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Risks of carbaryl use to the Federally listed endangered Barton Springs salamander (Eurycea sosorum)

U.S. Environmental Protection Agency

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Risks of Carbaryl Use to the Federally Listed Endangered Barton Springs Salamander
(Eurycea sosorum)

Pesticide Effects Determination

Environmental Fate and Effects Division
Office of Pesticide Programs
Washington, D.C. 20460

September 19, 2007
Acknowledgement

The carbaryl chemical team (Mr. Greg Orrick, Ms. Kristina Garber, Dr. R. David Jones, and Dr. Thomas Steeger) would like to acknowledge the extensive contribution of Dr. Paige Doelling Brown, Ms. Anita Pease, Mr. Brian Anderson, and Mr. Mark Corbin to synthesizing much of the information on the Barton Springs salamander contained in the document. The detailed descriptive information on the Barton Springs Segment of the Edwards Aquifer is also a result of work by these individuals and Ms. Elizabeth Behl.
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1. Executive Summary

The purpose of this assessment is to make an “effects determination” for the Barton Springs salamander *Eurycea sosorum* by evaluating the potential direct and indirect effects of currently registered uses of the insecticide carbaryl within the Barton Springs area (action area) on the survival, growth, and reproduction of this federally-listed endangered species. This assessment was completed in accordance with the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) *Endangered Species Consultation Handbook* (USFWS/NMFS, 1998 and procedures outlined in the Agency’s Overview Document (U.S. EPA, 2004).

The range of the Barton Springs salamander is restricted to four spring outlets that comprise the Barton Springs complex, which is located near downtown Austin, Texas. Subsurface flow from the Barton Springs segment of the Edwards Aquifer and its contributing zone supply all of the water in the springs that make up the Barton Springs complex. Therefore, the carbaryl action area as it relates to the Barton Springs salamander is defined by those areas within the hydrogeologic watershed that discharge to the Barton Springs.

Based on use estimates provided from the Biological and Economic Assessment Division, carbaryl is registered for use on many agricultural, professional turf management and ornamental production, and residential sites. Crops with the greatest annual use of carbaryl include apples, pecans, grapes, alfalfa, oranges, cherries, and asparagus. Based on discussions with U.S. Department of Agriculture extension agents in the Austin, TX, area, carbaryl has limited use on agricultural sites in the Barton Springs area, totaling 70 acres of orchards and vineyards. Carbaryl is also used by homeowners in residential settings for lawn care, gardening (vegetables and ornamentals), and pet care (pet collars, powders, dips, in kennels, and pet sleeping quarters). The compound is used by nursery, landscape, and golf course industries on turf, annuals, perennials, and shrubs. Carbaryl may also be used to treat pastures, rangeland, and rights-of-way.

Environmental fate and transport models were used to estimate high-end exposure values that could occur in water in the Barton Springs action area as a result of potential carbaryl use in accordance with label directions. Modeled concentrations in the Barton Springs provide estimates of exposure that are intended to represent possible carbaryl concentrations originating from all potential use sites. Transport of water containing carbaryl could occur in surface water in the contributing zone and in the recharge zone and is transported to the Springs predominantly from subsurface flow through the fractured karst limestone of the Edwards Aquifer. Estimated 1-in-10-year peak and annual average exposure values for the Barton Springs were aggregated from all potential use sites and used in risk estimation. Accurate data are not available on applications of carbaryl to turf, in particular, and necessitated assumptions regarding the number of times it is applied and the percentage of lawns treated at one time. On the conservative end, estimated 1-in-10-year annual average exposure values were up to two orders of magnitude higher than maximum concentrations reported in monitoring data taken in the springs, mostly due to the unlikely assumptions that carbaryl is used at maximum application rates (and numbers of treatments, arbitrarily limited at 25 applications per year) and simultaneously applied to all
lawns in the action area. 1-in-10-year annual average estimates are consistent with concentrations observed in the monitoring data when uses are modeled once per year across all use areas, or when uses are modeled at multiple times per year on a fraction of the possible use areas.

The highest potential exposure was predicted to occur from use of carbaryl on residential lawns due to the prevalence of home lawns in the action area (residential lawns are estimated to make up 45% of the action area). Also, some labels do not limit the number of applications allowed on parks, home lawns, and flower beds (e.g., EPA Reg. No. 9198-146). In the absence of limits, maximum use patterns for these uses were assumed to involve 25 applications at the maximum rate, occurring every 3 days; the impact of fewer applications was also assessed.

The assessment endpoints for the Barton Springs salamander include direct toxic effects on the survival, reproduction, and growth of the salamander itself, as well as indirect effects, such as reduction of the prey base and/or modification of its habitat. Direct effects to the Barton Springs salamander are based on toxicity information for freshwater fish, which are generally used as a surrogate for amphibians, as well as available aquatic-phase amphibian data from the open literature. Given that the salamander’s prey items and habitat requirements are dependant on the availability of freshwater aquatic invertebrates and aquatic plants, respectively, toxicity information for these taxonomic groups is also discussed.

Degradates of carbaryl include 1-naphthol. Comparison of available toxicity information for 1-naphthol indicates roughly equivalent aquatic toxicity to that of the parent for the species tested; however, 1-naphthol degrades more rapidly and is less mobile than the parent. Therefore, for this assessment, carbaryl parent is the residue of concern.

Risk quotients (RQs) are derived as quantitative estimates of potential high-end risk. Acute and chronic RQs are compared to the Agency’s levels of concern (LOCs) for Federally-listed endangered species to identify if carbaryl use within the action area has any direct or indirect effect on the Barton Springs salamander. Based on estimated environmental concentrations for the currently registered uses of carbaryl, RQ values exceed the Agency’s LOCs for direct acute and chronic effects on the Barton Springs salamander; this represents a likely to adversely affect determination. This determination is based primarily on the use of carbaryl on residential lawns in the BSSEA. Reduction in the number of applications allowed on the labels to only one per year does not reduce exposure estimates sufficiently to get below the acute risk to listed species LOC unless less than 5% of the lawns in the BSSEA are treated. Reductions in the maximum number of applications to lawn to 3 would, however, reduce exposure estimates enough to support a no effect determination for chronic risk.

There is a potential to indirectly adversely affect the Barton Springs salamander through reductions in its invertebrate forage base. However, based on this assessment, carbaryl use in the BSSEA has no effect on the critical habitat of the Barton Springs salamander. A summary of the risk conclusions and effects determination for the Barton Springs salamander is presented in Table 1.
### Table 1. Carbaryl Effects Determination Summary for the Barton Springs Salamander.

<table>
<thead>
<tr>
<th>Assessment Endpoint</th>
<th>Effects Determination</th>
<th>Basis for Determination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute mortality</td>
<td>May affect and likely to adversely affect</td>
<td>Acute risk LOC is exceeded based on the most sensitive surrogate freshwater vertebrate data and a variety of assumptions about numbers of applications and the percentage of area treated.</td>
</tr>
<tr>
<td>Chronic survival, growth, and reproduction effects on Barton Springs salamander individuals via direct effects</td>
<td>May affect and likely to adversely affect</td>
<td>Chronic risk LOC is exceeded based on the most sensitive surrogate freshwater vertebrate data. If the maximum number of applications was reduced to three, then the determination would be ‘no effect’.</td>
</tr>
<tr>
<td>Indirect effects to Barton Springs salamander via reduction of prey (i.e., freshwater invertebrates)</td>
<td>May affect and likely to adversely affect</td>
<td>Acute LOC is exceeded based on the most sensitive surrogate freshwater invertebrate data. Even using less conservative assumptions regarding application rates and the percentage of areas simultaneously treated in the BSSEA, the likelihood of acute mortality of prey items is considered high. Additionally, the species sensitivity distribution for freshwater invertebrates indicates that the toxicity endpoint used for evaluating effects to invertebrates is not conservative even though it is the most sensitive species.</td>
</tr>
<tr>
<td>Indirect effects to Barton Springs salamander via reduction of habitat and/or primary productivity (i.e., aquatic plants)</td>
<td>No effect</td>
<td>Carbaryl use does not directly affect individual non-vascular aquatic plants in Barton Springs. Estimated peak EECs for all modeled carbaryl use scenarios within the action area are well below the threshold concentration for aquatic, non-vascular plants.</td>
</tr>
</tbody>
</table>
2. Problem Formulation

Problem formulation provides a strategic framework for the risk assessment. By identifying the important components of the problem, it focuses the assessment on the most relevant life history stages, habitat components, chemical properties, exposure routes, and endpoints. The structure of this risk assessment is based on guidance contained in EPA’s Guidance for Ecological Risk Assessment (U.S. EPA, 1998), the Services’ Endangered Species Consultation Handbook (USFWS/NMFS, 1998) and procedures outlined in the Overview Document (U.S. EPA, 2004).

2.1 Purpose

This ecological risk assessment is conducted consistent with settlement of the court case “Center for Biological Diversity and Save Our Springs Alliance v. Leavitt, No. 1:04CV00126-CKK” filed January 26, 2004. The purpose of this ecological risk assessment is to make an “effects determination,” under Section 7(a) (2) of the Endangered Species Act, for the Barton Springs salamander (Eurycea sosorum), by evaluating the potential direct and indirect effects resulting from use of the insecticide carbaryl (1-naphthyl methylcarbamate) on the survival, growth, and/or reproduction of this federally listed endangered species. The Barton Springs salamander was federally listed as an endangered species on May 30, 1997 (62 FR 23377-23392) by the U.S. Fish and Wildlife Service (USFWS or the Service). No critical habitat has been designated for this species.

In this endangered species assessment, direct and indirect effects to the Barton Springs salamander are evaluated in accordance with the screening-level methodology described in the Agency’s Overview Document (U.S. EPA, 2004).

As part of the “effects determination”, the Agency will reach one of the following three conclusions regarding the potential for carbaryl to affect the Barton Springs salamander:

- “No effect”;
- “May affect, but not likely to adversely affect”; or
- “Likely to adversely affect”.

If the results of the screening-level assessment show no indirect effects and LOCs for the Barton Springs salamander are not exceeded for direct effects, a “no effect” determination is made, based on carbaryl’s use within the action area. If, however, indirect effects are anticipated and/or estimated exposure exceeds the LOCs for direct effects, the Agency concludes a preliminary “may affect” determination for the Barton Springs salamander.

If a determination is made that use of carbaryl within the action area “may affect” the Barton Springs salamander, additional information is considered to refine the potential for exposure at the predicted levels based on the life history characteristics (i.e., habitat range, feeding preferences, etc.) of the Barton Springs salamander and potential community-level effects to aquatic organisms. The Agency will use the best available information to distinguish those actions that “may affect, but are not likely to adversely affect” from those actions that are “likely to adversely affect” the Barton Springs salamander. This information is presented as part of the Risk Characterization in Section 5.
2.2 Scope

Carbaryl is a carbamate insecticide registered for control of a wide range of insect and other arthropod pests on over 100 agricultural and non-crop use sites, including home and garden uses. The chemical is also used to thin fruit in orchards.

The end result of the EPA pesticide registration process (the FIFRA regulatory action) is an approved product label. The label is a legal document that stipulates how and where a given pesticide may be used. Product labels (also known as end-use labels) describe the formulation type (e.g., liquid or granular), acceptable methods of application, approved use sites, and any restrictions on how applications may be conducted. Thus, the use or potential use of carbaryl in accordance with the approved product labels for Texas is “the action” being assessed.

This ecological risk assessment is for currently registered uses of carbaryl in portions of the action area that are reasonably assumed to be biologically relevant to the Barton Springs salamander (BSS) and its designated critical habitat. Further discussion of the action area for the BSS and its critical habitat is provided in Section 2.6.

This assessment quantitatively considers effects of exposures of carbaryl only. Carbaryl degrades into one notable degradate, 1-naphthol. Toxicity data indicate that 1-naphthol is roughly equal to or less toxic than the parent compound depending on the species tested. However, available environmental fate data indicate that 1-naphthol degrades more rapidly and is less mobile than the parent, limiting its exposure. Therefore, the risk assessment is considered protective for non-target species, as the toxicity endpoints are the most sensitive measured.

This assessment considers only the single active ingredient of carbaryl. However, the assessed species and their environments may be exposed to multiple pesticides simultaneously. Interactions of other toxic agents with carbaryl could result in additive effects, synergistic effects or antagonistic effects. Evaluation of pesticide mixtures is beyond the scope of this assessment because of the myriad factors that cannot be quantified based on the available data. Those factors include identification of other possible co-contaminants and their concentrations, differences in the pattern and duration of exposure among contaminants, and the differential effects of other physical/chemical characteristics of the receiving waters (e.g. organic matter present in sediment and suspended water). Evaluation of factors that could influence additivity/synergism is beyond the scope of this assessment and is beyond the capabilities of the available data to allow for an evaluation. However, it is acknowledged that not considering mixtures could over- or under-estimate risks depending on the type of interaction and factors discussed above. This assessment has however, analyzed the toxicity of formulated products (including formulations involving more than one active ingredient) an determined that none of the formulated products evaluated were more toxic than the technical grade active ingredient data used for assessing both direct and indirect risks.
2.3 Previous Assessments

2.3.1 Carbaryl

In March 2003, a revised environmental fate and ecological risk assessment was published in support of the interim reregistration eligibility decision on carbaryl (U.S. EPA, 2004b). The chapter was revised to include additional ecological effect studies and to address comments received during the public comment phase of the reregistration process. The screening-level risk assessment concluded that for many of the registered uses of carbaryl, acute and chronic risk levels of concern were exceeded for mammals and chronic risk levels of concern were exceeded for birds. Citrus was the only use that exceeded the acute risk LOC for fish; however, most of the uses exceeded the acute and chronic risk LOCs for aquatic invertebrates. Based on a single acceptable study of green algae, none of the uses evaluated exceeded the acute risk LOC for aquatic plants. No data were available to assess the risk of carbaryl to terrestrial plants; however according to some labels, it may cause injury to tender foliage if applied to wet foliage or during periods of high humidity and incident data suggested that both ornamental and agricultural crops could be adversely affected by carbaryl. Beneficial insects were sensitive to carbaryl and incident data submitted subsequent to the publication of the ecological risk assessment indicate that a number of bee kills have been associated with the use of carbaryl.

Although freshwater fish are typically used as surrogates for assessing the sensitivity of aquatic-phase amphibians to chemicals, carbaryl has a relatively large amount of data available on the effects of carbaryl on larval amphibians. These data were captured qualitatively in the screening-level assessment and the data indicate that across the species tested, amphibians are less sensitive to carbaryl than fish. However, studies examining the interaction of carbaryl with aquatic communities indicated that in some cases, carbaryl exposure could enhance the growth of larval amphibians (tadpoles) through the elimination of zooplankton that compete with tadpoles for food.

Because the Agency determined that carbaryl shares a common mechanism of toxicity with the structurally-related N-methyl carbamate insecticides, a cumulative human health risk assessment for the N-methyl carbamate insecticides was necessary before the Agency could make a final determination of reregistration eligibility of carbaryl. At this time, a cumulative ecological risk assessment for the N-methyl carbamate insecticides has not been completed.

As noted in the interim Reregistration Eligibility Decision (IRED) on carbaryl (U.S. EPA, 2004b), EPA consulted with the U.S. Fish and Wildlife Service in 1988 regarding carbaryl impacts on endangered species associated with specific registered uses. As a result, the U.S. Fish and Wildlife Service (USFWS) issued a formal Biological Opinion (USFWS 1989) which identified reasonable and prudent measures and alternatives to mitigate effects of carbaryl use on endangered species. EPA also consulted with the National Marine Fisheries Service concerning carbaryl effects on endangered salmon and steelhead to determine the best processes to assess pesticide impacts on endangered species.
In April 2003, EPA submitted to the National Marine Fisheries Service, an effects determination for uses of carbaryl which have a potential to affect 26 listed Pacific Salmon and Steelhead (www.epa.gov/espp). The assessment concluded that uses of carbaryl in the action area for these species, were likely to adversely affect 20 and not likely to adversely affect 2 of the environmentally significant units (ESUs) of fish. The determination also concluded that uses of carbaryl in the action area of these species would have no effect on 4 of the ESUs. The determinations were based on use of carbaryl on crops within the habitats and migration corridors of the ESUs, acute risk to endangered fish and the potential for indirect effects due to acute and chronic risks to their aquatic invertebrate food supply.

2.3.2. Barton Springs Salamander

The Agency has completed (U.S. EPA, 2006) an ecological risk assessment evaluating the potential effects of the herbicide atrazine on the Barton Springs salamander. The atrazine assessment was another component of the settlement of the court case “Center for Biological Diversity and Save Our Springs Alliance v. Leavitt, No. 1:04CV00126-CKK”. Conclusions regarding atrazine use in its action area were that it would have no direct effect on the Barton Springs salamander’s growth, reproduction or survival; furthermore, atrazine was not likely to indirectly affect the salamander through adverse effects on the salamander’s prey or through adverse effects on aquatic plants.

In 2007, the Agency also completed (U.S. EPA, 2007a) an ecological risk assessment evaluating the potential effects of the insecticide diazinon on the Barton Springs salamander. Conclusions regarding diazinon use in the action area were a “no effect” determination for direct acute effects on the Barton Springs salamander and a may affect but “not likely to adversely affect” through direct chronic effects on the Barton Springs salamander and through indirect effects to its invertebrate forage base.

Additionally, the Agency has completed (US. EPA 2007b) an ecological risk assessment evaluating the potential effects of the herbicide metaolachlor on the Barton Springs salamander. Conclusions regarding metolachlor use in the action area were a “may affect” but are “not likely to adversely affect” determination for both direct and indirect effects on the Barton Springs salamander.
2.4 Stressor Source and Distribution

2.4.1 Environmental Fate and Transport Assessment

The following fate and transport description for carbaryl is consistent with the information contained in the initial 2004 IRED (U.S. EPA, 2004b). Carbaryl dissipates in the soil environment by abiotic and microbially-mediated degradation. The major degradation product is 1-naphthol, which is further degraded to carbon dioxide. Abiotic routes of degradation include relatively rapid hydrolysis under alkaline conditions and photolysis in water. Under aerobic conditions, the compound degrades rapidly by microbial metabolism with half-lives of 4 to 5 days in soil and aquatic environments. Carbaryl dissipates rapidly from foliage and is mobile in the environment; however, the compound will increasingly partition to sediment as organic carbon content increases. Based on its octanol-water partition coefficient and bioconcentration factors, carbaryl is not expected to bioaccumulate (Table 2).
Table 2. Summary of Environmental Chemistry and Fate Parameters for Carbaryl (See Text for Analysis).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Selected Physical/Chemical Parameters</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Molecular Weight</td>
<td>201.22 g/mol</td>
<td>--</td>
</tr>
<tr>
<td>Water Solubility</td>
<td>32 mg/L (20° C)</td>
<td>Suntio, et al., 1988</td>
</tr>
<tr>
<td>Vapor Pressure</td>
<td>1.36 x 10^{-7} torr (25° C)</td>
<td>Ferrira and Seiber, 1981</td>
</tr>
<tr>
<td>Henry's Law Constant</td>
<td>1.28 x 10^{-9} atm m^{3}/mol</td>
<td>Suntio, et al., 1988</td>
</tr>
<tr>
<td>Octanol/Water Partition Coefficient (K_{ow})</td>
<td>229</td>
<td>Windholz et al., 1976</td>
</tr>
<tr>
<td><strong>Persistence</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydrolysis t_{1/2} pH 5</td>
<td>Stable</td>
<td>MRID 00163847, 44759301</td>
</tr>
<tr>
<td>Hydrolysis t_{1/2} pH 7</td>
<td>12 days</td>
<td></td>
</tr>
<tr>
<td>Hydrolysis t_{1/2} pH 9</td>
<td>3.2 hours</td>
<td></td>
</tr>
<tr>
<td>Aqueous Photolysis t_{1/2}</td>
<td>21 days</td>
<td>MRID 41982603</td>
</tr>
<tr>
<td>Soil Photolysis t_{1/2}</td>
<td>Assumed stable</td>
<td>No valid data submitted</td>
</tr>
<tr>
<td>Aerobic Soil Metabolism t_{1/2}</td>
<td>4 days in one sandy loam soil</td>
<td>MRID 42785101</td>
</tr>
<tr>
<td>Anaerobic Soil Metabolism t_{1/2}</td>
<td>72 days</td>
<td>MRID 42785102</td>
</tr>
<tr>
<td>Aerobic Aquatic Metabolism t_{1/2}</td>
<td>4.9 days</td>
<td>MRID 43143401</td>
</tr>
<tr>
<td>Anaerobic Aquatic Metabolism t_{1/2}</td>
<td>72 days</td>
<td>MRID 42785102</td>
</tr>
<tr>
<td><strong>Mobility</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Batch Equilibrium K_{F} (K_{OC}) = 1.74 (207)</td>
<td>sandy loam</td>
<td>MRID 43259301</td>
</tr>
<tr>
<td></td>
<td>2.04 (249) - clay loam sediment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.00 (211) - silt loam</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.52 (177) - silty clay loam</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1/n values ranged from 0.78-0.84</td>
<td></td>
</tr>
<tr>
<td>Column Leaching Slightly mobile in columns (30-cm</td>
<td></td>
<td>MRID 43320701</td>
</tr>
<tr>
<td></td>
<td>length) of sandy loam, silty clay loam,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>silt loam, and loamy sand soils</td>
<td></td>
</tr>
<tr>
<td>Bioconcentration Factor (BCF)</td>
<td>14x (edible), 75x (viscera), 45x (whole</td>
<td>MRID 00159342</td>
</tr>
<tr>
<td></td>
<td>fish)</td>
<td></td>
</tr>
<tr>
<td><strong>Field Dissipation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forestry Dissipation Foliar t_{1/2} = 21 days</td>
<td></td>
<td>MRID 43439801</td>
</tr>
<tr>
<td></td>
<td>Leaf Litter t_{1/2} = 75 days</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Soil t_{1/2} = 65 days</td>
<td></td>
</tr>
</tbody>
</table>

In available laboratory fate studies, 1-naphthol has been identified as the major degradate of carbaryl. In addition, several minor degradates of carbaryl were identified, including: 5-hydroxy-l-naphthyl methylcarbamate (aerobic soil metabolism, anaerobic aquatic studies), 1-naphthyl(hydroxymethyl)carbamate (aerobic soil metabolism, anaerobic aquatic studies), 1,4-naphthoquinone (aerobic aquatic metabolism, anaerobic aquatic studies), 4-hydroxy-1-naphthyl methylcarbamate (anaerobic aquatic study), 1,5-naphthalenediol (anaerobic aquatic study), and 1,4-naphthalenediol (anaerobic aquatic study); (hydroxy)naphthoquinone has been identified as a degradate of 1-naphthol.
Fate and transport data on the primary degradate, 1-naphthol, are limited; however, available data in the open literature indicate that its mobility is highly variable and less than the mobility of carbaryl on average (KOC range = 56-15,600 L/kgOC; U.S. EPA, 1980; Burgos et al., 1996). 1-Naphthol is not likely to persist due to fairly rapid degradation. In the open literature, the degradate has been observed to rapidly photooxidize (Lamberton, and Claeys, 1970) to below levels of detection in 2 hours under artificial light (Armburst and Crosby, 1991). Mihelcic and Luthy observed complete degradation of 1-naphthol in dark soil-water systems to below detection limits in 3 days under aerobic conditions and in 15-16 days under anaerobic conditions (1988). Since 1-naphthol can occur from a variety of natural and anthropogenic processes, its presence in the environment is not necessarily related to carbaryl use.

The mode of action of 1-naphthol is likely different than that of the parent. In fish, the mode of action of 1-naphthol has been described as narcosis (type II) (Russom et al., 1997). In plants, 1-naphthol can act as an auxin, which is a plant hormone essential to coordination of plant growth. Excessive amounts of auxins can result in inhibition of growth, leaf drop and plant death.

Carbaryl has been detected in surface water, ground water, air, and precipitation. Carbaryl has been detected frequently in surface water monitoring studies throughout the U.S., and infrequently in ground water monitoring studies. Surface water monitoring studies indicate that residential use of carbaryl is more frequently associated with surface water contamination. Carbaryl detections in air were observed more frequently and generally at higher concentrations at sampling locations in urban areas compared to agricultural areas (Foreman et al., 2000). Pesticide concentrations in fog formed in the vicinity of applications are often higher than those observed in rain water or surface water. Schomburg et al. (1991) reported carbaryl concentrations in fog ranging from 0.069 to 4.0 μg/L.

Potential transport mechanisms of carbaryl include pesticide surface water runoff, spray drift, and secondary drift of volatilized or soil-bound residues leading to deposition onto nearby or more distant ecosystems. The magnitude of pesticide transport via secondary drift depends on the pesticide’s ability to be mobilized into air and its eventual removal through wet and dry deposition of gases/particles and photochemical reactions in the atmosphere. A number of studies have documented atmospheric transport and redeposition of pesticides from the Central Valley to the Sierra Nevada Mountains (Fellers et al., 2004, Sparling et al., 2001, LeNoir et al., 1999, and McConnell et al., 1998). Prevailing winds blow across the Central Valley eastward to the Sierra Nevada Mountains, transporting airborne industrial and agricultural pollutants into Sierra Nevada ecosystems (Fellers et al., 2004, LeNoir et al., 1999, and McConnell et al., 1998). Therefore, physicochemical properties of the pesticide that describe its potential to enter the air from water or soil (e.g., Henry’s Law constant and vapor pressure), pesticide use, modeled estimated concentrations in water and air, and available air monitoring data from the Central Valley and the Sierra Nevada Mountains are considered in evaluating the potential for atmospheric transport of carbaryl to habitat for the BSS.
Carbaryl has been shown to be transported and deposited by atmospheric processes (Waite, et al., 1995; Foreman, et al., 2000; Sanusi et al., 2000). As with all chemicals applied by aerial or ground spray, spray drift can cause exposure to non-target organisms downwind. Vapor-phase transport and particulate transport may carry a compound far from the area of application. In the atmosphere, partitioning between particulate and gas phase is a function of temperature. Therefore, atmospheric transport distance and deposition are functions of temperature. In general, given carbaryl’s relatively rapid degradation and low vapor pressure, its potential for short-range and long-range atmospheric transport is very limited.

At this time, an approved model is not available for estimating atmospheric transport of pesticides and resulting exposure to aquatic organisms in areas receiving pesticide deposition from the atmosphere. Potential mechanisms of transport to the atmosphere, such as volatilization, wind erosion of soil, and spray drift, can only be discussed qualitatively for carbaryl. The extent to which carbaryl will be deposited from the air to the action area is not quantitatively known, but expected to be minimal due to carbaryl’s relatively rapid degradation and low vapor pressure.

2.4.2 Mechanism of Action

Carbaryl is an insecticide belonging to the N-methyl carbamate class of pesticides. Carbaryl is a cholinesterase inhibitor that acts on animals upon contact and upon ingestion by competing for binding sites on the enzyme acetyl cholinesterase, thus preventing the breakdown of the neurotransmitter acetylcholine. The primary degradate, 1-naphthol does not inhibit acetyl cholinesterase.

2.4.3 Use Characterization

According to the IRED (U.S. EPA, 2004b), carbaryl is nationally registered for over 400 uses in agriculture, professional turf management, ornamental production, and residential settings. Carbaryl also is registered for use as a mosquito adulticide. Agricultural uses include fruit and nut tree, fruit and vegetable, and grain crops. Carbaryl is used by homeowners in residential settings for lawn care, gardening (vegetables and ornamentals), and pet care (pet collars, powders, and dips, in kennels, and on pet sleeping quarters). Carbaryl also is used by nursery, landscape, and golf course industries on turf, annuals, perennials, and shrubs.

According to the IRED (U.S. EPA, 2004b), a total of approximately 3.9 million pounds of carbaryl active ingredient are sold annually in the U.S.; with about half used in agriculture and half in non-agricultural settings (per 1998 data). The amount of carbaryl usage in agriculture has declined form an average of 1.9 million pounds of active ingredient per year from 1992 through 2001, to 1 to 1.5 million pounds of active ingredient in 2001. Figure 1 depicts the extent of estimated annual agricultural carbaryl use nationally as of 2002, indicating that a total of 2,440,288 pounds of carbaryl were applied annually (USGS, 2007). The highest usage by weight (646,072 lbs) occurred on hay. Pecans (373,494 lbs) and apples (342,293 lbs) represented the second and third highest usage of carbaryl by weight.
Data regarding non-agricultural usage are limited. Data were not found that indicate how much carbaryl is usually applied in non-agricultural areas, when it is applied, and at what interval.

Analysis of labeled use information is the critical first step in evaluating the federal action. The current label for carbaryl represents the FIFRA regulatory action; therefore, labeled use and application rates specified on the label form the basis of this assessment. The assessment of use information is critical to the development of the action area and selection of appropriate modeling scenarios and inputs.

Based on a quantitative usage analysis based on survey data from 1992 – 2001, the crops with the largest number of acres treated and pounds of carbaryl active ingredient (a.i.) applied in Texas are: cantaloupe, cotton, grapefruit, oats/rye, pasture, peaches, pecans, rice, sorghum, squash, sugar beets, tomatoes, watermelon and wheat. This analysis does not reflect the decline in the usage of carbaryl reported by the registrant1 since 2002 because of the availability of alternative pesticides in the market nor does the analysis reflect mitigation imposed by the 2004 Interim Reregistration Eligibility Decision (IRED). Mitigation included the cancellation of pet uses except flea collars, cancellation of aerial applications of granular and bait formulations to corn, grain sorghum, alfalfa, rice and sunflowers; cancellation of use on succulent, shelled beans

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and peas (subgroup 6B); reduction in the maximum application rate from 7.5 to 5 lbs a.i./A to the citrus crop grouping; cancellation of the use on wheat; cancellation of the use on proso millet, and cancellation of the direct application of carbaryl to poultry and treatment of poultry houses.

2.5 Assessed Species

A brief introduction to the Barton Springs salamander, including a summary of habitat, diet, and reproduction data relevant to this endangered species risk assessment is provided below. Further information on the status and life history of the Barton Springs salamander is provided in Appendix D.

The Barton Springs salamander, shown in Figure D.1 of Appendix D, is aquatic throughout its entire life cycle. As members of the Plethodontidae family (lungless salamanders), they retain their gills when sexually mature and eventually reproduce in freshwater aquatic ecosystems. The available information indicates that the Barton Springs salamander is restricted to the immediate vicinity of the four spring outlets that make up the Barton Springs complex (Figure 2), located in Zilker Park near downtown Austin, Texas. Based on salamander survey results conducted by the City of Austin, Barton Springs salamanders appear to prefer areas near the spring outflows, with clean, loose substrate for cover, but may also be found in aquatic plants, such as moss. In addition to providing cover, moss and other aquatic plants harbor a variety and abundance of the freshwater invertebrates that salamanders eat. This species has one of the smallest ranges of any vertebrate species in North America (Chippindale, 1993). The Barton Springs segment of the Edwards Aquifer (BSSEA) and its contributing zone supply all of the water in the springs that make up the Barton Springs complex. Flows of clean spring water are essential to maintaining well-oxygenated water necessary for salamander respiration and survival.

The subterranean component of the Barton Spring salamander’s habitat may provide a location for reproduction (USFWS, 2005); however, little is known about the reproductive biology of the Barton Springs salamander in the wild. It appears that salamanders can reproduce year-round, based on observations of gravid females, eggs, and larvae throughout the year in Barton Springs (USFWS, 2005). Survey results indicate that Barton Springs salamanders prefer areas near the spring outflows, with clean, loose substrates for cover, but the salamanders may also be associated with aquatic plants (especially moss). In addition to providing cover, moss and other aquatic plants harbor a variety and abundance of the salamander’s prey, i.e., freshwater invertebrates.
2.6 Action Area

It is recognized that the overall action area for the national registration of carbaryl uses is likely to encompass considerable portions of the United States based on the large array of uses. However, the scope of this assessment limits consideration of the overall action area to those portions that may be applicable to the protection of the Barton Springs salamander from potential direct and indirect toxic effects of carbaryl and from potential adverse effects on its habitat, as they occur within the hydrogeologic framework of Barton Springs. Deriving the geographical extent of this portion of the action area is the product of consideration of the types of effects carbaryl may be expected to have on the environment, the carbaryl exposure levels that are associated with those effects, and the best available information concerning the use of carbaryl and its fate and transport within Barton Springs.

Unlike exposure pathways for most aquatic organisms, where pesticides are potentially transported via surface water to the receptor within a defined watershed, the Barton Springs salamander resides in a somewhat unique environment in which the water and the carbaryl reaches the salamander via subsurface flow. The Barton Springs salamander is known to inhabit only four springs and associated pools and subterranean areas in the aquifer itself (USFWS, 2005). Thus, the fate and transport of carbaryl is an important factor in defining the action area for the Barton Springs salamander. The fate profile (see Section 2.4.1) indicates why runoff from treated fields, transported in ground water that flows through the fractured limestone of the Edwards Aquifer, is considered the principal route of exposure for the salamander. Thus, the action area for this assessment is primarily defined by those areas within the hydrogeologic “watershed” that discharge to the springs. Figure 3 depicts the extent of the action area based on this hydrogeologic framework.
Barton Springs, located in Zilker Park near downtown Austin, Texas is an aquifer-fed system consisting of four hydrologically connected springs: (1) Main Springs (also known as Parthenia Springs or Barton Springs Pool); (2) Eliza Springs (also known as the Elks Pit); (3) Old Mill Springs (also known as Sunken Garden or Walsh Springs); and (4) Upper Barton Springs (Pipkin and Frech, 1993) (See Figure 2). Collective flow from this group of springs represents the fourth largest spring system in Texas (Brune, 1981). The springs are fed by the Barton Springs Segment of the Edwards Aquifer (BSSEA). During high flow conditions, the surface water flow from Barton Creek may enter the Barton Springs Pool, if it overtops the dam at the upper end of the pool. However, because surface water flow from Barton Creek into the pool system is diverted via a bypass channel upstream from the main pool to limit the input of surface water from Barton Creek, this is not expected to be a significant source of water in the areas where the salamander resides. Thus, ground water quality is the primary determinant of exposure for the salamander.

Flow to the Barton Springs is controlled by the geology and hydrogeology of the Barton Springs Watershed, which is divided into three hydrogeologic zones. These are, from west to east, the Contributing Zone (683 km$^2$), the Recharge Zone (233 km$^2$), and the Artesian Zone. Some have
sub-divided the Recharge Zone further into the Recharge and Transition Zones (Figure 3). The BSSEA is comprised of the Recharge and Artesian zones (401 km²). Of these zones, the Contributing and Recharge Zones have the greatest and most direct influence on Barton Springs. The Artesian Zone does not contribute subsurface flow to the springs (Slade et al., 1986, Hauwert et al., 2004). Therefore, the Contributing Zone and Recharge Zone (including the Transition Zone) comprise the action area for carbaryl as it relates to the Barton Springs salamander. A more detailed description of the geology and hydrogeology of these zones is provided in Section 3.2.2.

Numerous geological and ground water studies (Slade et al., 1986, Hauwert et al., 2004, Lindgren et al., 2004)) have been conducted that define the extent of the area contributing water to the Barton Springs. The Contributing Zone includes six creeks (Barton, Williamson, Slaughter, Bear, Little Bear, and Onion Creeks) that drain the watersheds and are maintained by spring flow from the Trinity aquifer. These creeks flow toward the Recharge Zone across the boundary of the Edwards aquifer. In the Recharge Zone, the creeks flow over the surface of the highly fractured and weathered limestone of the Edwards aquifer and rapidly infiltrate through the faults, caves, and sinkholes characteristic of a karst aquifer system. The Trinity aquifer is juxtaposed at depth against the Edwards aquifer and likely discharges into the Edwards aquifer, but this represents a minor portion of overall recharge (Lindgren et al., 2004).

