceptable study exists S = Supplemental study exists. Most aquatic studies are currently being upgraded from invalid to supplemental.							

Table II-2. Summary of toxicity values used in the aliphatic oils screening level ecological risk assessment.			
Surrogate Species	**Acute Toxicity Value Used in Assessment[a]**	**Comment**	**Data Source for toxicity value used in assessment**
Fish	None used	No effects were observed in multiple studies at the limit concentrations for these types of studies.	Weight of evidence was used to estimate potential risks.
Daphnia	0.02 mg/L	LC50s were 0.02, 0.1, <0.9, 0.41, and 2.4 mg/L. The lowest value of 0.02 was used in risk estimation.	41902803
Oysters	6 mg/L	EC50: 6 mg/L	44762002
Aquatic Plants	No data	None	N/A
Mammals	22 g/kg-bw	Data obtained from secondary literature; no chronic or reproduction toxicity studies were submitted.	NIOSH, 2004
Birds	LD50: >2250 mg/kg-bw LC50: >5620 ppm	No chronic or reproduction toxicity studies were submitted.	44608001;41793202; 41742101; 4780903; 44780902
Terrestrial Plants	No data	None	N/A
a No chronic or reproduction studies have been submitted to the Agency.			

A. Aquatic Species

1. Fish

Nine 96-hour acute studies in various fish species have been submitted to the Agency (summarized in Table II-3 below). No study alone was considered adequate for risk estimation due primarily to the low solubility of the oils and the lack of analytical confirmation of the test solutions; however, collectively, the data suggests that loading of the aliphatic oils at levels that approximate the limit concentration for acute fish toxicity studies (100 mg/L) is not expected to cause mortality in fish. Studies using N65DW did not observe mortality at up to a 50% mixture

(500,000 mg/L; MRID 44637335). The available acute fish toxicity studies are summarized below.

Table II-3. Summary of submitted fish studies for aliphatic oils			
Chemical	**CAS RN**	**EC50**	**MRID**
100 Paraffine Oil	64742-54-7	>100 mg/L	41368834 (2 studies)
GB-1111	None	>120 mg/L	44708201; 44762003
90 Neutral Oil	8012-95-1	>100 mg/L	41902801; 41902802
VHVI-4	None	>76 mg/L	44637336
N65DW	None	>500,000 mg/L	44637335; 44660001

2. Aquatic Invertebrates

Five 48-hour acute studies in daphnids using five different aliphatic oils have been submitted to the Agency (summarized in Table II-3 below).

All of the submitted studies in daphnids were previously considered invalid primarily because the test concentrations were not measured and evidence of dissolution (presence of oily sheen on the water surface) was observed. Although no study alone was considered adequate for risk assessment purposes, collectively, EFED believes that they inform the risk assessment because the studies generally reported consistent results and suggest that the 48-hour EC50 in daphnids is likely less than 1 mg/L. Therefore, even though limitations in the aquatic toxicity data exist, EFED believes that the data provides a weight of evidence regarding the toxicity of aliphatic oils and that these studies approximate drift and direct application to water exposures. Therefore, the studies were upgraded to supplemental and were considered useful for risk assessment purposes. The lowest reported EC50 from these studies was 0.02 mg/L (MRID 41902803).

Table II-3. Summary of submitted aquatic invertebrate studies for aliphatic oils			
Chemical	**CAS RN**	**EC50**	**MRID**
90 Neutral Oil	8012-95-1	0.02 mg/L	41902803
GB-1111	None reported	0.1 mg/L	44769301
100 Paraffine Oil	64742-54-7	0.41 mg/L	41368835
VHVI-4	None reported	<0.9 mg/L (100% mortality occurred at all concentrations)	44637337
70 Orchard Spray	64742-55-8	2.4 mg/L	41368833

It is uncertain if the effects observed in the daphnid toxicity studies submitted to the Agency were caused by physical effects resulting from coating the organism or from a different mode of action. In some of the studies (e.g., MRID 44637337), daphnids were observed floating on top of the containers within an oily sheen on the surface. Therefore, it would appear that some daphnids may have been trapped in the oils. However, some daphnids were also reportedly immobile on the bottom or in the middle of the containers. Therefore, a mode of action distinct from physical coating appears possible. EFED notes that risk would be of concern regardless of the mode of toxicity; however, oily sheens are less likely to occur in turbid waters. Therefore, entrapment in surface oil slicks would be less likely to occur in turbid waters such as streams and

rivers, and oil slicks would be a higher concern in quiescent waters such as wetlands and stagnant lakes.

In addition, a supplemental static acute study in Eastern oysters produced an EC50 of 6 mg/L and an acute NOAEC of 3 mg/L. This study suggests that aliphatic oils are moderately toxic to oysters.

B. Terrestrial Species

Based on submitted studies, the mixtures included in this assessment do not appear to be acutely toxic to birds or mammals when orally exposed. No mortality occurred at the limit dose for acute oral and subacute dietary studies in birds as demonstrated in Table II-4 below. However, subacute studies in birds have shown effects including reduced reaction to external stimuli and increased incidence of toe picking in bobwhite quail at 1000 ppm 90 Neutral Oil. No signs of toxicity were observed in similar studies using the two other oil products tested (Table II-4). Data have not been submitted to allow for a characterization of the acute toxicity of each of the oils included in this category. If the composition is different across the various oils included in the aliphatic oils PC Codes, then their toxicological properties may also be different.

The mammalian LD50 used in this assessment was 22,000 mg/kg-bw. However, the high dosing volumes needed to achieve this dose may have contributed to the toxicity observed in this study.

Sufficient data are not available to determine if these substances may affect reproduction in either birds or mammals. No reproduction studies in birds or mammals and no terrestrial plant studies have been submitted to OPP or were located in EPA's ECOTOX database. Six incidents involving aliphatic oils (063503) are in EFED's EIIS (Ecological Incidents Information System) database. All incidents involve plant damage (Appendix D). In addition, labels currently carry phytotoxicity warnings. These data support a concern for potential risks to terrestrial plants.

Table II-4. Terrestrial Toxicity Profile for Aliphatic Oils

Test Type	Test Substance	Value Used in Risk Assessment	Comments	MRID
Rat acute oral LD50	**PC Code 063502** 8012-95-1 **PC Code 063503** 64742-55-8 64742-54-7 64741-97-5	22,000 mg/kg (>5000 to 22,000 mg/kg-bw).	At 22,000 mg/kg-bw, it is uncertain if toxic effects are caused by the test substance or the high dosing volume needed to achieve this dose. RQs will not be calculated from this study.	No MRID available. Data from NIOSH, 2004, provided by the Special Review and Reregistration Division (SRRD).
Rat 2-generation reproduction	No data	Not available	In the absence of data, risk estimation cannot be performed, and risk cannot be precluded. However, some of these substances are applied directly to farm animals; therefore, some of these oils are not likely potent reproduction toxicants.	None available

Table II-4. Terrestrial Toxicity Profile for Aliphatic Oils				
Test Type	**Test Substance**	**Value Used in Risk Assessment**	**Comments**	**MRID**
Bird acute oral LD50 (Mallard Duck, Bobwhite Quail)	GB-1111 PC Code (063503) 90 Neutral oil (063502)	>2250 mg/kg-bw	Acceptable study. No mortality or signs of toxicity were observed.	44608001 41793202
Bird dietary LC_{50} (Mallard duck and Bobwhite quail)	90 Neutral oil and N65DW (063502) GB-1111 (063503)	>5620 ppm	NOAEC for sublethal effects was 1000 ppm for 90 Neutral oil based on reduced reaction to external stimuli and increased incidence of toe picking. No effects were observed in other dietary subacute studies at any concentration.	41742101 44780903 44780902
Reproductive Toxicity NOAEL (Bobwhite, mallard duck)	No data	Not available	In the absence of data, a risk estimation cannot be performed, and risk cannot be precluded.	None
Honey Bee Contact LD_{50}	GB-1111 (063503) 90 Neutral Oil (063502) N65DW (063502)	>25 ug/bee >100 ug/bee >1830 ug/bee	No treatment-related effects were observed in any of these studies.	44683301 41793201 44676701
Terrestrial Plants (Tier I)	No Data	Not available	In the absence of data, a risk estimation cannot be performed, and risk cannot be precluded.	None

III. Exposure Summary

A. Aquatic Systems

1. Aquatic Exposure Estimates from Spray Drift

EFED performed preliminary modeling to bracket the potential exposures resulting from spray drift alone assuming 9.7% of the mass applied to a 10 hectare field drifts into a 20,000,000 L water body (standard drift assumption in GENEEC2 for orchard airblast applications, and EFED's standard ecological water body volume). The results of this analysis are in Table III-1 below. These EECs assume no runoff and therefore are likely to under-estimate total exposure. Runoff exposure estimates are presented in Table III-2. It is uncertain if the runoff EECs are toxicologically comparable to the drift only EECs, the direct application to water EECs, and the available toxicity data because the various components within the oil mixtures are expected to degrade and partition in such a manner that would preclude the oil mixture from running off as an intact substance. Therefore, the composition of the individual components in surface water from runoff is expected to be different than the composition of the aliphatic oils applied to terrestrial environments.