Within the Recharge Zone of the BSSEA ground water is rapidly transported toward the Barton Springs with velocities along the dominant flow path of 1-5 miles/day, depending on ground water flow conditions (USFWS, 2005). Based on dye tracer studies, pesticides present within the recharge zone could potentially be transported to the springs on a time scale of hours to weeks (Hauwert et al., 2004).

An evaluation of usage information was completed to determine whether any or all of the area defined by the Barton Springs Watershed should be included in the Action Area. Current labels and local use information were reviewed to determine which carbaryl uses could possibly be present within the defined area. These data suggest that limited agricultural and ornamental uses are present within the defined area. Finally, local land cover data (City of Austin, 2003a and b; USGS, 2003) were analyzed and interviews with the local agricultural sector (Davis, 2006; Garcia, 2006; Perez, 2006; see Appendix B for more detail) were conducted to refine the characterization of potential carbaryl use in the areas defined by Hays, Travis, and Blanco counties.

In addition to carbaryl exposures from contaminated surface and ground water, there is potential that transport of carbaryl through spray drift and/or long-range atmospheric transport could contribute to concentrations in the aquatic habitat used by the salamander. The environmental fate profile of carbaryl suggests that long range transport of volatilized carbaryl is very limited (see Section 2.4.1). However, the available monitoring data suggest that long range transport of volatilized carbaryl cannot be precluded as a possible route of exposure to non-target organisms. The Agency does not currently have quantitative models to address the long range transport of pesticides from application sites. Therefore, the extent of the Action Area that could hypothetically be influenced by this route of exposure is uncertain but expected to be minimal.
Based on the available information on potential carbaryl use sites, none of the streams in the watersheds that are within the range of the Barton Spring salamander could be excluded from the action area. Therefore, the portion of the carbaryl action area assessed here includes the area within the boundaries of the watersheds that contain the Barton Springs salamander. Figure 3 depicts the action area graphically.

2.7 Assessment Endpoints and Measures of Ecological Effect

Assessment endpoints are defined as “explicit expressions of the actual environmental value that is to be protected” (U.S. EPA 1992). Selection of the assessment endpoints is based on valued entities (e.g., Barton Springs salamander), the ecosystems potentially at risk (e.g., Barton Springs), the migration pathways of carbaryl (e.g., runoff), and the routes by which ecological receptors are exposed to carbaryl-related contamination (e.g., direct contact).

Assessment endpoints for the Barton Springs salamander include direct toxic effects on the survival, reproduction, and growth of the salamander itself, as well as indirect effects, such as reduction of the prey base and/or modification of its habitat. Each assessment endpoint requires one or more “measures of ecological effect,” which are defined as changes in the attributes of an assessment endpoint itself or changes in a surrogate entity or attribute in response to exposure to a pesticide. Specific measures of ecological effect are evaluated based on acute and chronic toxicity information from registrant-submitted guideline tests that are performed on a limited number of organisms. Given that registrant-submitted amphibian toxicity tests are not available for this assessment, it is assumed that fish and aquatic-phase amphibian toxicities are similar. Birds are generally considered as surrogates for terrestrial-phase amphibians; however, Barton Springs salamanders are neotenic (i.e., retain gills throughout their lives) and are aquatic-phase amphibians. Consequently, fish are used as a surrogate for amphibian/salamanders, in accordance with guidance specified in the Agency’s Overview Document (U.S. EPA, 2004). Specific assessment endpoints and measures of ecological effects considered in this assessment are defined in Table 3. Additional ecological effects data from the open literature, as identified by ECOTOX, were also considered.

Table 3. Summary of Assessment Endpoints and Measures of Ecological Effect.

<table>
<thead>
<tr>
<th>Assessment Endpoint</th>
<th>Measures of Ecological Effect</th>
</tr>
</thead>
</table>
| 1. Survival, growth, and reproduction of Barton Springs salamander individuals via direct effects | 1a. Rainbow trout acute LC<sub>50</sub>  
1b. Brook trout chronic NOAEC |
| 2. Survival, growth, and reproduction of Barton Springs salamander individuals via indirect effects on prey (i.e., freshwater invertebrates) | 2a. Waterflea acute EC<sub>50</sub>  
2b. Waterflea chronic NOAEC  
2c. Acute EC/LC<sub>50</sub> data for freshwater invertebrates that are potential food items for the Barton Spring salamander |
| 3. Survival, growth, and reproduction of Barton Springs salamander individuals via indirect effects on habitat and/or primary productivity (i.e., aquatic plant community) | 3a. Non-vascular plant (freshwater algae) acute EC<sub>95</sub> |
2.8 Conceptual Model

2.8.1 Risk Hypotheses

Risk hypotheses are specific assumptions about potential adverse effects \(i.e.,\) changes in assessment endpoints\) and may be based on theory and logic, empirical data, mathematical models, or probability models (U.S. EPA, 1998). For this assessment, the risk is stressor-linked, where the stressor is the release of carbaryl to the environment. Based on the results of the 2004 carbaryl IRED (U.S. EPA, 2004), and considering the possibility that carbaryl has the potential for long-range transport, the following risk hypotheses are presumed for this endangered species assessment:

- Carbaryl in ground water, runoff, spray drift and/or atmospheric deposition from treated areas may directly affect Barton Springs salamanders by causing mortality or adversely affecting growth or fecundity;
- Carbaryl in ground water, runoff, spray drift and/or atmospheric deposition from treated areas may indirectly affect Barton Springs salamanders by reducing or changing the composition of prey populations; and
- Carbaryl in ground water, runoff, spray drift and/or atmospheric deposition from treated areas may indirectly affect Barton Springs salamanders by reducing or changing the composition of the plant community in the springs, thus affecting primary productivity and/or cover.

2.8.2 Diagram

The conceptual model is a graphic representation of the structure of the risk assessment. It specifies the stressor, release mechanisms, abiotic receiving media, biological receptor types, and effects endpoints of potential concern. The conceptual model for the potential effects of carbaryl on the Barton Springs salamander is shown in Figure 4.
Individual Barton Springs salamanders with the greatest potential to experience direct adverse effects from carbaryl use are those that occur in surface water and/or ground water with the highest concentrations of carbaryl. Water passing into, and through Barton Springs comes from ground water in the BSSEA. When Barton Creek floods, some of the surface flow enters Barton Springs Pool; however, during normal flow, the water from Barton Creek enters a bypass channel upstream from the main pool and does not enter the pool itself.
The source and mechanism of release of carbaryl into surface and ground water are ground applications via foliar spray to agricultural sites and on ornamentals. Surface water runoff from the areas of carbaryl application is assumed to follow topography, resulting in direct runoff to Barton Creek and/or runoff to the recharge area of the BSSEA, where it becomes ground water that discharges to the Barton Springs. Additional potential exposure routes include spray drift and atmospheric transport as a result of volatilization; however, these are not considered to be significant routes of exposure. Spray drift is not a relevant transport pathway because the source area for carbaryl is generally removed from the spring system where the salamander resides, and the carbaryl exposures that reach the springs do so via subsurface flow. Volatilization of carbaryl from treated areas resulting in atmospheric transport and eventual deposition is not expected to be a significant route of exposure due to the low vapor pressure of carbaryl ($1.36 \times 10^{-7}$ torr at 25°C).

At this time, EFED does not have an approved model for estimating atmospheric transport of pesticides and resulting exposure to aquatic organisms in areas receiving pesticide deposition from the atmosphere. Potential mechanisms of transport of carbaryl to the atmosphere, such as volatilization, wind erosion of soil, and spray drift, can only be discussed qualitatively. Given the presence of carbaryl in air and precipitation reported in monitoring data, it is possible that carbaryl is present in air and precipitation in the Barton Springs area. However, the majority of monitoring data for carbaryl relate to areas with significantly different use patterns than those found in Southern Texas. In particular, available monitoring data are generally relevant to California, which has greater use of carbaryl than Texas. Given a lack of appropriate modeling and relevant monitoring data, contributions of atmospheric transport and subsequent deposition of carbaryl to the exposure of the salamander are not considered quantitatively in this assessment. Qualitative discussions involving transport mechanisms and national monitoring data for carbaryl concentrations in air and precipitation are discussed in the uncertainty section of this document.

3. Exposure Assessment

3.1 Label Application Rates and Intervals

The only labeled carbaryl uses that are expected to potentially result in exposures from runoff to the Barton Springs Salamander are uses on peaches, grapes, pasture, parks, home lawns, and flowers in nurseries and along structural perimeters as these are the only reported uses of carbaryl in the BSSEA. Table 4 lists the pertinent label application information for these uses.
Table 4. Maximum Labeled Use Patterns of Carbaryl in the Action Area of the Barton Springs Salamander Endangered Species Assessment.

<table>
<thead>
<tr>
<th>Use Site</th>
<th>Method of Application</th>
<th>Maximum Number of Applications per Year</th>
<th>Maximum Application Rate (lbs a.i./acre)</th>
<th>Minimum Interval Between Applications (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home lawns&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Ground</td>
<td>2</td>
<td>9.1</td>
<td>7</td>
</tr>
<tr>
<td>Home lawns&lt;sup&gt;1&lt;/sup&gt;, parks,</td>
<td>Ground</td>
<td>Not stated</td>
<td>8.4</td>
<td>Not stated</td>
</tr>
<tr>
<td>flowers beds around buildings</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ornaments</td>
<td>Ground</td>
<td>4</td>
<td>7.8</td>
<td>7</td>
</tr>
<tr>
<td>Peaches</td>
<td>Aerial</td>
<td>2 (plus 1 dormant)</td>
<td>4 (5 dormant)</td>
<td>15</td>
</tr>
<tr>
<td>Grapes</td>
<td>Aerial</td>
<td>5</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Pasture</td>
<td>Aerial</td>
<td>2</td>
<td>1.5</td>
<td>14</td>
</tr>
</tbody>
</table>

<sup>1</sup> Use on home lawns is limited both to 2 applications at 9.1 lbs a.i./acre and to an unlimited number of applications at 8.4 lbs a.i./acre.

3.2 Aquatic Exposure Assessment

This exposure assessment represents an application of the standard approach outlined in the Overview Document (U.S. EPA, 2004) for the hydrogeologic conditions of the springs, using a combination of simulation modeling and monitoring data collected in the BSSEA action area. The Agency’s Pesticide Root Zone Model (PRZM, v3.12beta, May 24, 2001) was used to provide estimates of exposure in the Barton Springs resulting from direct transport in runoff water to streams in the contributing zone and resultant recharge and subsurface flow through the fractured limestone of the Edwards Aquifer. Regionally-specific PRZM scenarios representing both agricultural and non-agricultural use sites were developed following standard methodology (U.S. EPA, 2005) to capture the upper bounds of exposure.

Available historical monitoring data from the spring systems and ground water wells in the action area were evaluated. While of high quality, targeted to the Barton Springs system, and in selected instances targeted to pesticide use and single runoff events, the historical monitoring data are likely to miss peak concentrations due to insufficient sample frequency. Therefore, the monitoring data are useful for long duration (annual average) estimates of exposure, but they are not considered robust in terms of estimating acute or intermediate duration (14-day, 21-day, 30-day, 60-day, or 90-day average) exposures.

The highest potential exposure was predicted to occur from use of carbaryl on lawns within the recharge zone. The exposure assessment yields modeled 1-in-10-year annual average aggregate exposure estimates that are one and two orders of magnitude higher than concentrations seen in the monitoring data from creeks in the action area and the Barton Springs, respectively, due to the unlikely assumptions of simultaneous treatment of all lawns in the action area and of use at maximum application rates (arbitrarily limited at 25 applications per year). 1-in-10-year annual average estimates are consistent with concentrations observed in the monitoring data when uses
are modeled once per year across all use areas, or when uses are modeled at multiple times per year on a fraction of the possible use areas.

### 3.2.1 Background

The Barton Springs salamander resides in a geographically limited area defined by a set of spring-fed pools within the City of Austin, Texas. These pools represent the total areal extent of the salamander, as defined in Sections 2.5 and D.4 of Appendix D. The pools are a unique system in that they are fed via two sources of water. Surface water has historically reached the pool system via overland flow through Barton Creek. However, water from Barton Creek is currently diverted near the inflow to the pool system and provides only limited input to the pool system during high flow (flood) events. The bulk of the water reaching the pool system is fed via a series of springs. The springs consist of the Main Spring, Upper Spring, Old Mill Spring, and Eliza Spring; approximately 80% of the flow originates from the Main Spring. All of the springs are fed via subsurface flow originating in the fractured limestone of the Edwards Aquifer, which trends south-southwest away from the pool system. Ground water from the fractured limestone (karst) is derived from perennial ground water flow and via recharge that originates from both surface streams and infiltration of rainfall in the Barton Springs Watershed. Therefore, the basic conceptual model of exposure for this assessment focuses on the subsurface pathway delivering ground water to the pools via the karst system.

The hydrogeology of the Barton Springs Watershed defines the action area (see Section 2.6) of carbaryl use for the Barton Springs salamander. Several hydrogeologic zones define the watershed. From west to east, these are the Contributing Zone, the Recharge Zone (which some divide further into Transition and Recharge zones), and the Artesian Zone. The relevance and route of exposure relative to the Barton Springs system is different for each zone and is defined by the hydrogeology of the system. The Contributing Zone and the Recharge Zone contribute the majority of the water to the Barton Springs pool systems. Therefore, land use patterns within these zones were considered to determine the potential for carbaryl exposure to the Barton Springs salamander. **Figure 5** shows the extent of the Barton Springs Watershed.
Figure 5. Hydrologic zones of the Barton Springs Watershed.

Ground water flow within the Recharge Zone is dominated by subsurface flow through fractures and solution features of a portion of the limestone Edwards aquifer known as the BSSEA. Numerous studies have been conducted that document the nature of the subsurface geology and the nature and extent of ground water flow (Slade et al., 1986; Hauwert et al., 2004; Mahler, 2005, Lindgren et al., 2004). Ground water flow moves rapidly from various locations within the recharge zone to discharge at the springs, with transit times, measured in dye tracer studies, of hours to weeks following individual precipitation events. The sources of the ground water in the Edwards aquifer that contribute to the Barton Springs are primarily infiltration from streams and creeks that originate in the Contributing Zone, and recharge resulting from precipitation directly in the Recharge Zone. Slade et al. (1986) estimated that the streams contribute roughly 85% and direct precipitation roughly 15% of ground water to the Barton Springs.

The Contributing Zone lies due west of the Recharge Zone. In this zone, runoff from sites treated with carbaryl may be transported via overland flow to surface water streams and ponds. These streams also derive some component of their total flow, estimated at 30%, from the Trinity aquifer as baseflow (Kuriansky, 1990). Carbaryl may then be transported via surface water streams to the Recharge Zone, where it rapidly infiltrates into the network of karst fractures that ultimately feed the Barton Springs system. Unlike pesticides originating within the Recharge
Zone, some dilution and degradation is expected during this transport process. Ground water flow across the Trinity-Edwards aquifer boundary is negligible (Lindgren et al., 2004).

Historically, surface water flow through Barton Creek has contributed to the loading of water, sediment, and contaminants to the Barton Springs pools. However, in the current configuration of Barton Creek relative to the Barton Springs pools, the creek has been artificially routed past the pools to ensure that the springs are providing the bulk of the recharge to the pools. Occasionally, large precipitation events may result in a bypass of this configuration overflowing of the pool system. In general, however, the pools are typically fed by ground water flow through the Recharge Zone of the BSSEA.

The Barton Springs system consists of a series of connected pools located within the city limits of Austin, Texas. The Barton Springs salamander has been found within the fractures (springs) feeding the pool system and within the pools themselves. Each salamander location is somewhat unique from the other in how exposures are expected to interact with the salamander.

Potential exposures to pesticides for salamanders residing within the fracture system are due to a combination of sources of ground water: base flow from the Edwards aquifer and ground water recharge from precipitation events. Thus, salamanders residing within the fracture system of the springs are likely to be exposed to longer-term base flow concentrations of carbaryl with occasional shorter duration pulses correlated with precipitation-derived runoff events transported through the fractures.

Figures 6 and 7 present the conceptual models of both of these potential exposure pathways. More details on the geology and hydrogeology may be found in the following section. Finally, a more complete description of the Barton Springs pool system in which the salamander resides is provided in Section D.4 of Appendix D.
Figure 6. Hydrogeologic Cross Section of the Barton Springs Segment of the Edwards Aquifer and the Contributing Zone Showing Dominant Flow Pathways within Each Hydrozone (Taken from Mahler, 2005).
3.2.2 Geology/Hydrogeology

The Barton Springs pool system lies at the extreme northern end of the BSSEA, which is a portion of a larger fractured limestone aquifer system known as the Edwards Aquifer. The Edwards Aquifer is a major source of ground water used for drinking water and represents a critical source of water necessary to replenish surface water resources for both recreational and ecological uses throughout the eastern half of Texas.

The Edwards Aquifer is a karst system of limestone and dolomite of Cretaceous age (Slade et al., 1986). The aquifer covers roughly 6,000 square kilometers and stretches from north of Austin to an area southwest of San Antonio. In general, the physical trend of the Edwards Aquifer (and Barton Springs Segment) is south to north, and the carbonate rocks within the aquifer dip to the east except where broken by fractures within the Recharge Zone (Slade et al., 1986). The thickness of the aquifer generally increases from north to south and is typically 400 to 450 feet thick (Slade et al., 1986).

The Barton Springs Segment of the Edwards aquifer extends from the Colorado River of Texas south roughly 20 miles into Hays County and covers 401 square kilometers. The Barton Springs Segment is separated from the rest of the Edwards Aquifer by a hydrogeologic divide with ground water north of the divide flowing north-northeast towards the Colorado River of Texas and south of the divide flowing south-southwest. In general, the BSSEA is unconfined in the Recharge Zone and confined (by the Del Rio clay) in the Artesian Zone. It discharges at a
number of springs along the Colorado River and Barton Creek. Discharge into Barton Springs is predominantly through the Recharge Zone, and, based on hydrograph data, is typically around 35 cubic feet per second (cfs) during low flow periods (the median annual minimum flow), but can reach above 120 cfs during high flow conditions; the average flow is reported to range between 53 cfs (Hauwert et al., 2004) and 56 cfs (Mahler, 2005). Hydrograph data for Barton Springs from the USGS (Figure 8) yields an average flow of 62 cfs. Slade et al. (1986) estimated that up to 85% of the recharge reaching the BSSEA was derived from infiltration of the main creeks crossing the Recharge Zone. The remaining recharge is derived from water in inter-stream areas of the Recharge Zone, including from minor tributaries and direct infiltration of precipitation.

![Mean Flow (cfs) for Barton Springs](image)

**Figure 8. Flow Hydrograph Data for Barton Springs.**

Hauwert et al. (2004) conducted dye trace studies of the flow systems in the BSSEA between 1996 and 2002. In these studies, the authors attempted to discern specific flow patterns within the Recharge Zone using dye tracing, mapping of the potentiometric table, water chemistry, local knowledge of geology, and cave mapping. Non-toxic dye injection into caves, sinkholes, and wells was used to define the route of groundwater flow, estimate flow velocities, and approximate travel times. The important finding of this study relative to this assessment is that travel times within the Recharge Zone range from hours up to one week for locations in close proximity to the springs (defined by Travis County), while farther south and west in the recharge zone, travel times can increase to approximately 4 weeks. **Figure 9** presents a summary of the flow paths defined by this study (Hauwert et al., 2004).
3.2.3 Conceptual Model of Exposure

Given the understanding of the geology and hydrogeology described above, a combination of modeling and monitoring data is needed to assess the potential exposures from carbaryl to the Barton Springs salamander. Routes of exposure are dependent on the location of registered use sites for carbaryl within the action area (defined in Section 2.6 as the Contributing and Recharge Zones), and locations within the pool system (fractures versus pools) where the salamander resides. For instance, uses which are predominantly within the Recharge Zone of the BSSEA result in concentrations in water that are likely to reach the springs via direct transport through the fractures within the karst zone. Uses in the Contributing Zone result in concentrations in water that are transported over longer flow paths and are subject to both surface and sub-surface...
transport processes. The interconnected nature of the subsurface network in the BSSEA recharge Zone can have a significant influence on mixing, dilution, storage and degradation of flow (Field, 2004).

Because of the limited nature of the available monitoring data both within the spring network and in the surrounding ground water and surface water, an analysis of potential use sites within the action area is needed. Available agricultural statistics, land cover data, usage information, and soils data were evaluated relative to the hydrogeologic framework described above. This information was used to determine the presence and extent of use sites in the Recharge Zone and the Contributing Zone.

In order to address the potential for carbaryl exposure from use on these sites, a suite of PRZM modeling scenarios was developed for the specific agronomic, soil, and climatic data available. As noted above, the action area for the development of the Barton Springs scenarios is comprised of two primary hydrologic zones (in order of importance): 1) the Recharge Zone and 2) the Contributing Zone. Spatial data containing the hydrozone boundaries were obtained from the Barton Springs/Edwards Aquifer Conservation district (ftp://www.bseacd.org/from/HCP Shape Files/). The areas to the east of the Recharge Zone are not considered relevant to the assessment because ground water flow to the Barton Springs system comes either directly from transport through the Recharge Zone, which occurs generally south to north, or indirectly via the Contributing Zone/Recharge Zone interaction, where flow is dominantly west to east.

Runoff from the recharge zone is assumed to enter the karst environment directly, whereas runoff from the contributing zone is assumed to mix with stream water prior to entering the karst environment of the recharge zone. The long-term average flow volume in the streams in the contributing zone was assumed to be 30% due to aquifer discharge and 70% to runoff, as is consistent with Kuniansky (1989).

As carbaryl residue travel times in ground water may be on the order of hours to days, they were assumed short enough in the surface runoff and ground water of the karst environment to neglect degradation in the assessment. Under this assumption, carbaryl residues and runoff estimated by PRZM for all possible use areas were directly combined with a background flow and concentration in the aquifer discharge to produce estimated environmental concentrations (EEC) in the Barton Springs to which Barton Springs salamanders might be exposed. Spray drift and the farm pond EXAMS scenario, both of which are modeled in standard risk assessments, were not modeled in this exposure assessment due to the assumptions that the use sites in the action area are not adjacent to the springs and that residues in both ground water and surface runoff quickly flow to the Barton Springs without degrading.

### 3.2.4 Existing Water Monitoring Data

EFED finalized the Environmental Fate and Ecological Risk assessment for carbaryl in 2003 (U.S. EPA, 2003). The Carbaryl Interim Reregistration Eligibility Decision (IRED) was published for comment in 2004, and EFED completed a response to those comments in 2005 (U.S. EPA, 2005). Since that time, EFED has obtained the additional carbaryl monitoring data that is summarized below. Data specific to Texas, as well as the Barton Springs area are
described. These data include United States Geological Survey’s (USGS) National Water Quality Assessment (NAWQA) and targeted monitoring by USGS of the Barton Springs Watershed. In addition, observed trends in carbaryl concentrations in national surface waters are discussed.

3.2.4.1 USGS Data Set from Barton Springs Area

3.2.4.1.1 Data from Springs

The most relevant sampling data for this assessment are those collected from the springs (reported in Appendix C). Four springs were included in the USGS analysis, including Main Spring, Eliza Spring, Upper Spring, and the Old Mill Spring (see Figure 2). All four springs represent the main source of inflow into the Barton Springs pool system with the Main Spring providing roughly 80% of overall flow. These sampling locations are consistent with the reported locations of the Barton Springs salamander.

Carbaryl was detected in samples collected from Main Barton Springs and Upper Barton Springs. Carbaryl was not detected in samples collected from Old Mill Springs or Eliza Springs. The highest detection of carbaryl in any of the springs was 0.0657 μg/L, which was observed in Upper Barton Springs. A summary of the available data is located in Table 5. None of the samples collected from the 4 springs locations contained levels of carbaryl sufficient to exceed the LOCs for the salamander or for invertebrates (>12.5 and >0.255 μg/L, respectively).

Table 5. Detections of carbaryl in 4 spring sampling locations.

<table>
<thead>
<tr>
<th>Spring Site</th>
<th># Samples</th>
<th>Detection Rate</th>
<th>Sampling Dates</th>
<th>Maximum Concentration (μg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Barton</td>
<td>65</td>
<td>10.8%</td>
<td>2000-2005</td>
<td>0.0347</td>
</tr>
<tr>
<td>Upper Barton</td>
<td>43</td>
<td>11.6%</td>
<td>2001-2005</td>
<td>0.0657</td>
</tr>
<tr>
<td>Old Mill</td>
<td>12</td>
<td>Not detected</td>
<td>2001-2005</td>
<td>&lt;LOD¹</td>
</tr>
<tr>
<td>Eliza</td>
<td>15</td>
<td>Not detected</td>
<td>2000-2005</td>
<td>&lt;LOD¹</td>
</tr>
<tr>
<td>Total</td>
<td>135</td>
<td>8.9%</td>
<td>2000-2005</td>
<td>0.0657</td>
</tr>
</tbody>
</table>

¹<LOD means less than the level of detection (0.041 μg/L).

3.2.4.1.2 Data from Creeks

There are a total of 8 sites in and near the action area where creeks were sampled from 2000-2005 and analyzed for carbaryl (Table 6; Figure 13). The highest measured concentration of carbaryl was 0.472 μg/L. Samples taken from Barton Creek above Barton Springs and the Williamson Creek at Manchaca were at levels sufficient to exceeded the acute LOCs for invertebrates (e.g., >0.255 μg/L).
### Table 6. Detections of carbaryl in 8 creek sampling locations from 2000 to 2005.

<table>
<thead>
<tr>
<th>Creek Site</th>
<th># Samples</th>
<th>Detection Rate</th>
<th>Sampling Dates</th>
<th>Maximum Concentration (µg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barton 71</td>
<td>8</td>
<td>50.0%</td>
<td>2002-2004</td>
<td>0.23</td>
</tr>
<tr>
<td>Barton Creek above Barton Springs</td>
<td>13</td>
<td>46.2%</td>
<td>2000-2004</td>
<td>0.302</td>
</tr>
<tr>
<td>Bear Creek near Brodie</td>
<td>1</td>
<td>Not detected</td>
<td>2004</td>
<td>&lt;LOD&lt;sup&gt;i&lt;/sup&gt;</td>
</tr>
<tr>
<td>Onion Creek at Driftwood</td>
<td>5</td>
<td>Not detected</td>
<td>2003-2005</td>
<td>&lt;LOD&lt;sup&gt;i&lt;/sup&gt;</td>
</tr>
<tr>
<td>Onion Creek at Twin Creeks Road</td>
<td>3</td>
<td>33.3%</td>
<td>2004-2005</td>
<td>0.0929</td>
</tr>
<tr>
<td>Slaughter Creek at 2304</td>
<td>3</td>
<td>100.0%</td>
<td>2004-2005</td>
<td>0.301</td>
</tr>
<tr>
<td>Williamson Creek at Oak Hill</td>
<td>3</td>
<td>Not detected</td>
<td>2004-2005</td>
<td>&lt;LOD&lt;sup&gt;i&lt;/sup&gt;</td>
</tr>
<tr>
<td>Williamson Creek at Manchaca</td>
<td>9</td>
<td>100.0%</td>
<td>2000-2005</td>
<td>0.472</td>
</tr>
<tr>
<td>Total</td>
<td>45</td>
<td>51.1%</td>
<td>2000-2005</td>
<td>0.472</td>
</tr>
</tbody>
</table>

<sup>i</sup>LOD means less than the level of detection (0.041 µg/L).

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**Figure 10.** Location of Surface Water Monitoring Sites within the Barton Springs Watershed.
3.2.4.1.3 Data from ground water wells

There are a total of 16 sites in and near the action area where wells were sampled for carbaryl (Figure 14). Of a total of 71 samples taken during 2001-2005 from 16 wells, 1 contained a detectable level of carbaryl (estimated at 0.008 µg/L).

3.2.4.2 NAWQA data

This section discusses trends that have been observed in carbaryl concentrations in urban areas since the announcement of the phase-out of two other insecticides widely used in urban area, i.e., diazinon and chlorpyrifos. There was speculation that with diazinon and chlorpyrifos no longer
available, homeowners would use more carbaryl, and that carbaryl concentrations in streams in urban areas would increase. The residential use of liquid broadcast formulations of carbaryl on turf was restricted in 2005 to areas of less than 1000 ft$^2$. Risk managers concluded that this restriction may help reduce potential runoff of carbaryl in urban environments; however the labels for granular formulations were not modified. How the carbaryl label changes impact the extent of the area treated and how that would affect carbaryl concentrations in urban streams is unclear.

The timing of the phase-out decisions is important in understanding trends in pesticide concentrations in the environment. On one hand, the date of the announcement of a phase out initiates a multi-year process stipulating a “stop sale” date and some additional time for pesticide applicators to use products they have purchased. On the other hand, the market and pesticide applicators may react quickly to such an announcement. EPA announced the agreement to phase out and eliminate all residential uses of the insecticide diazinon on December 5, 2000. The terms of the four-year phase-out stipulated that technical registrants reduce the amount of diazinon produced by 50% or more by 2003. As of December 31, 2004, it was unlawful to sell diazinon outdoor, non-agricultural products in the United States (the “stop sale” date for all outdoor diazinon home, lawn, and garden products). According to existing stocks provisions, it remained legal for consumers to use products bearing labeling that allowed these uses after that date. On June 8, 2000, EPA announced an agreement with pesticide registrants to phase-out and cancel nearly all indoor and outdoor residential uses of chlorpyrifos within 18 months, effectively eliminating use by homeowners. Residential uses were restricted to certified. Those uses that posed the most immediate potential risks to children (home lawn, indoor crack and crevice treatments, uses in schools, parks) were canceled first, ending as of 12/31/2001. The last remaining residential use, products used for pre-construction termite control, was cancelled as of December 31, 2005.

Based on the studies described below, the longer term impact of the phase-out on carbaryl concentrations in urban areas is not clear and may vary by region due to differences in pest pressure and perhaps marketing of different products. Unlike the clear downward trend in concentrations observed within a few years for the phased-out compounds (diazinon and chlorpyrifos), the environmental outcome of this registration decision may take longer to discern. However, based on these available data, there does not appear to be a steady upward trend to carbaryl concentrations in urban areas following the phase-out of diazinon and chlorpyrifos.

In a poster, Embrey and Moran (2006) summarized data collected by the NAWQA program over a decade in the Puget Sound Basin and included data on diazinon and carbaryl collected in Thornton Creek (King County, WA). During the first cycle, the insecticide diazinon was often detected in samples from Thornton Creek; some samples were at concentrations greater than 0.1 μg/L. Figure 12, which was taken from the poster, shows a decrease in diazinon detections and concentrations following the announcement of the phase out in 2000. There is also an increase in carbaryl detection frequency and concentrations in the years following the announcement of the phase out of diazinon. The data also appear to show that carbaryl concentrations began to decline toward the end of the study period in 2005, rarely exceeding 0.1 μg/L.
A recently published paper by USGS scientists evaluated trends in concentrations of carbaryl in the Northeast and Mid-West after the phase out of diazinon and chlorpyrifos, insecticides in urban environments (Phillips et al., 2007). They compared concentrations of these pesticides in samples collected from 20 streams by the USGS between 1992 and 2004 and determined that 16 of these streams met criteria established for assessing trends of carbaryl in urban streams. Sample collection and analysis followed standard NAWQA procedures for collection and analysis. Using seasonal step trend analysis they evaluated the data to identify trends in summer, fall/winter, and winter/spring. Results showed a decrease in diazinon and chlorpyrifos concentrations following the announcement of the phase out in 2000. In contrast, trends were not observed in carbaryl concentrations in these regions during the same time period.

### 3.2.5 Modeling Approach

**Standard Approach for Water Body Modeling.** OPP’s standard approach for conducting modeling in support of ecological risk assessment assumes that 100% of a 10-hectare field is covered by the relevant use and that a standard water body adjacent to the field receives the edge-of-field runoff and spray drift. The standard water body is of fixed geometry and includes processes of degradation and sorption expected to occur in ponds, canals, and low order streams (e.g. first and second order streams), but with no flow through the system. Modeling scenarios for the 10-hectare field are linked with meteorological data to represent use sites in areas that are highly vulnerable to runoff, erosion, or spray drift. Runoff and spray drift estimates predicted by PRZM (v3.12beta, May 24, 2001) are linked to the Exposure Analysis Modeling System (EXAMS v2.98.04, Jul. 18, 2002) using a graphical user interface or shell (PE4v01.pl, Aug. 13, 2003) to yield 1-in-10-year estimated environmental concentrations (EEC).

**The Approach for Barton Springs Modeling.** Because of the unique geology and location-specific focus of the Barton Springs assessment, an approach was taken that incorporated the
specific hydrology of the area in an effort to make the modeling approach more relevant than the standard modeling approach that the Agency uses for more generic nationwide assessments. A brief description of the Spring’s salient features are given here.

The Barton Springs are supplied predominantly with water discharging from fractures and conduits formed in the Barton Springs Segment of the Edwards Aquifer (BSSEA) as a result of dissolution of the fractured limestone aquifer over time. Approximately 85% of the water that recharges this aquifer infiltrates through the beds of six creeks that cross the recharge zone (Slade et al., 1986; Barrett and Charbeneau, 1996), with the remaining approximately 15% of the recharge derived from precipitation and recharge in interbed areas in the recharge zone. In the BSSEA, natural ground water discharge occurs primarily at Barton Springs (Lindgren et al., 2004). Recharge features in creek bottoms overlying the recharge zone allow only a limited flow of water during a storm event; therefore, water that is in excess of the flow capacities of recharge features leaves the recharge zone as creek flow. The contributing zone encompasses the watersheds of the six major creeks that cross the Recharge Zone, and therefore provides the source for most of the water that will enter the BSSEA as recharge. These streams gain water, as they flow across the land surface in the contributing zone, from the lower-permeability Glen Rose limestone of the Trinity aquifer (Lindgren et al., 2004). Kuniansky (1989) estimated baseflow discharge from the Trinity aquifer to streams and creeks in this area ranging from 25% to 90% of total flow. In the portion of the Trinity aquifer nearest the contributing zone this was loosely estimated at 30%. The remainder of water in creeks in the contributing zone is derived from precipitation and runoff.

The conceptual model attempts to capture the most important aspects of this unique hydrology. In this regard, the nature of the contributing zone and the recharge zone are distinguished and treated separately. Runoff from the recharge zone is assumed to enter the karst environment directly, whereas runoff from the contributing zone is assumed to mix with stream water prior to entering the karst environment of the recharge zone. The long-term average flow volume in the streams in the contributing zone was assumed to be 30% due to aquifer discharge and 70% to runoff, as is consistent with Kuniansky (1989).

Chemical masses (loading) and volumes of runoff were produced in daily time series for each zone of the action area in this assessment using the model PRZM and input scenarios that were developed specifically for the orchards, nurseries, rangeland, residential areas, parks, and other areas found in the Barton Springs Salamander action area (see Section 3.2.6 and Appendix B). Rangeland and pasture uses were modeled with the rangeland scenario. Uses on peaches and grapes were modeled with the orchard scenario. Use on parks was modeled with the turf scenario. Uses on home lawns and perimeter flower beds were modeled with the residential scenario. And ornamental flower uses were modeled with the nursery scenario. Daily chemical loadings in runoff in the contributing zone were diluted with aquifer discharge and combined with the loadings in runoff in the recharge zone to estimate daily exposure in the Barton Springs. Similar to the Agency’s standard ecological risk assessment methodology described above, 30 years of meteorological data for the Austin area were used in these specific scenarios to estimate 1-in-10-year exposure from the daily concentration values in the Barton Springs.
A summary of the potential carbaryl use areas is presented in Table 7. The area of nurseries (3.25 acres) in the action area was investigated using a variety of sources (see p. 11 of Appendix B). The total area of rangeland, vineyards, and orchards may be up to 34,200 acres, 56.7 acres, and 7 acres, respectively (USGS, 2003). The total area of parks, residential areas, and commercial areas may be as much as 5,680 acres, 105,000 acres, and 4,150 acres, respectively (COA, 2003). Home lawns and perimeter flower beds in residential and commercial areas were assumed to account for only 70% and 4.4% of land cover, respectively. The area where no use occurs (non-use area), accounts for the remainder of the action area.


<table>
<thead>
<tr>
<th>Use Pattern</th>
<th>PRZM Scenario</th>
<th>Area (acres)</th>
<th>Area in Contributing Zone (acres)</th>
<th>Area in Recharge Zone (acres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ornaments</td>
<td>Nursery</td>
<td>3.25 (0.00144%)</td>
<td>0.5 (0.0003%)</td>
<td>2.75 (0.00477%)</td>
</tr>
<tr>
<td>Peaches</td>
<td>Orchard</td>
<td>7 (0.00297%)</td>
<td>7 (0.00297%)</td>
<td>0</td>
</tr>
<tr>
<td>Vineyards</td>
<td>Orchard</td>
<td>56.7 (0.0241%)</td>
<td>48.2 (0.0205%)</td>
<td>8.51 (0.00361%)</td>
</tr>
<tr>
<td>Rangeland and pasture</td>
<td>Rangeland</td>
<td>34,200 (14.5%)</td>
<td>26,200 (11.1%)</td>
<td>7980 (3.39%)</td>
</tr>
<tr>
<td>Parks</td>
<td>Turf</td>
<td>5680 (2.37%)</td>
<td>2110 (0.876%)</td>
<td>3580 (1.49%)</td>
</tr>
<tr>
<td>Home lawns and flower beds&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Residential, Impervious</td>
<td>105,000 (43.5%)</td>
<td>80,300 (33.4%)</td>
<td>24,200 (10.1%)</td>
</tr>
<tr>
<td>Commercial flower beds&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Residential, Impervious</td>
<td>4150 (1.73%)</td>
<td>2340 (0.975%)</td>
<td>1810 (0.752%)</td>
</tr>
<tr>
<td>Non-use area</td>
<td>Rangeland</td>
<td>90,400 (38.4%)</td>
<td>68,100 (28.9%)</td>
<td>22,400 (9.50%)</td>
</tr>
<tr>
<td>(BSSEA Totals)</td>
<td>--</td>
<td>235,000 (100%)</td>
<td>179,000 (76.0%)</td>
<td>56,400 (24.0%)</td>
</tr>
</tbody>
</table>

<sup>1</sup> Areas reflect residential and commercial areas, of which only a fraction accounts for the use patterns. Model outputs were refined to reflect the actual use areas, as described in Appendix E.

**Determination of Runoff Concentrations and Volume.** As described previously, the contributing zone and the recharge zone are treated differently. Calculations for the contributing zone are described first and these are followed by calculations for the recharge zone.

**Contributing Zone.** This assessment uses the long-term average stream flow information to calculate an approximate average daily stream flow in the contributing zone. Because the ratio of runoff flow to base stream flow was estimated to be 70:30, estimating the long-term (30 years simulated) runoff flow enables an estimate of the long-term average stream flow. The long-term runoff volume was calculated for each of the scenarios in Table 7 using PRZM and the respective areas within the contributing zone. The cumulative runoff volume for the contributing zone was calculated according to

\[ V_{CZ} = \sum_{t=1}^{n} \sum_{i} (V_{CZi,t}) \]  

(3.1)
where $V_{CZ} =$ 30-year simulated cumulative runoff volume [volume]
$V_{CZi,t} =$ the runoff volume for scenario i on day t in the contributing zone [volume]
$n =$ number of days in simulation

The estimated daily aquifer-driven base flow in the streams within the contributing zone was calculated from the 70:30 ratio as given by Kuniansky (1989):

$$ V_{base} = \frac{V_{CZ}}{n} \left( \frac{0.30}{0.70} \right) \quad (3.2) $$

where $V_{base} =$ the long-term average daily aquifer-driven stream volume [volume]

Daily runoff volume was calculated by adding the daily runoff flows as follows:

$$ V_{CZ,t} = \sum_i (V_{Ci,t}) \quad (3.3) $$

where $V_{CZ,t} =$ the total runoff volume on day t in the contributing zone [volume]

Daily stream volume was calculated by adding the base stream flow to the daily runoff volume as follows:

$$ V_{stream,t} = V_{CZ,t} + V_{base} \quad (3.4) $$

where $V_{stream,t} =$ the total stream volume on day t in the contributing zone [volume]

Because PRZM calculates mass per unit area, the concentration in runoff in the contributing zone was calculated directly from the PRZM output and the area of the scenarios (see Table 7 for areas) as follows:

$$ C_{CZ,t} = \frac{\sum_i (M_{CZi,t})}{(V_{CZ,t})} \quad (3.5) $$

where $C_{CZ,t} =$ the concentration in runoff across the contributing zone on any day t [mass/volume]

$M_{CZi,t} =$ the mass of carbaryl in runoff in the contributing zone for scenario i on any day t [mass]

Daily stream concentrations were calculated from the PRZM output, the area of the scenario, the stream base flow, and the average base flow concentration as follows:

$$ C_{stream,t} = \frac{(C_{CZ,t} \times V_{CZ,t} + C_{base} \times V_{base})}{V_{stream,t}} \quad (3.6) $$
where \( C_{\text{stream},t} \) = the concentration in contributing zone streams on any day \( t \) [mass/volume] \\
\( C_{\text{base}} \) = the average concentration monitored in base flow [mass/volume]

Note that the background concentration in base flow was assumed to be 0.008 µg/L. This is a conservative estimate from the non-targeted monitoring data, in which carbaryl was detected (at this concentration) in 1 of 71 ground water samples in this region. Also, carbaryl is expected to hydrolyze readily in matrix flow under karst conditions (half-life of 3.2 hours at pH 9), which underlines the conservatism of this estimate.

The above calculated stream volume (\( V_{\text{stream},t} \)) in Eqn. 3.4 along with its associated concentration (\( C_{\text{stream},t} \)) in Eqn. 3.6 are assumed to be delivered to the recharge zone where they will mix with recharge zone runoff as described next.

**Recharge Zone.** Runoff originating in the recharge zone was determined in a similar manner as for the contributing zone:

\[
V_{\text{RZ},t} = \sum_i (V_{\text{RZi},t})
\]  

(3.7)

where \( V_{\text{RZ}} \) = runoff volume on day \( t \) in the recharge zone [volume] \\
\( V_{\text{RZi},t} \) = the runoff volume for scenario \( i \) on day \( t \) in the recharge zone [volume]

The concentration of runoff in the recharge zone was determined from the PRZM mass output (output as mass/area), the area represented by the scenario, and the volume of runoff in the recharge zone as follows:

\[
C_{\text{RZ},t} = \frac{\sum_i (M_{\text{RZi},t})}{V_{\text{RZ},t}}
\]  

(3.8)

where \( C_{\text{RZ},t} \) = the concentration in runoff across the recharge zone on any day \( t \) [mass/volume] \\
\( M_{\text{RZi},t} \) = the mass of carbaryl in runoff in the recharge zone for scenario \( i \) on any day \( t \) [mass]

**Barton Springs Daily Concentrations.** It is assumed that the stream flow from the contributing area and the runoff from the recharge area mix and flow through the karst and into the Barton Springs. Stream flow that does not ultimately pass through the Barton Springs is assumed not important because of the assumption of instant mixing of carbaryl residues in flow volumes prior to potential diversion. The discharge in streams that leave the action area as a result of large precipitation events is assumed negligible. Therefore, the total discharge produced is determined as:

\[
V_{\text{Springs},t} = V_{\text{stream},t} + V_{\text{RZ},t}
\]  

(3.9)
where \( V_{Sprs,t} \) = the total flow through the Barton Springs on day \( t \) [volume]

Using these calculations, runoff from the recharge zone provides 11\% of discharge through the Barton Springs, on average. This is similar to the approximation by Slade et al. (1986) and Barrett and Charbeneau (1996) that 15\% of recharge to the Barton Springs originates in the recharge zone and 85\% originates in the contributing zone.

Finally, the concentration in the Barton Springs is determined from:

\[
C_{Sprs,t} = \frac{C_{RZ,t}V_{RZ,t} + C_{stream,t}V_{stream,t}}{V_{Sprs,t}} \tag{3.10}
\]

where \( C_{Sprs,t} \) = the daily concentration in Barton Springs [mass/volume]

Daily EECs in the Barton Springs were post-processed (see Appendix E for details) in order to provide durations of exposure. Peak, 14-day, 21-day, 30-day, 60-day, and 90-day average concentrations were calculated across 30 years of daily EEC values. In order to match the standard PRZM/EXAMS output, the maximum values for each of the 30 years of daily and rolling averages were ranked and the 90\% percentiles from the rankings were selected as the final 1-in-10-year EECs for use in risk estimation.

### 3.2.5.1 Model Inputs

The appropriate PRZM input parameters were selected from the current labels for carbaryl and the environmental fate data submitted by the registrant, in accordance with EFED water model input parameter selection guidance (U.S. EPA, 2002). The use patterns that may result in aquatic exposure, as summarized in Table 4, are listed below in Table 8.

**Table 8. Use patterns for the assessment of aquatic exposure from carbaryl to the Barton Springs Salamander.**

<table>
<thead>
<tr>
<th>Use Pattern</th>
<th>Scenario</th>
<th>Date of Initial Application</th>
<th>Max. App. Rate (lbs a.i./acre)</th>
<th>Max. No. of Apps.</th>
<th>Application Intervals (days)</th>
<th>Application Method</th>
<th>IPSCND(^1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home lawns, flower beds</td>
<td>Residential, Impervious</td>
<td>Apr. 28(^{th})</td>
<td>8.3</td>
<td>25 assumed</td>
<td>3 assumed</td>
<td>Ground</td>
<td>1</td>
</tr>
<tr>
<td>Parks</td>
<td>Turf</td>
<td>Apr. 28(^{th})</td>
<td>8.3</td>
<td>25 assumed</td>
<td>3 assumed</td>
<td>Ground</td>
<td>3</td>
</tr>
<tr>
<td>Pasture</td>
<td>Rangeland</td>
<td>Apr. 28(^{th})</td>
<td>1.5</td>
<td>2</td>
<td>14</td>
<td>Aerial</td>
<td>3</td>
</tr>
<tr>
<td>Ornamentals</td>
<td>Nursery</td>
<td>Apr. 28(^{th})</td>
<td>7.8</td>
<td>4</td>
<td>7</td>
<td>Ground</td>
<td>2</td>
</tr>
<tr>
<td>Peaches</td>
<td>Orchard</td>
<td>Sep. 25(^{th})</td>
<td>4</td>
<td>2 + 1 dormant</td>
<td>15</td>
<td>Aerial</td>
<td>1</td>
</tr>
<tr>
<td>Vineyards</td>
<td>Orchard</td>
<td>Apr. 28(^{th})</td>
<td>2</td>
<td>5</td>
<td>7</td>
<td>Aerial</td>
<td>1</td>
</tr>
</tbody>
</table>

\(^1\) IPSCND: condition for disposition of foliar pesticide after harvest. 1 = surface applied, 2 = complete removal, 3 = left alone.
The deposition of carbaryl in the post-season (termed “IPSCND” for PRZM modeling) was modeled as completely removed during harvest for ornamentals. For parks and pastures, this parameter was modeled as partially removed, with the remaining surface residue undergoing decay on plant surfaces. Foliar residues were modeled as surface applied in the post-season for peaches, vineyards, home lawns, and flower beds.

The environmental fate input parameters selected are similar to those used in the 2002 carbaryl IRED (U.S. EPA, 2006); no new environmental fate data were incorporated into this assessment (Table 9). Input parameters relating to the EXAMS model were unnecessary for this modeling approach. Model input reports and the stepwise approach for processing model output are provided in Appendix E.

Table 9. PRZM Input Parameters. Source Data are in Table 2.

<table>
<thead>
<tr>
<th>Input Parameter</th>
<th>Value</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date of Initial Application</td>
<td>Peaches: Sep 25th Other use patterns: Apr. 28th</td>
<td>Current labels and USDA Crop Profiles¹</td>
</tr>
<tr>
<td>Application Efficiency²</td>
<td>95% for aerial 99% for ground</td>
<td>Input Parameter Guidance³</td>
</tr>
<tr>
<td>CAM Input</td>
<td>2</td>
<td>Active labels</td>
</tr>
<tr>
<td>Aerobic Soil Metabolism Half-life (days)</td>
<td>12</td>
<td>MRID 42785101</td>
</tr>
<tr>
<td>Koc (L/kgOC)</td>
<td>198</td>
<td>MRID 43259301</td>
</tr>
<tr>
<td>Foliar Degradation Rate</td>
<td>0.187 d⁻¹</td>
<td>MRID 45860501</td>
</tr>
<tr>
<td>Foliar Wash off Coefficient</td>
<td>3.70 cm⁻¹</td>
<td>U.S. EPA, 2003</td>
</tr>
</tbody>
</table>

¹ – USDA Crop Profiles information is located at: http://pestdata.ncsu.edu/cropprofiles.
² – Spray drift not included in final EEC due to proximity of use areas to Barton Springs.
³ – Inputs determined in accordance with EFED water model input parameter selection guidance (U.S. EPA, 2002).

Spray drift is not considered to be a significant route of exposure because the source area for carbaryl is generally removed from the spring system where the salamander resides, and the carbaryl exposures that reach the springs do so via subsurface flow. Therefore, spray drift is assumed to be negligible.

The single available aerobic soil metabolism half-life of 4 days was multiplied by 3 to account for potential environmental variability, following current EFED guidance for selecting water model input parameters (U.S. EPA, 2002). Because carbaryl partitions well to organic carbon, the average K_OC of three soils (198 L/kgOC) was used to represent binding to soil and sediment.

Registrant-submitted data indicate that carbaryl degrades on foliage at a substantially faster rate than the OPP default half-life of 35 d (MRID 45860501). The submitted data were reviewed and analyzed (U.S. EPA, 2003; DP 288376), resulting in a foliar degradation half-life of 3.71 days, which represents an upper 90% confidence bound on the mean from 30 foliar dissipation studies. Data were also submitted that support a revised estimate of the foliar wash off coefficient, which represents the fraction of chemical that washes off with each 1 cm of rainfall. An analysis of two
relevant studies indicates that a wash off coefficient of 3.70 cm$^{-1}$ is appropriate (U.S. EPA, 2003; DP 288376).

### 3.2.5.2 PRZM Scenarios

Six PRZM scenarios developed for assessment of the Barton Springs Salamander were used to model applications of carbaryl: nursery, orchard, rangeland, turf, impervious, and residential. The rangeland scenario was used both as a use scenario and to provide runoff estimates representative of the action area where no carbaryl use is expected, as it is the scenario that appears to be most representative of undeveloped areas. Each scenario used meteorological data from a weather station located in Austin, Texas. No weather station closer to the action area provides the data required for exposure modeling. A discussion of each assessed exposure scenario is provided below.

#### 3.2.5.2.1 Nursery

NASS data for 2002 indicate that outside acreage for reported ornamental crops in Hays and Travis Counties is negligible relative to indoor acreage (outside being $<0.1\%$ of the total indoor and outdoor acreage combined). The majority of acreage for nursery, greenhouse, floriculture, mushrooms, sod, and vegetable seeds in both years and both counties was grown under glass or other protection. Three confirmed outdoor nursery operations reside within the BSSEA (Kathy Shay, personal communication; Andrea DeLong-Amaya, personal communication); all three are within the Travis county portion of the BSSEA. Total outside wholesale nursery production in the BSSEA is approximately three acres.

For the purposes of modeling a nursery operation in the BSSEA, one of the nurseries was used to conceptualize a facility that is representative of one located within the BSSEA. This nursery was chosen because it had the largest acreage of the three identified nurseries in the action area. Communications with a staff member were used to parameterize the model. The nursery of interest has indoor and outdoor areas for growing and maintaining plants. Outdoor plants include cacti, annuals, perennials, shrubs, and trees. Outdoor plants are maintained on either weed control mats or on gravel. Plants are kept in pots of various sizes, ranging from 4” to multiple gallons, depending upon the type of plant kept within. Irrigation is carried out daily with either hose or sprinkler systems. Plants are maintained outside year-round, with some becoming dormant in the winter and some remaining green. Spring and fall represent the busiest times for plant production and sales for this nursery (personal communication with nursery employee).

#### 3.2.5.2.2 Orchard

This scenario is intended to represent an orchard that may include cultivation of peaches, nectarines or pecans. USDA data for Hays and Travis counties do not include harvest data for these crops from 1990-2007 (USDA, 2007); however, the 2002 agricultural census for the two counties includes over 2000 acres of land in orchards (USDA, 2002). Discussions with extension agents in Hays and Travis counties indicated that some cultivation of peaches and nectarines occurs in the BSSEA specifically in Hays County (Bryan Davis, personal communication).
communication). Crop parameters for this scenario were chosen to be reflective of a peach orchard in this area.

### 3.2.5.2.3 Turf

This scenario is intended to represent turf areas (golf courses, parks, sod farms, and recreational fields) in the BSSEA. Brackett soil was chosen to represent turf areas in the BSSEA because it is a benchmark soil, is highly representative of golf course areas in the BSSEA, and it approximately represents the 90th percentile of vulnerability in drainage, erodibility, and slope. The Brackett series is in Hydrologic Group C and is found in both the contributing and recharge zones of the Edwards Aquifer. Brackett soil is the most common soil found in golf course areas (USDA, 2006; COA, 2003) and the second most common within the entire turf land cover class (golf courses, cemeteries, parks, and greenways). The top of the soil profile in the scenario was modified to represent a 2-cm deep layer of thatch.

### 3.2.5.2.4 Rangeland

This scenario is intended to represent pesticide application on pastures, grassland, and rangeland in the BSSEA. Vegetation is generally dominated by grasses, forbs and shrubs. In the BSSEA, rangeland vegetation is a heterogeneous mixture of trees and grasses. Common tree species include: ash juniper (a nuisance species), oaks, hackberry and elms. Grass species including little blue stem, side oats gramma, indian grass, switch grass, king ranch bluestem (introduced) and kline grass (introduced) are typical. These areas are composed of approximately 60-65% trees and 30-35% grasses (Perez, 2006). Although these landcovers contain a significant amount of tree cover, this “crop” was modeled as a field crop rather than an orchard. This was believed to be a conservative approach; however, the orchard scenario that maintains 60% tree cover yields higher exposure estimates than this scenario. The Brackett series was selected for this scenario because it is both highly representative of rangeland/pastureland areas in the BSSEA and because it represents the 90th percentile of vulnerability, drainage, erodibility, and slope.

### 3.2.5.2.5 Residential

This scenario is intended to represent pervious urban/suburban home and residential areas in the Barton Springs watershed. Brackett soils were chosen to represent residential areas, as they are found in both the contributing and recharge zones and are the most common soil on which residential dwellings are located, accounting for 35% of all soils in residential areas (USDA, 2006; USGS, 2003). Brackett is a Hydrologic Group C soil, which accounts for approximately 47% of residential soils in drainage.

### 3.2.5.2.6 Impervious

This scenario is intended to be used to mimic hydrology of impervious portions of residential areas in the BSSEA. It relies on the Brackett soil series that was chosen to represent the residential scenario in order to supply the soil parameters required by PRZM. However, the upper horizon is adjusted to a non-soil nature.
3.2.6 Aquatic Modeling Results

Table 10 presents the 1-in-10-year exposure estimates in the Barton Springs from all relevant use scenarios, both individually and aggregated. The aggregate estimates are not totals of the 1-in-10-year exposure estimates for individual use scenarios, as they are 1-in-10-year estimates as well.

Table 10. 1-in-10-year Barton Springs EECs for Modeled PRZM Scenarios.

<table>
<thead>
<tr>
<th>Use Pattern</th>
<th>Peak EEC (μg/L)</th>
<th>14-day EEC (μg/L)</th>
<th>21-day EEC (μg/L)</th>
<th>30-day EEC (μg/L)</th>
<th>60-day EEC (μg/L)</th>
<th>90-day EEC (μg/L)</th>
<th>Annual Avg. EEC (μg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lawns</td>
<td>534</td>
<td>94.8</td>
<td>70.4</td>
<td>55.8</td>
<td>38.1</td>
<td>25.4</td>
<td>6.28</td>
</tr>
<tr>
<td>Pasture</td>
<td>23.0</td>
<td>2.49</td>
<td>2.17</td>
<td>1.65</td>
<td>0.835</td>
<td>0.559</td>
<td>0.143</td>
</tr>
<tr>
<td>Parks</td>
<td>19</td>
<td>2.38</td>
<td>1.63</td>
<td>1.32</td>
<td>0.853</td>
<td>0.571</td>
<td>0.147</td>
</tr>
<tr>
<td>Flower beds</td>
<td>1.33</td>
<td>0.241</td>
<td>0.182</td>
<td>0.145</td>
<td>0.101</td>
<td>0.0702</td>
<td>0.0230</td>
</tr>
<tr>
<td>Vineyards</td>
<td>0.0511</td>
<td>0.0119</td>
<td>0.0110</td>
<td>0.0101</td>
<td>0.00884</td>
<td>0.00844</td>
<td>0.00754</td>
</tr>
<tr>
<td>Nurseries</td>
<td>0.0295</td>
<td>0.0108</td>
<td>0.00971</td>
<td>0.00928</td>
<td>0.00850</td>
<td>0.00817</td>
<td>0.00750</td>
</tr>
<tr>
<td>Peaches</td>
<td>0.00800</td>
<td>0.00800</td>
<td>0.00800</td>
<td>0.00800</td>
<td>0.00795</td>
<td>0.00780</td>
<td>0.00738</td>
</tr>
<tr>
<td>Aggregate(^1)</td>
<td>555</td>
<td>97.4</td>
<td>72.3</td>
<td>57.2</td>
<td>39.2</td>
<td>26.1</td>
<td>6.46</td>
</tr>
</tbody>
</table>

\(^1\) Aggregate estimates are 1-in-10-year values that do not sum the above 1-in-10-year estimates for individual use patterns.

The modeled 1-in-10-year aggregate annual average exposure estimates are two orders of magnitude higher than concentrations monitored in the Barton Springs (up to 0.06 μg/L). Due to the conservative assumptions made in the conceptual model (e.g., no degradation after runoff) and the modeling of maximum application practices and simultaneous application, these values overestimate exposure. Use on home lawns accounts for the majority of aggregate exposure because of the assumptions of application to 70% of all residential areas (30% of the BSSEA) and of 25 applications made per year (due to no label limit on the number of applications). If applications to lawns were limited to once per year, exposure estimates would be reduced by approximately one order of magnitude (Table 11).

Table 11. 1-in-10-year Barton Springs EECs for Reduced Numbers of Applications to Lawns.

<table>
<thead>
<tr>
<th>Number of Applications per Year</th>
<th>Peak EEC (μg/L)</th>
<th>14-day EEC (μg/L)</th>
<th>21-day EEC (μg/L)</th>
<th>30-day EEC (μg/L)</th>
<th>60-day EEC (μg/L)</th>
<th>90-day EEC (μg/L)</th>
<th>Annual Avg. EEC (μg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>183</td>
<td>21.4</td>
<td>15.9</td>
<td>11.4</td>
<td>5.71</td>
<td>3.81</td>
<td>0.943</td>
</tr>
<tr>
<td>1</td>
<td>97.4</td>
<td>12.8</td>
<td>8.88</td>
<td>6.44</td>
<td>3.23</td>
<td>2.15</td>
<td>0.536</td>
</tr>
</tbody>
</table>
The 1-in-10-year annual average EEC (0.536 µg/L) from one application of carbaryl to all home lawns in the action area is consistent with concentrations observed in the monitoring data for creeks in the BSSEA (0.47 µg/L) and within an order of magnitude of concentrations observed in the Barton Springs (0.06 µg/L). Multiple applications of carbaryl (25 applications with a 3-day reapplication interval) on approximately 10% of home lawns in the action area would, likewise, reduce exposure estimates (0.652 µg/L) to those consistent with monitored concentrations (Table 12). Table 13 lists EEC based on single applications to lawns and two applications to pastures with reduced spatial fractions.

### Table 12. 1-in-10-year Barton Springs EECs for Reduced Spatial Fractions of Use Areas Treated based on 25 applications with a 3-day Reapplication Interval.

<table>
<thead>
<tr>
<th>Spatial Fraction of Use Areas Treated</th>
<th>Peak EEC (µg/L)</th>
<th>14-day EEC (µg/L)</th>
<th>21-day EEC (µg/L)</th>
<th>30-day EEC (µg/L)</th>
<th>60-day EEC (µg/L)</th>
<th>90-day EEC (µg/L)</th>
<th>Annual Avg. EEC (µg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50%</td>
<td>277</td>
<td>48.7</td>
<td>36.2</td>
<td>28.6</td>
<td>19.6</td>
<td>13.1</td>
<td>3.23</td>
</tr>
<tr>
<td>25%</td>
<td>139</td>
<td>24.4</td>
<td>18.1</td>
<td>14.3</td>
<td>9.80</td>
<td>6.54</td>
<td>1.62</td>
</tr>
<tr>
<td>10%</td>
<td>55.5</td>
<td>9.75</td>
<td>7.24</td>
<td>5.72</td>
<td>3.92</td>
<td>2.62</td>
<td>0.652</td>
</tr>
</tbody>
</table>

### Table 13. 1-in-10-year Barton Springs EECs for Reduced Spatial Fractions of Use Areas Treated based on Single applications to lawns and two applications to Pastures.

<table>
<thead>
<tr>
<th>1-in-10 yr EECs</th>
<th>Peak (µg/L)</th>
<th>21-day (µg/L)</th>
<th>60-day (µg/L)</th>
<th>Annual Avg (µg/L)</th>
<th>No. of Apps</th>
<th>Interval (d)</th>
<th>% treated</th>
</tr>
</thead>
<tbody>
<tr>
<td>lawns</td>
<td>244</td>
<td>20.6</td>
<td>7.33</td>
<td>1.21</td>
<td>1</td>
<td>n/a</td>
<td>100</td>
</tr>
<tr>
<td>lawns</td>
<td>122</td>
<td>10.3</td>
<td>3.67</td>
<td>0.61</td>
<td>1</td>
<td>n/a</td>
<td>50</td>
</tr>
<tr>
<td>lawns</td>
<td>12.2</td>
<td>1.03</td>
<td>0.37</td>
<td>0.067</td>
<td>1</td>
<td>n/a</td>
<td>5</td>
</tr>
<tr>
<td>lawns</td>
<td>9.74</td>
<td>0.83</td>
<td>0.30</td>
<td>0.055</td>
<td>1</td>
<td>n/a</td>
<td>4</td>
</tr>
<tr>
<td>Pasture</td>
<td>23.0</td>
<td>2.17</td>
<td>0.84</td>
<td>0.14</td>
<td>2</td>
<td>14</td>
<td>100</td>
</tr>
<tr>
<td>Pasture</td>
<td>11.5</td>
<td>1.09</td>
<td>0.42</td>
<td>0.075</td>
<td>2</td>
<td>14</td>
<td>50</td>
</tr>
<tr>
<td>Pasture</td>
<td>5.75</td>
<td>0.55</td>
<td>0.21</td>
<td>0.041</td>
<td>2</td>
<td>14</td>
<td>25</td>
</tr>
<tr>
<td>Pasture</td>
<td>2.3</td>
<td>0.22</td>
<td>0.089</td>
<td>0.021</td>
<td>2</td>
<td>14</td>
<td>10</td>
</tr>
<tr>
<td>Pasture</td>
<td>13.6</td>
<td>1.05</td>
<td>0.37</td>
<td>0.067</td>
<td>1</td>
<td>n/a</td>
<td>100</td>
</tr>
<tr>
<td>Pasture</td>
<td>10.2</td>
<td>0.79</td>
<td>0.28</td>
<td>0.052</td>
<td>1</td>
<td>n/a</td>
<td>75</td>
</tr>
<tr>
<td>Pasture</td>
<td>6.81</td>
<td>0.53</td>
<td>0.19</td>
<td>0.037</td>
<td>1</td>
<td>n/a</td>
<td>50</td>
</tr>
<tr>
<td>Pasture</td>
<td>3.41</td>
<td>0.27</td>
<td>0.098</td>
<td>0.022</td>
<td>1</td>
<td>n/a</td>
<td>25</td>
</tr>
<tr>
<td>Pasture</td>
<td>1.36</td>
<td>0.11</td>
<td>0.043</td>
<td>0.013</td>
<td>1</td>
<td>n/a</td>
<td>10</td>
</tr>
</tbody>
</table>

4. Effects Assessment

This assessment evaluates the potential for carbaryl to adversely affect the Barton Springs salamander. As previously discussed in Section 2.7, assessment endpoints for the Barton Springs salamander include direct toxic effects on the survival, reproduction, and growth of the salamander itself, as well as indirect effects, such as reduction of the prey base and/or modification of its habitat. Direct effects to the Barton Springs salamander are based on toxicity information for freshwater vertebrates, including fish, which are generally used as a surrogate for
amphibians, as well as available amphibian toxicity data from the open literature. Given that the salamander’s prey items and habitat requirements are dependent on the availability of freshwater aquatic invertebrates and aquatic plants, toxicity information for various freshwater aquatic invertebrates and plants is also discussed. Acute (short-term) and chronic (long-term) toxicity information is characterized based on registrant-submitted studies and a comprehensive review of the open literature on carbaryl.

The available information also indicates that aquatic organisms are more sensitive to the technical grade (TGAI) than the formulated products of carbaryl; therefore, the focus of this assessment is on the TGAI of carbaryl.

Toxicity endpoints are established based on data generated from guideline studies submitted by the registrant, and from open literature studies that meet the criteria for inclusion into the ECOTOX database maintained by EPA/Office of Research and Development (ORD) (U.S. EPA, 2004). Open literature data presented in this assessment were obtained from the 2003 carbaryl IRED (U.S. EPA, 2004b) as well as information obtained from ECOTOX on December 14, 2006. The December 2006 ECOTOX search included all open literature data for carbaryl and 1-naphthol (i.e., pre- and post-IRED). In order to be included in the ECOTOX database, papers must meet the following minimum criteria:

- the toxic effects are related to single chemical exposure;
- the toxic effects are on an aquatic or terrestrial plant or animal species;
- there is a biological effect on live, whole organisms;
- a concurrent environmental chemical concentration/dose or application rate is reported; and
- there is an explicit duration of exposure.

Data that pass the ECOTOX screen are evaluated along with the registrant-submitted data, and may be incorporated qualitatively or quantitatively into this endangered species assessment. In general, effects data in the open literature that are more conservative than the registrant-submitted data are considered.

Toxicity testing reported in this section is based on studies using only a few surrogate species for freshwater. The assessment of risk or hazard makes the assumption that fish and aquatic-phase amphibian sensitivities to carbaryl are similar.
4.1. Evaluation of Aquatic Ecotoxicity Studies for Carbaryl

As described in the Agency’s Overview Document (U.S. EPA, 2004), the most sensitive endpoint for each taxa is evaluated. For this assessment, evaluated taxa relevant to the aquatic habitat of the BSS include freshwater fish, freshwater aquatic invertebrates, and freshwater aquatic plants. Currently, no guideline tests exist for frogs. Therefore, surrogate species are used as described in the Overview Document (U.S. EPA, 2004). In addition, aquatic-phase amphibian ecotoxicity data from the open literature are qualitatively discussed. **Table 14** summarizes the most sensitive ecological toxicity endpoints for the BSS, its prey and its habitat, based on an evaluation of both the submitted studies and the open literature, as previously discussed. A brief summary of submitted and open literature data considered relevant to this ecological risk assessment for the BSS is presented below. Additional information is provided in Appendix A.

Table 14. Summary of acute and chronic toxicity estimates for freshwater aquatic organisms using technical grade carbaryl.

<table>
<thead>
<tr>
<th>Species</th>
<th>Acute Toxicity</th>
<th>Chronic Toxicity</th>
<th>Affected Endpoints</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>96-hr LC₅₀ (mg/L)</td>
<td>48-hr EC₅₀ (mg/L)</td>
<td>Acute Toxicity (MRID)</td>
</tr>
<tr>
<td>Atlantic Salmon</td>
<td>0.220</td>
<td>--</td>
<td>highly toxic (40098001)</td>
</tr>
<tr>
<td><em>Salmo salar</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fathead Minnow</td>
<td>7.7</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td><em>Pimephales promelas</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stonefly</td>
<td>0.0017</td>
<td>--</td>
<td>very highly toxic (400980-01)</td>
</tr>
<tr>
<td><em>Isoroperla grammatica</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water flea</td>
<td>0.0056</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td><em>Daphnia magna</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freshwater diatom</td>
<td>14-day EC₅₀</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td><em>Navicula spp.</em></td>
<td>0.66</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duckweed</td>
<td>!4-day EC₅₀=1.5</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td><em>Lemma gibba</em></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

¹ Estimated NOEC using acute to chronic ratio for fathead minnow.
² Estimated NOEC using acute to chronic ratio for *Daphnia magna*

Acute toxicity to aquatic fish and invertebrates is categorized using the system shown in **Table 15** (U.S. EPA, 2004). Toxicity categories for aquatic plants have not been defined. Based on these categories, at most, carbaryl is classified very highly toxic to freshwater fish and invertebrates on an acute exposure basis.
4.1.1. Toxicity to Freshwater Fish

As previously discussed, no guideline toxicity tests currently exist for frogs; therefore, freshwater fish are used as surrogate species for amphibians including frogs (U.S. EPA, 2004). The available open literature information on carbaryl toxicity to aquatic-phase amphibians, which is provided in Section 4.1.2, shows that acute and chronic ecotoxicity endpoints for amphibians are generally less sensitive than fish. Therefore, endpoints based on freshwater fish ecotoxicity data are assumed to be protective of potential direct effects to aquatic-phase amphibians, including the BSS. A summary of acute and chronic freshwater fish data, including sublethal effects, is provided below.