Table III-1. Preliminary Aquatic EECs from Drift Into a Standard Ecological Pond	
Application Rate	**Preliminary EEC Only from 9.7% Drift**
477 lbs a.i./Acre	2.6 mg/L
150 lbs a.i./Acre	0.82 mg/L
50 lbs a.i./Acre	0.27 mg/L
10 lbs a.i./Acre	0.05 mg/L

An important uncertainty is that several of the components of the mixtures included in this assessment are expected to be volatile. However, the overall mixtures of the aliphatic hydrocarbons are expected to be generally dominated by the longer chain hydrocarbons that tend to be less volatile. Therefore, exposure to some of the components may be lower than the screening level drift only EECs would suggest although this is not expected to be significant. Also, volatilization would also suggest that inhalation exposure could be an important exposure route for terrestrial organisms, and potential risk from inhalation exposure cannot be estimated unless inhalation toxicity information is available.

2. Direct Application to Water

For registered aliphatic hydrocarbon products (both aliphatic and mineral oil registrations) there are labeled uses for direct application to water bodies. In order to address this use, EFED has assumed the maximum labeled application rate (37 lbs/acre) of petroleum product will be applied directly to the treated water body. In order to estimate an EEC for the ecological risk assessment, EFED has assumed the application will occur to EFED's standard EXAMS water body of 20,000,000 L. As such, the acute concentration, assuming instantaneous equilibrium, for petroleum when applied directly to the water body is 2.1 ppm. This is obtained by converting the pounds applied per acre to kilograms per hectare (1 lb/acre is equivalent to 1.12 kg/ha), which yields an application rate of 41.4 kg/ha. Thus, the total pesticide load to the pond is 41.4 kilograms per 20,000,000 liters (the standard pond has a one hectare surface area) which yields a concentration of 2.1 ppm. The equation follows:

((37 lbs per acre x (1.12 kg per hectare/1 lb per acre)) x 1,000 g/kg x 1,000 mg/g) / 20,000,000 liters = **2.1 mg/liter (ppm).**

There are a number of uncertainties and assumptions inherent in the direct application scenario that may influence the interpretation of risk associated with this use pattern. For example, the conceptual model of this exposure scenario assumes that the application occurs to the standard water body that has a one hectare surface area and is two meters deep. While the surface area does not influence model prediction (because of an assumption that the pesticide is applied to the entire surface area) the depth of the water body does impact the results. For example, a similar application (maximum label rate) to a water body of similar geometry but which is only one meter deep will yield an EEC twice the number calculated for a 1 meter depth. Conversely, an

application to a water body twice as deep will yield an EEC half the EEC derived above. More information about typical use sites other than that provided on the label analysis is needed to determine what is an appropriate receiving water body. However, given the screening level nature of this assessment and the nature of the exposures resulting from the agricultural uses assessed (477 lbs/acre to orchards) these estimates for the direct application to water seem reasonable, but the nature of the uncertainty cannot be assessed as to whether exposures are overestimating or underestimating risk.

In addition, there is an assumption of instantaneous and uniform mixing in this scenario. It is possible that the application of a petroleum product to the surface of a water body could result in a separation of phases. In other words, it is possible that the petroleum may not mix within the water column and exposures could be restricted to a higher concentration of a film, or layer, of petroleum on the surface of the water that would yield a higher exposure but to a smaller proportion of the water body.

Finally, as with the standard runoff and drift estimates, it is expected that some amount of volatility will occur. However, it is also expected, based on the assumed physical-chemical properties described above, that the products included in this assessment tend to be heavier petroleum products with longer carbon chains and therefore, volatilization of the product is less likely. Regardless, it is expected that some proportion of the applied product will be lost due to drift and volatility and that is not captured in this estimate.

3. Aquatic Exposure Estimates from Runoff

In order to qualitatively evaluate the contribution of runoff to overall exposure, EFED conducted a simple screening level analysis using GENEEC. In this instance, GENEEC was run assuming aliphatic hydrocarbons would be applied by granular application (not a labeled use) as a convenience to minimize spray drift in the model run to zero. In lieu of any available environmental fate data EFED assumed that the relevant processes in GENEEC (aerobic soil and aquatic metabolism, hydrolysis and photolysis) were all stable. GENEEC was then run by varying the Koc across the potential range of Koc that might be expected for any of the various constituents within the aliphatic hydrocarbons. Table III-2 presents the results of this analysis which suggests that even with the dramatic variation in Koc used in this screen the predicted EEC at the highest application rate (477 lbs/acre) varies by only a factor of 20. Interestingly, the analysis indicates that between a Koc of 0.001 and 100 there is very little difference in resulting EEC. As Koc increases beyond this range a dramatic drop in EEC is noted when moving from a Koc of 100 to Koc of 1000. This is significant because it is expected that most of the components which make up the aliphatic hydrocarbons will be in the high Koc range. Therefore, if the Koc of the majority of the constituents is >1000, then the contribution to the EEC from runoff would not be expected to exceed 10 ppm from a single application of 477 lbs a.i./Acre.

The Horticultural Spray Oil Task Force (HSOTF) recently submitted two studies which support EFED's assessment of risk with the aliphatic hydrocarbons. First, the HSOTF submitted a summary of available data from the open literature (MRID 45945301) which reported that the aliphatic oils in general are relatively immobile. However, of the three studies cited, only the

study by Nudelman et al (2002) reported a Koc, which ranged between 900 and 6600. In addition to the open literature studies, the HSOTF study estimated adsorption/desorption using physicochemical parameters. In this exercise the authors reported a single estimated Koc of 47860. There were no actual analytical data presented in this summary and therefore the data can only be considered supplemental. However, the weight of evidence of these summaries suggests that for aliphatic hydrocarbons a reasonable estimate of Koc for these complex mixtures is between 1000 and 100000. Thus, comparing these estimated Koc with the GENEEC estimates provided above suggest that the higher Koc EEC approximated by 10000 may be a reasonable assumption of exposure due to runoff.

Also the HSOTF submitted a spray drift exercise (MRID 46042801) intended to confirm that the application of aliphatic hydrocarbons will not pose a risk to aquatic organisms and thus no spray drift data are needed to support this registration. Unfortunately, the exercise relies on unknown assumptions of application rate (57 lbs per acre) as well as degradation rates which are unsupported by data. The authors also compare the predicted EEC estimated in this exercise with aquatic toxicity data which excludes the most sensitive value available. In addition, in determining that there is no risk to aquatic species the authors rely only on the Acute Risk Level of Concern while ignoring the Acute Restricted Use LOC and the Endangered Species LOC. Interestingly, the exercise does provide EEC, which, if it had been is modeled at the maximum label rate (477 lbs/acre) used in EFED's assessment, would generally confirm that magnitude of exposure predicted in EFED's modeling. Because this study represents a non-GLP exercise the data can only be considered supplemental and the analysis does not support the contention of no risk.

Both of these studies are under review and Data Evaluation Records (DER) will be created for each study separate from this assessment.

Table III-2. EECs Predicted Using GENEEC Assuming No Spray Drift and Stability to All Dissipation Processes

Application Rate	Koc	EEC (ppm)
477 lbs a.i./Acre	0.001	26.79
477 lbs a.i./Acre	0.01	26.79
477 lbs a.i./Acre	0.1	26.79
477 lbs a.i./Acre	1	26.76
477 lbs a.i./Acre	10	26.35
477 lbs a.i./Acre	100	22.79
477 lbs a.i./Acre	1000	10.04
477 lbs a.i./Acre	10000	2.51

Table III-2. EECs Predicted Using GENEEC Assuming No Spray Drift and Stability to All Dissipation Processes		
Application Rate	**Koc**	**EEC (ppm)**
477 lbs a.i./Acre	100000	1.41

B. Terrestrial Systems

Estimated environmental concentrations (EECs) on terrestrial systems were calculated using the application rates of 10, 50, 150, and 477 lbs/acre (single application) using the Tier I exposure model, T-REX (Version 1.2.3.). This analysis indicates that aliphatic oils may be found on dietary food items at extremely high concentrations (up to 114,000 ppm). The resulting EECs used in risk assessment are in Table III-3. These dietary concentrations were converted to doses (mg/kg-bw) for 15-, 35-, and 1000-gram mammals and 20-, 100-, and 1000-gram birds. Body weight adjusted EECs for 10, 150, and 477 lbs/acre applications for birds and mammals are in Appendix B.

Table III-3. Estimated Aliphatic Oil Concentrations on Selected Terrestrial Animal Food Items After Applications of 10 to 477 lbs a.i./Acre.				
Food Item	**EEC (ppm) from application rates of 10 to 477 lbs a.i./Acre**			
	10 lbs a.i./Acre	**50 lbs a.i./Acre**	**150 lbs a.i./Acre**	**477 lbs a.i./Acre**
Short grass	2400	12,000	36,000	114,000
Tall grass	1100	5500	17,000	52,000
Broadleaf forage, small insects	1350	6800	20,000	64,000
Fruits, seeds, pods, large insects	150	750	2300	7200

In addition to contamination of potential food items of terrestrial species, aliphatic oils may be deposited onto eggs of terrestrial organisms. Potential risks from this exposure route are further discussed in Section IV.

IV. Preliminary Risk Estimation

A. Aquatic Systems

Table IV-1 below presents preliminary risk quotients for aquatic invertebrates based on the drift only and direct application to water EECs and the lowest EC50 in daphnids of 0.02 mg/L. Contribution of runoff to the EEC is discussed qualitatively because the composition of the runoff component may or may not be toxicologically similar to the composition of oils that enters water via spraydrift or that were used in the available toxicity studies.

Table IV-1. Preliminary Aquatic Invertebrate (daphnids) EECs from Drift Into a Standard Ecological Pond

Application Rate	Drift EEC from 9.7% Drift into a 20,000,000 L ecological pond	Daphnid RQ based on an EC50 of 0.02 mg/L	Oyster RQ based on an EC50 of 6 mg/L
477 lbs a.i./Acre	2.6 mg/L	130	0.43
150 lbs a.i./Acre	0.82 mg/L	41	0.14
50 lbs a.i./Acre	0.27 mg/L	14	0.045
10 lbs a.i./Acre	0.05 mg/L	2.5	<0.01
Direct Application EEC	2.1 mg/L	105	0.35

EFED has conducted a simple analysis of the extent of a spray drift buffer that would be needed to reduce the EEC at the various *single* application rates to below the most sensitive level of concern (1 ppb for endangered aquatic invertebrates; lowest EC50 of 0.02 mg/L x endangered species LOC of 0.05 = 0.001 mg/L = 1 ppb). Using the Tier I module within AgDrift for orchard airblast applications, EFED has determined that for the range of application rates allowable on current labels the buffers needed to reduce drift to levels below the endangered species LOC are either at or beyond the limits of the model and is 177 feet at the lowest modeled application rate of 10 lbs/acre. This analysis is based on a single application rate; the effect of multiple applications was not evaluated. The results of this analysis are presented in Table IV-2. This analysis is not applicable to the direct application to water scenario.

Table IV-2. Spray drift buffer distances needed to reduce the EECs in Table IV-1 to 1 ppb, which is the highest level that would not exceed the Aquatic Invertebrate Endangered Species Level of Concern (LOC) based on the currently available data.

Application Rate	Buffer Distance
477 lbs a.i./Acre	>1000 feet*
150 lbs a.i./Acre	>1000 feet*
50 lbs a.i./Acre	902 feet
10 lbs a.i./Acre	177 feet

* - 1000 feet equals the limit of the Tier I model within AgDrift

As noted above, the estimates for spray drift only EEC and the estimate of buffer width to reduce EEC are both limited in that the spray drift only estimates do not account for the potential impact of runoff. However, given the high expected Koc, buffer zones expected to reduce EECs to levels that are protective from drift exposure are expected to be protective from runoff exposures as well.

B. Terrestrial Animals

The available data for acute risk to terrestrial organisms is difficult to use because no mortality was observed at the limit dose in acute and subacute bird studies. However, the test levels were not as high as the potential exposures from the high application rates. For example, the avian LC50 is >5620 ppm. Any applications at 23 lb ai/acre or higher will result in estimated residues on food items greater than 5620 ppm. Ground spray, air blast, chemigation, or aerial applications may apply up to 477 lbs a.i./Acre. At that rate, concentrations on terrestrial organism food items were estimated at up to 114,000 ppm, which is well above any concentration tested in the available toxicity studies. Table IV-3 below presents application rates associated with key toxicity endpoints in terrestrial organisms.

Table IV-3. Application rates associated with key toxicity endpoints in terrestrial organisms

Application Rate	Toxicity Endpoint	Comment
Birds		
4 lbs a.i./Acre	Application rate associated with lowest dietary concentration that produced a toxic effect in birds (1000 ppm; MRID 1742101).	Toxic effects included reduced reaction to external stimuli and increased incidence of toe picking in bobwhite quail.
6 lbs a.i./Acre	Application rate associated with highest body weight adjusted dose tested in available acute oral gavage bird studies (1620 mg/kg-bw; adjusted from 2250 mg/kg-bw for a 20-gram bird).	No mortality occurred at this dose.
23 lbs a.i./Acre	Application rate associated with highest dietary concentration tested in available bird studies (5620 ppm).	No mortality occurred at this concentration.
Mammals		
10 lbs a.i./Acre	Application rate associated with concentrations on short grass that is 1/10th of the LD50 in mammals of 22,000 mg/kg-bw.	Data from NIOSH, 2004

In addition, oils such as corn oils and mineral oils are used to prevent hatching of undesirable birds by applying the oils directly onto the eggs. The oils may block pores in the eggshells, which prevents oxygen from entering the egg. Therefore, the developing embryo effectively suffocates. Limited dose-response data are available to allow for an estimation of the proportion of unhatched eggs associated with a given amount of applied oil; however, APHIS (2003) indicates that 2 mL of egg oil causes nearly 100% prevention of hatching birds in gulls and that 7 mL/egg is effective for goose egg treatment. In addition, Hoffman et al. (2003) estimated an LD50 for GB-1111, which is a pesticide within the PC Code 063503, of approximately 10 gallons/acre (approximately 75 lbs/Acre, assuming a specific gravity 0.875 to 0.905 for mineral oil; as cited in http://sis.nlm.nih.gov/enviro.html). This rate reportedly corresponds to approximately 20 uL/egg. Aliphatic oils may be applied at rates considerably higher than 75 lbs a.i./Acre; therefore, there is presumably risk to bird eggs either on or adjacent to the treated field. There would also presumably be risk to other terrestrial organisms that lay eggs on or near treated fields.

Some oils, such as crude oil, have been shown to be considerably more potent than oils used to prevent hatching of pest birds. Literature data suggests that treatment of an egg with 1 to 5 microliters prevents hatching, which suggests that some oils have a mode of action other than coverage of an egg to prevent gas exchange (Hoffman, 1979). Because the composition of the oils being assessed is uncertain, it is possible that the oils included in this assessment may also possess additional modes of action.

1. Risk to Endangered and Threatened Species

a. Potential Direct Effects to Aquatic Organisms

Endangered species LOCs were exceeded for aquatic invertebrates. Toxicity data were not available to allow for an assessment of risk to aquatic plants or chronic risk to fish or aquatic invertebrates. Therefore, a finding of not likely to adversely affect endangered species is not possible for these surrogate species at this time.

b. Potential Risk to Endangered and Threatened Birds and Mammals

Risks to endangered birds and mammals remain uncertain. Aliphatic oils do not appear to be acutely toxic to birds or mammals; however, the high application rates of these oils would result in potential exposure levels that exceed the highest doses tested in the available toxicity studies. No reproduction studies in birds or mammals were available for use in risk assessment. However, direct deposition of oils onto eggs in close proximity to the use area would presumably put them at risk because coating of eggs by oils can result in suffocation of the developing organism (Hoffman et al., 2004; Albers et al., 2003).

c. Potential Risk to Endangered and Threatened Plants in Terrestrial and Semi-aquatic Environments

Potential risks to terrestrial plants were not assessed because no toxicity data were available for use in risk assessment. Six incidences of plant damage are in EFED's Ecological Incidence Information System (EIIS) database for PC Code 063503 at the time this analysis was prepared, which would support a concern for potential risks to non-target plants.

d. Indirect Effect Analyses

The Agency acknowledges that pesticides have the potential to exert indirect effects upon the listed organisms by, for example, perturbing forage or prey availability, altering the extent of nesting habitat, etc. In conducting a screen for indirect effects, direct effect LOCs for each taxonomic group are used to make inferences concerning the potential for indirect effects upon listed species that rely upon non-endangered organisms in these taxonomic groups as resources critical to their life cycle. Based on the data limitations, this analysis suggests that risk of direct effects from use of aliphatic oils cannot be precluded for any of the surrogate species considered in this assessment, although acute risk to fish was presumably lower than the Agency's concern level. Therefore, there may be a potential concern for indirect effects to organisms that depend on species at risk for survival, habitat, or reproduction.