4.1.1.1. Freshwater Fish: Acute Exposure (Mortality) Studies

On an acute exposure basis, technical grade (purity > 90%) carbaryl ranged in toxicity from highly to slightly toxic (LC$_{50}$ = 0.22 - 20 mg/L) to freshwater fish and to fish that spend a portion of their life cycle in fresh water, such as the Atlantic salmon (Salmo salar). Although the carbaryl IRED (U.S. EPA 2004b) listed the most sensitive fish (Atlantic salmon) as having an 96-hr LC$_{50}$ value of 0.25 mg/L, a reanalysis of the raw data using the PROC Probit procedure of SAS® (SAS® Institute, Release 9.1.3, Cary, NC) indicated that the 96-hr LC$_{50}$ is 0.22 mg/L. Figure 12 shows a cumulative percent frequency distribution of 96-hour LC$_{50}$ values for freshwater fish and demonstrates that for the majority (78%) of fish tested, carbaryl was moderately toxic (LC$_{50}$ range: 1 - 10 mg/L). In general, coldwater species (e.g., salmonids) appear to be more sensitive to carbaryl than warm water species (e.g., centrarchid sunfish and bass). Although Atlantic salmon (Salmo salar) are used as the most sensitive species (96-hr LC$_{50}$ = 0.220 mg/L), they represent an extreme in the range of sensitivities among freshwater fish; assuming a log-normal distribution for the LC$_{50}$ values, the mean is 1.28 mg/L and the lower 5% confidence interval is 1.23 mg/L. LC$_{50}$ values for the typical end use products (purity range: 5 to 82%) from 1.4 to 290 mg/L, falling in the moderately to practically nontoxic categories. Toxicity testing of carbaryl’s hydrolysis degrade 1-naphthol in fish shows that the compound ranged from being highly toxic to rainbow trout (LC$_{50}$ = 0.75 mg/L) to moderately toxic to bluegill sunfish (LC$_{50}$ = 1.6 mg/L) on an acute exposure basis (U.S. EPA, 2004b).

### Table 15. Categories of Acute Toxicity for Aquatic Organisms.

<table>
<thead>
<tr>
<th>LC$_{50}$ (mg/L)</th>
<th>Toxicity Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 0.100</td>
<td>Very highly toxic</td>
</tr>
<tr>
<td>&gt; 0.10 – 1.00</td>
<td>Highly toxic</td>
</tr>
<tr>
<td>&gt; 1.00 – 10.0</td>
<td>Moderately toxic</td>
</tr>
<tr>
<td>&gt; 10.0 – 100</td>
<td>Slightly toxic</td>
</tr>
<tr>
<td>&gt; 100</td>
<td>Practically nontoxic</td>
</tr>
</tbody>
</table>

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4.1.1.2. Freshwater Fish: Chronic Exposure (Growth/Reproduction) Studies

Similar to the acute data, chronic freshwater fish toxicity studies are used to assess potential direct effects to the BSS because direct chronic toxicity guideline data for frogs do not exist. Chronic exposure of fathead minnows (*Pimephales promelas*) to carbaryl resulted in reduced survival and reproductive effects (NOEC = 0.210 mg/L) including reduced number of eggs per female and reduced number of eggs spawned. Chronic exposure of fathead minnows to 1-naphthol reduced larval growth and survival (NOEC = 0.1 mg/L). However, since Atlantic salmon are the most sensitive species on an acute exposure basis and no chronic toxicity data are available, an acute to chronic ratio was used to estimate the chronic toxicity of carbaryl to Atlantic salmon. Based on the information contained in the carbaryl IRED (U.S. EPA, 2004b), the 96-hr acute LC$_{50}$ value for fathead minnows is 7.7 mg/L. With an acute LC$_{50}$ of 7.7 mg/L and a chronic NOEC of 0.21, the acute to chronic ratio (ACR) for fathead minnow is 36.7 (7.7÷0.21). When the ACR is applied to the Atlantic salmon data, the resulting estimated NOAEC is 0.0068 mg/L.

4.1.2. Toxicity to Aquatic-phase Amphibians

Available toxicity information on potential carbaryl-related mortality and sublethal effects to aquatic-phase amphibians from the open literature is summarized below in Sections 4.1.2.1 and 4.1.2.2, respectively. Guideline ecotoxicity studies for amphibians are not available.

The majority of data available on amphibians focused on the aquatic-phase larval (tadpole) stage of frogs. Carbaryl ranged from moderately toxic (96-hr LC$_{50} = 8.4$ mg/L) to Southern leopard frogs (*Rana sphenoecephalia*) to slightly toxic (96-hr LC$_{50} = 12.2$ mg/L) to boreal toads (*Bufo boreas*) on an acute exposure basis (Appendix A). In toxicity testing with formulated product (purity = 50% carbaryl) was practically nontoxic to bullfrogs (*Rana catesbeiana*) with a LD$_{50}$
greater than 4,000 mg/kg (MRID 00160000). The sensitivity of tadpoles to carbaryl exhibited considerable intra- and interspecies variability. Depending on the stage of development, the conditions of exposure, and which frog populations were sampled, frog susceptibility to carbaryl varied. For example, the 96-hr LC$_{50}$ for green frogs (Rana clamitans) roughly doubled when temperature dropped from 27°C (LC$_{50}$ = 11.3 mg/L) to 17°C (LC$_{50}$ = 22 mg/L).

The U.S. Geological Survey Biological Resource Division’s Columbia Environmental Research Center has examined the effects of carbaryl on amphibians (Appendix A). These studies have shown that frogs can exhibit considerable intraspecies (Boone and Bridges, 1998) and interspecies (Boone and Semlitsch, 2002) variability in their response to carbaryl exposure. Genetic factors and stage of development during which exposure took place can impact the vulnerability of frogs. For example, frogs exposed during egg stage had lower weights than corresponding control animals and nearly 18% of leopard frogs exposed to carbaryl during development exhibited some type of developmental deformity (including visceral and limb malformations). Additionally, environmental conditions such as temperature appear to impact the sensitivity of frogs to carbaryl. In a 96-hr acute toxicity study, green frogs (Rana clamitans) had an LC$_{50}$ of 22.0 mg/L at 17°C but at 27°C the LC$_{50}$ was roughly half (96-hr LC$_{50}$ = 11.32 mg/L) (Boone and Bridges, 1998).

Furthermore, in studies comparing the direct toxicity of carbaryl to Southern leopard frogs (Lithobates sphenoecephala formerly Rana sphenoecephala) and fish, tadpoles were relatively tolerant (96-hr LC$_{50}$ = 8.4 mg/L) to carbaryl compared to bluegill sunfish (96-hr LC$_{50}$ = 6.2 mg/L), fathead minnow (96-hr LC$_{50}$ = 5.21 mg/L) and rainbow trout (LC$_{50}$ = 1.88 mg/L). The study also reports the 96-hr LC$_{50}$ (12.31 mg/L) for the boreal toad (Bufo boreas); these data suggest that the surrogate fish species used to evaluate the toxicity to carbaryl are protective for amphibians (Bridges et al., 2002).

Several studies have suggested that carbaryl exposure impairs predator avoidance behavior in frogs (Bridges, 1997; Bridges, 1999), affects the length of time required for tadpoles to complete metamorphosis into adults (Boone and Semlitsch, 2002), and affected the weight of animals undergoing metamorphosis. Carbaryl concentrations greater than 3.5 mg/L significantly affected the time tadpoles spent being active where control animals exhibited greater sprint speeds and were able to swim greater distances (Bridges, 1997). Slower swimming speeds, altered activity patterns and prolonged juvenile stages have been suggested as increasing the vulnerability of frogs to predation (Bridges, 1997; Bridges, 1999; Relyea and Mills, 2001) and/or that the threat of predation renders the animals more susceptible to the direct toxicity of carbaryl (Relyea and Mills 2001). While the Relyea and Mills paper indicates that carbaryl was 2 to 4 times more lethal to gray treefrogs (Hyla versicolor) in the presence of a predator, the study is confounded by the potential effects of water quality on mortality (Appendix A).

Additionally, increased vulnerability to predation assumes that only the prey are incapacitated by carbaryl. The Bridges (1999) study indicates however, the predators may also be impacted and that gray treefrogs actually spent less time being active, but that the active times were primarily spent foraging. However, in some cases, it is unclear whether the effects of carbaryl on amphibians have been entirely adverse. For example, Southern leopard frogs exposed to carbaryl at 5 mg/L exhibited a 20% increase in weight at metamorphosis (Bridges and Boone,
2003) and that at concentrations as high as 7 mg/L, Woodhouse’s toad (Bufo woodhousii) survival was roughly 30% higher than controls (Boone and Semlitsch, 2002). The increase in weight of leopard frogs was attributed to the indirect effect of carbaryl in reducing zooplankton that would normally have competed with tadpoles for phytoplankton. With zooplankton numbers reduced by carbaryl treatments, phytoplankton increased thereby increasing the amount of food available to tadpoles. However, aquatic-phase amphibians such as the Barton Springs salamander that forage on zooplankton would not likely benefit since their food source would be diminished.

Additionally, open literature suggests that the toxicity of carbaryl to amphibians is enhanced in the presence of light (Zaga et al., 1998); the study reports that in the absence of simulated sunlight, the 96-hr LC50 for larval African clawed frogs (Xenopus laevis) and gray treefrogs (Hyla versicolor) are 1.73 and 2.47 mg/L, respectively (Appendix A). In the presence of simulated light, the number of mortalities was higher; however, the study did not provide revised 96-hr LC50 estimates for the combination of carbaryl plus simulated sunlight. The extent to which sunlight can increase the sensitivity of aquatic-phase amphibians to carbaryl is uncertain.

On a chronic exposure basis, carbaryl has been shown to have the potential to adversely affect amphibians. Southern leopard frog tadpoles exposed to carbaryl during development exhibited developmental deformities, including both visceral and limb malformations, compared to less than 1% in control tadpoles (Bridges, 2000). Although the length of the larval period was the same for all experimental groups, tadpoles exposed throughout the egg stage were smaller than their corresponding controls. However, in some cases, it is unclear whether the effects of carbaryl on amphibians have been entirely adverse. For example, Southern leopard frogs exposed to carbaryl at 5 mg/L exhibited a 20% increase in weight at metamorphosis (Bridges and Boone, 2003) and that at concentrations as high as 7 mg/L, Woodhouse’s toad (Bufo woodhousii) survival was roughly 30% higher than controls (Boone and Semlitsch, 2002).

None of the amphibian toxicity data reviewed in the open literature were considered sufficiently robust to use quantitatively for risk assessment purposes. The available lines of evidence suggest however, that both aquatic and terrestrial-phase amphibians are less sensitive to carbaryl than the most sensitive fish discussed in the preceding sections. The open literature is useful though in characterizing potential indirect effects of carbaryl that may impact aquatic-phase amphibians, particularly as they relate to reductions in zooplankton (Bridges and Boone 2003).

No data are available on the acute or chronic toxicity of 1-naphthol to amphibians.

4.1.3. Toxicity to Freshwater Invertebrates

Barton Springs salamanders feed on a wide range of freshwater aquatic invertebrates including ostracods, copepods, chironomids, snails, amphipods, mayfly larvae, leeches, and adult riffle beetles. Based on analysis of the stomach and fecal samples from a limited number of adult and juvenile Barton Springs salamanders, the most prevalent organisms found were ostracods, amphipods, and chironomids (USFWS, 2005). However, data on the relative percentage of each type of aquatic invertebrate in the salamander’s diet are not available.
A summary of acute and chronic freshwater invertebrate data, including published data in the open literature since completion of the IRED (U.S. EPA, 2004b), is provided below in Sections 4.1.3.1 through 4.1.3.3.

4.1.3.1. Freshwater Invertebrates: Acute Exposure Studies

Technical grade carbaryl is very highly toxic to aquatic invertebrates with EC$_{50}$ values ranging from 0.0017 - 0.026 mg/L on an acute exposure basis. Stoneflies (*Isoperla grammatica*) are the most sensitive freshwater invertebrate in an acute toxicity study (96-hr LC$_{50}$=0.0017 mg/L). Figure 13 shows a cumulative percent distribution of 96-hr EC$_{50}$ values for freshwater invertebrates; roughly 80% of the species tested had EC$_{50}$ values between 0.002 and 0.006 mg/L. In general, freshwater invertebrates exhibited the same sensitivity (EC$_{50}$ range: 0.007 - 0.013 mg/L) to formulated end products (purity range: 44 - 81%). In studies examining the toxicity of carbaryl to aquatic invertebrates in the presence of sediment, toxicity values were more widely distributed (EC$_{50}$ range 0.005 to > 2.5 mg/L) suggesting that a tendency of carbaryl and its hydrolysis degradate 1-naphthol to partition to sediment may limit their bioavailability and hence reduce toxicity under more natural exposure conditions.

Studies have indicated that acute exposure to carbaryl impacts predator avoidance mechanisms in invertebrates (Hanazato, 1995), reduces overall zooplankton abundance (Havens, 1995; Hanazato, 1989), and may actually promote phytoplankton growth through reduced predation by zooplankton (Bridges and Boone, 2003). As discussed previously, though, while decreases in zooplankton can benefit aquatic-phase amphibians that depend on phytoplankton, decreased zooplankton can reduce growth and survival of those aquatic animals, such as the Barton Springs salamander, that forage on zooplankton.

![Figure 13. Cumulative freshwater invertebrate sensitivity distribution (LC$_{50}$ values).](image-url)
Exposure of freshwater invertebrates to 1-naphthol indicated the degradate ranged from being moderately to highly toxic (EC\textsubscript{50} range: 0.2 - 3.3 mg/L) to \textit{D. magna} (U.S. EPA, 2004b) to aquatic invertebrates on an acute exposure basis.

\textbf{4.1.3.2. Freshwater Invertebrates: Chronic Exposure Studies}

On a chronic exposure basis, carbaryl affected reproduction (NOEC = 0.0015 mg/L) in water fleas (\textit{Daphnia magna}). However, since stoneflies are the most sensitive invertebrate species on an acute exposure basis and no chronic toxicity data are available, an acute to chronic ratio was used to estimate the chronic toxicity of carbaryl to stoneflies. Based on the information contained in the carbaryl IRED (U.S. EPA, 2004b), the 48-hr acute LC\textsubscript{50} value for \textit{Daphnia magna} is 0.0056 mg/L. With an acute LC\textsubscript{50} of 0.0056 mg/L and a chronic NOEC of 0.0015, the acute to chronic ratio (ACR) for fathead minnow is 3.73 (0.0056÷0.0015). When the ACR is applied to the stonefly data, the resulting estimated NOAEC is 0.0005 mg/L.

Chronic toxicity data for 1-naphthoehol using \textit{D. magna} (NOAEC=0.0095 mg/L indicates that the degradate is less toxic to aquatic invertebrates than the parent compound.

\textbf{4.1.4. Toxicity to Aquatic Plants}

Aquatic plant toxicity studies are used as one of the measures of effect to evaluate whether carbaryl may affect primary production. Primary productivity is essential for indirectly supporting the growth and abundance of the BSS. In addition to providing cover, aquatic plants harbor a variety of aquatic invertebrates that aquatic-phase BSS eat.

Two types of studies are used to evaluate the potential of carbaryl to affect primary productivity. Laboratory studies are used to determine whether carbaryl may cause direct effects to aquatic plants. In addition, the threshold concentrations, described in Section 4.1, are used to further characterize potential community level effects to BSS resulting from potential effects to aquatic plants. A summary of the laboratory data for aquatic plants is provided in Section 4.1.4.1.

\textbf{4.1.4.1. Toxicity to Freshwater Non-vascular Plants}

Only two studies of the filamentous green algae \textit{Pseudokirchneriella subcapitata} were available to assess the toxicity of carbaryl to aquatic plants. With technical grade carbaryl the concentration inhibiting plant growth (in terms of number of algal cells) by 50\% (IC\textsubscript{50}) is 1.27 mg/L. The most sensitive freshwater aquatic plant is the freshwater diatom \textit{Navicula} with an EC\textsubscript{50} of 0.66 mg/L.

Carbaryl was roughly similar to the endpoint for formulated product (IC\textsubscript{50} = 3.2 mg/L). In neither study were abnormalities in cell morphology or signs of phytotoxic effects observed. As reported earlier, carbaryl use has been associated with increases in phytoplankton numbers. Whether this is due to reduced predation by zooplankton as a result of their greater susceptibility to carbaryl and/or a response to 1-naphthol being a plant auxin is unclear.
4.1.4.1. Toxicity to Freshwater Vascular Plants

In a supplemental study (MRID 423721-02) with duckweed (Lemna gibba), the 14-day EC<sub>50</sub> was 1.5 mg/L based on reduced number of fronds. ECOTOX provided limited information on the toxicity of carbaryl to aquatic plants. In a study by Peterson et al. 1994, a single concentration of carbaryl (3.67 mg/L) resulted in 33% inhibition of L. gibba growth after 7-days static exposure (Appendix A). Although the study suggests that carbaryl has an effect on vascular aquatic plant growth, the study does not provide any information on dose response given that only a single concentration was tested.

4.1.5. Freshwater Field Studies

Mesocosm studies with carbaryl provide measurements of primary productivity that incorporate the aggregate responses of multiple species in aquatic communities. Because various aquatic species vary widely in their sensitivity to carbaryl, the overall response of the aquatic community may be different from the responses of the individual species measured in laboratory toxicity tests. Mesocosm studies allow observation of population and community recovery from carbaryl effects and of indirect effects on higher trophic levels. In addition, mesocosm studies, especially those conducted in outdoor systems, incorporate partitioning, degradation, and dissipation, factors that are not usually accounted for in laboratory toxicity studies, but that may influence the magnitude of ecological effects.

The screening-level risk assessment reviewed several mesocosm studies of carbaryl and demonstrated that overall the results of these studies are highly variable. Studying natural plankton communities in enclosed mesocosms, Havens (1995) reports a decline in total zooplankton biomass and individuals across the range of carbaryl treatments (0 - 100 µg/L). Furthermore, at carbaryl concentrations greater than 20 µg/L Daphnia was no longer found and that at concentrations above 50 µg/L all cladocerans were eliminated, resulting in an increase in algal biomass, representing a repartitioning of biomass from zooplankton to phytoplankton. Hanazato (1995) exposed Daphnia ambigua to carbaryl and a kairomone released by the predator Chaoborus (phantom midge) simultaneously. Daphnia developed helmets in response to the kairomone, but not in response to carbaryl at 1-3 µg/L. However, carbaryl enhanced the development of high helmets and prolonged the maintenance period of the helmets in the presence of the kairomone, suggesting that at low concentrations carbaryl can alter predator-prey interactions by inducing helmet formation and vulnerability to predation in Daphnia. In related mesocosms studies, exposure to carbaryl at 1 ppm killed all plankton species, including Chaoborus larvae (Hanazato, 1989). However, this concentration is well above the maximum EECS modeled for carbaryl, and is unlikely that such high levels of this chemical would be found under field conditions.

In some cases, mesocosms exposed to carbaryl exhibited transitory effects. In a study by Boone et al., 2003 (Appendix A), carbaryl exposure significantly reduced chlorophyll concentrations 12-days after exposure; however, by the end of the study, there was no difference between carbaryl treated and control. While these studies demonstrate that a range of factors (e.g.,
hydronper period and larval density) can influence the effects of carbaryl alone or in combination with other pesticides (e.g., atrazine) the sensitivity of the amphibians in these studies is less than the surrogate fish species reported earlier.

4.1.5. Carbaryl Formulated Product Toxicity

As discussed previously, toxicity testing of carbaryl formulated product with aquatic animals has indicated that none of the formulations tested were more toxic than the technical grade active ingredient (Table 16). A review of formulated product testing conducted with rats indicates that none of the formulated products (including those involving a second active ingredient, i.e., metaldehyde, were more toxic than the technical grade (Sevin® Technical LD₅₀=614 mg/kg body weight). Further analysis of the toxicity of formulated products is included in Appendix K.

Table 16. Rat acute 96-hr oral toxicity test data for formulated products of carbaryl.

<table>
<thead>
<tr>
<th>Formulated Product</th>
<th>Percent Active Ingredient</th>
<th>Rat Acute Oral LD₅₀ (mg/kg body weight)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sevin® Brand 85 Sprayable Insecticide</td>
<td>85% Carbaryl</td>
<td>&gt;50</td>
</tr>
<tr>
<td>Sevin® Technical</td>
<td>99.45%</td>
<td>614</td>
</tr>
<tr>
<td>Sevin® XLR Plus Carbaryl Insecticide</td>
<td>44.1%</td>
<td>698.5</td>
</tr>
<tr>
<td>Sevin® Brand Granular Insecticide</td>
<td>7%</td>
<td>3240</td>
</tr>
<tr>
<td>Sevin® 5 Bait</td>
<td>5%</td>
<td>3129</td>
</tr>
<tr>
<td>Sevin® 10% Granules</td>
<td>10%</td>
<td>3620</td>
</tr>
<tr>
<td>Turf Pride Fertilizer with 2% Sevin®</td>
<td>2%</td>
<td>3129</td>
</tr>
<tr>
<td>Corry’s Slug, Snail and Insect Killer</td>
<td>5% carbaryl 2% metaldehyde</td>
<td>&gt;5000</td>
</tr>
<tr>
<td>Anderson’s 8% Granular</td>
<td>8%</td>
<td>1750</td>
</tr>
<tr>
<td>GrubTo®x Lawn Grub and Insect Killer</td>
<td>4.6%</td>
<td>3129</td>
</tr>
<tr>
<td>Bonide® Slug, Snail and Sowbug Bait</td>
<td>5% carbaryl 2% metaldehyde</td>
<td>&gt;5000</td>
</tr>
<tr>
<td>Sevin® 4% Plus Fertilizer</td>
<td>4%</td>
<td>5000</td>
</tr>
<tr>
<td>Sevin® Brand Granular Insecticide</td>
<td>6.3%</td>
<td>&gt;5000</td>
</tr>
</tbody>
</table>

5. Risk Characterization

Risk characterization is the integration of the exposure and effects characterizations to determine the potential ecological risk from varying carbaryl use scenarios within the action area and likelihood of direct and indirect effects on the Barton Springs salamander. The risk characterization provides an estimation and a description of the likelihood of adverse effects; articulates risk assessment assumptions, limitations, and uncertainties; and synthesizes an overall conclusion regarding the effects determination (i.e., “no effect,” “likely to adversely affect,” or “may affect, but not likely to adversely affect”) for the Barton Springs salamander.

5.1 Risk Estimation

Risk is estimated by calculating the ratio of exposure to toxicity using 1-in-10-year estimated environmental concentrations (EECs; Table 10) and the appropriate toxicity endpoint (see Table 14). This ratio is the risk quotient (RQ), which is then compared to pre-established acute and chronic levels of concern (LOCs) for each category evaluated (Appendix G). For acute
exposures to the salamander and invertebrates, the LOC is 0.05. The LOC for chronic exposures to fish and invertebrates, as well as acute exposures to aquatic plants is 1.0.

RQs were based on the most sensitive endpoints and modeled surface water concentrations from the following scenarios for carbaryl:

- outdoor ornamental use @ 7.8 lbs a.i./A; 4 applications with 7 days between applications
- peach use @ 4 lbs a.i./A; 3 applications, twice in-season with 15 days between applications and once at dormancy
- grape use @ 2 lbs a.i./A; 5 applications with 7 days between applications
- pasture use @ 1.5 lbs a.i./A; 2 applications with 14 days between applications
- home lawns, parks, flower beds around building use @ 8.4 lbs a.i./A; 25 applications with 3 days between applications (number of applications and reapplication interval assumed in the lack of label statements)
- home lawns @ 9.1 lbs a.i./A; 2 applications with 7 days between applications.

In addition, RQs were derived based on the aggregate exposure of the six uses listed above.

5.1.1 Direct Effects

For assessing risks of direct effects to the salamander, 1-in-10 year peak EECs are used with the lowest acute toxicity value for fish in order to derive acute risk quotients for the salamander. For chronic risks, 1-in-10 year peak 60-day EECs and the lowest chronic toxicity value for fish are used to derive RQ values for the salamander.

Based on RQ values calculated using individual 1-in-10 year EECs for waters within the Barton Springs proper, for acute exposures, the acute risk to listed species LOC (RQ≥0.05) is exceeded for carbaryl use on lawns (RQ=2.4), and pasture (RQ=0.10. Additionally, acute exposure of the salamander to carbaryl from all uses (aggregate) exceeds (RQ=2.5) the acute risk LOC for listed species. For chronic exposures, the LOC is exceeded for lawn uses (RQ=5.6) (Table 17) and for the aggregate of all uses (RQ=5.8).
Table 17. Direct Effect RQs for the Barton Springs Salamander based on refined EECs.

<table>
<thead>
<tr>
<th>Duration of Exposure</th>
<th>Toxicity Value (μg/L)</th>
<th>Use</th>
<th>EEC (μg/L)³</th>
<th>RQ</th>
<th>LOC Exceedance?⁴</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute 220</td>
<td></td>
<td>Lawns</td>
<td>534</td>
<td>2.43</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pasture</td>
<td>23.0</td>
<td>0.10</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Park</td>
<td>19</td>
<td>0.09</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Flower Beds</td>
<td>1.33</td>
<td>0.01</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vineyard</td>
<td>0.0511</td>
<td>&lt;0.01</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nusery</td>
<td>0.0295</td>
<td>&lt;0.01</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Peach</td>
<td>0.008</td>
<td>&lt;0.01</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Aggregate</td>
<td>555</td>
<td>2.52</td>
<td>Yes</td>
</tr>
<tr>
<td>Chronic 6.8</td>
<td></td>
<td>Lawns</td>
<td>38.1</td>
<td>5.60</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pasture</td>
<td>0.835</td>
<td>0.12</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Park</td>
<td>0.853</td>
<td>0.13</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Flower Beds</td>
<td>0.101</td>
<td>0.01</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vineyard</td>
<td>0.00884</td>
<td>&lt;0.01</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nusery</td>
<td>0.00850</td>
<td>&lt;0.01</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Peach</td>
<td>0.00795</td>
<td>&lt;0.01</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Aggregate</td>
<td>39.2</td>
<td>5.8</td>
<td>Yes</td>
</tr>
</tbody>
</table>

¹ 96-h LC₅₀ value (220 μg/L) from toxicity study with Atlantic salmon (MRID 400980-01).
² NOAEC (6.8 μg/L) based on acute to chronic ratio.
³ EECs are from Table 10. RQs for acute exposures utilize peak EECs, while RQs for chronic exposures utilize 60-day EECs.
⁴ For acute exposures, the LOC is 0.05. For chronic exposures, the LOC is 1.0.
⁵ Aggregate use represents the sum of carbaryl from all uses.
⁶ Potentially exceeds chronic risk level of concern (RQ≥1.0)

### 5.1.2 Indirect Effects

**5.1.2.1 Evaluation of Potential Indirect Effects via Reduction in Food Items (Freshwater Invertebrates)**

For assessing risks of indirect effects to the salamander due to effects to its prey, RQs were derived for freshwater invertebrates based on EECs representative of concentrations of carbaryl in the springs. Peak 1-in-10 year EECs for the Barton Springs are used with the lowest acute toxicity value for invertebrates in order to derive acute risk quotients for invertebrates. For chronic risks, 1-in-10 year peak EECs over a 21-day period and the lowest chronic toxicity value for freshwater invertebrates are used to derive RQ values.

For acute exposures, the acute risk to listed species LOC (RQ≥0.05) is exceeded for use on lawns (RQ=314), pasture (RQ=14), parks (RQ=11), flower around buildings beds (RQ=0.78) and for aggregated uses (RQ=326). Chronic exposures of invertebrates to carbaryl from lawns (RQ=141), pasture (RQ=4.3), park (RQ=3.3) and aggregated uses (RQ=145) exceed the chronic risk LOC (Table 18).
Table 18. Invertebrate RQs relevant to indirect effects to the Barton Springs Salamander.

<table>
<thead>
<tr>
<th>Duration of Exposure</th>
<th>Toxicity Value (μg/L)</th>
<th>Use</th>
<th>EEC (μg/L)³</th>
<th>RQ</th>
<th>LOC Exceedance? ² ⁴</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute</td>
<td>1.7</td>
<td>Lawns</td>
<td>534</td>
<td>314</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pasture</td>
<td>23.0</td>
<td>13.5</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Park</td>
<td>19</td>
<td>112</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Flower Beds</td>
<td>1.33</td>
<td>0.78</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vineyard</td>
<td>0.0511</td>
<td>0.03</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nursery</td>
<td>0.0295</td>
<td>0.02</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Peach</td>
<td>0.008</td>
<td>&lt;0.01</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Aggregate</td>
<td>555</td>
<td>326</td>
<td>Yes</td>
</tr>
<tr>
<td>Chronic</td>
<td>0.5</td>
<td>Lawns</td>
<td>70.4</td>
<td>141</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pasture</td>
<td>2.17</td>
<td>4.3</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Park</td>
<td>1.63</td>
<td>3.3</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Flower Beds</td>
<td>0.182</td>
<td>0.36</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vineyard</td>
<td>0.0110</td>
<td>0.02</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nursery</td>
<td>0.00971</td>
<td>0.02</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Peach</td>
<td>0.0080</td>
<td>0.02</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Aggregate</td>
<td>72.3</td>
<td>145</td>
<td>Yes</td>
</tr>
</tbody>
</table>

¹ 48-h EC₅₀ value (1.7 μg/L) from toxicity study with Isoperla grammatica.
² NOAEC value based on acute to chronic ratio (3.73) estimation (NOEC=0.5 μg/L).
³ EECs are from Table 10. RQs for acute exposures utilize peak EECs, while RQs for chronic exposures utilize 21-day EECs.
⁴ For acute exposures, the LOC is 0.05. For chronic exposures, the LOC is 1.0.
⁵ Aggregate use represents the sum of carbaryl from all uses.
⁶ Exceeds the acute risk to endangered species LOC (RQ=0.05)

5.1.2.2 Evaluation of Potential Indirect Effects via Reduction in Habitat and/or Primary Productivity (Freshwater Aquatic Plants)

For assessing risks of indirect effects to the salamander due to effects to its habitat, RQs were derived for aquatic plants based on EECs representative of concentrations of carbaryl in the springs. Peak 1-in-10 year EECs are used with the lowest acute toxicity value for aquatic plants in order to derive acute risk quotients for plants.

For all exposures, including the aggregate of all exposures, the acute risk to listed species LOC (RQ≥1.0) is not exceeded by RQs for aquatic plants (Table 19). Additionally, there are no reported field incidents involving plants related to the use of carbaryl. Therefore, at the application rates modeled and based on the available data, the use of carbaryl in the action area is not likely to indirectly affect the Barton Springs salamander based on reductions in aquatic plants.
Table 19. Aquatic plant RQs relevant to indirect effects to the Barton Springs Salamander.

<table>
<thead>
<tr>
<th>Plant Type</th>
<th>Toxicity Value (μg/L)</th>
<th>Use</th>
<th>EEC (μg/L)²</th>
<th>RQ</th>
<th>LOC Exceedance?³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nonvascular</td>
<td>660⁴</td>
<td>Lawns</td>
<td>534</td>
<td>0.81</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pasture</td>
<td>23.0</td>
<td>0.03</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Park</td>
<td>19</td>
<td>0.03</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Flower Beds</td>
<td>1.33</td>
<td>&lt;0.01</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vineyard</td>
<td>0.0511</td>
<td>&lt;0.01</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nursery</td>
<td>0.0295</td>
<td>&lt;0.01</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Peach</td>
<td>0.008</td>
<td>&lt;0.01</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Aggregate</td>
<td>555</td>
<td>0.84</td>
<td>No</td>
</tr>
<tr>
<td>Vascular</td>
<td>1500⁵</td>
<td>Lawns</td>
<td>534</td>
<td>0.36</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pasture</td>
<td>23.0</td>
<td>0.02</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Park</td>
<td>19</td>
<td>0.01</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Flower Beds</td>
<td>1.33</td>
<td>0.01</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vineyard</td>
<td>0.0511</td>
<td>&lt;0.01</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nursery</td>
<td>0.0295</td>
<td>&lt;0.01</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Peach</td>
<td>0.008</td>
<td>&lt;0.01</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Aggregate</td>
<td>555</td>
<td>0.37</td>
<td>No</td>
</tr>
</tbody>
</table>

¹ EC₅₀ value from toxicity study with freshwater diatom (MRID 424316-01).
² EC₅₀ value from toxicity study with duckweed (MRID 423721-02)
³ RQs are from Table 10. RQs utilize peak EECs.
⁴ For exposures to plants, the LOC is 1.0.
⁵ Aggregate use represents the sum of carbaryl from all uses.

5.2 Risk Description

The risk description synthesizes an overall conclusion regarding the likelihood of adverse impacts leading to an effects determination (i.e., “no effect,” “may affect, but not likely to adversely affect,” or “likely to adversely affect”) for the Barton Springs salamander.

If the RQs presented in the Risk Estimation (Section 5.1) show no indirect effects and LOCs for the Barton Springs salamander are not exceeded for direct effects, a “no effect” determination is made, based on carbaryl’s use within the action area. If, however, indirect effects are anticipated and/or exposure exceeds the LOCs for direct effects, the Agency concludes a preliminary “may affect” determination for the Barton Springs salamander.

Following a “may affect” determination, additional information is considered to refine the potential for exposure at the predicted levels based on the life history characteristics (i.e., habitat range, feeding preferences, etc) of the Barton Spring salamander and potential community-level effects to aquatic plants. Based on the best available information, the Agency uses the refined evaluation to distinguish those actions that “may affect, but are not likely to adversely affect” from those actions that are “likely to adversely affect” the Barton Springs salamander.

The criteria used to make determinations that the effects of an action are “not likely to adversely affect” the Barton Springs salamander include the following:

- **Significance of Effect:** Insignificant effects are those that cannot be meaningfully measured, detected, or evaluated in the context of a level of effect where “take”
occurs for even a single individual. “Take” in this context means to harass or harm, defined as the following:

- Harm includes significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering.
- Harass is defined as actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering.

- Likelihood of the Effect Occurring: Discountable effects are those that are extremely unlikely to occur. For example, use of dose-response information to estimate the likelihood of effects can inform the evaluation of some discountable effects.
- Adverse Nature of Effect: Effects that are wholly beneficial without any adverse effects are not considered adverse.

A description of the risk and effects determination for each of the established assessment endpoints for the Barton Springs salamander is provided in Sections 5.2.1 through 5.2.3.

5.2.1 Direct Effects to the Barton Springs Salamander

Based on exposure estimates for use of carbaryl on individual (lawns and pasture) uses alone and for the aggregate exposure within the action area, the acute risk to endangered species LOC is exceeded for direct effects to the salamander. Risk from the use of carbaryl on lawns is based on a spectrum of assumptions. The conservative assumptions include that there are 25 applications at a rate of 8.3 lbs a.i./A and that 100% of lawns are treated on the same day. A lower labeled use pattern on lawns (2 applications of 9.1 lbs a.i./A) provides a less conservative, more realistic use estimate in which peak exposure estimates decline to 183 µg/L and the resulting risk quotient is 0.83. Thus, estimates based on realistic assumptions about use still exceed the acute risk to listed species LOC. Even from a single application at the maximum rate, assuming 5% of lawns are treated on the same day (EEC=12.2 µg/L; Table 13)) results in an RQ (RQ=0.06) that exceeds the acute listed species LOC. Thus, carbaryl applications to lawns would have to be restricted to a single application to less than 5% of the lawns in the BSSEA to result in a no effect.

With respect to carbaryl use on pastures, two applications to 50% of the rangeland (EEC=12 µg/L; Table 13)) in the BSSEA would exceed (RQ=0.05) the acute risk to listed species LOC. A single application of carbaryl to more than 75% of the rangeland (EEC=10 µg/L) would also exceed the acute risk to listed species LOC (RQ=0.05).