The Agency uses the dose-response relationship from the toxicity studies used for calculating the RQ to estimate the probability of acute effects associated with an exposure equivalent to the endangered species LOC. However, based on limitations of the toxicity data, EFED did not calculate probabilities of acute effects based on the dose-response from the available toxicity studies. However, using EFED's default probit slope of 4.5 with lower and upper ranges of 2 to 9, the range of estimates of probabilities of individual effects would be extremely variable.

This information serves as a guide to establish the need for and extent of additional analysis that may be performed using Services-provided "species profiles" as well as evaluations of the geographical and temporal nature of the exposure to ascertain if a "not likely to adversely affect" determination can be made. The degree to which additional analyses are performed is commensurate with the predicted probability of adverse effects from the comparison of the dose-response information with the EECs. The greater the probability that exposures will produce effects on a taxa, the greater the concern for potential indirect effects for listed species dependent upon that taxa, and therefore, the more intensive the analysis on the potential listed species of concern, their locations relative to the use site, and information regarding the use scenario (e.g., timing, frequency, and geographical extent of pesticide application).

e. Critical Habitat

In the evaluation of pesticide effects on designated critical habitat, consideration is given to the physical and biological features (constituent elements) of a critical habitat identified by the U.S Fish and Wildlife and National Marine Fisheries Services as essential to the conservation of a listed species and which may require special management considerations or protection. The evaluation of impacts for a screening level pesticide risk assessment focuses on the biological features that are constituent elements and is accomplished using the screening-level taxonomic analysis (risk quotients, RQS) and listed species levels of concern (LOCs) that are used to evaluate direct and indirect effects to listed organisms.

The screening-level risk assessment has identified potential concerns for indirect effects for all surrogate species. Further analysis on potential impacts on critical habitat is not possible until uncertainty in this assessment is addressed. If additional data are submitted, and the Agency's

LOCs remain exceeded, then the next step for EPA and the Service(s) would be to identify which listed species and critical habitat are potentially implicated. Analytically, the identification of such species and critical habitat can occur in either of two ways. First, the agencies could determine whether the action area overlaps critical habitat or the occupied range of any listed species. If so, EPA would examine whether the pesticide's potential impacts on non-endangered species would affect the listed species indirectly or directly affect a constituent element of the critical habitat. Alternatively, the agencies could determine which listed species depend on biological resources, or have constituent elements that fall into, the taxa that may be directly or indirectly impacted by the pesticide. Then EPA would determine whether use of the pesticide overlaps the critical habitat or the occupied range of those listed species. At present, the information reviewed by EPA does not permit use of either analytical approach to make a definitive identification of species that are potentially impacted indirectly or critical habitats that is potentially impacted directly by the use of the pesticide. EPA and the Service(s) are working together to conduct the necessary analysis.

This screening-level risk assessment for critical habitat provides a listing of potential biological features that, if they are constituent elements of one or more critical habitats, would be of potential concern. These correspond to the taxa identified above as being of potential concern for indirect effects and include all surrogate species assessed. This list should serve as an initial step in problem formulation for further assessment of critical habitat impacts outlined above, should additional work be necessary.

f. Co-occurrence Analysis

The goal of the analysis for co-location is to determine whether sites of pesticide use are geographically associated with known locations of listed species. A co-occurrence analysis was not performed at this time due to the large amount of uncertainty identified in this assessment. Based on the risks currently identified in this assessment and the large number of labeled uses of aliphatic oils, the co-occurrence analysis would include virtually all endangered species.

g. Summary of Taxa Potentially at Risk

Potential risks to endangered species are summarized in Table IV-4 below.

Table IV-4. Listed species risks associated with direct or indirect effects due to applications of aliphatic solvents for terrestrial uses.

Listed Taxon	Direct Effects	Indirect Effects
Terrestrial and semi-aquatic plants – monocots and dicots	Yes[1]	Yes [1,7]
Insects	Yes[2]	Yes [2,7]
Birds	Reproduction[3]	Yes[1,2,3,6,8]
Terrestrial phase amphibians	Yes[4]	Yes[1,2,3,4,5,8,9]
Reptiles	Yes[4]	Yes[1,2,3,4,5,6,8]
Mammals	None identified[10]	Yes[1,2,3,4,5,6,8]
Aquatic vascular plants	Yes[5]	Yes[5,7]
Freshwater fish	None identified[11]	Yes[5,6]
Aquatic phase amphibians	None identified[11]	Yes[5,6]
Freshwater crustaceans	Yes[6]	Yes[5,6]
Mollusks	Yes[6]	Yes[5,6]
Marine/estuarine fish	None identified[11]	Yes[5,6]
Marine/estuarine crustaceans	Yes[6]	Yes[5,6]

1 No terrestrial plant data available, effects to terrestrial plants are unknown. However, aliphatic solvent labels indicate phytotoxic effects to plants, and incidences have been reported of crop damage from use of aliphatic oils.
2 Aliphatic solvents are registered as an insecticide and miticide, some risk to nontarget insects is anticipated.
3 Oils such as mineral oils are used to prevent hatching of undesirable egg-laying animals by applying the oils directly onto the eggs, there is presumably risk to eggs either on or adjacent to the treated field.
4 Birds are used as surrogate for terrestrial-phase reptiles and amphibians.
5 Effects to aquatic plants are unknown; aliphatic solvent labels indicate phytotoxic effects to plants.
6 Endangered species LOCs were exceeded for aquatic invertebrates.
7 Potential concerns for indirect effects on plants that require birds or insects as pollinators or seed dispersers.
8 Potential concerns for indirect effects on animals that eat birds.
9 Potential concerns for indirect effects on animals that require reptile burrows as habitat.
10 Residue levels may be higher than levels tested in acute studies, and risk of reproduction effects were not quantified due to lack of available toxicity data. Therefore, potential risks to mammals could not be precluded.
11 Chronic studies were not submitted; therefore, a chronic risk assessment was not conducted.

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Appendix A. Rationale for not including High Production Volume summary aquatic toxicity data in this ecological risk assessment

- Most studies were conducted using water accommodated fractions (WAFs). WAFs are prepared by loading the test system with a nominal concentration that is above the solubility of the test substance, mixing the solution, then allowing the mixture to equilibrate. The resulting aqueous fraction is the WAF. Results of analytical confirmation of the concentrations in the WAF were not reported; therefore, the concentration or the composition of the WAF is uncertain.

- Original study reports were not submitted to the Agency; therefore, EFED has not performed an independent evaluation of data adequacy. In some cases, LC50 and EC50 values were reported that did not have accompanying robust summaries; therefore, data quality could not be independently verified by EFED.

- Water hardness in the daphnid studies was high and ranged from 174 to 274 mg $CaCO_3$/L. High water hardness reduces solubility of petroleum oils. Therefore, exposure to daphnids in these studies may have been lower relative to potential environmental concentrations.

- Although aquatic toxicity tests with aliphatic oils with the same CAS Nos. or with similar descriptions as those included in PC Codes 063502 and 063503 were conducted, it is uncertain if the substances tested were equivalent to the substances used as biocides.

For these reasons, the summaries submitted to the HPV program were not used quantitatively in this assessment. Nonetheless, numerous studies were reported that produced apparently consistent results; therefore, together with the studies submitted to EFED, they may provide some insight into the toxicity of aliphatic oils from nominal loading (e.g., direct application to water and drift) into an aqueous environment.

Appendix B-1. Methodology used to convert dietary concentration to dose (mg/kg-day).

EECs (mg/kg-bw) for various size classes of mammals and birds may be calculated based on the dietary residue concentrations derived using the methods described above. To allow for this type of analysis, the EECs and toxicity values are adjusted based on food intake and body weight differences so that they are comparable for a given weight class of animal. Size classes assessed include 20-, 100-, and 1000- gram birds and 15-, 35-, and 1000-gram mammals. Dietary concentrations presented in Table III-5 above along with estimated food intake levels are used to calculate daily doses for the size of bird or mammal being assessed. These calculations are presented below.

Daily food intake (g/day) is assumed to correlate with body weight using the following empirically derived equation (U.S. EPA, 1993):

Avian food consumption (g/day)

$$F = \frac{0.648 * BW^{0.651}}{(1 - W)}$$

where:

F = food intake in grams of fresh weight per day (g/day)

BW = body mass of animal (g)

W = mass fraction of water in the food (EFED value = 0.8 for birds and herbivorous mammals)

Based on this equation, a 20-gram bird would consume 22.8 grams of food daily (114% of its body weight), a 100-gram bird would consume 65 grams of food daily (65% of its body weight daily), and 1000-gram bird would consume 290 grams of food daily (29% of its body weight). These data, together with the dietary residue concentrations (mg/kg-food item) on selected food items (Table III-5), are used to estimate the dose (mg/kg-bw) of residue consumed by the three size classes of birds assessed. Using a small (20-gram) bird as an example, a dietary concentration of 100 mg/kg-diet (ppm) x 1.14 kg diet/kg bw (114%) would result in an equivalent dose-based EEC of 114 mg/kg-bw.

A similar relationship between body weight and food intake has been derived for mammals (U.S. EPA 1993):

Mammalian food consumption (g/day)

$$F = \frac{0.621 * BW^{0.564}}{(1 - W)}$$

where:

F = food intake in grams of fresh weight per day (g/day)
BW = body mass of animal (g)
W = mass fraction of water in the food (EFED value = 0.8 for herbivorous mammals, 0.1 for granivorous mammals)

The scaling factors result in the following percent body weight consumed for each weight class of mammal:

- 15-gram mammal: 14 grams of food consumed daily (95% of its body weight)
- 35-gram mammal: 23 grams of food consumed daily (66% of its body weight daily)
- 1000-gram mammal: 150 grams of food consumed daily (15% of its body weight).

These values are used in the same manner described for birds to calculate dose-based EECs (mg/kg-bw). Using a small (15-gram) mammal as an example, aliphatic oil concentrations on a dietary food item of 100 mg/kg-diet (ppm) x 0.95 kg diet/kg bw (95%) would result in an equivalent dose-based EEC of 95 mg/kg-bw. Dose based EECs are presented in Tables III-6 and III-7 below for birds and mammals, respectively.

Appendix B-2. Dose based EECs from application of 10, 150 and 477 lbs a.i./Acre in birds and mammals

477 lbs/Acre, mammals

Dose-Based EECs (mg/kg-bw)	Mammalian Classes and Body weight		
	Herbivores/ insectivores		
	15 g	35 g	1000 g
Short Grass	109147.91	75435.81	17490.06
Tall Grass	50026.13	34574.75	8016.28
Broadleaf plants/sm Insects	61395.70	42432.64	9838.16
Fruits/pods/seeds/lg insects	6821.74	4714.74	1093.13

477 lbs/Acre, birds

Dose-based EECs (mg/kg-bw)	Avian Classes and Body Weights		
	small	mid	large
	20 g	100 g	1000 g
Short Grass	130381.26	74348.91	33287.00
Tall Grass	59758.08	34076.59	15256.54
Broadleaf plants/sm Insects	73339.46	41821.26	18723.94
Fruits/pods/seeds/lg insects	8148.83	4646.81	2080.44

150 lbs/Acre, mammals

Dose-Based EECs (mg/kg-bw)	Mammalian Classes and Body weight		
	Herbivores/ insectivores		
	15 g	35 g	1000 g
Short Grass	34323.24	23721.95	5500.02
Tall Grass	15731.49	10872.56	2520.84
Broadleaf plants/sm Insects	19306.82	13343.60	3093.76
Fruits/pods/seeds/lg insects	2145.20	1482.62	343.75

150 lbs/Acre, birds

Dose-based EECs (mg/kg-bw)	Avian Classes and Body Weights		
	small	mid	large
	20 g	100 g	1000 g
Short Grass	41000.40	23380.16	10467.61
Tall Grass	18791.85	10715.91	4797.65
Broadleaf plants/sm Insects	23062.72	13151.34	5888.03
Fruits/pods/seeds/lg insects	2562.52	1461.26	654.23

10 lbs/Acre, mammals

Dose-Based EECs (mg/kg-bw)	Mammalian Classes and Body weight		
	Herbivores/ insectivores		
	15 g	35 g	1000 g
Short Grass	2288.22	1581.46	366.67
Tall Grass	1048.77	724.84	168.06
Broadleaf plants/sm Insects	1287.12	889.57	206.25
Fruits/pods/seeds/lg insects	143.01	98.84	22.92

10 lbs/Acre, birds

Dose-based EECs (mg/kg-bw)	Avian Classes and Body Weights		
	small	mid	large
	20 g	100 g	1000 g
Short Grass	2733.36	1558.68	697.84
Tall Grass	1252.79	714.39	319.84
Broadleaf plants/sm Insects	1537.51	876.76	392.54
Fruits/pods/seeds/lg insects	170.83	97.42	43.62

Appendix C. Summary of Registered Aliphatic oils Uses

Table C-1. Overview of Aliphatic oil Uses	
Crop Grouping	**Representative Use**
Terrestrial food and feed crop	Acerola (West Indies Cherry), alfalfa, almond, amaranth-Chinese, apple, apricots, artichoke-Chinese, asparagus, atemoya, avocado, balm, banana, basil, beans, beans-succulent (lima), beans-succulent (snap), beets, blackberries, blueberries, boysenberries, broccoli, broccoli-Chinese, brussels sprouts, bushberries, cabbage, cabbage-Chinese, caneberries, carambola (jalea), cauliflower, celery, cherry, citron (citrus), citrus, citrus hybrids, coffee, cole crops, collards, corianders, corn (general), field corn, sweet corn, popcorn, cotton, cranberries, cucumber, cucurbit vegetables, currant, deciduous fruit trees, dewberries, eggplant, fig, flavoring/spice crops, ginger, ginseng (medicinal), gourd (wax)-Chinese, grapefruit, grapes, grasses grown for seed, honeycomb, hops, kiwi fruit, lemon, lettuce, lime, loganberry, macadamia nut (bushnut), mango, marjoram/oregano, melons, melons-bitter (balsam pear), melons-cantaloupe, melons-citron, melons-water, mint/peppermint/spearmint, mustard, nectarines, okra, olives, onions, oranges, papaya, pastures, peas-southern, peach, peanuts, pear, pecan, pepper, pepper (chili type), persimmon, pineapple, pistachio, plantains, plum, potato-white/irish, prune, pumpkin, radish, radish-Chinese, rambutan, raspberries, small fruits, sorghum, soybean, spinach, squash, stone fruits, strawberry, sugar beets (include tops), sweet potato, tangelo, tangerines, taro, tomato, turnips and walnut (black/English).
Terrestrial non-food crop	Christmas tree plantations, non-agricultural right-of-way/ fence rows / hedgerows, non-agricultural uncultivated areas, ornamentals, shade trees, herbaceous plants, woody shrubs and vines, recreational areas, tobacco, urban areas, wide areas/general outdoor treatment (public health use), citrus, commercial / institutions / industrial premises/equipments (outdoor), deciduous fruit trees and pears.
Aquatic non-food industrial	Drainage systems, lakes/ponds/reservoirs (without human/wildlife use) and sewage systems.
Aquatic non-food outdoors	Intermittently flooded areas, salt water sites, swamps, marshes, wetlands and stagnant water areas.
Aquatic food crop	Agricultural drainage systems, intermittently flooded areas, salt water sites, swamps, marshes, wetlands, stagnant water areas and lakes/ponds/reservoirs (without human/wildlife use).
Greenhouse non-food	Ornamentals, shade trees, herbaceous plants, non-flowering plants, woody shrubs and vines and tobacco.
Greenhouse food crop	Asparagus, balm, basil, beans, beets, cabbage, cauliflower, corn, citrus, cucurbit vegetables, eggplant, fig, flavoring/spice crops, grapefruit, lettuce, marjoram/oregano, melons, mint/peppermint/spearmint, pepper, potato-white/irish, radish, squash, sweet potato, tomato, cole crops, popcorn, sweet corn, cotton, cucumber, lemon, macadamia nut (bushnut), mango, nectarine, onions, oranges, peach, pears, pecans, plum, prunes, pumpkins, strawberry, sugar beets and walnuts (black/English).

Table C-1. Overview of Aliphatic oil Uses	
Crop Grouping	**Representative Use**
Outdoor residential	Household/domestic dwelling contents/outdoor premises, ornamentals, shade trees, herbaceous plants, woody shrubs and vines and urban areas.
Indoor residential	Ornamentals, shade trees, herbaceous plants, non-flowering plants, woody shrubs and vines, dogs/canines, household/domestic dwelling contents/indoor premises, human bedding/mattresses, human clothing (for mildew/mold control) and pets living/sleeping quarters.
Indoor non-food	Ornamentals, shade trees, herbaceous plants, non-flowering plants, woody shrubs and vines, animal kennels/sleeping quarters (commercial), birdseed (processed), commercial storage/warehouse premises, commercial / institutions / industrial premises/equipments (indoor), eating establishments, horses, pets and specialized animals.
Indoor food	Agricultural/farm premises, barley, barns, barnyards, auction barns, beef/range/feeder cattle (meat), buckwheat, commercial storage/warehouse premises, commercial transportation facilities-feed/food-empty, corn (unspecified), dairy cattle, dairy farm milk handling facilities/equipments, dairy farm milk storage rooms/houses/sheds, dairy farm milking stalls/parlors, eating establishments, food handling areas, egg handling areas, feed/food treatment-storage/processing/handling equipments, food and feed products (processed), food processing plant premises/equipments, food stores/markets/supermarket premises, food/grocery/marketing/storage/distribution facility premises, fruits (dried/dehydrated), grain/cereal/flour bins-empty or full, grain/cereal/flour elevators-empty or full, grain/cereal/flour storage areas-full, hog/pig/swine (meat), household/domestic dwelling indoor food handling areas, meat processing plants premises, poultry (egg/meat), poultry processing plants premises, rice, rye and seeds.
Indoor medicinal	Hospitals/medicinal institutions premises.