The chronic risk RQ value for use of carbaryl on lawns and for the aggregated risk for direct effects to the Barton Springs salamander exceed the chronic risk LOC by a factor of 5X. Similar
to what was done for evaluating acute risk, if the maximum number of applications to lawns was three times per year rather than 25, the 60-day average exposure value would be 6.64 µg/L and the resulting RQ value (0.98) would fall just below the chronic risk LOC. After a single application the 60-day average concentration would be 2.15 µg/L and the RQ value (0.32) would be well below the chronic risk LOC.

An analysis of the likelihood of individual direct mortality (Appendix I) indicates that based on the highest RQ value (aggregate RQ= 2.52) for direct effects on the Barton Springs salamander and with a dose-response slope of 4.62, the likelihood is 1 in 1. At the endangered species LOC, i.e., RQ=0.05, the likelihood of individual mortality is 1 in 2.4 x 10^16. At the RQ value (RQ=0.44) for single applications to lawns, the likelihood of individual effect is 1 in 88 and at the RQ value (RQ=0.83) for three applications to lawn, the likelihood of an individual effect is 1 in 3.

Therefore, carbaryl use in the action area is likely to affect the Barton Springs salamander through direct acute and chronic effects on the salamander. As discussed previously, though, there is uncertainty regarding what can reasonably be assumed to be the maximum number of applications per year to residential lawns. Additionally, there is uncertainty in the extent to which residential lawn are treated at a single time. The modeling assumes that 45% of the BSSEA is made up of residential lawns and assessed exposure assuming a range of percentages of that area (4%, 5%, 10%, 25%, 50%, 100%) were treated at the same time. With respect to acute mortality, if applications were limited to a single application per year and limitations were in place to ensure that a maximum of 4% of the lawns were treated in the BSSEA, RQ values would fall below the LOC and result in a no effect determination.

Similarly, if the maximum number of applications were reduced to 3 and even if 100% of the lawns were treated simultaneously, the determination for direct chronic effects would be no effect.

5.2.2 Indirect Effects via Reduction in Food Items (Freshwater Invertebrates)

Consistent with the toxicity data indicating that carbaryl is highly toxic to freshwater invertebrates, exposure estimates for each of the evaluated uses exceed the acute risk to endangered species LOC by factors as high as 6280X. Based on an estimated probit dose-response slope of 4.3 and an RQ value of 314, the likelihood of acute mortality for individual invertebrates following use of carbaryl on lawns in the action area is 1 out of 1 (100%) (Appendix I). Use on lawns, pasture, parks and flower beds around buildings and aggregated uses are expected to result in carbaryl concentrations in runoff that will result in acute mortality of aquatic invertebrates. Even a single application of carbaryl to lawns would result in an exceedance (RQ~14) of the acute risk to listed species LOC although the likelihood of an individual invertebrate mortality would again be 100%. Even using less sensitive estimates of acute toxicity, e.g., LC_{50}=5.1 mg/L, the RQ value (RQ=19) would exceed the acute risk to endangered species LOC by a factor of 382X following a single application of carbaryl to lawns.

The data on waterfleas represent information on the sensitivity of zooplankton to carbaryl as the remaining taxa for which there are data are more representative of macroinvertebrates. The
zoooplankton serve as prey for aquatic macroinvertebrates and the apparent sensitivity of zoooplankton to carbaryl suggests that macroinvertebrates could be affected through reduction in their forage base.

As discussed in greater detail in Appendix D, although the Barton Springs salamander is considered an opportunistic feeder, the most prevalent invertebrates found in stomach content analyses were macroinvertebrates consisting of ostracods, amphipods, and chironomids (USFWS, 2005). These are relatively large invertebrates (macroinvertebrates) and it is not clear as to the extent that smaller invertebrates (zoo plankton) like cladocers make up the diet of the salamander. Additionally, it is uncertain as to the extent that the most sensitive species used in this assessment reflect the sensitivities of the larger prey items; however, the sensitivity distribution depicted in Figure 13 suggests that larger invertebrates tend to be less sensitive than smaller invertebrates. To the extent that larger invertebrates are less sensitive and to the extent that Barton Springs salamanders preferentially feed on the less sensitive taxa would markedly affect risk estimates for indirect effects to the salamander.

Based on the likelihood of individual effect analysis where 100% of the most sensitive species are expected to experience acute mortality at the estimated environmental concentrations for carbaryl in the BSSEA, the likelihood of indirect effects on the Barton Springs salamander from the use of carbaryl is viewed as a may affect and likely to adversely affect.

5.2.3 Indirect Effects via Reduction in Habitat and/or Primary Productivity (Freshwater Aquatic Plants)

With an EC₅₀ of 1,270 μg/L, aquatic plants were some of the least sensitive aquatic organism tested with carbaryl. Based on the available data for freshwater nonvascular plants, estimated carbaryl concentrations have no affect on aquatic [nonvascular] plants.

There is uncertainty regarding the potential effect of carbaryl on aquatic vascular plants since the habitat of the salamander is composed of moss and vascular plants (See Appendix D). However, the risk of carbaryl to the salamander through reduction of habitat is considered to be low based on the data available for aquatic nonvascular plants, vascular terrestrial plants and the lack of any reported field incidents involving plants.

5.2.4. Incident reports

Although a total of three fish-kill incidents were reported for carbaryl, only one report (#B0000-501-92) could be credibly associated with a specific carbaryl use (i.e., to control gypsy moth in New Jersey). Relative to other carbamate pesticides, the number of aquatic (fish kill) incidents associated with carbaryl has been low.

A total of 5 incidents related to carbaryl’s effects on terrestrial invertebrates are reported in the EIIS database. Two of the reports (I005855-001 and B0000-300-03) do not contain any data but rather reflect general concerns expressed by the American Beekeeper Federation and the Honey Industry Council on the role pesticides in bee kills. The Honey Industry Council sited the specific use of carbaryl on alfalfa during the day. In North Carolina (incident #I003826-021), a
bee mortality was associated with 0.8 ppm carbaryl residues; however, in a second incident (#I003826-0090 in North Carolina, bee mortality was more likely attributed to methyl parathion than carbaryl. Only in one incident (I001611-002) though, was the use of carbaryl on a specific crop, i.e., asparagus in Washington, clearly associated with carbaryl residues in dead bees. Subsequent to the publication of the IRED, a number (48) of bee kill incidents were associated in Washington State along with several from Minnesota.

5.2.5 Description of Assumptions, Limitations, Uncertainties, Strengths and Data Gaps

5.2.5.1. Exposure Assessment

5.2.5.1.1 Aquatic exposure modeling of carbaryl

Exposure modeling is characterized by the use of simplifying assumptions that allow complex systems to be described in manageable terms. The complexity of the karst hydrology of the BSSEA increases the number of assumptions and uncertainties that usually characterize exposure modeling. For this assessment, all precipitation and applied carbaryl in the contributing zone are assumed to have an equal chance of arriving at the recharge zone and all precipitation, applied carbaryl, and discharge from the contributing zone are assumed to have an equal chance of arriving at the Barton Springs. All runoff and baseflow in the action area is assumed to recharge the Barton Springs and be available to dilute all carbaryl concentrations in runoff. All four Barton Springs are assumed to receive recharge from the same sources.

Ground water baseflow from the Trinity aquifer is assumed to contribute 30% of the average flow from the contributing zone, although baseflow is likely to vary over time. All transit times across zones are assumed equal and instantaneous with negligible degradation between the edge-of-field and the Barton Springs. Losses from evaporation, transpiration, aquifer storage, stream flow that doesn’t pass through the Springs, and withdrawal for drinking water are neglected.

Contributions from eroded sediment containing bound carbaryl are assumed negligible. Contributions from overflow of Barton Creek during large stormflow are also assumed negligible. Spray drift contributions for applications in the action area are assumed negligible as well because of the conceptual model that assumes all runoff from treated areas that occurs in the recharge zone is instantaneously recharged and that applications are at sufficient distances from the Barton springs such that the exposed water in the springs is not directly impacted by spray drift.

The modeled use scenarios are assumed to represent actual use sites in the action area. The rangeland scenario is assumed to represent the entire action area where use does not occur. Modeled exposure estimates were generated to reflect the maximum application practices allowed on current labels. Because actual carbaryl usage may be less than that allowed on current labels, both in application practices and in percent of the action area where applied at any time, modeled EECs may over-estimate exposure.

Estimated 1-in-10-year annual average exposure values were up to two orders of magnitude higher than maximum concentrations reported in monitoring data taken in the springs, mostly

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due to the assumptions that carbaryl is used at maximum application rates (arbitrarily limited at 25 applications per year) and simultaneously applied to all lawns in the action area. 1-in-10-year annual average estimates are consistent with concentrations observed in the monitoring data when uses are modeled once per year across all use areas, or when uses are modeled at multiple times per year on a fraction of the possible use areas.

In this assessment, exposures are estimated for salamanders residing within the fractures (springs) feeding the pool system and within the pools themselves of the BSSEA. Thus, salamanders residing within the fracture/pool system of the springs are likely to be exposed to longer-term base flow concentrations of carbaryl with occasional shorter-duration pulses correlated with precipitation-derived runoff events transported through the fractures. Salamanders have also been found to reside within the pools themselves. In general, the organisms residing in the pools will be exposed to the same sources of exposure. However, it is expected that the magnitude and duration of exposure will be somewhat different given the tendency of water to move through the pools (except in the most extreme climatic events) more slowly. This suggests that exposures in the pools will be generally lower in magnitude than in the springs, but will also tend to have a longer duration of exposure than in the springs.

5.2.5.1.2 Mixture Effects

This assessment considered only the single active ingredient of carbaryl. However, the assessed species and their environments may be exposed to multiple pesticides simultaneously. Evaluation of pesticide mixtures is beyond the scope of this assessment because of the myriad factors that cannot be quantified based on the available data. Those factors include identification of other possible co-contaminants and their concentrations, differences in the pattern and duration of exposure among contaminants, and the differential effects of other physical/chemical characteristics of the receiving waters (e.g. organic matter present in sediment and suspended water). Evaluation of factors that could influence additivity/synergism is beyond the scope of this assessment and is beyond the capabilities of the available data to allow for an evaluation. However, it is acknowledged that not considering mixtures could over- or under-estimate risks depending on the type of interaction and factors discussed above. This assessment has however, analyzed the toxicity of carbaryl formulated product mixtures (including carbaryl formulations involving more than one active ingredient) and has determined that none of the formulated products evaluated were more toxic than the technical grade active ingredient data used for assessing both direct and indirect risks in this document.
5.2.5.2 Effects Assessment

5.2.5.2.1 Direct Effects

As previously discussed, direct effects to the Barton Springs salamander were based on freshwater fish data, which are used as a surrogate for aquatic-phase amphibians. While a limited amount of amphibian data are available, these studies either failed to establish an LC50 value or did not report measured concentration values. The available data suggest that amphibians are considerably less sensitive to carbaryl than fish. To the extent to which amphibians are less sensitive than the surrogate species used in this assessment, the assessment is conservative.

5.2.5.2.2 Sublethal Effects

Open literature is useful in identifying sublethal effects associated with exposure to carbaryl. However, no data are available to link the sublethal measurement endpoints to direct mortality or diminished reproduction, growth and survival that are used by OPP as assessment endpoints. OPP acknowledges that a number of sublethal effects have been associated with carbaryl exposure; however, at this point there are insufficient data to definitively link the measurement endpoints to assessment endpoints. To the extent to which sublethal effects are not considered in this assessment, the potential direct and indirect effects of carbaryl on CRLF may be underestimated.

5.2.5.2.3 Indirect Effects

Indirect effects on the Barton Springs salamander are estimated based on the most sensitive invertebrate tested, i.e., Chloroperla grammatica. While this is a relatively common invertebrate, stoneflies do not appear to be a major food source for Barton springs salamanders based on stomach content analyses where ostracod exoskeletons have been identified. Thus, the extent to which the most sensitive species used in this analysis is representative of the diet of Barton Springs salamanders is uncertain. However, it should be noted that the toxicity endpoints for surrogate organisms are not intended to represent specific taxa but rather they serve as indicators of the potential sensitivity of invertebrates as a whole.

5.2.5.2.4. Sensitivity Distributions

In order to characterize the conservativeness of the endpoints selected to represent direct effects to the Barton Springs Salamander (e.g., Atlantic salmon LC50 = 220 µg/L) and indirect effects to the Barton Springs Salamander through direct effects to its aquatic prey (e.g. Stonefly EC50 = 1.7 µg/L) genus sensitivity distributions are derived using the available acute toxicity data for freshwater fish and invertebrates, respectively.

A quantitative distribution is established for each set of data; including studies classified acceptable or supplemental. Once a data set is assembled, the average of the Log10 values of the EC50 values for a species is calculated. Then, the average of the Log10 values of the genera is
estimated. A semi-lognormal distribution is used to estimate the sensitivity distribution by considering the mean and standard deviation of all genus mean values. A full description of the data and results used to derive these distributions is included in Appendix F. The number of data points, species and genera incorporated into each of the sensitivity distributions is identified in Table 20. The curves of the sensitivity distributions are represented by Figures 14-15. In the figures, each point represents the genus mean value for the respective genus and the solid line represents the sensitivity distribution based on these data.

<table>
<thead>
<tr>
<th>Taxa</th>
<th>Number of Data Values</th>
<th>Number of Species</th>
<th>Number of Genuses</th>
<th>Toxicity endpoint for assessment</th>
<th>Lower 95th Percentile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fish</td>
<td>19</td>
<td>17</td>
<td>10</td>
<td>220 µg/L</td>
<td>499 µg/L</td>
</tr>
<tr>
<td>Invertebrates</td>
<td>12</td>
<td>9</td>
<td>7</td>
<td>1.7 µg/L</td>
<td>0.7 µg/L</td>
</tr>
</tbody>
</table>

The lower 95th percentile of the fish distribution (499 µg/L) indicates that the use of the lowest available toxicity value (220 µg/L) is likely a conservative estimate of the toxicity of carbaryl to freshwater vertebrates. When considering estimated aquatic exposure concentrations (peak), aggregate use of carbaryl in the Barton Springs area, as well as on lawns is sufficient to exceed the LOC for approximately 85% of the fish sensitivity distribution. Estimated aquatic concentrations resulting from uses on pasture are at levels sufficient to exceed the LOC for 5% of fish species. Uses of carbaryl on parks, flowerbeds, vineyards, nurseries and peaches are at levels that would exceed the LOC for <5% of fish species.

The lower 95th percentile of the invertebrate distribution (0.7 µg/L) indicates that the use of the lowest available toxicity value (1.7 µg/L) is not as conservative as the value used for invertebrates. When considering estimated aquatic exposure concentrations (peak), aggregate use of carbaryl in the Barton Springs area, as well as on lawns, pastures and parks are sufficient to exceed the LOC for greater than 95% of the invertebrate sensitivity distribution. Estimated aquatic concentrations resulting from uses on flower beds are at levels sufficient to exceed the LOC for approximately 73% of invertebrate species. Currently registered maximum use rates for carbaryl on vineyards and nurseries yield estimated environmental concentrations that result in RQ values which exceed the acute risk to endangered species LOC for approximately 7% and 5% of invertebrate species, respectively. At maximum label rates for use of carbaryl on peaches, EECs result in RQ values which exceed the acute risk to endangered species LOC for <5% of invertebrate species.
Figure 14. Fish sensitivity distribution based 96-h LC$_{50}$ values from acute exposures of fish to carbaryl.

Figure 15. Invertebrate sensitivity distribution based 48-h and 96-h LC$_{50}$ values from acute exposures of invertebrates to carbaryl.
5.3. Conclusions

The conceptual model for potential risks of carbaryl use to Barton Springs salamanders (Figure 4) depicts direct and indirect changes in receptor attributes. Biological receptors included the Barton Springs salamander, aquatic invertebrates that serve as the salamanders’ forage base for the salamander, and aquatic plants that serve as habitat/cover for the species and its prey. Potential attribute changes for these receptors included decreased survival, reproduction and growth. An assessment of potential sources (routes of exposure) for carbaryl estimates peak aggregate exposure concentrations in the Barton Springs at 555 μg/L and chronic 1-in-10 year average 60-day chronic aggregate exposure is estimated at 39 μg/L. These exposure estimates combined with acute (220 μg/L) and chronic (6.8 μg/L) toxicity estimates for the most sensitive species result in a likely to adversely affect determination for direct acute effects on the salamander and a likely to adversely affect determination for chronic effects to the salamander (Table 21). Even if less conservative assumptions were made regarding application rates and the percentage of areas treated, this assessment indicates that the use of carbaryl on lawns would be likely to adversely affect the Barton Springs salamander. A single application of carbaryl to as little as 5% of the lawns in the BSSEA results in risk estimates that exceed the acute risk to listed species LOC.

With respect to direct chronic risk to Barton Springs salamander, if the number of applications could be restricted to a maximum of 3, then risk estimates would drop below the chronic risk LOC and result in an no effect determination.

For indirect effects on the salamander’s forage base, the estimated peak concentration (555 μg/L) was compared to the most sensitive invertebrate toxicity estimate (1.7 μg/L). The resulting risk quotients for the use of carbaryl on lawns, pasture, parks, and flower beds around buildings exceed the endangered species level of concern and the likelihood of individual effects is 100%. Therefore, the use of carbaryl in the BSSE results in a likely to adversely affect determination (Table 21) for indirect effects to the Barton Springs salamander through potential reductions in its invertebrate forage base.

For indirect effects to habitat, the peak estimated environmental concentration (555 μg/L) was compared to the most sensitive aquatic plant species (3700 μg/L) and the resulting risk quotient was below the acute risk LOC. The result is a no effect determination for habitat (Table 21).

Although there are a number of uncertainties in this assessment, the approaches used to estimate potential exposure and effects are considered relatively conservative and protective for the species.
Table 21. Carbaryl Effects Determination Summary for the Barton Springs Salamander.

<table>
<thead>
<tr>
<th>Assessment Endpoint</th>
<th>Effects Determination</th>
<th>Basis for Determination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute mortality</td>
<td>May affect and likely to adversely affect</td>
<td>Acute risk LOC is exceeded based on the most sensitive surrogate freshwater vertebrate data and a variety of assumptions about numbers of applications and the percentage of area treated.</td>
</tr>
<tr>
<td>Chronic survival, growth, and reproduction effects on Barton Springs salamander individuals via direct effects</td>
<td>May affect and likely to adversely affect</td>
<td>Chronic risk LOC is exceeded based on the most sensitive surrogate freshwater vertebrate data. If the maximum number of applications was reduced to three, then the determination would be “no effect”.</td>
</tr>
<tr>
<td>Indirect effects to Barton Springs salamander via reduction of prey (i.e., freshwater invertebrates)</td>
<td>May affect and likely to adversely affect</td>
<td>Acute risk LOC is exceeded based on the most sensitive surrogate freshwater invertebrate data. Even using less conservative assumptions regarding application rates and the percentage of areas simultaneously treated in the BSSEA, the likelihood of acute mortality of prey items is considered high. Additionally, the species sensitivity distribution for freshwater invertebrates indicates that the toxicity endpoint used for evaluating effects to invertebrates is not conservative even though it is the most sensitive species.</td>
</tr>
<tr>
<td>Indirect effects to Barton Springs salamander via reduction of habitat and/or primary productivity (i.e., aquatic plants)</td>
<td>No effect</td>
<td>Carbaryl use does not directly affect individual non-vascular aquatic plants in Barton Springs. Estimated peak EECs for all modeled carbaryl use scenarios within the action area are well below the threshold concentration for aquatic, non-vascular plants.</td>
</tr>
</tbody>
</table>
6. Literature Cited


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6.1. Submitted studies


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Appendix A. ECOTOX Open Literature Reviews.

Open Literature Review Summary

Chemical Name: Carbaryl
CAS No: 63-25-2


Purpose of Review (DP Barcode or Litigation): Endangered species assessment

Date of Review: May 27, 2007

Summary of Study Findings:

Green frog (Rana clamitans) tadpoles weighing an average of 80 mg (± 15 mg) (Gosner Stage 25) were exposed to one of nine chemical treatments, i.e., water control, solvent (acetone 0.5 mL/L), 3.5, 5.0, 7.2, 10.3, 14.7, 21.0 and 30.0 mg carbaryl/L, and to one of three temperature treatments, i.e., 17, 22, or 27°C, in a 96-hr static test. The tests were conducted in 3.8-L glass jars containing 2 L of well water (ph 7.8, hardness 286 mg/L as CaCO₃). Each treatment was replicated three times. Ten tadpoles were randomly assigned to each glass jar and the percent mortality was determined at 12, 24, 48, and 96 hours. Tadpoles were not fed during the exposure.

Average survival was significantly different at each temperature treatment. At 24 hours survival was significantly lower at 27°C without exposure to other chemicals. Lower concentrations (3.5, 5.0, 7.2 and 10.3 mg/L) were not significantly different from controls (survival > 96%). The two greatest concentrations (21 and 30 mg/L) were significantly different from controls at all times and had an average survival below 42%, with no tadpoles surviving in the 30 mg/L group for 96 hours. Tadpoles at 17 and 22°C had greater survival at higher concentrations than tadpoles at 27°C. At 48 hours, the LC₅₀ at 27°C was 16.17 mg/L and at 17°C the LC₅₀ was 26.01 mg/L. By 96 hours, the LC₅₀ at 27°C (11.32 mg/L) was twice as large as at 17°C (22.02 mg/L); that is, a smaller amount of carbaryl was needed to induce mortality at a high temperature (Table 22) The authors conclude that temperature, chemical concentration, and the interaction of temperature and chemical significantly affected survival; generally, increased temperature resulted in lower survival. According to the authors, the study suggests a range of temperatures realistic for a species should be used in toxicity tests.

Table 22. Median lethal concentrations (LC₅₀) in mg/L (ppm) for aquatic-phase green frogs (R. clamitans) exposed to carbaryl for various lengths of exposure and temperatures. Values in parentheses represent 95% confidence interval.

<table>
<thead>
<tr>
<th>Time (hrs)</th>
<th>17°C</th>
<th>22°C</th>
<th>27°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>&lt;30</td>
<td>22.55</td>
<td>17.57</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(20.96 – 24.27)</td>
<td>(16.29 – 18.95)</td>
</tr>
<tr>
<td>48</td>
<td>26.01</td>
<td>21.76</td>
<td>16.17</td>
</tr>
<tr>
<td>72</td>
<td>24.80</td>
<td>20.02</td>
<td>14.88</td>
</tr>
<tr>
<td></td>
<td>(23.57 – 26.10)</td>
<td>(18.56 – 21.60)</td>
<td>(13.83 – 16.02)</td>
</tr>
<tr>
<td>96</td>
<td>22.02</td>
<td>17.36</td>
<td>11.32</td>
</tr>
</tbody>
</table>
Description of Use in Document (QUAL, QUAN, INV): Qualitative

Rationale for Use: Study provides useful information on the median lethal concentration of carbaryl at varying lengths of exposures and temperatures. The study is useful for qualitatively characterizing the effect of temperature on the toxicity of carbaryl to aquatic-phase amphibians.

Limitations of Study: Egg masses were collected in the wild (pond at the Baskett Wildlife Research Area, Ashland, Missouri). Loading rate (10 tadpoles/2 L) exceeds the EPA recommended rate of 1 tadpole/L. Individual treatment concentrations were not verified; only the stock solution was analytically measured. Concentration (0.5 ml/L) of co-solvent (acetone) exceeded EPA recommended maximum of 0.1 mL/L.

Primary Reviewer: Thomas Steeger, Ph.D., Senior Biologist
Chemical Name: Carbayl
CAS No: 63-25-2


Purpose of Review (DP Barcode or Litigation): Endangered species assessment in response to litigation.

Date of Review: May 27, 2007

Summary of Study Findings: Egg masses of southern leopard frogs collected from Wilson County, TN, reared in lab. Animals (3-wks post-hatch) were at relativity uniform size (0.05 mg) and development stage (Gosner Stage 25) were fasted 24 hours prior to study initiation.

Study was conducted at 22°C; alkalinity 115 mg/L as CaCO₃; hardness 171 mg/L as CaCO₃; pH 8.32.

Five chemicals were selected based on their differing modes of action. Chemicals included 4-nonylphenol (narcotic/oxidative stressor), carbaryl (acetylcholinesterase inhibitor), copper (osmoregulatory obstructor), permethrin (neurotoxin) and pentachlorophenol (oxidative phosphorylation inhibitor); all stock solutions except copper were dissolved in technical grade acetone; copper prepared in deionized water. Concentrations in each of the organic stock solutions was confirmed using liquid chromatography; copper concentration of stock solution confirmed using atomic absorption. Toxicity tests were conducted in triplicate using 19.6-L jars containing 15 L of ATSM hard water. Each chemical tested used 6 concentrations. Ten tadpoles were tested per replicate. Mortality was recorded at 6, 12, 24, 48, 72 and 96 hrs. Dissolved oxygen was measured at 0, 48 and 96 hrs and pH was measured at 0 and 96 hrs. Dissolved oxygen did not fall below EPA-recommended standards and mortality in the controls did not exceed 10%. Tadpoles were fasted during the study.

The study concludes that based on the 96-hr LC₅₀ values (Table 23), tadpoles were, in general, of equal or greater tolerance to organic chemical compounds than were reported fish (Table 24); fish toxicity data were pulled from other sources. However, southern leopard frogs were more sensitive to copper than were the fish. According to the study authors, southern leopard frog tadpoles were significantly more tolerant to both carbaryl and permethrin when compared to other species. Based on 96-hr LC₅₀, the rank order of toxicity of compounds to southern leopard frogs, from greatest to least toxic was: permethrin>copper>pentachlorophenol>4-nonylphenol>carbaryl. Since tadpoles were always of equal or greater tolerance than published
24 and 96-hr LC_{50}s for rainbow trout, rainbow trout [according to the authors] may be conservative for many chemicals and therefore protective of amphibians. However, the authors also conclude that since the southern leopard frog was more sensitive to one of the chemicals, more of an effort should be expended to include amphibians in aquatic toxicity testing.

### Table 23. Median lethal concentration (96-hr) in mg/L to aquatic-phase southern leopard frog for 5 chemicals. Values in parentheses represent 95% confidence interval.

<table>
<thead>
<tr>
<th>Endpoint</th>
<th>4-nonylphenol µg/L</th>
<th>Carbaryl mg/L</th>
<th>Copper mg/L</th>
<th>Pentachlorophenol mg/L</th>
<th>Permethrin µg/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>96 hr LC_{50}</td>
<td>0.34 (0.31 – 0.37)</td>
<td>8.4 (7.4 – 9.6)</td>
<td>0.23 (0.21 – 0.25)</td>
<td>0.14 (0.12 – 0.17)</td>
<td>18.2</td>
</tr>
</tbody>
</table>

### Table 24. Comparison of 96-hr LC_{50} values across species for 5 chemicals. Values in parentheses are 95% confidence intervals. Only southern leopard frogs were tested in the current study.

<table>
<thead>
<tr>
<th>Test Animals</th>
<th>4-nonylphenol µg/L</th>
<th>Carbaryl mg/L</th>
<th>Copper mg/L</th>
<th>Pentachlorophenol mg/L</th>
<th>Permethrin µg/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boreal toad tadpoles</td>
<td>0.12 (0.09 – 0.15)</td>
<td>12.31 (10.3 – 14.7)</td>
<td>0.12 (0.07 – 0.18)</td>
<td>0.37 (0.25 – 0.42)</td>
<td>&gt;10</td>
</tr>
<tr>
<td>Bluegill sunfish</td>
<td>NA</td>
<td>6.2</td>
<td>7.3</td>
<td>0.19</td>
<td>6.2</td>
</tr>
<tr>
<td>Fathead minnow</td>
<td>0.27</td>
<td>5.21</td>
<td>0.47</td>
<td>0.25</td>
<td>9.38</td>
</tr>
<tr>
<td>Rainbow trout</td>
<td>0.19</td>
<td>1.88</td>
<td>0.88</td>
<td>0.016</td>
<td>3.31</td>
</tr>
<tr>
<td>Southern leopard frog tadpoles</td>
<td>0.34 (0.31 – 0.37)</td>
<td>8.4 (7.4 – 9.6)</td>
<td>0.23 (0.21 – 0.25)</td>
<td>0.14 (0.12 – 0.17)</td>
<td>18.2</td>
</tr>
</tbody>
</table>

**Description of Use in Document (QUAL, QUAN, INV):** Qualitative

**Rationale for Use:** Study provides useful information on the toxicity of carbaryl to aquatic-phase amphibians and on the sensitivity of amphibians to pesticides relative to other test species.

**Limitations of Study:** Test animals were collected from the field where there previous exposure history is unknown. Verification of test concentrations was conducted on the organic stock solutions and not on the diluted test solutions. Loading rate (10 tadpoles/15 L) was higher than EPA recommended rate of 1 tadpole/L. Concentration of acetone in solvent control not reported.

**Primary Reviewer:** Thomas Steeger, Ph.D, Senior Biologist.
Chemical Name: Carbaryl

CAS No: 63-25-2


Purpose of Review (DP Barcode or Litigation): Endangered species assessment in response to litigation.

Date of Review: May 27, 2007

Summary of Study Findings: All species of algae and cyanobacteria tested were from established laboratory cultures, maintained as chemostat cultures (steady-state populations of nutrient-limited cells using defined media and set dilution rates). Species included: diatom (Cyclotella meneghiana), green algae (Scenedesmus quadricauda and Pseudokirchneriella subcapitata), unicellular cyanobacteria (Microcystis aeruginosa (PPC7820 and U2063), filamentous cyanobacteria (Pseudoanabaena sp. and Oscillatoria sp.), and filamentous cyanobacteria (nitrogen-fixing) (Aphanizomenon flos-aquae and Anabaena inaequalis).

Duckweed (Lemna gibba) was obtained from a pond near Saskatoon, Saskatchewan (CN).

For algae, each treatment unit consisted of a 7 ml vial filled with 2 ml of media and inoculated with 0.2 ml of pesticide solution (total volume 2.2 ml). Mixtures were incubated for 6 hours, then 0.01 µCi of NaH14CO3 were added and then further incubated for 16 hours while undergoing constant agitation. Afterward 200 µL of 12.5% HCl was added to terminate the incubations and to convert any “inorganic” (unfixed by the algae) 14C to the gas phase, which was then exhausted. Tests were replicated in triplicate.

Duckweed was incubated in 6-well 12 ml microplate containing 10-ml fill volume containing 3 mature duckweed leaves per well with 4 replicates. Leaves were counted after 7 days. Growth inhibition was expressed as a portion of of controls.

Pesticide exposure was based on the estimated environmental concentration resulting from maximum registered application label rate for agriculture use in Canada

Results of the single concentration toxicity tests are presented in Tables 25 – 28. Inhibition exceeded 75% for each of the triazines in all species except the nitrogen-fixing cyanobacterium Anabaena inaequalis, for which inhibition ranged from 58 to 65% (Table 25). Triazines caused ≥95% growth inhibition of duckweed. The four sulfonylurea herbicides had little to no inhibition of algal species at the concentrations tested but did cause significant stimulation of growth in some of the species tested (Table 26). For three of the four sulfonylurea herbicides, growth was inhibited ≥63% in duckweed. The phenoxyaldane and pyridine herbicides tested had low toxicity to algal species at the concentrations tested and caused less than 50% inhibition of growth in duckweed (Table 27). Picloram had not significant impact on any of the test species while triclopyr cause significant stimulation of growth in green algae and nitrogen-fixing cyanobacteria. Triclopyr significantly reduced plant growth in Pseudoanabaena and duckweed but stimulated growth of Nitzchia by 40% (Table 28). Acrolein and tebuthiuron inhibited growth by >70% in almost all of the species tested. Glyphosate significantly inhibited growth...
≥73% in only 3 of the species tested (Table 27). The two forms (formulated and technical) of the fungicide propioconazole had <20% inhibition in all species tested and stimulated growth in cyanobacteria and diatoms. Carbaryl caused >50% inhibition in 9 of the 10 algal species tested; diatoms were less sensitive (33% inhibition) (Table 28); however, carbofuran had relatively low inhibition in the plants tested. Carbofuran though significantly inhibited Scenedesmus, Microcystis and duckweed by 21 – 31%.

The authors proceed to rank the pesticides based on the known EEC/EC₅₀ (EC₅₀ values were not determined in this study) ratios based on the results of this study. The following categories were developed: very high EEC/EC₅₀>1 since the EEC tested caused >50% difference in growth; high where 25 – 50% differences in growth; moderate where 5 – 25% differences in growth; potentially low where<5% differences in growth. Based on these rankings, the authors concluded that the triazine herbicides, diquat, acrolein, tebu thiuron and carbaryl were classified as high hazards to almost all of the plant species tested and only picloram presented a low hazard.

The authors noted the high algal toxicity of carbaryl at its estimated environment concentration and speculated that because carbaryl is not as acutely toxic to insects or vertebrates as carbofuran, it is registered for insect control at much higher rates and that while it may not have a greater intrinsic toxicity to algae, its higher rate of use and hence 5-fold higher EEC makes it a greater hazard to the aquatic environment.
Table 25. Percent inhibition of plant growth across herbicides; values in parentheses represent standard deviation. Exposure based on maximum label rates. Simazine is tested as formulated endproduct while other herbicides are technical grade.