TABLE C-2. Selected Registered Uses of Aliphatic oils					
Use	**Product**	**Formulation Description**	**Application Rate**	**Max # Appl/Yr**	**Application Methods**
Terrestrial Crop / Greenhouse / Outdoor Residential	PURESPRAY Spray Oil 10E	Oil (98% petroleum oil)	0.1103 lb/gal - 469.2 lb/A	Not specified	Ground, air-blast and aerial spray
	Spray Oil 13E	Oil (98% petroleum oil)	0.1103 lb/gal - 469.2 lb/A	Not specified	Ground, air-blast and aerial spray Mist blower
	Spray Oil 15E	Oil (98% petroleum oil)	0.1103 lb/gal - 469.2 lb/A	Not specified	Ground, air-blast and aerial spray
	Spray Oil 22E	Oil (98% petroleum oil)	0.1103 lb/gal - 469.2 lb/A	Not specified	Ground, air-blast and aerial spray Dip tank treatment Mist blower
Terrestrial and Outdoor Residential	Red-Top Superior Spray Oil N.W.	Oil (99% oil)	7.0191 lb/100 gal - 14.04 lb/100 gal	Not specified	Ground and air-blast spray
Terrestrial	Red-Top Superior Spray Oil	Emulsifiable concentrate (99% oil)	14.04 - 84.23 lb/A	Not specified	Ground, air-blast and aerial spray
Terrestrial, Indoors and Greenhouse	Summit Horticultural Spray Oil	Emulsifiable concentrate (98.8% oil)	0.0685 - 0.274 lb/gal	When necessary	Ground and air-blast spray.
Terrestrial	Britz Citrus Supreme Oil Spray	Emulsifiable concentrate (99% oil)	3.47 lb/A - 41.64 lb/A	Not specified	Ground and air-blast spray.
Terrestrial	Gavicide Super 90 New Superior Spray for Deciduous Fruits	Emulsifiable concentrate (99% oil)	50.24 lb/A - 57.42 lb/A	Not specified	Ground, air-blast and aerial spray
Terrestrial	First Choice Narrow Range 415 Spray Oil	Emulsifiable concentrate (98% oil)	0.7 - 50 gal/A	Not specified	Ground, air-blast and aerial spray
Terrestrial, Greenhouse and Indoor	Super-Fine Spray Oil	Oil (98.8% oil)	2.5 - 7.5 Tbsp (L)	Not specified	Ground and air-blast spray

TABLE C-2. Selected Registered Uses of Aliphatic oils					
Use	**Product**	**Formulation Description**	**Application Rate**	**Max # Appl/Yr**	**Application Methods**
Terrestrial	BAC HI Supreme Spray Oil	Emulsifiable concentrate (98% petroleum oil)	6.958 lb/100 gal - 139.16 lb/A	Not specified	Ground, air-blast and aerial spray Mist sprayer
Terrestrial, Indoor/Outdoor Residential and Greenhouse	Volck Oil Spray	Emulsifiable concentrate (97% oil)	1 Tbsp/L - 0.2856 lb/gal (spray) and 0.0268 lb/gal (tank)	Not specified	Ground, air-blast and aerial spray
Terrestrial and Outdoor Residential	Supreme Oil	Emulsifiable concentrate (99% oil)	7.0191 - 56.15 lb/A	Not specified	Ground, air-blast and aerial spray
Terrestrial	Supreme Oil 98	Emulsifiable concentrate (98% oil)	13.9 lb/100 gal - 55.59 lb/A	Not specified	Ground, air-blast and aerial spray
Terrestrial and Outdoor Residential	Sim-Chem Superior Spray oil	Emulsifiable concentrate (98.84% oil)	7.018 lb/100 gal - 35.09 lb/A	Not specified	Ground, air-blast and aerial spray.
Terrestrial	Gavicide-C Narrow Range 440 Spray Oil for Citrus	Emulsifiable concentrate (99.7% mineral oil)	10.12 lb/100 gal - 216.8 lb/A	Not specified	Ground, air-blast and aerial spray.
Terrestrial, Outdoor Residential and Greenhouse	BioCover SS	Oil (98% petroleum oil)	0.1397 lb/gal - 475.8 lb/A	Not specified	Ground, air-blast and aerial spray Dip tank treatment Mist blower
	BioCover UL	Oil (98% petroleum oil)	0.1397 lb/gal - 475.8 lb/A	Not specified	Ground, air-blast and aerial spray Dip tank treatment Mist blower
Terrestrial, Greenhouse and Indoor	Glacial Spray Fluid	Oil (98.4% petroleum oil)	0.1122 lb/gal - 477.7 lb/A	When necessary	Ground, air-blast and aerial spray Mist blower
Indoor Residential	Heartland Auto-Mist 3 Insect Killer	Pressurized Liquid (13.12% oil)	1 - - (L)	When necessary	Ground spray (automatic aerosol dispenser)

TABLE C-2. Selected Registered Uses of Aliphatic oils					
Use	**Product**	**Formulation Description**	**Application Rate**	**Max # Appl/Yr**	**Application Methods**
Indoor Residential	Heartland Auto-Mist 2 Insect Killer	Pressurized Liquid (13.66% oil)	1 - (L)	When necessary	Ground spray (automatic aerosol dispenser)
Indoor	Heartland Farm & Dairy Insecticide	Pressurized Liquid (2% oil)	2 - 3 sec 1K cu.ft/L and 1 - 5 sec animal	Not specified	Sprayer Enclosed premise treatment Animal treatment
Terrestrial, Indoor/Outdoor Residential and Greenhouse	Sunspray 6E Plus	Oil (98.8% paraffinic oil with emulsifier)	7.0148 lb/100 gal - 168.4	Not specified	Ground, air-blast and aerial spray
Terrestrial and Outdoor Residential	Helen Florida-FLO 90 Oil Emulsion	Emulsifiable concentrate (90% oil)	6.39 lb/99 gal - 38.34 lb/A	Not specified	Ground, air-blast and aerial spray
Terrestrial and Outdoor Residential	Supreme Spray Insecticide-Miticide Liquid	Emulsifiable concentrate (98% oil)	10.437 lb/100 gal - 55.664 lb/A	Not specified	Ground, air-blast and aerial spray
Terrestrial and Outdoor Residential	Drexel Damoil	Emulsifiable concentrate (98% oil)	1.7395 lb/100 gal - 42.22 lb/A	Not specified	Ground, air-blast and aerial spray
Terrestrial and Outdoor Residential	Volck Supreme Spray	Oil (97.95% petroleum oil)	6.925 lb/100 gal - 103.9 lb/A	Not specified	Ground, air-blast and aerial spray Mist blower
Terrestrial, Outdoor Residential and Greenhouse	Oil-I-Cide Spray Oil Emulsion	Emulsifiable concentrate (80% oil)	11.92 lb/100 gal	Not specified	Ground and air-blast spray

TABLE C-2. Selected Registered Uses of Aliphatic oils					
Use	**Product**	**Formulation Description**	**Application Rate**	**Max # Appl/Yr**	**Application Methods**
Terrestrial, Outdoor Residential and Greenhouse	JMS Stylet-Oil	Emulsifiable concentrate (97.1% oil)	0.1612 lb K sq.ft - 30.67 lb/A	Not specified	Ground and air-blast spray
Terrestrial	Dragon Horticultural Spray Oil	Emulsifiable concentrate (98% oil)	2.4 Tbsp/L -7.5 Tbsp/L	Not specified	Ground and air-blast spray
Terrestrial and Outdoor Residential	Lilly/Miller Superior Type Spray Oil	Emulsifiable concentrate (99% oil)	7.029 lb/100 gal - 70.29 lb/A	Not specified	Ground, air-blast and aerial spray
Terrestrial	Sunspray 11C	Oil (100% oil)	21.6 lb/A	Not specified	Chemigation Sprinkler irrigation
Terrestrial and Outdoor Residential	Sunoco Sunspray 11E	Oil (98.8% refined petroleum distillate with emulsifier)	14.17 lb/A - 157 lb/A	Not specified	Ground, air-blast and aerial spray
Terrestrial and Outdoor Residential	Sunspray 6E	Oil (98.8% refined petroleum distillate with emulsifier)	3 gal/L - 155.7 lb/A	Not specified	Ground, air-blast and aerial spray
Terrestrial	Sunspray 6C	Oil (100% oil)	21.3 lb/A	Not specified	Chemigation Sprinkler irrigation
Terrestrial	Sunspray 7E	Oil (98.8% oil)	6 gal/L - 82.65 lb/A	Not specified	Ground, air-blast and aerial spray
Terrestrial and Outdoor Residential	Sunspray 9E	Oil (98.8% oil)	2 gal/L - 70.54 lb/A	Not specified	Ground, air-blast and aerial spray
Terrestrial	Sunspray 9C	Oil (100% oil)	21.6 lb/A	Not specified	Chemigation Sprinkler irrigation

TABLE C-2. Selected Registered Uses of Aliphatic oils					
Use	**Product**	**Formulation Description**	**Application Rate**	**Max # Appl/Yr**	**Application Methods**
Terrestrial, Outdoor Residential and Greenhouse	Sunspray Ultra-Fine Year Round Pesticidal Oil	Oil (98.8% oil)	0.0685 lb/gal - 52.611 lb/gal	Not specified	Ground and air-blast spray
Terrestrial	Sunspray 6E Western	Oil (98.8% paraffinic petroleum oil with emulsifier)	7.0148 lb/100 gal - 210.4 lb/A	Not specified	Ground, air-blast and aerial spray
Terrestrial	Leffingwell Supreme 415 Oil	Emulsifiable concentrate (96.7% oil)	13.73 - 304.4 lb/A	Not specified	Ground, air-blast and aerial spray
Terrestrial	Par F 70 Soluble Oil	Emulsifiable concentrate (99% oil)	9.951 lb/100 gal - 28.15 lb/A	Not specified	Sprayer
Terrestrial and Outdoor Residential	415 OIL 98	Emulsifiable concentrate (98% petroleum oil)	6.958 lb/A - 20.874 lb/A	Not specified	Ground, air-blast and aerial spray
Terrestrial and Outdoor Residential	415 OIL 98.8	Emulsifiable concentrate (98.8% oil)	7.0148 lb/A - 105.2 lb/A	Not specified	Ground, air-blast and aerial spray
Terrestrial	435 OIL 98	Emulsifiable concentrate (98% oil)	7.056 lb/A - 70.56 lb/A	Not specified	Ground, air-blast and aerial spray
Terrestrial	435 OIL 98.8	Oil (98.8% oil)	10.67 lb/A - 106.7 lb/A	Not specified	Ground, air-blast and aerial spray
Terrestrial and Outdoor Residential	455 OIL 98	Emulsifiable concentrate (98% oil)	7.056 lb/A -70.56 lb/A	Not specified	Ground, air-blast and aerial spray
Terrestrial and Outdoor Residential	455 OIL 98.8	Oil (98.8% oil)	10.67 lb/A - 71.136 lb/A	Not specified	Ground, air-blast and aerial spray

TABLE C-2. Selected Registered Uses of Aliphatic oils					
Use	**Product**	**Formulation Description**	**Application Rate**	**Max # Appl/Yr**	**Application Methods**
Terrestrial, Outdoor Residential and Greenhouse	Drexel 8020 I	Oil (80% oil)	11.2 lb/A	Not specified	Ground, air-blast and aerial spray
Terrestrial and Outdoor Residential	Drexel F0-70	Oil (98% oil)	1.5 gal/L - 12 gal/L	Not specified	Ground, air-blast and aerial spray Mist blower
Terrestrial	Dormant Flowable Emulsion	Emulsifiable concentrate (80% oil)	12.224 lb/100 gal - 87.31 lb/A	Not specified	Ground and air-blast spray
Terrestrial	Niagara Dormant Quik-Mix Heavy	Emulsifiable concentrate (98% oil)	14.82 lb/100 gal - 85.49 lb/A	Not specified	Ground and air-blast spray
Terrestrial and Outdoor Residential	Niagara Supreme Oil Code 30497	Emulsifiable concentrate (98% oil)	8.8935 lb/98.5 gal - 56.92 lb/A	Not specified	Ground, air-blast and aerial spray
Terrestrial	Summer Flowable Emulsion Light-Medium Insecticide-Miticide	Oil (80% oil)	8.76 lb/100 gal - 11.68 lb/100 gal	Not specified	Sprayer
Terrestrial	Niagara Summer Quik Mix; Light Medium Code R-292	Oil (98% oil)	10.731 - 17.885 lb/A	Not specified	Ground spray
Terrestrial	Niagara Citrus Soluble Oil (Heavy Medium)	Emulsifiable concentrate (99.3% oil)	14.14 lb/ 100 gal - 70.7 lb/A	Not specified	Ground spray Sprayer
Terrestrial and Outdoor Residential	Niagara Citrus Sol Oil Light Medium Code 30390	Emulsifiable concentrate (99.3% oil)	7.2489 lb/100 gal	Not specified	Ground spray Dip tank treatment

TABLE C-2. Selected Registered Uses of Aliphatic oils					
Use	**Product**	**Formulation Description**	**Application Rate**	**Max # Appl/Yr**	**Application Methods**
Terrestrial	Super 94 Spray Oil	Oil (98% oil)	9.7412 lb/ 100 gal - 69.58 lb/A	Not specified	Ground, air-blast and aerial spray
Terrestrial and Outdoor Residential	415 Spray Oil	Oil (98% oil)	9.931 lb/100 gal - 113.3 lb/A	Not specified	Sprayer
Terrestrial, Greenhouse and Outdoor Residential	BioCover LS	Oil (98% petroleum oil)	7.154 lb/100 gal - 125 lb/100 gal	Not specified	Ground spray Sprayer
Terrestrial, Greenhouse, Indoor/Outdoor Residential	Fasco Fascocol-97 Prod. No. 908	Emulsifiable concentrate (99% petroleum oil)	0.137 lb/gal - 141.2 lb/80 gal	Not specified	Ground, air-blast and aerial spray
Terrestrial and Outdoor Residential	SK Enspray 99	Oil (99% petroleum oil with surfactant)	6.831 lb/100 gal - 453.3 lb/A	Not specified	Ground, air-blast and aerial spray Mist blower
Indoor Residential	Perfumed Up and At EM Water Based Insecticide	Liquid- Ready To Use (0.48% oil)	3.131E-04 - 0.0534 lb 1K cu.ft/L	When necessary	Enclosed premise treatment Ground spray
Indoor Residential	Bear-Cat Concentrate	Emulsifiable concentrate (12% oil)	1 part/L	When necessary	Ground spray Animal treatment/Dip tank Fogger/Mist blower
Terrestrial and Outdoor Residential	Rockland “Dormant Oil Spray”	Emulsifiable concentrate (98.8% oil)	2.6 fl.oz/L - 1 gal/L	Not specified	Hose-end sprayer Sprayer
Terrestrial and Outdoor Residential	Parsons Dormant Oil Spray Emulsion for Fruit Trees	Emulsifiable concentrate (98.8% oil)	28.652 lb/100 gal	Not specified	Ground, air-blast and aerial spray

TABLE C-2. Selected Registered Uses of Aliphatic oils					
Use	**Product**	**Formulation Description**	**Application Rate**	**Max # Appl/Yr**	**Application Methods**
Terrestrial and Outdoor Residential	Supreme Oil 70	Emulsifiable concentrate (98% oil)	1 gal/L - 2 gal/L and 1 quart/L	Not specified	Sprayer
Terrestrial and Outdoor Residential	Pratt's 6N Superior Oil	Emulsifiable concentrate (98.75% oil)	2 gal/L - 3 gal/L	Not specified	Sprayer
Terrestrial and Outdoor Residential	Agrisect Superior Oil	Emulsifiable concentrate (98% oil)	10.437 - 20.874 lb/ 50 gal	Not specified	Ground, air-blast and aerial spray
Terrestrial, Indoor/Outdoor Residential	S A 50 Brand Soluble Oil Spray	Emulsifiable concentrate (98% oil)	0.0551 lb/gal - 0.2205 lb/gal	Not specified	Sprayer Wipe-on treatment (cloth/sponge) Wiper treatment
Terrestrial and Outdoor Residential	Green Light Dormant Spray also Summer Spray	Oil (97% oil)	0.1353 lb/gal - 0.2705 lb/gal	Not specified	Sprayer
Terrestrial, Outdoor Residential and Greenhouse	Unico Superior Miscible Spray Oil 60 Seconds Viscosity	Emulsifiable concentrate (98.8% oil)	14.17 lb/100 gal - 0.0553 lb/gal	Not specified	Ground and air-blast spray
Terrestrial and Outdoor Residential	Supreme Oil Insecticide	Emulsifiable concentrate (98.8% oil)	7.0148 lb/99 gal, 21.04 lb/97 gal or 14.03 lb/98 gal	Not specified	Ground and air-blast spray
Terrestrial and Indoor/ Outdoor Residential	Royal 70 Superior Spray Oil	Emulsifiable concentrate (97% oil)	2 Tbsp/L - 4 Tbsp/L	Not specified	Ground and air-blast spray
Terrestrial and Outdoor Residential	Ferti-Lome Dormant Spray and Summer Oil Spray	Oil (99% oil)	0.0824 lb/gal - 0.1647 lb/gal	Not specified	Sprayer