<table>
<thead>
<tr>
<th>Family</th>
<th>Species</th>
<th>Atrazine 2.67 mg/L</th>
<th>Cyanazine 2.67 mg/L</th>
<th>Hexazene 2.87 mg/L</th>
<th>Metribuzine 2.67 mg/L</th>
<th>Simazine 2.67 mg/L</th>
<th>Chlorsulfuron 0.020 mg/L</th>
<th>Ethametsulfuron 0.015 mg/L</th>
<th>Metsulfuron 0.003 mg/L</th>
<th>Trisulfuron 0.018 mg/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algae</td>
<td>C. meneghiana</td>
<td>97* (1)</td>
<td>98* (0)</td>
<td>98* (1)</td>
<td>98* (0)</td>
<td>83* (5)</td>
<td>-8 (6)</td>
<td>-4 (3)</td>
<td>-16 (9)</td>
<td>13 (14)</td>
</tr>
<tr>
<td></td>
<td>Nitzschia</td>
<td>99* (0)</td>
<td>99* (0)</td>
<td>99* (0)</td>
<td>99* (0)</td>
<td>82* (5)</td>
<td>-6 (10)</td>
<td>-10 (12)</td>
<td>-9 (8)</td>
<td>-39* (9)</td>
</tr>
<tr>
<td></td>
<td>S. quadricauda</td>
<td>96* (1)</td>
<td>95* (2)</td>
<td>96* (1)</td>
<td>96* (1)</td>
<td>93* (2)</td>
<td>-3 (10)</td>
<td>0 (5)</td>
<td>-6 (11)</td>
<td>-8 (13)</td>
</tr>
<tr>
<td></td>
<td>P. subcapitata</td>
<td>99* (0)</td>
<td>100* (0)</td>
<td>100* (0)</td>
<td>100* (0)</td>
<td>99* (0)</td>
<td>-13 (12)</td>
<td>-11 (8)</td>
<td>27* (3)</td>
<td>-3 (10)</td>
</tr>
<tr>
<td>Cyanobacteria</td>
<td>M. (PCC7820)</td>
<td>96* (1)</td>
<td>98* (0)</td>
<td>96* (0)</td>
<td>97* (1)</td>
<td>96* (1)</td>
<td>-1 (17)</td>
<td>0 (6)</td>
<td>1 (9)</td>
<td>1 (4)</td>
</tr>
<tr>
<td></td>
<td>M. (U2063)</td>
<td>84* (0)</td>
<td>97* (0)</td>
<td>95* (0)</td>
<td>94* (0)</td>
<td>92* (0)</td>
<td>-23* (3)</td>
<td>16 (3)</td>
<td>14* (4)</td>
<td>-10 (4)</td>
</tr>
<tr>
<td></td>
<td>Oscillatoria</td>
<td>87* (0)</td>
<td>87* (0)</td>
<td>76* (2)</td>
<td>87* (1)</td>
<td>86* (3)</td>
<td>-17 (14)</td>
<td>-12* (3)</td>
<td>2 (7)</td>
<td>8 (3)</td>
</tr>
<tr>
<td></td>
<td>Pseudoanabaena</td>
<td>91* (0)</td>
<td>97* (1)</td>
<td>96* (1)</td>
<td>97* (0)</td>
<td>96* (0)</td>
<td>-2 (7)</td>
<td>13 (9)</td>
<td>-7 (12)</td>
<td>1 (2)</td>
</tr>
<tr>
<td></td>
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<td>65* (2)</td>
<td>92* (3)</td>
<td>58* (8)</td>
<td>94* (2)</td>
<td>63* (2)</td>
<td>-4 (6)</td>
<td>0 (3)</td>
<td>-9 (8)</td>
<td>15 (4)</td>
</tr>
<tr>
<td></td>
<td>Aphanisomenon</td>
<td>97* (1)</td>
<td>98* (1)</td>
<td>96* (1)</td>
<td>97* (1)</td>
<td>88* (5)</td>
<td>4 (14)</td>
<td>-9 (12)</td>
<td>-36* (5)</td>
<td>-13 (13)</td>
</tr>
<tr>
<td>Duckweed</td>
<td>Lemna</td>
<td>95* (5)</td>
<td>100* (0)</td>
<td>100* (0)</td>
<td>100* (0)</td>
<td>100* (0)</td>
<td>86* (5)</td>
<td>33* (6)</td>
<td>63* (0)</td>
<td>91* (0)</td>
</tr>
</tbody>
</table>

*statistically significant at 95%
### Table 26. Percent inhibition of plant growth across herbicides; values in parentheses represent standard deviation. Exposure based on maximum label rates. Herbicides tested are technical grade.

<table>
<thead>
<tr>
<th>Family</th>
<th>Species</th>
<th>Phenoxalkanes</th>
<th>Pyridines</th>
<th>Brominated Herbicides</th>
<th>Diquat</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2,4-D</td>
<td>MCPA</td>
<td>Picroxide</td>
<td>Bromoxoil</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.92 mg/L</td>
<td>1.4 mg/L</td>
<td>1.76 mg/L</td>
<td>0.28 mg/L</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Triclopyr</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.56 mg/L</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Algae</td>
<td>C. meneghiana</td>
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<td>-3 (8)</td>
<td>-12 (5)</td>
<td>-15 (12)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nitzschia</td>
<td>1 (10)</td>
<td>-18* (5)</td>
<td>-7 (21)</td>
<td>-4 (3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>S. quadricauda</td>
<td>-1 (12)</td>
<td>1 (3)</td>
<td>-7 (12)</td>
<td>13 (9)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>P. subcapitata</td>
<td>-2 (9)</td>
<td>-18* (8)</td>
<td>-2 (8)</td>
<td>-24* (6)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cyanobacteria</td>
<td>M. (PCC7820)</td>
<td>9 (8)</td>
<td>0 (24)</td>
<td>3 (8)</td>
<td>-10 (8)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>M. (U2063)</td>
<td>11 (13)</td>
<td>8 (5)</td>
<td>-27 (6)</td>
<td>-2 (12)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Oscillatoria</td>
<td>4 (9)</td>
<td>-7 (16)</td>
<td>8 (1)</td>
<td>-9 (3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pseudoanabaena</td>
<td>-7 (6)</td>
<td>19* (2)</td>
<td>15 (10)</td>
<td>13* (3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Anabaena</td>
<td>-14 (8)</td>
<td>-15 (11)</td>
<td>14 (8)</td>
<td>-4 (13)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Aphanisomenon</td>
<td>0 (1)</td>
<td>11 (7)</td>
<td>0 (17)</td>
<td>-34* (16)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duckweed</td>
<td>Lemma</td>
<td>34* (5)</td>
<td>42* (3)</td>
<td>10 (5)</td>
<td>23* (4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 27. Percent inhibition of plant growth across herbicides; values in parentheses represent standard deviation. Exposure based on maximum label rates. Glyphosate is tested as formulated endproduct while other herbicides are technical grade.

<table>
<thead>
<tr>
<th>Family</th>
<th>Species</th>
<th>Acrolein 1.0 mg/L</th>
<th>Glyphosate 2.85 mg/L</th>
<th>Imazethapyr 0.067 mg/L</th>
<th>Metolachlor 3.0 mg/L</th>
<th>Tebuthiuron 5.87 mg/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algae</td>
<td>C. meneghiana</td>
<td>97* (1)</td>
<td>73* (3)</td>
<td>-5 (5)</td>
<td>-5 (1)</td>
<td>98* (1)</td>
</tr>
<tr>
<td></td>
<td>Nitzschia</td>
<td>99* (0)</td>
<td>77* (5)</td>
<td>-11 (8)</td>
<td>0 (4)</td>
<td>99* (0)</td>
</tr>
<tr>
<td></td>
<td>S. quadricauda</td>
<td>99* (0)</td>
<td>3 (1)</td>
<td>10 (5)</td>
<td>15 (6)</td>
<td>90 (4)</td>
</tr>
<tr>
<td></td>
<td>P. subcapitata</td>
<td>97* (2)</td>
<td>18 (15)</td>
<td>7 (5)</td>
<td>24* (12)</td>
<td>100* (0)</td>
</tr>
<tr>
<td>Cyanobacteria</td>
<td>M. (PCC7820)</td>
<td>100* (0)</td>
<td>-41 (5)</td>
<td>29* (3)</td>
<td>3 (11)</td>
<td>90* (1)</td>
</tr>
<tr>
<td></td>
<td>M. (U2063)</td>
<td>96* (1)</td>
<td>16 (5)</td>
<td>16 (5)</td>
<td>6 (4)</td>
<td>88* (2)</td>
</tr>
<tr>
<td></td>
<td>Oscillatoria</td>
<td>95* (1)</td>
<td>-12 (4)</td>
<td>-2 (7)</td>
<td>12 (1)</td>
<td>76* (0)</td>
</tr>
<tr>
<td></td>
<td>Pseudoanabaena</td>
<td>100* (0)</td>
<td>12 (6)</td>
<td>3 (5)</td>
<td>19* (8)</td>
<td>93* (1)</td>
</tr>
<tr>
<td></td>
<td>Anabaena</td>
<td>100* (0)</td>
<td>11 (11)</td>
<td>-16 (3)</td>
<td>0 (4)</td>
<td>26* (3)</td>
</tr>
<tr>
<td></td>
<td>Aphanisomenon</td>
<td>100* (0)</td>
<td>74* (1)</td>
<td>10 (9)</td>
<td>-15 (17)</td>
<td>89* (3)</td>
</tr>
<tr>
<td>Duckweed</td>
<td>Lemna</td>
<td>73* (2)</td>
<td>0 (4)</td>
<td>46* (0)</td>
<td>81* (0)</td>
<td>100* (0)</td>
</tr>
</tbody>
</table>
Table 28. Percent inhibition of plant growth across pesticides; values in parentheses represent standard deviation. Exposure based on maximum label rates. Propiconazole is tested as formulated endproduct and technical grade while other pesticides are technical grade alone.

<table>
<thead>
<tr>
<th>Family</th>
<th>Species</th>
<th>Carbaryl 3.67 mg/L</th>
<th>Carbofuran 0.67 mg/L</th>
<th>Propiconazole (tech) 0.083 mg/L</th>
<th>Propiconazole (form) 0.083 mg/L</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Algae</strong></td>
<td>C. meneghiana</td>
<td>35* (8)</td>
<td>4 (4)</td>
<td>3 (5)</td>
<td>-28* (11)</td>
</tr>
<tr>
<td></td>
<td>Nitzschia</td>
<td>58* (7)</td>
<td>-6 (23)</td>
<td>32 (3)</td>
<td>-36* (4)</td>
</tr>
<tr>
<td></td>
<td>S. quadricauda</td>
<td>67* (12)</td>
<td>31* (5)</td>
<td>0 (6)</td>
<td>13* (8)</td>
</tr>
<tr>
<td></td>
<td>P. subcapitata</td>
<td>68* (2)</td>
<td>1 (3)</td>
<td>13 (3)</td>
<td>-10 (8)</td>
</tr>
<tr>
<td><strong>Cyanobacteria</strong></td>
<td>M. (PCC7820)</td>
<td>76* (5)</td>
<td>24* (3)</td>
<td>3 (6)</td>
<td>-4 (10)</td>
</tr>
<tr>
<td></td>
<td>M. (U2063)</td>
<td>70* (3)</td>
<td>8 (6)</td>
<td>-13 (5)</td>
<td>8 (7)</td>
</tr>
<tr>
<td></td>
<td>Oscillatoria</td>
<td>56* (4)</td>
<td>3 (15)</td>
<td>-6 (8)</td>
<td>-15* (4)</td>
</tr>
<tr>
<td></td>
<td>Pseudoanabaena</td>
<td>86* (2)</td>
<td>8 (12)</td>
<td>-10 (5)</td>
<td>-13 (3)</td>
</tr>
<tr>
<td></td>
<td>Anabaena</td>
<td>86* (6)</td>
<td>5 (21)</td>
<td>-14 (18)</td>
<td>-1 (22)</td>
</tr>
<tr>
<td></td>
<td>Aphanisomenon</td>
<td>73* (1)</td>
<td>-2 (7)</td>
<td>-16 (1)</td>
<td>-25 (12)</td>
</tr>
<tr>
<td><strong>Duckweed</strong></td>
<td>Lemna</td>
<td>33* (9)</td>
<td>21* (8)</td>
<td>32* (6)</td>
<td>10 (4)</td>
</tr>
</tbody>
</table>
Rationale for Use: Even though only a single concentration is tested, the study provides useful information on the potential effects of pesticides on aquatic plants at concentrations that may be considered environmentally relevant.

Limitations of Study: Duckweek was collected from the wild and prior exposure history is uncertain. Only a single concentration is tested at each. Test concentrations are nominal and were not measured. Light source and intensity during the study were not reported.

Primary Reviewer: Thomas Steeger, Ph.D., Senior Biologist.
**Chemical Name:** Carbaryl  
**CAS No:** 63-25-2  

**Purpose of Review (DP Barcode or Litigation):** Endangered species assessment in response to litigation.

**Date of Review:** May 28, 2007

**Summary of Study Findings:** The purpose of this study was to determine the effects of UV-B radiation and the insecticide carbaryl, both alone and in combination, on African clawed frogs (*Xenopus laevis*) and the gray tree frog (*Hyla versicolor*). Adult gray tree frogs were collected from the Thomas S. Baskett Wildlife Center, Ashland, MO, and bred in lab. Tadpoles (approximately 7 days post-hatch) were used in the study. African clawed frog adults were obtained from Xenopus 1 and bred in lab.

Acute LC$_{50}$ toxicity studies were performed using the ASTM guidelines for amphibians. Technical grade carbaryl was dissolved in acetone. Static renewal tests consisted of 2 replicates with 10 tadpoles per treatment. Carbaryl concentrations were 0.24, 0.81, 2.7, 9 and 30 mg/L.

Experiments were performed in solar simulators having a light-cap fixture containing four 160-W UV-B lamps with peak emission at 313 nm, eight UV-A lamps, 10 cool-white fluorescent lamps and three halide lamps. The cool white and UV-A lamps operated for 12 hrs each day while the UV-B lamps operated for 5 hours each day which began 2.5 hr after the onset of the UVA-cool white light photoperiod. The UV-A cool white operated for 4.5 hours after the UV-B exposure to ensure sufficient irradiance for photorepair. The exposure chambers were constructed of glass (14 x 14 x 14 cm$^2$).

Ultraviolet-B LD$_{50}$ with *X. laevis* embryos were static, nonrenewal tests consisting of two replicates with 10 organisms per treatment. The test chamber consisted of 14 x 14 cm glass containing 1 l of well water maintained between 22 – 24°C. Test treatments included 0.88, 3.3, 148, 166 and 293 µW/cm$^3$ of UV-B. Similar treatments were conducted with Xenopus tadpoles using 3.86, 24.48, 54.95 and 64.39 µW/cm$^3$ of UV-B and with gray tree frog tadpoles using 4.79, 46.15, 63.95 and 78.7 µW/cm$^3$ of UV-B.

Studies (96-hr) with UV-B and carbaryl combined were performed for each species and life stage under static conditions. UV-B consisted of two doses, 6 and 65 µW/cm$^3$ as well as a control for UV-B. Treatment concentrations for carbaryl consisted of three carbaryl concentrations and a solvent (acetone) control. Each exposure chamber consisted of three replicates with 10 organisms/replicate at a temperature of 23 ± 1°C. Hatching success was measured in experiments with embryos of both species. Post exposure growth inhibition and mortality were
evaluated for gray tree frog embryos only when the survivors of the 96-hr tadpole study were then transferred to clean water for a 2-wk recovery period.

Photoactivation of carbaryl was evaluated by irradiating the carbaryl chamber containing 7.5 mg/L of carbaryl at 4 µW/cm³ UV-B for 5 hrs before tadpoles were introduced. Photosensitization studies involved exposure to nonirradiated carbaryl for 4 days. The exposed embryos were then placed in chambers with no UV radiation in clean water to determine whether delayed mortality would occur. Embryos were also placed in chambers and subjected to low UV-B (4 µW/cm³) to determine whether carbaryl was a photosensitizing compound. These studies used three replicates in 14x14x14 cm³ glass chambers. Carbaryl concentrations of 7.5 mg/L was used and was below the measured LC50 (15.25 mg/L). The irradiation (4 µW/cm³) was well below the LD50 (112 µW/cm³) for UV-B.

The UV-B levels used in the study were consistently lower than those measured in outdoor ponds.

The UV-B LD₅₀ for *X. laevis* and *H. versicolor* tadpoles were 4.66 (95% CI: 3.28 – 6.05) and 80.43 (60.15 – 100.7) µW/cm³, respectively. The LD₅₀ for *Xenopus* embryos was 112.28 (74.13 – 150.43) µW/cm³

The 96-hr acute LC₅₀ value for *X. laevis* and *H. versicolor* tadpoles were 1.73 (95% CI: 1.31 – 2.16) and 2.47 (1.76 – 3.19) mg/L, respectively. For *X. laevis* embryos the 96-hr LC₅₀ value was 15.25 (10.89 – 19.59) mg/L.

UV-B induced significant tadpole mortality in all combination treatments for both *X. laevis* and *H. versicolor*; however, revised LC50 values were not calculated.

There were no significant differences in growth of *H. versicolor* among treatment groups 2 weeks after exposure; however, there were significant differences for delayed mortality among carbaryl treatments.

Behavior studies of *X. laevis* showed that 1 day of exposure to carbaryl in the absence of UV-B, tadpoles significantly increased swimming activity compared to controls. Under UV-B exposure, the swimming activity was significantly lower that that of controls. For *H. versicolor*, swimming behavior was significantly reduced for tadpoles exposed to UV-B alone, carbaryl alone, or UV-B in combination with carbaryl compared to controls.

Irradiated carbaryl treatment (7.5 mg/L) induced 100% mortality in *X. laevis* embryos whereas the nonirradiated carbaryl treatment did not cause any mortality.
The mortality of *X. laevis* embryos (43%) previously exposed to carbaryl and subsequently exposed to UV-B was not significantly different from previously exposed embryos (33%) that did not receive subsequent UV-B exposure.

**Description of Use in Document (QUAL, QUAN, INV):** Qualitative

**Rationale for Use:** Study provides useful information on carbaryl 96-hr LC50 values for *X. laevis* and *H. versicolor* and demonstrates that sunlight can influence the toxicity of carbaryl to both embryonic and larval amphibians.

**Limitations of Study:** Gray tree frogs were collected from the wild and their previous exposure history is unknown. Reported concentrations are nominal and were not verified. Concentration of acetone (solvent) in the treatments is not reported.

**Primary Reviewer:** Thomas Steeger, Ph.D., Senior Biologist.
Chemical Name: Carbayrl
CAS No: 63-25-2

ECOTOX Record Number and Citation: 17138 Brooke, L. T. 1991. Results of freshwater exposures with the chemicals atrazine, biphenyl, butachlor, carbaryl, carbazole, dibenzofuran, 3, 3’-dichlorobenzidine, diclorovos, 1, 2-epoxyethylbenzene (styrene oxide), isophorone, isopropalin, oxychlorodane, pentachloroanisole, propoxur (baygon), tetrabromobisphenol A, 1, 2, 4, 5-tetrachlorobenzene, and 1, 2, 3-trichloropropene to selected freshwater organisms. Center for Lake Superior Environmental Studies, Environmental Health Laboratory, Cooperative Research Unit, The University of Wisconsin – Superior.

Purpose of Review (DP Barcode or Litigation): Endangered species assessment in response to litigation.

Date of Review: May 31, 2007

Summary of Study Findings: In-lab cultures of fathead minnows (Pimephales promelas), waterfleas (Daphnia magna and Ceriodaphnia dubia), annelids (Lubriculus variegatus), freshwater hydra (Hydra americana), snails (Physella virgata), and amphipods (Hyalella azteca) and stoneflies (Acroneuria sp.) collected from the Eau Claire River (Gordon, WI) were used in acute (48 – 96 hr) and chronic (21-day) toxicity tests. Chemical concentrations for tests with daphnids were measured at 0, 24 and 48 hours for acute tests and were measured at solution renewal days (Mondays, Wednesday, Friday). Flow-through studies with fathead minnows, annelids, amphipods and stoneflies and static tests with fathead minnows were samples at 0, 48 and 96 hrs. For newel tests with annelids, snails and hydras, samples were collected at 24-hr intervals. For the 21-day chronic studies with dichlorovos using D. magna, the only concentration measured was the new solution from the high exposure. All other exposure concentrations, including the old high solutions after 24 hours or more, were below the detection limit of 70 μg/L.

Flow-through acute toxicity studies with fathead minnows (30 ± 5 days old) were conducted in a modified Benoit mini-diluter using 5.8-L glass aquaria contain 2.4 L. Static studies with fathead minnows were conducted in 6.4-L or 4-L glass beakers with a 4-L volume. Temperature ranged from 21.1 – 23.3°C; hardness and alkalinity ranged between 36 – 75.8 and 38 – 70.9 mg/L as CaCO₃, respectively. Early life stage studies were conducted with fathead minnow embryos <24 hrs post-fertilization placed in glass incubation cups with cup bottoms consisting of nylon mesh; on hatch, 15 fry were transferred to 3.4-L tanks containing 2.4 L of fill volume; young fish were fed 3 X daily with live brine shrimp and fish were exposed for 28 days.

Toxicity studies with D. magna (<24-hr neonates) were conducted in 118-mL plastic Solo® cups containing 50 mL except for studies with isopropalin which were conducted in 100-mL glass beakers containing 50 mL fill. Studies with C. dubia (<24-hr neonates) were conducted in 30-mL plastic Solo® cups containing 50 mL fill. Acute exposures were renewed at 24 hrs and chronic exposures on a MWF regime. Temperature maintained at 22 ± 2°C with dissolved oxygen >75% in both acute and chronic studies.
Flow-through studies with adult annelids (mean weight: 0.003 g) were conducted in 250-mL glass beakers with screened holes on the sides suspended in 3.4-L containing 200 mL fill volume. Static renewal studies were conducted in 250-mL glass beakers containing 200 mL of solution. Temperatures were maintained at 21 ± 2°C and dissolved oxygen >60%; hardness and alkalinity ranged from 51.9 – 73.8 and 44.0 – 58.0 mg/L as CaCO₃, respectively.

Static-renewal studies with hydras were conducted in 250-mL glass beakers containing 200 mL of test solution. Temperature was maintained at 21.1 ± 0.3°C and dissolved oxygen of 90.1 ± 3.7%; hardness and alkalinity means were 48.9±3.8 and 45.0 ± 3.8 mg/L as CaCO₃, respectively.

Toxicity tests with snails (mean weight 0.052 ± 0.022 g) were conducted in 250 mL glass beakers containing 200 mL exposure solution. Snails were placed in 3x12 cm screen cage within beaker. Temperature was maintained at 22 ± 1°C with dissolved oxygen > 67%. Hardness and alkalinity ranged from 43.9 – 79.8 and 40.0 – 52.0 mg/L as CaCO₃, respectively.

Adult amphipod (mean weight: 0.002 g) flow-through studies were conducted in 250 mL glass beakers with screened holes on the sides and suspended in 3.4 L glass aquaria. Temperature ranged between 19.0 – 21.0°C and dissolved oxygen was >73%; hardness and alkalinity ranged from 47.9 – 89.8 and 36.0 – 64.0 mg/L as CaCO₃, respectively.

Flow-through studies with the stonefly nymphs (mean wt: 0.145 ± 0.076 g) were conducted in 3.4-L glass aquaria with 2.4 L of exposure solution containing a 10 cm (3.5 cm diameter) PVC pipe for cover. Temperature was 19.7 ± 0.4°C and dissolved oxygen was >73%; mean hardness and alkalinity were 67.4 ± 19.0 and 50.0 ± 14.0 mg/L as CaCO₃, respectively.

**Table 28** provides a summary of the toxicity test results.
<table>
<thead>
<tr>
<th>Compound</th>
<th>Test Organism</th>
<th>Stage or Age</th>
<th>Type of Test</th>
<th>96-H LC50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atrazine</td>
<td>J ackb (Acrocnemia sp.)</td>
<td>nymphs</td>
<td>Flow-thru acute</td>
<td>6700 (3)</td>
</tr>
<tr>
<td>Atrazine</td>
<td>Hvallaea azteca</td>
<td>adults</td>
<td>Flow-thru acute</td>
<td>14700 (1)</td>
</tr>
<tr>
<td>Atrazine</td>
<td>Annelid (Lumbriculus variegatus)</td>
<td>adults</td>
<td>Flow-thru acute</td>
<td>&gt;</td>
</tr>
<tr>
<td>Atrazine</td>
<td>Snail (Physella virgata)</td>
<td>adults</td>
<td>Static renewal 96-hr acute</td>
<td>&gt;</td>
</tr>
<tr>
<td>Atrazine</td>
<td>Hydra americana</td>
<td>adults</td>
<td>Static renewal 96-hr acute</td>
<td>3</td>
</tr>
<tr>
<td>Biphenyl</td>
<td>Fathead minnow</td>
<td>30 + 5 day</td>
<td>Flow-thru acute</td>
<td>1950 (1)</td>
</tr>
<tr>
<td>Biphenyl</td>
<td>Fathead minnow</td>
<td>30 + 5 day</td>
<td>Static acute1</td>
<td>3500 (2)</td>
</tr>
<tr>
<td>Biphenyl</td>
<td>Fathead minnow</td>
<td>30 + 5 day</td>
<td>Static acute2</td>
<td>2940 (2)</td>
</tr>
<tr>
<td>Biphenyl</td>
<td>Fathead minnow</td>
<td>30 + 5 day</td>
<td>Static acute3</td>
<td>1450 (1)</td>
</tr>
<tr>
<td>Butachlor</td>
<td>Fathead minnow</td>
<td>30 + 2 day</td>
<td>Flow-thru acute</td>
<td>280 (1)</td>
</tr>
<tr>
<td>Butachlor</td>
<td>Fathead minnow</td>
<td>30 + 2 day</td>
<td>Static acute1</td>
<td>750 (1)</td>
</tr>
<tr>
<td>Butachlor</td>
<td>Fathead minnow</td>
<td>30 + 2 day</td>
<td>Static acute2</td>
<td>750 (1)</td>
</tr>
<tr>
<td>Butachlor</td>
<td>Fathead minnow</td>
<td>30 + 2 day</td>
<td>Static acute3</td>
<td>640 (1)</td>
</tr>
<tr>
<td>Butachlor</td>
<td>[3. magna]</td>
<td>&lt;24-hr</td>
<td>Static renewal</td>
<td>1050 (1)</td>
</tr>
<tr>
<td>Carbaryl</td>
<td>C. dubia</td>
<td>&lt;24-hr</td>
<td>Static renewal 48-hr acute</td>
<td>3.08 (6)</td>
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<tr>
<td>Compound</td>
<td>Test</td>
<td>Organism</td>
<td>Stage or Age</td>
<td>Type of Test</td>
</tr>
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<td>-------------------</td>
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<td>--------------</td>
<td>------------------------</td>
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<tr>
<td>Carbaryl</td>
<td>D. magna</td>
<td>&lt;24-hr</td>
<td></td>
<td>Static renewal 48-hr acute</td>
</tr>
<tr>
<td>Carbaryl</td>
<td>D magna</td>
<td>&lt;24-hr</td>
<td></td>
<td>21-day chronic</td>
</tr>
<tr>
<td>Carbaryl</td>
<td>Fathead</td>
<td>minnow</td>
<td>30 ±5 day</td>
<td>Flow-thru acute</td>
</tr>
<tr>
<td>Carbazole</td>
<td>Fathead</td>
<td>minnow</td>
<td>30 ±4 day</td>
<td>Static acute</td>
</tr>
<tr>
<td>Carbazole</td>
<td>Fathead</td>
<td>minnow</td>
<td>30 ±4 day</td>
<td>Static acute</td>
</tr>
<tr>
<td>Carbazole</td>
<td>Fathead</td>
<td>minnow</td>
<td>30 ±4 day</td>
<td>Static acute</td>
</tr>
<tr>
<td>Carbazole</td>
<td>D. magna</td>
<td>&lt;24-hr</td>
<td></td>
<td>Static renewal 48-hr acute</td>
</tr>
<tr>
<td>Dibenzo-furan</td>
<td>Fathead</td>
<td>minnow</td>
<td>30 ±5 day</td>
<td>Flow-thru acute</td>
</tr>
<tr>
<td>Dibenzo-furan</td>
<td>Fathead</td>
<td>minnow</td>
<td>30 ±5 day</td>
<td>Static acute</td>
</tr>
<tr>
<td>Dibenzo-furan</td>
<td>Fathead</td>
<td>minnow</td>
<td>30 ±2 day</td>
<td>Static acute</td>
</tr>
<tr>
<td>Dibenzo-furan</td>
<td>Fathead</td>
<td>minnow</td>
<td>30 ±5 day</td>
<td>Static acute</td>
</tr>
<tr>
<td>3,3'-Dichloro-benzene</td>
<td>Fathead</td>
<td>minnow</td>
<td>30 ±4 day</td>
<td>Static acute</td>
</tr>
<tr>
<td>3,3'-Dichloro-benzene</td>
<td>Fathead</td>
<td>minnow</td>
<td>30 ±4 day</td>
<td>Static acute</td>
</tr>
<tr>
<td>3,3'-Dichloro-benzene</td>
<td>Fathead</td>
<td>minnow</td>
<td>30 ±4 day</td>
<td>Static acute</td>
</tr>
<tr>
<td>3,3'-Dichloro-</td>
<td>D. magna</td>
<td>&lt;24-hr</td>
<td></td>
<td>Static renewal</td>
</tr>
<tr>
<td>benzene</td>
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48-hr acute
<table>
<thead>
<tr>
<th>Compound</th>
<th>Test Organism</th>
<th>Stage or Age</th>
<th>Type of Test</th>
<th>96-H LC50 (95% CD uq/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3,3'-Dichloro-benzene</td>
<td>Fathead minnow</td>
<td>3 0 + 2 day</td>
<td>Flow-thru acute</td>
<td>1770 (1640-1920)</td>
</tr>
<tr>
<td>3,3'-Dichloro-benzidine</td>
<td>Fathead minnow</td>
<td>3 0 + 2 day</td>
<td>Static acute¹ #2</td>
<td>2150 (1840-2500)</td>
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<tr>
<td>3,3'-Dichloro-benzidine</td>
<td>Fathead minnow</td>
<td>3 0 + 2 day</td>
<td>Static acute² #2</td>
<td>1880 (1610-2200)</td>
</tr>
<tr>
<td>3,3'-Dichloro-benzidine</td>
<td>Fathead minnow</td>
<td>3 0 + 2 day</td>
<td>Static acute³ #2</td>
<td>1050 (820-1340)</td>
</tr>
<tr>
<td>Dichlorovos</td>
<td>Annelids(Lumbriculus varieqatus)</td>
<td>adults</td>
<td>Static renewal 96-hr acute</td>
<td>2180 (1960-2440)</td>
</tr>
<tr>
<td>Dichlorovos</td>
<td>Snail (Chysea virgata)</td>
<td>adults</td>
<td>Static renewal 96-hr acute</td>
<td>170 (140-200)</td>
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<tr>
<td>Dichlorovos</td>
<td>C. dubia</td>
<td>&lt;24-hr</td>
<td>Static renewal 48-hr acute</td>
<td>0.149&quot;(0.127-0.175)</td>
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<tr>
<td>Dichlorovos</td>
<td>D. magna</td>
<td>&lt;24-hr</td>
<td>Static renewal 48-hr acute</td>
<td>0.266&quot;(0.244-0.286)</td>
</tr>
<tr>
<td>Dichlorovos</td>
<td>D. magna</td>
<td>&lt;24-hr</td>
<td>21-day chronic</td>
<td>&gt;0.109²</td>
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<tr>
<td>Dichlorovos</td>
<td>Fathead minnow</td>
<td>3 0 + 4 day</td>
<td>Flow-thru acute</td>
<td>3090 (2570-3730)</td>
</tr>
<tr>
<td>Dichlorovos</td>
<td>Fathead minnow #1</td>
<td>&lt;24-hr</td>
<td>28-day post hatch</td>
<td>d</td>
</tr>
<tr>
<td>Dichlorovos</td>
<td>Fathead minnow #2</td>
<td>&lt;24-hr</td>
<td>chronic flow-thru</td>
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</tr>
<tr>
<td>Dichlorovos</td>
<td>28-day post hatch chronic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compound</td>
<td>Test Organism</td>
<td>Stage or Age</td>
<td>Type of Test</td>
<td>96-H LC50 (95% CI) ug/L</td>
</tr>
<tr>
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<td>--------------</td>
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<td>-------------------------</td>
</tr>
<tr>
<td>1,2-Epoxyethyl-benzene (Styrene Oxide)</td>
<td>Fathead minnow</td>
<td>30 + 5 day</td>
<td>Flow-thru acute</td>
<td>4540</td>
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<tr>
<td>1,2-Epoxyethyl-benzene</td>
<td>Fathead minnow</td>
<td>30 + 5 day</td>
<td>Static acute&lt;sup&gt;1&lt;/sup&gt;</td>
<td>13800</td>
</tr>
<tr>
<td>1,2-Epoxyethyl-benzene</td>
<td>Fathead minnow</td>
<td>30 + 5 day</td>
<td>Static acute&lt;sup&gt;2&lt;/sup&gt;</td>
<td>26330</td>
</tr>
<tr>
<td>1,2-Epoxyethyl-benzene</td>
<td>Fathead minnow</td>
<td>30 + 5 day</td>
<td>Static acute&lt;sup&gt;3&lt;/sup&gt;</td>
<td>10700</td>
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<tr>
<td>1,2-Epoxyethyl-benzene</td>
<td>D. magna</td>
<td>&lt;24-hr</td>
<td>Static renewal 48-hr acute</td>
<td>11600&lt;sup&gt;+&lt;/sup&gt; (10200-13100)</td>
</tr>
<tr>
<td>Isophorone</td>
<td>Fathead minnow</td>
<td>30 + 5 day</td>
<td>Flow-thru acute</td>
<td>253000 (228000-280000)</td>
</tr>
<tr>
<td>Isophorone</td>
<td>Fathead minnow</td>
<td>30 + 5 day</td>
<td>Static acute&lt;sup&gt;1&lt;/sup&gt;</td>
<td>319000 (285000-356000)</td>
</tr>
<tr>
<td>Isophorone</td>
<td>Fathead minnow</td>
<td>30 + 5 day</td>
<td>Static acute&lt;sup&gt;2&lt;/sup&gt;</td>
<td>275000 (246000-308000)</td>
</tr>
<tr>
<td>Isophorone</td>
<td>Fathead minnow</td>
<td>30 + 2 day</td>
<td>Static acute&lt;sup&gt;3&lt;/sup&gt;</td>
<td>240000 (213000-271000)</td>
</tr>
<tr>
<td>Isophorone</td>
<td>Fathead minnow</td>
<td>30 + 2 day</td>
<td>Flow-thru acute</td>
<td>270 (220-3350)</td>
</tr>
<tr>
<td>Isopropalin</td>
<td>Fathead minnow</td>
<td>30 + 2 day</td>
<td>Static acute&lt;sup&gt;1&lt;/sup&gt;</td>
<td>610 (510-730)</td>
</tr>
<tr>
<td>Isopropalin</td>
<td>Fathead minnow</td>
<td>30 + 2 day</td>
<td>Static acute&lt;sup&gt;2&lt;/sup&gt;</td>
<td>670 (560-790)</td>
</tr>
<tr>
<td>Isopropalin</td>
<td>Fathead minnow</td>
<td>30 + 2 day</td>
<td>Static acute&lt;sup&gt;3&lt;/sup&gt;</td>
<td>310 (280-360)</td>
</tr>
<tr>
<td>Isopropalin</td>
<td>D. magna</td>
<td>&lt;24-hr</td>
<td>Acute renewal 48-hr acute</td>
<td>30&lt;sup&gt;+&lt;/sup&gt; (22-40)</td>
</tr>
</tbody>
</table>
TABLE 6 Cont.  Summary of Toxicity.