TABLE C-2. Selected Registered Uses of Aliphatic oils					
Use	**Product**	**Formulation Description**	**Application Rate**	**Max # Appl/Yr**	**Application Methods**
Terrestrial and Outdoor Residential	Ferti Lome Scale Insect Spray	Oil (97% oil)	1 quart/L	Not specified	Sprayer
Terrestrial	Hi-Yield Dormant Spray	Oil (97% oil)	0.0807 lb/gal - 0.1614 lb/gal	Not specified	Ground and air-blast spray
Terrestrial, Outdoor Residential and Greenhouse	Scalecide	Emulsifiable concentrate (98.8% oil)	2.5 fl.oz/L - 3.8 fl.oz/L	Not specified	Ground and air-blast spray
Terrestrial and Outdoor Residential	Riverside Dormant Oil	Emulsifiable concentrate (98.8% oil)	14.03 lb/A - 21.04 lb/A and 7.0148 lb/4 gal	Not specified	Ground, air-blast and aerial spray
Terrestrial and Outdoor Residential	Tropic Supreme Oil	Emulsifiable concentrate (90% oil)	7.228 lb/A - 21.68 lb/A	Not specified	Ground, air-blast and aerial spray
Terrestrial and Outdoor Residential	Lesco Horticultural Oil Insecticide	Emulsifiable concentrate (98.8% refined petroleum distillate)	44.19 lb/A - 107.92 lb/A	Not specified	Sprayer
Terrestrial and Outdoor Residential	Security Ornamental and Fruit Spray Oil	Oil (98% oil)	3 Tbsp/L - 9 Tbsp/L	Not specified	Sprayer
Terrestrial and Outdoor	Acme Dormant Oil Spray	Emulsifiable concentrate (97% oil)	0.5 cup/L to 1 cup/L	Not specified	Hose-end sprayer / sprayer
Terrestrial and Outdoor Residential	Superior 70 Oil	Oil (97% oil)	20.66 lb/100 gal - 10.33 lb/A	Not specified	Sprayer Mist blower
Terrestrial and Outdoor	Amoco Superior Dormant Spray Oil	Emulsifiable concentrate (99% oil)	21.32 lb/97 gal, 14.22 lb/98 gal and 28.43 lb/96 gal	Not specified	Mist blower Ground spray

TABLE C-2. Selected Registered Uses of Aliphatic oils					
Use	**Product**	**Formulation Description**	**Application Rate**	**Max # Appl/Yr**	**Application Methods**
Terrestrial and Outdoor Residential	Standard Brand 435 Soluble Oil	Emulsifiable concentrate (97% oil)	0.2155 lb/gal to 68.967 lb/A	Not specified	Sprayer
Indoor and Terrestrial	Ford's Pyre-Dust Roach Powder	Dust (1.9% oil)	1 (L) - 0.57 lb/A and 0.004 lb cwt	When necessary	Duster/Shovel Seed treatment
Indoor	Ford's Multipurpose Aerosol	Pressurized Liquid (4.3% oil)	1 sec 1K cu.ft/L, 6 sec animal/L, 1 sec 1K cu.ft/L to 10 sec 1K cu.ft/L	Not specified	Ground spray
Indoor	Universal Quick-Tox Fog Spray	Liquid- Ready to Use (10% oil)	7 fl. oz. 1K cu.ft/L	Not specified	Fogger/ Mist blower Enclosed premise treatment Surface treatment
Indoor	Mercomist Aerosol Insect Killer	Pressurized Liquid (12.5% oil)	2 sec 1K cu.ft/L to 20 sec 100 sq. ft/L	Not specified	Ground spray
Terrestrial and Indoor/ Outdoor Residence	Black Leaf Dormant Spray	Emulsifiable concentrate (98.8 oil)	2 Tbsp/L, 0.0829 lb/gal to 0.2763 lb/gal	Not specified	Ground, air-blast and aerial spray Greenhouse treatment
Terrestrial	Citrus Soluble Oil - Medium Code 30143	Oil (99.3% oil)	14.14 lb/100 gal - 70.7 lb/A	Not specified	Ground spray
Terrestrial	Growers 455 Soluble Oil	Emulsifiable concentrate (97% oil)	69.937 - 70.713 lb/A	Not specified	Sprayer
Terrestrial	Tide Citri Oil	Emulsifiable concentrate (99% oil)	24.6 lb/100 gal - 56.232 lb/A	Not specified	Sprayer
Aquatic and Industrial	Bonide Mosquito Larvicide	Oil (98% mineral oil with emulsifier)	27.28 (aerial) 34.104 (ground)	When necessary	Direct to water (ground and aerial spray)
Aquatic and Terrestrial	Mosquito Larvicide GB-1111	Oil (98.7% oil with surfactant)	36.67 lb/A	When necessary	Direct to water (ground and aerial spray)

TABLE C-2. Selected Registered Uses of Aliphatic oils					
Use	**Product**	**Formulation Description**	**Application Rate**	**Max # Appl/Yr**	**Application Methods**
Aquatic	B.A. 2 Larvicide	Liquid-ready to use (97% oil with surfactant)	34.435 lb/A	When necessary	Direct to water (ground and aerial spray)
Aquatic and Indoor Residential	Kamikaze Insecticide	Emulsifiable concentrate (94% petroleum distillate, 1% pyrethrin, 2% piper only but oxide and 2.94% n-octal bicycloheptene dicarboximide)	0.3684 lb/A (sprayer), 1.0 part/L (ground) and 0.2462 lb 1K cu.ft (ultra low volume)	When necessary	Direct to water (ground and aerial spray) Animal treatment Fogger Vaporizer Enclosed premise treatment
Aquatic/Terrestrial and Indoor/Outdoor Residence	Insectaway Multi-Purpose Insecticide II	Emulsifiable concentrate (5% oil, 12.5% Piperonyl but oxide and 1.25% Pyrethrin)	0.001 lb1K sq ft to 0.0416 lb1K sq.ft, 0.0017 lb1K cu.ft, 0.4 lb/11.5 gal and 0.0005 lb/animal	When necessary	Direct to water (ground spray) Fogger Ground broadcast Animal treatment Spot treatment Surface treatment

Appendix D. Summary of Ecological Incidence.

To comply with 6(a)2 regulations, Sunoco reported a controversy regarding some deleterious effects of SUN SPRAY ULTRA-FINE YEAR ROUND PESTICIDAL OIL. A resident of Idaho Springs, CO, wrote a letter to the publication ""Hobby Greenhouse"" alleging that the product killed all the cucmber plants and several varieties of tomatoes, and damaged or outright killed several greens. Sunoco responded to the letter and, according to a researcher at Cornell U., foliar burn may have occurred but he questioned the fact that the product killed the plants.

Homeowner had arborist perform routine maintenance on 2 very large, old ornamental beech trees in fall 1993. The trees were sprayed with dormant oil product (Scalecide) which allegedly caused tree damage and death. According to the report the MI Ag. Dept. stated that dormant oil should not be used on beech trees, but registered sites did include ornamental shade and deciduous trees. Analysis of the tree leaves and branches revealed no detectable disease.

To comply with 6(a)2 regulations, Sunoco reported a complaint from Venice, FL, that Sunspray 6E Plus had ruined 21 rosebushes. It was the first time that the complainant had used this product. Allegedly, the temperature and relative humidity appeared OK for spraying.

"The California Dept. of Pesticide Regulations reported an incident in which a total of 380 acres of kiwifruits were damaged. One firm owns the kiwifruits but they are located in several areas and were not all sprayed at the same time. Dormex was applied during January and February, 2004, as was Valent Volck Supreme Oil Spray more than three weeks apart. A burning of buds was observed on the kiwi vines where both products were applied. Damage amounted to about a 20% loss of crop. A label for Dormex use on kiwifruit in Australia states ""dormant sprays containing oil should not be made closer than 14 days before or after Dormex application."" This would suggest that the combination of the two products is potentially harmless.","USA","I016036-

To comply with 6(a)2 regulations, Sunoco reported a complaint it received from Dundee, FL alleging that there had been burn on leaves and twigs, and fruit drop, on 50-year old early mid-round oranges. This was allegedly the result of using Sunspray 9E.

To comply with 6(a)2 regulations, Sunoco reported an incident in California in which an olive grove exhibited problems of pitting, slight burn, and leaf drop. The application was made from August 19 to 31, 1999. The rate used was 1.5 gallons Sunspray 6E/100 gallons water, and 9 1/3 lb. Sevin 80W/acre applied dilute.