<table>
<thead>
<tr>
<th>Compound</th>
<th>Test Organism</th>
<th>Stage or Age</th>
<th>Type of Test</th>
<th>96-H LC50 (95% CD uq/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxychlorodane</td>
<td>Fathead minnow</td>
<td>30 + 2 day</td>
<td>Flow-thru acute</td>
<td>248</td>
</tr>
<tr>
<td>Oxychlorodane</td>
<td>Fathead minnow</td>
<td>30 + 2 day</td>
<td>Static acute&lt;sup&gt;1&lt;/sup&gt;</td>
<td>431 (381-488)</td>
</tr>
<tr>
<td>Oxychlorodane</td>
<td>Fathead minnow</td>
<td>30 + 2 day</td>
<td>Static acute&lt;sup&gt;2&lt;/sup&gt;</td>
<td>6.32 (5.55-7.19)</td>
</tr>
<tr>
<td>Oxychlorodane</td>
<td>Fathead minnow</td>
<td>30 + 2 day</td>
<td>Static acute&lt;sup&gt;3&lt;/sup&gt;</td>
<td>2.63 (2.23-3.10)</td>
</tr>
<tr>
<td>Oxychlorodane</td>
<td>D. magna</td>
<td>&lt;24-hr</td>
<td>Static renewal 48-hr acute</td>
<td>1300 (860-1960)</td>
</tr>
<tr>
<td>Pentachloroanisole</td>
<td>Fathead minnow</td>
<td>30 + 4 day</td>
<td>Flow-thru acute</td>
<td>650 (500-840)</td>
</tr>
<tr>
<td>Pentachloroanisole</td>
<td>Fathead minnow</td>
<td>30 + 4 day</td>
<td>Static acute</td>
<td>&gt;1190</td>
</tr>
<tr>
<td>Pentachloroanisole</td>
<td>D. magna</td>
<td>&lt;24-hr</td>
<td>Static renewal 48-hr acute</td>
<td>180&lt;sup&gt;*&lt;/sup&gt; (170-200)</td>
</tr>
<tr>
<td>Propoxur (baygon)</td>
<td>Annelid</td>
<td>Adults</td>
<td>Static renewal 96-hr acute</td>
<td>14600&lt;sup&gt;f&lt;/sup&gt;</td>
</tr>
<tr>
<td>Propoxur</td>
<td>D. magna</td>
<td>&lt;24-hr</td>
<td>Static renewal 48-hr acute</td>
<td>272&lt;sup&gt;*&lt;/sup&gt; (209-365)</td>
</tr>
<tr>
<td>Propoxur</td>
<td>D. magna</td>
<td>&lt;24-hr</td>
<td>21-day chronic</td>
<td>&gt;17.2&lt;sup&gt;g&lt;/sup&gt;</td>
</tr>
<tr>
<td>Tetrabromobis-phenol A</td>
<td>Fathead minnow</td>
<td>26 + 2 day</td>
<td>Flow-thru acute</td>
<td>1040 (999-1100)</td>
</tr>
<tr>
<td>Tetrabromobis-phenol A</td>
<td>Fathead minnow</td>
<td>30 + 2 day</td>
<td>Static acute&lt;sup&gt;1&lt;/sup&gt;</td>
<td>710&lt;sup&gt;*&lt;/sup&gt;</td>
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<tr>
<td>Tetrabromobis-phenol A</td>
<td>Fathead minnow</td>
<td>30 + 2 day</td>
<td>Static acute&lt;sup&gt;2&lt;/sup&gt;</td>
<td>800&lt;sup&gt;*&lt;/sup&gt;</td>
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</tbody>
</table>
TABLE 6 Cont. Summary of Toxicity.

<table>
<thead>
<tr>
<th>Compound</th>
<th>Test Organism</th>
<th>Stage or Age</th>
<th>Type of Test</th>
<th>96-H LC50 (95% CI) ug/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tetrabromobis-phenol A</td>
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<td>30 ± 2 day</td>
<td>Static acute</td>
<td>60</td>
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<tr>
<td>Tetrabromobis-phenol A</td>
<td>O. magna</td>
<td>&lt;24 hr</td>
<td>Static renewal 48-hr acute</td>
<td>790 (6800-200)</td>
</tr>
<tr>
<td>1,2,4,5-Tetrachlorobenzene</td>
<td>Fathead minnow</td>
<td>3 0 + 5 day</td>
<td>Flow-thru acute</td>
<td>320</td>
</tr>
<tr>
<td>1,2,4,5-Tetrachlorobenzene</td>
<td>Fathead minnow</td>
<td>3 0 + 5 day</td>
<td>Static acute</td>
<td>&gt;460</td>
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<tr>
<td>1,2,4,5-Tetrachlorobenzene</td>
<td>Fathead minnow</td>
<td>3 0 + 5 day</td>
<td>Static acute</td>
<td>&gt;320</td>
</tr>
<tr>
<td>1,2,4,5-Tetrachlorobenzene</td>
<td>Fathead minnow</td>
<td>3 0 + 5 day</td>
<td>Static acute</td>
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<tr>
<td>1,2,3-Trichloro-propane</td>
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<td>3 0 + 4 day</td>
<td>Flow-thru acute</td>
<td>50800</td>
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<tr>
<td>1,2,3-Trichloro-propane</td>
<td>Fathead minnow</td>
<td>3 0 + 4 day</td>
<td>Static acute</td>
<td>69900 (67100-72900)</td>
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<tr>
<td>1,2,3-Trichloro-propane</td>
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<td>3 0 + 4 day</td>
<td>Static acute</td>
<td>57600 (55400-59900)</td>
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<tr>
<td>1,2,3-Trichloro-propane</td>
<td>Fathead minnow</td>
<td>3 0 + 4 day</td>
<td>Static acute</td>
<td>27400 (25900-28900)</td>
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<tr>
<td>1,2,3-Trichloro-propane</td>
<td>O. malla</td>
<td>&lt;24-hr</td>
<td>Static renewal 48-hr acute</td>
<td>33800 b (27800-41100)</td>
</tr>
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</table>
Due to no partial mortalities, the 95% confidence intervals could not be determined.

48hr EC50.

96hr EC50.

NOEC.

LC50 based on nominal concentrations.

LC50 based on 0-hr concentrations. LC50 based on all concentrations.
Description of Use in Document (QUAL, QUAN, INV): Qualitative

Rationale for Use: Study provides useful information to characterize toxicity of carbaryl to aquatic invertebrates.

Limitations of Study: Raw data are not available to verify EC50 values

Primary Reviewer: Thomas Steeger, Ph.D., Senior Biologist
**Chemical Name:** Carbaryl and atrazine  
**CAS No:** 63-25-2 (Carbaryl); 1912-24-9  
**ECOTOX Record Number and Citation:** 81455; Boone, M. D. and S. M. James. 2003. Interactions of an insecticide, herbicide, and natural stressors in amphibian community mesocosms. Ecological Applications 13(3): 829 – 841.  
**Purpose of Review (DP Barcode or Litigation):** Endangered species assessment in response to litigation.  
**Date of Review:** 05/28/2007  
**Summary of Study Findings:**  
Three egg masses of southern leopard frogs (*Rana sphenocephala*) and 21 egg masses of spotted salamanders (*Ambystoma maculatum*) were collected from Basket Wildlife Area (Boone County, MI). Egg masses of American toads (*Bufo americanus*) were collected from the Forum Nature Area (Boone County, MI) and approximately 30 egg masses of small-mouth salamanders (*Ambystoma texanum*) were collected from Basket Wildlife area. All eggs were hatched in the laboratory.  
Polyethylene cattle tanks (1.85 m diameter) contained 1,000 L of tapwater, 1 kg of leaf litter from deciduous forests and plankton from natural ponds. Each tank was covered with screen mesh lids.  

**Experiment 1 Effects of Competition, Atrazine, and Carbaryl on Larval Amphibians.**

The purpose of this study was to manipulate 3 factors in a fully crossed design with three replicates (36 ponds) (1) competition using low initial anuran density (20 tadpoles/1000L) or high (60 tadpoles/1000 L); carbaryl concentration (0, 3.5 and 7 mg/L) and atrazine concentration (0 and 200 μg/L). Controls (each species alone with 2 densities for anurans and one density for caudates) were replicated 3 times (9 ponds). Twelve spotted salamanders were added to each pond on March 28; spotted leopard frogs were added on April 4 (Day 0). Liquid Sevin (Ortho; 21.3% carbaryl) added to achieve a nominal concentration of 3.5 mg carbaryl/L; liquid Astrex (Syngenta formerly Novartis; 40.8% atrazine) added to achieve a nominal concentration of 200 μg/L. Chlorophyll determinations were made: prior to chemical addition, Day 15, Day 22, Day 29 and Day 42. Water quality reported as pH 7.9 ± 0.01 and a temperature of 14.6 ± 0.06°C. Three 2-L water samples taken from the 7 mg/L carbaryl (no atrazine) treatment at 1, 24, 48 and 96 hr; the three samples were composited. Samples were also taken from the atrazine 200 μg/L treatment at 1, 15 and 57 days. Based on these samples, the half-lives of carbaryl and atrazine were determined to be 4.5 days and 34 days, respectively. Exposures were terminated between 56 to 58 days and preceding the point where most larvae reached metamorphosis. Mean body mass, developmental (Gosner) stage, snout-vent length (SVL) and pond survival for each species were determined. To normalize the data, all proportion data (e.g., survival) were angularly transformed while length and weight data were log transformed.
Spotted salamander survival has significantly (p=0.0077) reduced by carbaryl exposure.

Experiment II: Effects of Hydroperiod, Atrazine, and Carbaryl on Amphibians Reared through Metamorphosis.

Three factors were manipulated in a fully crossed design with 4 replicates (32 ponds): hydroperiod (constant or drying), exposure to carbaryl (0 or 5 mg/L), and exposure to atrazine (0 or 200 μg/L). Twelve small-mouthed salamander larvae and 45 American toad tadpoles were added to each pond on Day 0. Water pH and temperature averaged 7.7 ± 0.03 and 13.3 ± 0.04°C, respectively. Water samples from the carbaryl treatment were taken at 1 and 48 hrs and from the atrazine treatment after 1 day; based on these analyses, carbaryl was determined to have half-life of approximately 3 day. Measured concentrations for carbaryl after 1 hour were 76% of nominal and measured concentrations of atrazine after 1 day were 99% of nominal. After 88 days of exposure, ponds were drained and amphibians were weighed and measured; time to metamorphosis was also determined along with survival estimates. Chlorophyll determinations were made: prior to chemical addition, Day 8 and Day 50.

Description of Use in Document (QUAL, QUAN, INV): Qualitative

Rationale for Use: Study provides useful information on the effects of formulated carbaryl on salamanders; however, control salamander survival was relatively low in the study.

Limitations of Study:
Animals used in study were wild-caught and their previous exposure history is unknown. It is not clear from the study whether the amphibian loading rates were representative of what may be typically encountered in nature. Concentration were only measured in the carbaryl 7 mg/L and the atrazine 200 μg/L treatments and were apparently only used to determine the half-life of the compound; however, after 1 hour the concentration of carbaryl (7 mg/L) was equivalent to the nominal concentration. Similarly, after 1 day, the concentration of atrazine (207 μg/L) was 104% of nominal. In the second study carbaryl and atrazine were 76% and 99% of nominal around the initiation of the study.

Although spotted salamander survival was significantly reduced by carbaryl exposure the report figures suggest that larval survival was relatively low in controls as well and averaged roughly 55%; survival appears to have averaged 10% and 0% in the 3.5 mg/L and 7 mg/L carbaryl treatments. Figure 3 indicates that carbaryl significantly (p<0.05) mass, SVL, developmental stage and survival of spotted salamanders; atrazine and carbaryl combined significantly (p=0.02) SVL. For southern leopard frog (Figure 3), carbaryl significantly (p=0.0001) weight; atrazine significantly (p=0.0052) affected mass. Carbaryl plus density significantly (p=0.0273) affected SVL; however, density alone also affected SVL (p=0.0001).
Multivariate analysis on salamander data indicated carbaryl exposure and the interaction of carbaryl by atrazine negatively affected weights, SVL and delayed developmental stage for larvae exposed to 3.5 mg/L compared to controls; however, the presence of atrazine ameliorated the effect.

Survival of leopard frogs was not significantly impacted by either chemical alone, but atrazine x density did impact (reduce) survival in the highest density group. Multivariate responses of leopard frogs were significantly affected by carbaryl exposure, atrazine exposure and initial density (Table 2); mass significantly increased with carbaryl exposure and decreased with atrazine exposure compared to controls.

In Study II, small-mouthed salamander survival to metamorphosis was significantly reduced by carbaryl exposure. Multivariate analysis indicated that atrazine exposure, hydropereid and the interaction of atrazine and hydropereid significantly affected mass and time to metamorphosis resulting in longer larval periods in constant hydropereids and smaller mass at metamorphosis in drying hydropereids.
Carbaryl exposure significantly reduced survival of American toads by approximately 20%. Multivariate responses were significantly affected by carbaryl exposure, atrazine exposure, and carbaryl x hydroperiod interaction with carbaryl significantly extending larval period. Atrazine exposure reduced total weight at metamorphosis.

In Study I density, atrazine exposure, carbaryl exposure and carbaryl x atrazine interaction significantly affected chlorophyll over time. Atrazine decreased chlorophyll 12-day after exposure although there was no difference by the end of the study. Carbaryl exposure reduced chlorophyll 12-day after exposure although there was no difference by the end of the study.

Low density increased chlorophyll concentrations.

In Study II, hydroperiod x carbaryl significantly affected chlorophyll; however, this may have been an artifact from the sampling procedure.

**Primary Reviewer:** Thomas Steeger, Ph.D., Senior Biologist
Appendix B. Supporting Information for PRZM Scenario Development.

INTRODUCTION

EFED initiated an effort to develop a suite of new PRZM/EXAMS scenarios useful for all six chemicals in the Barton Springs endangered species lawsuit including atrazine, simazine, prometion, metolachlor, diazinon, and carbaryl. EFED initiated an evaluation of the potential use sites relevant to all six chemicals for development as possible modeling scenarios. The evaluation consisted of an investigation of geology, hydrogeology, land cover data, use information, soils information, and conversations with local experts knowledgeable in all of the above.

Initial investigation indicated that the geology and hydrogeology are the defining issues surrounding how the action area for each chemical would be defined. As noted in the atrazine assessment, the action area for the development of the Barton Springs Scenarios was comprised of three hydrologic zones (in order of importance) of the Barton Springs Segment of the Edwards Aquifer: 1) the recharge zone which consists of a fractured karstic geology, 2) the contributing zone where surface runoff may flow to the recharge zone, and 3) the transition zone which has a remote potential to contribute to the recharge zone (http://www.edwardsaquifer.net/intro.html). Although the transition zone was considered in this assessment, primary emphasis was given to the recharge zone with secondary emphasis on the contributing zone.

Investigation indicated that areas to the east of the Recharge Zone might not be relevant to the assessment (ground water flow to the Barton Spring system comes either directly from transport through the Recharge Zone, which occurs generally south to north, or indirectly via the Contributing Zone/Recharge Zone interaction where flow is dominantly west to east). For example, agricultural uses lying east of the Recharge Zone (roughly defined by the Interstate 35 corridor) can be considered outside the area of interest and no scenario need be developed for this use. However, if any of the uses are present west of this area within either Recharge or Contributing Zones, then these scenarios should be developed as described below.

Given these facts it was quickly decided that any new scenarios developed needed to be based on the extent of the potential action area for each chemical. In general, this action area consists of three zones identified above including the Contributing Zone, the Recharge Zone, and the Transition Zone. Primary emphasis for scenario development was placed on use sites (both agricultural and non-agricultural) within the Contributing and Recharge Zones. No scenarios were parameterized based solely on the transition zone. Spatial data containing the Hydrozone boundaries were obtained from the Barton Springs/Edwards Aquifer Conservation district (ftp://www.bseacd.org/from/HCP Shape Files/).

These new scenarios were developed under contract with specific guidelines on how to evaluate the need for a scenario and how to parameterize the scenarios that were developed. The process involved numerous interactions between the contractor and EFED and ultimately all decisions on which scenarios to develop were the responsibility of EFED. If the contractor determined that a particular use site is likely to be outside the area of interest and not likely to contribute to the exposures in Barton Springs a written description of the steps taken to determine this and rational for the exclusion was documented and is discussed in the sections that follow.
The following sections discuss the various data sources used in this assessment and ultimately provide a rational for the development of each scenario. Note that not all scenarios were used in each assessment but were selected based on specific analysis of each chemical labeled uses and an understanding of which uses are actually present in the action area for each chemical. In the case of atrazine, the scenarios ultimately used in the assessment were one agricultural site (fallow/idle land using the meadow scenario) and three non-agricultural uses including residential, turf and rights-of-way.

**SOURCES OF DATA**

**Land use data**

The contractor obtained two land use coverage’s from the City of Austin (COA) and the Texas Commission on Environmental Quality (TCEQ). The land use data were important for quantifying the extent of a particular land use and for identifying representative, yet vulnerable soils. The data set from Austin includes land use by tax parcels and was particularly important for the turf (golf courses) and right-of-way scenarios. The TCEQ dataset developed by the USGS (2003) provided agricultural land cover data, including areas representative of meadows and rangelands, and residential areas. Based on a review of the data, residential areas appeared better classified in the USGS (2003) data set; the COA data set tended to include all lots zoned for residential and often included areas well outside of where pesticides would presumably be applied. Abstracts from the metadata of the two land cover data sets are included below.

**COA land use data set:** “From October 2003 until December 2004, the City of Austin Watershed Protection and Development Review Department (WPDR) and the Transportation Planning and Sustainability Department (TPSD) produced this land use and tax parcel inventory. The extent of the data includes the watersheds of Travis, Hays, Williamson, and Blanco County that drain into Austin city limits. This includes the City of Austin extra-territorial jurisdiction. The layer is used in watershed, land use, and transportation modeling. More specifically, the information will be used to estimate and forecast impervious cover, population and housing density, and land use change. Parcels were created to reflect 2003 tax maps by either updating year 2000 parcel polygons, or converting and attributing lot lines from the City base map or county appraisal district CAD files. After completing parcel polygons, appraisal district land use data was joined to the layer using the parcel identification number. In addition, historical land use data was joined through GIS overlays. We then coded land use by comparing appraisal district data to the historical data where possible. The land use coding system used in year 2000 data was expanded to reflect the needs of both the planning and watershed management disciplines and the availability of new data. Infrared and color aerial photos were used to confirm or make determinations, especially where data was unavailable or questionable. Other GIS layers such as buildings and parks were used in this verification process.” (COA 2003)

**USGS (TCEQ) land use data set:** “This layer delineates the land use/land cover (LULC) polygons for the Edwards Aquifer Project in Texas from the years 1995 and 1996. Attribution of the polygons is based on a modified Anderson classification schema. LULC classification was done to Level 3 of the classification schema and a new category of Mixed Forest/Shrub was added to better represent the land cover of the area. Fieldwork was performed prior to compilation to gather local data and relate aerial photo images to corresponding ground
features. Because of the stunted or lower tree growth common in this region it was difficult at
times to differentiate between Forest, Mixed Forest/Shrub, and Shrub. It should be noted that
much of the Planted/cultivated land is highly managed pastureland. A detailed description of the
schema can be found in the Supplemental Information Section. All the LULC data was
collected from color infrared DOQQs and high-resolution (1:40,000-scale) aerial photography.
The minimum mapping unit used for delineating a polygon is 5 acres and the minimum polygon
width is 125 feet.” (USGS 2003)

Soils data

Data for Hays and Travis counties were downloaded from Soil Data Mart (USDA 2006) and
clipped to the hydrozones of the BSS AOI (ftp://www.bseacd.org/from/HCP Shape Files/).
EFED indicated that scenarios should be parameterized based on representative soils that will
yield high-end runoff and sediment values. Specifically, this focused on Hydrological Group C
and D soils with high erodibility and slope. Quantitative descriptions of the soil selection
process are provided in the metadata for each scenario with additional detail provided in later
sections of this report.

Official soil series descriptions (OSD) of the selected soils were used to characterize the soils of
interest for the scenarios (Soil Survey Staff 2006a, b). Soil parameters were obtained from
USDA Soil Data Mart (USDA 2006).

Additional Data Sources

When exploring the extent of agricultural areas in the AOI, areas of crops grown in Hays and
Travis counties were obtained from NASS (USDA 1997, 2002). This was used as a preliminary
attempt to understand the types of crops grown in the AOI and their respective magnitudes.

City and County officials and extension agents were contacted to understand and verify correct
parameters to represent each of the scenarios that were developed.

In cases where similar PRZM scenarios were available, parameters were reviewed for
consistency. Specifically, the BS turf scenario was compared to the PA turf and FL turf
scenarios.

For determination of USLEC and Manning’s N values, the RUSLE EPA Pesticide project (2000)
was used. Existing files were considered according to current U.S. EPA guidance (U.S. EPA
1998). The Barton Springs area is located in Land Resource Region (LRR) I. The San Antonio
climate station is located within this LRR and is an appropriate location for which to select
appropriate RUSLE data files. Available crops for this climate station include: 1) Range, 2)
Pasture, warm season, 3) peanut, Spanish, 4) Sorghum, grain, and 5) Wheat, winter. For
scenarios where appropriate files did not exist (i.e. impervious surfaces), appropriate values
were selected to represent USLEC and Manning’s N values. Curve numbers were derived based on
USDA TR-55: Urban Hydrology for Small Watersheds document (USDA 1986) or from the
GLEAMS (USDA 2000) manual when appropriate. Further details are provided in the metadata
for each scenario.
CONCEPTUAL MODELS OF DEVELOPED SCENARIOS

Residential

This scenario intended to be used as a surrogate for all urban/suburban home and residential uses in the Barton Springs Segment (BSS) of the Edwards Aquifer. The intention is to couple the edge of field concentrations from this scenario with the edge of field concentrations from the impervious surface scenario for Barton Springs to generate weighted concentrations for areas of varying impervious cover. Crop parameters have been chosen to reflect residential turf areas, primarily lawns, within the BSS.

For this scenario estimates of typical impervious fractions in suburban watersheds were obtained from a City of Austin COA (2002) report for the COA jurisdictional section of the Barton Springs Segment (BSS) and from local runoff studies obtained from the COA. Within the City of Austin Jurisdiction of the Barton Springs Zone approximately 7.5% or 5098 acres consists of impervious surfaces. Within the recharge zone, the City of Austin restricts impervious cover for new development to 15% of the net site area and 20% of the site area in the Barton Creek contributing zone (COA, 2002). However, based on unpublished data obtained from the City of Austin some residential watersheds in the area may be as high as 40% (Rich Robinson, COA, personal communication).

The analysis of land cover information is provided in Figure 1. A conceptual model of this approach is provided in the assessment.
Figure 1. Location of Brackett Soils in single- and multi-family residential areas of the Barton Springs Segment of the Edwards Aquifer, Hays and Travis Counties, Texas.

Impervious

This scenario is intended to be used to mimic hydrology of untreated portions of the Barton Springs Segment (BSS) of the Edwards Aquifer. The intention is to couple the edge of field concentrations from this scenario with the edge of field concentrations from the residential scenario for Barton Springs to generate weighted concentrations for areas of varying impervious cover. Therefore, this scenario relies on a similar soil series as the residential scenario; however the upper horizon has been adjusted to a non-soil nature. As noted above, data indicate that impervious fractions of residential areas in the BSS range from less than 10% (COA 2002) to as high as approximately 40% (Rich Robinson, COA, personal communication). The analysis of land cover information is provided in Figure 2.
Figure 2. Percentage of Impervious Surfaces near Barton Springs.

Turf

This scenario is intended to represent turf areas (golf courses, parks, sod farms, and recreational fields) in the Barton Springs Segment (BSS) of the Edwards Aquifer. Because golf courses are
expected to be the most likely turf areas where pesticides may be applied, much of this scenario has been parameterized to be reflective of golf course turf. NASS data for 1997 and 2002 (USDA 1997, 2002) contained no record of sod harvest in either Hays or Travis counties. Since there are several golf courses located within the BSS (COA 2003), this scenario was parameterized to represent turf on golf courses and may be generally representative of other potential turf areas. Crop parameters are based primarily on bermudagrass (*Cynodon* spp.) since it is a primary turf grass for golf courses and athletic fields. The analysis of land cover information is provided in Figure 3.

![Figure 3. Location of Brackett Soils in golf course areas of the Barton Springs Segment of the Edwards Aquifer, Hays and Travis Counties, Texas.](image)

**Right-of-Way**

This scenario is intended to represent right-of-way areas including roads, fence lines, power lines, and railroads in the Barton Springs Segment (BSS) of the Edwards Aquifer. Unlike most of EFED existing scenarios, the scenario is conceptually different in that it represents a linear surface that drains into an adjacent water body (drainage ditch). However, for this exercise, EFED assumes that while conceptually different, the scenario is for practicality purposes developed in a similar manner as a standard scenario that assumes a 10-hectare field draining into a 1-hectare static pond.
Crop cover parameters for this scenario were based on typical plants found adjacent to state maintained highway right-of-ways. State-maintained highways include farm-to-market (FM) roads, state highways, interstates, and US highways. Bermuda grass is typically found in right-of-way areas in urban areas, while rural areas are dominated by native species such as little bluestem, side-oats grama, and hairy grama (John Mason, Vegetation Management Specialist, Texas DOT, Maintenance Div., personal communication).

The contractor attempted to determine where pesticides may or may not be applied to Right-Of-Ways (including highway/railroad/utility segments). COA was not aware of a source for this information (Nancy McClintock, personal communication). According to Texas Department of Transportation (TX DOT), Vegetation Manager Dennis Markwardt, the TX DOT applies herbicides only (no insecticides) to all of its state roadways. They only apply herbicide to a one-foot wide area along the roadway, not the entire right-of-way. They also limit the use of herbicides within the BSZ to mainly Round-Up, and to a more limited extent, Oust, OutRider and Escort. Occasionally they will need to apply spot treatment to noxious weeds.

According to Travis County Transportation and Natural Resources, Road and Bridge Division Maintenance Manager, Don Ward, Travis County applies herbicide only to their rural roads where there is no curbing gutter. They apply only Round-Up and apply it to a four foot wide area along the roadway approximately two times per year. Scott Lambert provided us with a GIS layer of the Travis County roads where herbicide may be applied. The analysis of land cover information is provided in Figure 4.
Figure 4. Location of Brackett soils in right-of-way areas (streets/roads/railroads/utilities) of the Barton Springs Segment of the Edwards Aquifer, Hays and Travis Counties, Texas.
**Right-of-Way**

This scenario is intended to represent right-of-way areas including roads, fence lines, power lines, and railroads in the Barton Springs Segment (BSS) of the Edwards Aquifer. Unlike most of EFED existing scenarios, the scenario is conceptually different in that it represents a linear surface that drains into an adjacent water body (drainage ditch). However, for this exercise, EFED assumes that while conceptually different, the scenario is for practicality purposes developed in a similar manner as a standard scenario that assumes a 10-hectare field draining into a 1-hectare static pond.

Crop cover parameters for this scenario were based on typical plants found adjacent to state maintained highway right-of-ways. State-maintained highways include farm-to-market (FM) roads, state highways, interstates, and US highways. Bermuda grass is typically found in right-of-way areas in urban areas, while rural areas are dominated by native species such as little bluestem, side-oats grama, and hairy grama (John Mason, Vegetation Management Specialist, Texas DOT, Maintenance Div., personal communication).

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**Rangeland/Pastureland**

In the BSS, rangeland vegetation is a heterogeneous mixture of trees and grasses. Common tree species include: ash juniper (a nuisance species), oaks, hackberry and elms. Grass species including little blue stem, side oats grama, Indian grass, switch grass, king ranch bluestem (introduced) and kline grass (introduced) are typical. These areas are composed of approximately 60-65% trees and 30-35% grasses (Perez 2006). Although this land cover contains a significant amount of tree cover, this “crop” was modeled as a field crop rather than an orchard in order to model a more conservative field. The analysis of land cover information is provided in Figure 5.
Figure 5. Location of Brackett Soils in natural herbaceous areas of the Barton Springs segment of the Edwards Aquifer, Hays and Travis Counties, Texas.
Meadow

This scenario is intended to represent a meadow that may include cultivation of herbaceous, non-grass animal feeds (forage, fodder, straw, and hay) (IR4 generalized crop group #18). The USDA census of agriculture (USDA 1997, 2002) indicates that hay of varying types is grown extensively in Travis and Hays Counties (Table 6). Discussions with extension agents in Hays and Travis counties indicated that some cultivation of sorghum hay, and hay grazer, or sweet sorghum does occur in the Barton Springs Segment. Bermuda grass is also planted but is primarily for grazing and not harvested (Perez 2006). Most of this type of crop is for livestock grazing (Davis, 2006). The analysis of land cover information is provided in Figure 6.

Figure 6. Location of Brackett soils in planted/cultivated areas of the Barton Springs segment of the Edwards Aquifer, Hays and Travis Counties, Texas.
Outdoor Nursery

The contractor conducted an investigation of wholesale nurseries in the BSZ using a variety of data sources to determine the extent of nurseries in the BSZ and the potential for _outside_ pesticide use. NASS data for 2002 (Table 1) indicate that _outside_ acreage for reported ornamental crops in all of Hays and Travis Counties is negligible relative to indoor acreage (< 0.1% total indoor and outdoor acreage). The majority of acreage for nursery, greenhouse, floriculture, mushrooms, sod, and vegetable seeds in both years and both counties was grown under glass or other protection. The contractor conducted a refined investigation to determine if this trend was similar in the BSZ.

| Table 1. NASS 1997/2002 census of agriculture for ornamental production for open areas versus under glass in Hays and Travis Counties, Texas. |
|-----------------|-----------------|-----------------|-----------------|-----------------|
| Crop                                           | HAYS 1997 Total Acres | HAYS 2002 Total Acres | TRAVIS 1997 Total Acres | TRAVIS 2002 Total Acres |
| Nursery, greenhouse, floriculture, aquatic plants, mushrooms, flower seeds, vegetable seeds, sod harvested, total **In open** | x | 65 | x | 111 |
| Nursery, greenhouse, floriculture, aquatic plants, mushrooms, flower seeds, vegetable seeds, sod harvested, total **Under glass (not applicable for modeling)** | x | 407,925 | x | 115,274 |
| Nursery, floriculture, vegetable and flower seed crops, sod harvested, etc., grown in the open, irrigated | 26 | 36 | 99 | 106 |
| Floriculture crops – bedding/garden plants, cut flowers and cut florist greens, foliage plants, and potted flowering plants, total, in open | x | 14 | 23 | x |
| Bedding/garden plants, in open | 4 | x | 6 | 4 |
| Nursery stock, in open | 2 | 27 | 73 | 90 |
| Other nursery and greenhouse crops, in open | x | 25 | x | X |

_X = data not available, not applicable or withheld_
Initially, nurseries in BSZ were identified through the Texas Nursery and Landscape Association Growers List, “Austin at a Glance Local Business Search”, and Google Local Maps. Five potential wholesale nurseries in the BSZ were identified. The contractor confirmed the existence of these nurseries and the potential for other through sources in the City of Austin Watershed Protection and Development Review Board (Kathy Shay, personal communication) and the Ladybird Johnson Wildflower Center (Andrea DeLong-Amaya, personal communication). Both sources confirmed these nurseries and neither source was aware of additional nurseries in the BSZ that would have outdoor wholesale nursery production. The contractor then contacted each of the five nurseries identified to determine the extent of outside production acreage and the potential for pesticide application. Total outside wholesale nursery production the entire Barton Spring Zone is approximately three acres. Only three of the five nurseries had outdoor wholesale production (Figure 1). Of these three, two had less than 0.5 acres outdoor production. The remaining site, Barton Springs Nursery, has approximately 2.5 acres of outdoor production. The Barton Springs Nursery has a reputation for being “environmentally conscious” (Kathy Shay, personal communication). When the nursery was contacted it indicated that it does use pesticides “when called for”.

For the purposes of modeling a nursery/ornamental operation in the BSS, one of the nurseries (Barton Springs Nursery) was used to conceptualize a facility that is representative of one located within the BSS. Communications with a staff member were used to parameterize the model. The nursery of interest has indoor and outdoor areas for growing and maintaining plants. Outdoor plants include cacti, annuals, perennials, shrubs, and trees. Outdoor plants are maintained on either weed control mat or on gravel. Plants are kept in pots of various sizes, ranging from 4” to multiple gallons, depending upon the type of plant kept within. Irrigation is carried out daily with either hose or sprinkler systems. Plants are maintained outside year-round, with some becoming dormant in the winter and some remaining green. Spring and fall represent the busiest times for plant production and sales for this nursery (personal communication with nursery employee). Several assumptions were made to parameterize the model. First, it was assumed that the area that would yield the greatest runoff potential would be from a bare surface that would be represented by the walkways between the potted plants. These areas could potentially receive direct applications of pesticides sprayed on potted plants. Therefore, the surface of the soil was conceptualized as being gravel or dirt (area under weed mats). This was an assumption that affected selection of curve numbers, USLE C and Manning’s N. Second, it was assumed that pesticide runoff of potted soil would not degrade or adsorb and would therefore, be applied directly to the soil.

The contractor also researched regulations for pesticide runoff from nurseries. Cindy Hooper of the TX Commission on Environmental Quality (TCEQ) Stormwater Team, which regulates the State TPDES for the federal NPDES, stated that the Nursery SIC code is 0181 which is an Agricultural type SIC code. Therefore nurseries are not required to have a TPDES Multi-Sector General Permit. Nancy McClintock, Assistant Director of the City of Austin Watershed Protection and Development Review Board indicated that a recent ordinance requires Integrated Pest Management (IPM) plans for new development; however the plan does not have specific pesticide runoff control requirements. It is important to note that this ordinance applies only to those areas of the BSZ under the jurisdiction of the City of Austin (approximately one-quarter of the BSZ). The analysis of land cover information is provided in Figure 7.
Figure 7. Location of outdoor wholesale nurseries in the Barton Springs segment of the Edwards Aquifer
LAND USE / LAND COVER ANALYSIS

Percent of each land use was computed for each of the land use / land cover datasets used in scenario development. Table 2 presents the percent of each land use as classified by USGS (2003) for the Barton Springs Segment in Hays and Travis counties, TX. Table 3 presents the percent of each land use as classified by COA (2003). Datasets were spatially “clipped” in ArcGIS to the area of interest as defined in the SOW for this assessment, specifically the Barton Springs Contributing, Recharge, and Transition zones in Hays and Travis Counties, TX.

Table 2. Percent of each land use in the Barton Springs Segment of Hays and Travis Counties, TX computed from USGS (2003) dataset. Based on the table "edw_lulc_BSS_AOI_UTM_SOIL " in the BartonSpringsAOI.mdb geodatabase

<table>
<thead>
<tr>
<th>Land Use / Land Cover</th>
<th>Area (acres)</th>
<th>%</th>
<th>Related Scenario</th>
</tr>
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<tbody>
<tr>
<td>Forested</td>
<td>138,670</td>
<td>54.60%</td>
<td>NA</td>
</tr>
<tr>
<td>Natural Herbaceous</td>
<td>37,700</td>
<td>14.84%</td>
<td>Rangeland</td>
</tr>
<tr>
<td>Single-Family Residential</td>
<td>28,352</td>
<td>11.16%</td>
<td>Residential</td>
</tr>
<tr>
<td>Mixed Forest/Shrub</td>
<td>26,068</td>
<td>10.26%</td>
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</tr>
<tr>
<td>Planted/Cultivated Herbaceous</td>
<td>8,098</td>
<td>3.19%</td>
<td>Meadow</td>
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<tr>
<td>Shrubland</td>
<td>5,989</td>
<td>2.36%</td>
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<tr>
<td>Transportation</td>
<td>2,278</td>
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<tr>
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<td>1,339</td>
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<td>854</td>
<td>0.34%</td>
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<td>Communications And Utilities</td>
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<tr>
<td>Transitional Bare</td>
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<tr>
<td>Heavy Industry</td>
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<td>NA</td>
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<tr>
<td>Stream/River</td>
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<td>0.01%</td>
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<tr>
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<tr>
<td>Woody Wetland</td>
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</tr>
<tr>
<td>Total*</td>
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<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

* Note: Total area does not match exactly between the COA and USGS data sets due to differences in boundary delineations by each organization. USGS did not include Blanco
county and several fringe areas that were included in the COA dataset. Both datasets were clipped to the area of interest as defined in the SOW for this assessment, specifically the Barton Springs Contributing, Recharge, and Transition zones in Hays and Travis Counties, TX.

<table>
<thead>
<tr>
<th>Land Use / Land Cover</th>
<th>Area (acres)</th>
<th>%</th>
<th>Related Scenario</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large-lot Single Family</td>
<td>71,669</td>
<td>28.2%</td>
<td>NA</td>
</tr>
<tr>
<td>Undeveloped</td>
<td>59,320</td>
<td>23.3%</td>
<td>NA</td>
</tr>
<tr>
<td>Agricultural</td>
<td>38,166</td>
<td>15.0%</td>
<td>NA</td>
</tr>
<tr>
<td>Single Family Residential</td>
<td>33,502</td>
<td>13.2%</td>
<td>NA</td>
</tr>
<tr>
<td>Preserves</td>
<td>20,020</td>
<td>7.9%</td>
<td>NA</td>
</tr>
<tr>
<td>Streets and Roads</td>
<td>10,684</td>
<td>4.2%</td>
<td>Right-of-way</td>
</tr>
<tr>
<td>Parks/Greenbelts</td>
<td>6,136</td>
<td>2.4%</td>
<td>NA</td>
</tr>
<tr>
<td>Mobile Homes</td>
<td>2,923</td>
<td>1.1%</td>
<td>NA</td>
</tr>
<tr>
<td>Commercial</td>
<td>2,353</td>
<td>0.9%</td>
<td>NA</td>
</tr>
<tr>
<td>Resource Extraction</td>
<td>1,713</td>
<td>0.7%</td>
<td>NA</td>
</tr>
<tr>
<td>Apartment/Condo</td>
<td>1,494</td>
<td>0.6%</td>
<td>NA</td>
</tr>
<tr>
<td>Educational</td>
<td>1,184</td>
<td>0.5%</td>
<td>NA</td>
</tr>
<tr>
<td>Golf Courses</td>
<td>1,152</td>
<td>0.5%</td>
<td>Turf</td>
</tr>
<tr>
<td>Warehousing</td>
<td>1,136</td>
<td>0.4%</td>
<td>NA</td>
</tr>
<tr>
<td>Office</td>
<td>792</td>
<td>0.3%</td>
<td>NA</td>
</tr>
<tr>
<td>Meeting and Assembly</td>
<td>752</td>
<td>0.3%</td>
<td>NA</td>
</tr>
<tr>
<td>Duplexes</td>
<td>505</td>
<td>0.2%</td>
<td>NA</td>
</tr>
<tr>
<td>Utilities</td>
<td>249</td>
<td>0.1%</td>
<td>Right-of-way</td>
</tr>
<tr>
<td>Three/Fourplex</td>
<td>157</td>
<td>0.1%</td>
<td>NA</td>
</tr>
<tr>
<td>Miscellaneous Industrial</td>
<td>154</td>
<td>0.1%</td>
<td>NA</td>
</tr>
<tr>
<td>Government Services</td>
<td>114</td>
<td>0.0%</td>
<td>NA</td>
</tr>
<tr>
<td>Aviation facilities</td>
<td>59</td>
<td>0.0%</td>
<td>NA</td>
</tr>
<tr>
<td>Hospitals</td>
<td>58</td>
<td>0.0%</td>
<td>NA</td>
</tr>
<tr>
<td>Water</td>
<td>52</td>
<td>0.0%</td>
<td>NA</td>
</tr>
<tr>
<td>Railroad Facilities</td>
<td>45</td>
<td>0.0%</td>
<td>Right-of-way</td>
</tr>
<tr>
<td>Cemeteries</td>
<td>39</td>
<td>0.0%</td>
<td>NA</td>
</tr>
<tr>
<td>Retirement Housing</td>
<td>26</td>
<td>0.0%</td>
<td>NA</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>22</td>
<td>0.0%</td>
<td>NA</td>
</tr>
<tr>
<td>Parking</td>
<td>9</td>
<td>0.0%</td>
<td>NA</td>
</tr>
<tr>
<td>Marinas</td>
<td>3</td>
<td>0.0%</td>
<td>NA</td>
</tr>
<tr>
<td>Group Quarters</td>
<td>2</td>
<td>0.0%</td>
<td>NA</td>
</tr>
<tr>
<td>Semi-institutional Housing</td>
<td>0</td>
<td>0.0%</td>
<td>NA</td>
</tr>
<tr>
<td>Total*</td>
<td>254,490</td>
<td>100.0%</td>
<td></td>
</tr>
</tbody>
</table>
* Note: Total area does not match exactly between the COA and USGS data sets due to differences in boundary delineations by each organization. USGS did not include Blanco county and several fringe areas that were included in the COA dataset. Both datasets were clipped to the area of interest as defined in the SOW for this assessment, specifically the Barton Springs Contributing, Recharge, and Transition zones in Hays and Travis Counties, TX.
CLIMATE AND TIME PARAMETERS

Geographic parameters located in table 1 of the metadata files were determined based on the AOI. The meteorological station selected for the scenarios was located in Austin, Texas (W13958). This station was the closest available weather station that included data required for PRZM. PFAC and ANETD values were determined for the location of the AOI as it corresponded to PRZM manual figures 5.1 and 5.2, respectively (U.S. EPA 1998). It was assumed that snowfall could occur and persist based on meteorological data for Austin, which indicated that from 1971-2001, the average snowfall for the winter season was 0.6 inches (NOAA 2006); therefore, the SFAC value was set to correspond to the value representative of open areas (Table 5.1, U.S. EPA 1998).

SOIL SELECTION/PARAMETERIZATION

Soil series were selected for the Barton Springs scenarios based on geospatial analysis and discussions with local experts. Percent of each soil type within a particular LULC of interest in the Barton Springs Segment (BSS) was determined by intersecting the LULC data sets (USGS 2003, COA 2003) with soils data (USDA 2006). Soils were then selected based on various factors, including: extent, representativeness, benchmark soil, and/or high vulnerability of soil to erosion.

The Brackett soil series was selected for six of the seven scenarios, including: residential, impervious, right-of-way, turf, meadow and rangeland/pastureland. The Tarrant soil series was selected for the nursery scenario. Data for these soils was obtained from Soil Data Mart (USDA 2006) for the county with the most extensive amount of the relevant LULC (Table 4). Values for thickness, bulk density, initial water content, field capacity, and wilting point were taken from soil data mart for the horizons of interest. Organic carbon was determined for each horizon with organic matter data that were adjusted using the relationship % OC = % Organic Matter/1.724 (Doucette 2000). In all scenarios, Soil Data Mart included information for an additional soil horizon. Since this horizon was bedrock, the horizon was not added to the soil profiles.

Table 4. Soil types and county locations of soil data for each of the Barton Springs scenarios.

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Soil</th>
<th>Soil Confirmed?</th>
<th>County</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meadow</td>
<td>Brackett-Rock Outcrop-Comfort Complex</td>
<td>yes</td>
<td>Hays</td>
</tr>
<tr>
<td>Rangeland/Pastureland</td>
<td>Brackett-Rock Outcrop-Comfort Complex</td>
<td>yes</td>
<td>Hays</td>
</tr>
<tr>
<td>Residential</td>
<td>Brackett-Rock Outcrop-Complex</td>
<td>yes</td>
<td>Travis</td>
</tr>
<tr>
<td>Impervious</td>
<td>Brackett-Rock Outcrop-Complex</td>
<td>yes</td>
<td>Travis</td>
</tr>
<tr>
<td>Turf</td>
<td>Brackett-Rock Outcrop-Complex</td>
<td>yes</td>
<td>Travis</td>
</tr>
<tr>
<td>Right-of-Way</td>
<td>Brackett-Rock Outcrop-Complex</td>
<td>yes</td>
<td>Travis</td>
</tr>
<tr>
<td>Nursery</td>
<td>Tarrant soils and urban land</td>
<td>No*</td>
<td>Travis</td>
</tr>
</tbody>
</table>

* See nursery soil selection information below.
The Brackett series approximates the 90th percentile of vulnerability, drainage, erodibility, and slope. The relatively low organic matter content is also expected to result in lower microbial activity and thus reduced potential for pesticide degradation. Brackett soils have a USLE K factor of 0.37 which includes the 90th percentile of these soils in erodibility. Brackett is a benchmark soil as well as a Hydrologic Group C. Slopes can range from 1 to 60 percent (Soil Survey Staff, 2006a); however the most typical range for the Brackett series in residential areas is either 1-8 percent (Hays County) or 1-12 percent (Travis County) (USDA 2006).

Tarrant is a Hydrologic Group D soil, with a USLE K factor of 0.32 (USDA 2006). Slopes range from 1 to 8 percent for this series (USDA 1997), but for the portion that overlaps with the nursery, the slope range is 0 to 2 percent. Since all three outdoor nursery operations in the BSS are located within Travis County, soil parameters were obtained soil data mart information pertaining to Travis County (USDA 2006).

**Residential and Impervious**

Soils were selected based on vulnerability and the extent within single- and multi-family residential areas in BSS. Based on a geospatial analysis of soils (USDA 2006) and land use data (USGS 2003) for residential areas as well as conversations with local soil experts, Brackett soils were chosen to represent residential areas in the BSS. Brackett soils are in Hydrologic Group C, are found in both the contributing and recharge zones of the Edwards Aquifer (Figure 1), and are the most common soil on which residential dwellings are located, accounting for 35% of all soils in residential areas (*Table 5*). Brackett soils are often undulating (Soil Survey Staff 2006a) making them desirable for development due to their scenic nature (Volente 2004). The location of Brackett soils was also cross-checked with aerial photography (TWDB 2004) to ensure that the soil chosen coincided with residential areas where pesticides would reasonably be applied. A local soil expert also confirmed that Brackett soil is a common soil type in residential areas of the BSS (Perez, 2006). A thatch layer was added to the top of the soil layer according to U.S. EPA guidance on modeling turf, as provided with the SOW.

The impervious scenario is intended to be coupled to the residential scenario to mimic hydrology of untreated portions of the Barton Springs Segment (BSS) of the Edwards Aquifer. The intention is to couple the edge of field concentrations from this scenario with the edge of field concentrations from the residential scenario for Barton Springs to generate weighted concentrations for areas of varying impervious cover. Therefore, this scenario relies on a similar soil series as the residential scenario (Brackett); however the upper horizon has been adjusted to a non-soil nature. This included setting a high curve number, high bulk density, low curve number, and setting organic carbon to zero.
<table>
<thead>
<tr>
<th>Hydrologic Group</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>water/cut &amp; fill /etc.</td>
<td>0.06%</td>
</tr>
<tr>
<td>A</td>
<td>0.37%</td>
</tr>
<tr>
<td>B</td>
<td>1.35%</td>
</tr>
<tr>
<td>C</td>
<td>47.14%</td>
</tr>
<tr>
<td>D</td>
<td>51.09%</td>
</tr>
<tr>
<td></td>
<td>100.00%</td>
</tr>
</tbody>
</table>

Table 5. Analysis of Residential Soils Types.

Types of D soils in single- and multi-family residential land use type in the Barton Springs Segment of The Edwards Aquifer (percent of LULC in parenthesis).

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speck stony clay loam</td>
<td>16.9%</td>
</tr>
<tr>
<td>Comfort-Rock outcrop complex</td>
<td>12.6%</td>
</tr>
<tr>
<td>Real-Comfort-Doss complex</td>
<td>12.0%</td>
</tr>
<tr>
<td>Tarrant and Speck soils</td>
<td>8.55%</td>
</tr>
<tr>
<td>Tarrant soils and Urban land</td>
<td>7.11%</td>
</tr>
<tr>
<td>Tarrant soils</td>
<td>6.09%</td>
</tr>
<tr>
<td>Doss silty clay</td>
<td>5.55%</td>
</tr>
<tr>
<td>Denton silty clay</td>
<td>3.68%</td>
</tr>
<tr>
<td>Urban land and Brackett soils</td>
<td>2.61%</td>
</tr>
<tr>
<td>Urban land and Austin soils</td>
<td>2.57%</td>
</tr>
<tr>
<td>Crawford clay</td>
<td>2.42%</td>
</tr>
<tr>
<td>Urban land, Austin, and Whitewright soils</td>
<td>2.40%</td>
</tr>
<tr>
<td>Purves silty clay</td>
<td>2.13%</td>
</tr>
<tr>
<td>Krum clay</td>
<td>2.13%</td>
</tr>
<tr>
<td>Houston Black soils and Urban land</td>
<td>1.97%</td>
</tr>
<tr>
<td>Heiden clay</td>
<td>1.27%</td>
</tr>
<tr>
<td>San Saba soils and Urban land</td>
<td>1.12%</td>
</tr>
<tr>
<td>Medlin-Eckrant association</td>
<td>1.07%</td>
</tr>
<tr>
<td>Tarpley clay</td>
<td>1.01%</td>
</tr>
<tr>
<td>San Saba clay</td>
<td>0.95%</td>
</tr>
<tr>
<td>Purves clay</td>
<td>0.90%</td>
</tr>
<tr>
<td>Real gravelly loam</td>
<td>0.80%</td>
</tr>
<tr>
<td>Tarrant-Rock outcrop complex</td>
<td>0.75%</td>
</tr>
<tr>
<td>Speck clay loam</td>
<td>0.65%</td>
</tr>
<tr>
<td>Anhalt clay</td>
<td>0.63%</td>
</tr>
<tr>
<td>Urban land and Ferris soils</td>
<td>0.58%</td>
</tr>
<tr>
<td>Urban land</td>
<td>0.41%</td>
</tr>
<tr>
<td>Gruene clay</td>
<td>0.39%</td>
</tr>
<tr>
<td>Soil Type</td>
<td>Percentage in Barto Springs Segment</td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>-------------------------------------</td>
</tr>
<tr>
<td>Eckrant-Rock outcrop complex</td>
<td>0.19%</td>
</tr>
<tr>
<td>Ferris-Heiden complex</td>
<td>0.17%</td>
</tr>
<tr>
<td>Houston Black clay</td>
<td>0.10%</td>
</tr>
<tr>
<td>Tinn clay</td>
<td>0.03%</td>
</tr>
<tr>
<td><strong>Types of C soils in single- and multi-family residential land use type in the Barton Springs Segment of The Edwards Aquifer (percent of LULC in parenthesis).</strong></td>
<td></td>
</tr>
<tr>
<td>Brackett-Rock outcrop (Comfort or Real) complex</td>
<td>73.6% (34.7%)</td>
</tr>
<tr>
<td>Rumple-Comfort association</td>
<td>8.22%</td>
</tr>
<tr>
<td>Eddy soils and Urban land</td>
<td>4.88%</td>
</tr>
<tr>
<td>Volente silty clay loam</td>
<td>4.87%</td>
</tr>
<tr>
<td>Eddy gravelly loam</td>
<td>2.15%</td>
</tr>
<tr>
<td>Austin silty clay</td>
<td>2.09%</td>
</tr>
<tr>
<td>Bolar clay loam</td>
<td>1.26%</td>
</tr>
<tr>
<td>Volente soils and Urban land</td>
<td>1.23%</td>
</tr>
<tr>
<td>Caste Stephen silty clay loam</td>
<td>0.94%</td>
</tr>
<tr>
<td>Austin-Caste Stephen complex</td>
<td>0.42%</td>
</tr>
<tr>
<td>Altoga soils and Urban land</td>
<td>0.07%</td>
</tr>
<tr>
<td>Algoa silty clay</td>
<td>0.04%</td>
</tr>
<tr>
<td>Travis soils and urban land</td>
<td>0.02%</td>
</tr>
<tr>
<td>Whitewright clay loam</td>
<td>0.01%</td>
</tr>
<tr>
<td>Caste Stephen clay loam</td>
<td>0.00%</td>
</tr>
<tr>
<td><strong>Types of B soils in single- and multi-family residential land use type in the Barton Springs Segment of the Edwards Aquifer (percent of LULC in parenthesis).</strong></td>
<td></td>
</tr>
<tr>
<td>Sunev clay loam</td>
<td>39.0%</td>
</tr>
<tr>
<td>Lewisville silty clay</td>
<td>19.7%</td>
</tr>
<tr>
<td>Patrick soils</td>
<td>14.9%</td>
</tr>
<tr>
<td>Lewisville soils and Urban land</td>
<td>10.4%</td>
</tr>
<tr>
<td>Patrick soils and urban land</td>
<td>6.90%</td>
</tr>
<tr>
<td>Sunev silty clay loam</td>
<td>2.82%</td>
</tr>
<tr>
<td>Seawillow clay loam</td>
<td>2.36%</td>
</tr>
<tr>
<td>Oakalla soils</td>
<td>2.08%</td>
</tr>
<tr>
<td>Hardeman soils and Urban land</td>
<td>0.80%</td>
</tr>
<tr>
<td>Oakalla silty clay loam</td>
<td>0.41%</td>
</tr>
<tr>
<td>Bergstrom soils and Urban land</td>
<td>0.33%</td>
</tr>
<tr>
<td>Boerne fine sandy loam</td>
<td>0.12%</td>
</tr>
<tr>
<td><strong>Types of A soils in single- and multi-family residential land use type in the Barton Springs Segment of the Edwards Aquifer (percent of LULC in parenthesis).</strong></td>
<td></td>
</tr>
<tr>
<td>Mixed alluvial land</td>
<td>82.4%</td>
</tr>
<tr>
<td>Orif soils</td>
<td>15.7%</td>
</tr>
<tr>
<td>Gaddy soils and Urban land</td>
<td>1.76%</td>
</tr>
</tbody>
</table>
Turf

Soil parameters were determined using data from Soil Data Mart (USDA 2006) for Travis County and land use data from the City of Austin (COA, 2003). This county data set was used since the majority of golf courses in the AOI reside within Travis County. The specific soil chosen was Brackett-Rock Outcrop-Complex, with 1-12% slopes, which is the most common soil located within golf course areas of BSS (Figure 3). A thatch layer was added to the top of the soil layer according to U.S. EPA guidance on modeling turf, as provided with the SOW. The properties of the thatch layer are consistent with existing turf scenarios: PA turf and FL turf.

The Brackett series was chosen to represent turf areas in the BSS (Table 5) because it is a benchmark soil, is highly representative of golf course areas in the BSS, and it approximates the 90th percentile of vulnerability in drainage, erodibility, and slope. Brackett soils are in Hydrologic Group C soils and are found in both the contributing and recharge zones of the Edwards Aquifer. Brackett soils are the most common soil type found in golf course areas of the BSS (Table 6).

<table>
<thead>
<tr>
<th>Table 6. Analysis of Golf Course Soil Types.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Types of D soils in golf course land use type in the Barton Springs Segment of Edwards Aquifer (percent of LULC in parenthesis).</td>
</tr>
<tr>
<td>Tarrant 38.0% (12.5%)</td>
</tr>
<tr>
<td>Speck 28.6% (9.45%)</td>
</tr>
<tr>
<td>San Saba 19.3% (6.39%)</td>
</tr>
<tr>
<td>Crawford 11.4% (3.76%)</td>
</tr>
<tr>
<td>Doss 2.52% (0.83%)</td>
</tr>
<tr>
<td>Types of C soils in golf course land use type in the Barton Springs Segment of Edwards Aquifer (percent of LULC in parenthesis).</td>
</tr>
<tr>
<td>Brackett 77.6% (50.5%)</td>
</tr>
<tr>
<td>Volente 22.3% (14.5%)</td>
</tr>
<tr>
<td>Types of A soils in golf course land use type in the Barton Springs Segment of Edwards Aquifer (percent of LULC in parenthesis).</td>
</tr>
<tr>
<td>Alluvial land 100% (1.91%)</td>
</tr>
</tbody>
</table>

Right-of-way

Soils were chosen based on co-location with right-of-way areas based on land use coverage developed by the City of Austin (City of Austin 2003). The land use data set include streets, roads, utilities, and railroads, but does not include fence lines. Based on a geospatial analysis of right-of-way land uses (City of Austin 2003) and USDA soils data (USDA 2006), Brackett soils were chosen to represent right-of-way areas in the BSS. Brackett soils are found in both the contributing and recharge zones of the Edwards Aquifer and are the most common soil on which right-of-way areas are located (Figure 4), accounting for 32% of soils in right-of-way areas.
(Table 7). The soil data for Travis County, Brackett-Rock Outcrop-Complex soil with slopes 112% was used to parameterize the soil component of this scenario (USDA 2006).

<table>
<thead>
<tr>
<th>Types of D soils in right-of-way (streets/roads/utilities/railroads) land use type in the Barton Springs Segment of Edwards Aquifer (percent of AOI in parenthesis).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speck stony clay loam 23.5% (12.8%)</td>
</tr>
<tr>
<td>Tarrant and Speck soils 10.2% (5.54%)</td>
</tr>
<tr>
<td>Tarrant soils 7.05% (3.83%)</td>
</tr>
<tr>
<td>Real-Comfort-Doss complex 6.85% (3.72%)</td>
</tr>
<tr>
<td>Crawford clay 6.85% (3.72%)</td>
</tr>
<tr>
<td>Comfort-Rock outcrop complex 6.50% (3.53%)</td>
</tr>
<tr>
<td>Tarrant soils and Urban land 5.75% (3.12%)</td>
</tr>
<tr>
<td>Doss silty clay 4.07% (2.21%)</td>
</tr>
<tr>
<td>Denton silty clay 3.55% (1.93%)</td>
</tr>
<tr>
<td>Urban land and Austin soils 2.28% (1.23%)</td>
</tr>
<tr>
<td>San Saba clay 2.24% (1.21%)</td>
</tr>
<tr>
<td>Krum clay 2.22% (1.20%)</td>
</tr>
<tr>
<td>Heiden clay 2.08% (1.13%)</td>
</tr>
<tr>
<td>Purves silty clay 1.83% (0.99%)</td>
</tr>
<tr>
<td>Urban land Austin and Whitewright soils 1.59% (0.86%)</td>
</tr>
<tr>
<td>Houston Black soils and Urban land 1.54% (0.83%)</td>
</tr>
<tr>
<td>San Saba soils and Urban land 1.53% (0.83%)</td>
</tr>
<tr>
<td>Urban land and Brackett soils 1.38% (0.75%)</td>
</tr>
<tr>
<td>Urban land 1.18% (0.64%)</td>
</tr>
<tr>
<td>Tarpley clay 1.01% (0.55%)</td>
</tr>
<tr>
<td>Gruene clay 0.96% (0.52%)</td>
</tr>
<tr>
<td>Purves clay 0.84% (0.45%)</td>
</tr>
<tr>
<td>Medlin-Eckrant association 0.80% (0.43%)</td>
</tr>
<tr>
<td>Tarrant-Rock outcrop complex 0.77% (0.41%)</td>
</tr>
<tr>
<td>Speck clay loam 0.66% (0.36%)</td>
</tr>
<tr>
<td>Ferris-Heiden complex 0.59% (0.32%)</td>
</tr>
<tr>
<td>Anhalt clay 0.42% (0.23%)</td>
</tr>
<tr>
<td>Branyon clay 0.41% (0.22%)</td>
</tr>
<tr>
<td>Real gravelly loam 0.36% (0.19%)</td>
</tr>
<tr>
<td>Houston Black clay 0.32% (0.17%)</td>
</tr>
<tr>
<td>Urban land and Ferris soils 0.23% (0.12%)</td>
</tr>
<tr>
<td>Eckrant-Rock outcrop complex 0.15% (0.08%)</td>
</tr>
<tr>
<td>Tinn clay 0.07% (0.03%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Types of C soils in right-of-way (streets/roads/utilities/railroads) land use type in the Barton Springs Segment of Edwards Aquifer (percent of AOI in parenthesis).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speck clay loam 0.66% (0.36%)</td>
</tr>
<tr>
<td>Ferris-Heiden complex 0.59% (0.32%)</td>
</tr>
<tr>
<td>Anhalt clay 0.42% (0.23%)</td>
</tr>
<tr>
<td>Branyon clay 0.41% (0.22%)</td>
</tr>
<tr>
<td>Real gravelly loam 0.36% (0.19%)</td>
</tr>
<tr>
<td>Houston Black clay 0.32% (0.17%)</td>
</tr>
<tr>
<td>Urban land and Ferris soils 0.23% (0.12%)</td>
</tr>
<tr>
<td>Eckrant-Rock outcrop complex 0.15% (0.08%)</td>
</tr>
<tr>
<td>Types of Soil Complex</td>
</tr>
<tr>
<td>-------------------------------</td>
</tr>
<tr>
<td>Brackett-Rock outcrop (Comfort or Real) complex</td>
</tr>
<tr>
<td>Rumple-Comfort association</td>
</tr>
<tr>
<td>Volente silty clay loam</td>
</tr>
<tr>
<td>Eddy soils and Urban land</td>
</tr>
<tr>
<td>Austin silty clay</td>
</tr>
<tr>
<td>Bolar clay loam</td>
</tr>
<tr>
<td>Eddy gravelly loam</td>
</tr>
<tr>
<td>Castephen silty clay loam</td>
</tr>
<tr>
<td>Volente soils and Urban land</td>
</tr>
<tr>
<td>Austin-Castephen complex</td>
</tr>
<tr>
<td>Castephen clay loam</td>
</tr>
<tr>
<td>Travis soils and urban land</td>
</tr>
<tr>
<td>Altoga soils and Urban land</td>
</tr>
<tr>
<td>Whitewright clay loam</td>
</tr>
<tr>
<td>Altoga silty clay</td>
</tr>
</tbody>
</table>

Types of B soils in right-of-way (streets/roads/utilities/railroads) land use type in the Barton Springs Segment of Edwards Aquifer (percent of AOI in parenthesis).

<table>
<thead>
<tr>
<th>Types of Soil</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sunev clay loam</td>
<td>40.7% (0.60%)</td>
</tr>
<tr>
<td>Lewisville silty clay</td>
<td>21.5% (0.32%)</td>
</tr>
<tr>
<td>Patrick soils</td>
<td>10.9% (0.16%)</td>
</tr>
<tr>
<td>Lewisville soils and Urban land</td>
<td>5.63% (0.08%)</td>
</tr>
<tr>
<td>Hardeman soils and Urban land</td>
<td>5.36% (0.07%)</td>
</tr>
<tr>
<td>Patrick soils and urban land</td>
<td>4.93% (0.07%)</td>
</tr>
<tr>
<td>Oakalla silty clay loam</td>
<td>3.01% (0.04%)</td>
</tr>
<tr>
<td>Oakalla soils</td>
<td>2.92% (0.04%)</td>
</tr>
<tr>
<td>Bergstrom soils and Urban land</td>
<td>2.64% (0.03%)</td>
</tr>
<tr>
<td>Sunev silty clay loam</td>
<td>1.43% (0.02%)</td>
</tr>
<tr>
<td>Whitewright clay loam</td>
<td>0.77% (0.01%)</td>
</tr>
</tbody>
</table>

Types of A soils in right-of-way (streets/roads/utilities/railroads) land use type in the Barton Springs Segment of Edwards Aquifer (percent of AOI in parenthesis).

<table>
<thead>
<tr>
<th>Types of Soil</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixed alluvial land</td>
<td>80.3% (0.46%)</td>
</tr>
<tr>
<td>Orif soils</td>
<td>19.2% (0.11%)</td>
</tr>
<tr>
<td>Gaddy soils and Urban land</td>
<td>0.30% (0.00%)</td>
</tr>
</tbody>
</table>
Rangeland/pastureland

Rangeland and pastureland were identified based on the natural herbaceous land cover classification in the BSS (USGS 2003). Based on the analysis of land use and soils data, Brackett soils were chosen to represent rangelands and pasturelands in the BSS (Table 5). Brackett soils are found in both the contributing and recharge zones of the Edwards Aquifer and are the most common soil on which rangeland is located (Table 8). This soil type was confirmed by an extension agent (Perez, 2006).

<table>
<thead>
<tr>
<th>Hydrologic Group</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>water/cut &amp; fill /etc.</td>
<td>0.25%</td>
</tr>
<tr>
<td>A</td>
<td>0.68%</td>
</tr>
<tr>
<td>B</td>
<td>6.67%</td>
</tr>
<tr>
<td>C</td>
<td>49.95%</td>
</tr>
<tr>
<td>D</td>
<td>42.45%</td>
</tr>
<tr>
<td></td>
<td>100.00%</td>
</tr>
</tbody>
</table>

Table 8. Analysis of Rangeland Soil Types.

<table>
<thead>
<tr>
<th>Types of D soils in natural herbaceous land use type in the Barton Springs Segment of Edwards Aquifer (percent of LULC in parenthesis).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doss silty clay 25.1% (10.6%)</td>
</tr>
<tr>
<td>Real-Comfort-Doss complex 15.4% (6.54%)</td>
</tr>
<tr>
<td>Comfort-Rock outcrop complex 10.3% (4.40%)</td>
</tr>
<tr>
<td>Krum clay 6.58% (2.79%)</td>
</tr>
<tr>
<td>Tarpley clay 4.83% (2.04%)</td>
</tr>
<tr>
<td>Denton silty clay 4.74% (2.01%)</td>
</tr>
<tr>
<td>Purves clay 4.44% (1.88%)</td>
</tr>
<tr>
<td>Speck stony clay loam 3.14% (1.33%)</td>
</tr>
<tr>
<td>Crawford clay 2.86% (1.21%)</td>
</tr>
<tr>
<td>Houston Black clay 2.43% (1.03%)</td>
</tr>
<tr>
<td>Anhalt clay 2.22% (0.94%)</td>
</tr>
<tr>
<td>Gruene clay 2.14% (0.90%)</td>
</tr>
<tr>
<td>Tarrant soils 2.12% (0.89%)</td>
</tr>
<tr>
<td>Krum clay 1.99% (0.84%)</td>
</tr>
<tr>
<td>Purves silty clay 1.59% (0.67%)</td>
</tr>
<tr>
<td>Tarrant and Speck soils 1.51% (0.64%)</td>
</tr>
<tr>
<td>San Saba clay 1.10% (0.46%)</td>
</tr>
<tr>
<td>Branyon clay 0.98% (0.41%)</td>
</tr>
<tr>
<td>Soil Type</td>
</tr>
<tr>
<td>---------------------------------------------</td>
</tr>
<tr>
<td>Heiden clay</td>
</tr>
<tr>
<td>Denton silty clay</td>
</tr>
<tr>
<td>Tinn clay</td>
</tr>
<tr>
<td>Heiden clay</td>
</tr>
<tr>
<td>Speck clay loam</td>
</tr>
<tr>
<td>Real gravelly loam</td>
</tr>
<tr>
<td>Eckrant-Rock outcrop complex</td>
</tr>
<tr>
<td>Heiden clay</td>
</tr>
<tr>
<td>Medlin-Eckrant association</td>
</tr>
<tr>
<td>Denton silty clay</td>
</tr>
<tr>
<td>Medlin-Eckrant association</td>
</tr>
<tr>
<td>Krum clay</td>
</tr>
<tr>
<td>Urban land and Austin soils</td>
</tr>
<tr>
<td>Crawford clay</td>
</tr>
<tr>
<td>Heiden clay</td>
</tr>
<tr>
<td>Houston Black clay</td>
</tr>
<tr>
<td>Tarrant soils and Urban land</td>
</tr>
<tr>
<td>San Saba soils and Urban land</td>
</tr>
<tr>
<td>Urban land, Austin and Whitewright soils</td>
</tr>
<tr>
<td>Urban land</td>
</tr>
<tr>
<td>Tarrant-Rock outcrop complex</td>
</tr>
<tr>
<td>Branyon clay</td>
</tr>
<tr>
<td>Houston Black clay</td>
</tr>
<tr>
<td>Houston Black soils and Urban land</td>
</tr>
<tr>
<td>Ferris-Heiden complex</td>
</tr>
<tr>
<td>Tarrant soils and Urban land</td>
</tr>
<tr>
<td>Tarrant soils and Urban land</td>
</tr>
</tbody>
</table>

**Types of C soils in natural herbaceous land use type in the Barton Springs Segment of Edwards Aquifer** (percent of LULC in parenthesis).

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>Percent (LULC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brackett-Rock outcrop (Comfort or Real)</td>
<td>82.9% (22.7%)</td>
</tr>
<tr>
<td>Rumple-Comfort association</td>
<td>57.7% (15.8%)</td>
</tr>
<tr>
<td>Bolar clay loam</td>
<td>15.4% (4.24%)</td>
</tr>
<tr>
<td>Volente silty clay loam</td>
<td>14.3% (3.93%)</td>
</tr>
<tr>
<td>Austin-Castephen complex</td>
<td>4.78% (1.31%)</td>
</tr>
<tr>
<td>Austin silty clay</td>
<td>1.73% (0.47%)</td>
</tr>
<tr>
<td>Austin-Castephen complex</td>
<td>1.63% (0.44%)</td>
</tr>
<tr>
<td>Volente silty clay loam</td>
<td>1.44% (0.39%)</td>
</tr>
<tr>
<td>Castephen silty clay loam</td>
<td>1.27% (0.34%)</td>
</tr>
<tr>
<td>Castephen silty clay loam</td>
<td>0.40% (0.11%)</td>
</tr>
<tr>
<td>Altoga silty clay</td>
<td>0.33% (0.09%)</td>
</tr>
</tbody>
</table>
Meadow

Soils were selected based on the extent within herbaceous planted areas in BSS and the potential to yield high-end runoff and erosion. Based on a geospatial analysis of soils (USDA 2006) and land use data (USGS 2003) for herbaceous planted areas as well as conversations with local soil experts, Brackett soils were chosen to represent meadow areas in the BSS (Table 5). Location of the Brackett soils was also cross-checked with aerial photography (TWDB 2004) to ensure that the soil chosen coincided with herbaceous planted areas where pesticides would reasonably be applied. A local soil expert also confirmed that Brackett soils are extensive soil types of meadows in the BSS (Perez 2006). Brackett soils while not the most extensive soil in this land use; it is the second most extensive benchmark soil in the herbaceous planted land use. One
benchmark soil is more extensive (Denton), however Brackett was chosen over this soil since Brackett soils have a higher erodibility potential. Data from Hays County were selected since the majority of this LULC is located in this county.

<table>
<thead>
<tr>
<th>Hydrologic Group</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>water</td>
<td>0.03%</td>
</tr>
<tr>
<td>A</td>
<td>0.15%</td>
</tr>
<tr>
<td>B</td>
<td>16.27%</td>
</tr>
<tr>
<td>C</td>
<td>17.76%</td>
</tr>
<tr>
<td>D</td>
<td>65.79%</td>
</tr>
<tr>
<td></td>
<td>100.00%</td>
</tr>
</tbody>
</table>

Table 9. Analysis of Meadow Soil Types.

Types of D soils in herbaceous planted land use type in the Barton Springs Segment of Edwards Aquifer (percent in LULC in parenthesis).

- Doss silty clay 28.2% (18.5%)
- Krum clay 21.4% (14.0%)
- Denton silty clay 7.91% (5.20%)
- Heiden clay 6.61% (4.35%)
- Houston Black clay 5.84% (3.84%)
- Tarpley clay 4.05% (2.66%)
- Anhalt clay 3.73% (2.45%)
- Purves clay 3.64% (2.39%)
- Crawford clay 3.48% (2.29%)
- Gruene clay 3.10% (2.04%)
- Branyon clay 2.24% (1.47%)
- Purves silty clay 2.19% (1.44%)
- Speck clay loam 1.95% (1.28%)
- Real-Comfort-Doss complex 1.94% (1.28%)
- San Saba clay 1.28% (0.84%)
- Comfort-Rock outcrop complex 0.84% (0.55%)
- Medlin-Eckrant association 0.59% (0.39%)
- Real gravelly loam 0.22% (0.14%)
- Speck stony clay loam 0.20% (0.13%)
- Tarrant and Speck soils 0.13% (0.09%)
- Tinn clay 0.12% (0.08%)
- Tarrant soils 0.10% (0.07%)
- Urban land and Austin soils 0.07% (0.04%)
- Urban land, Austin, and Whitewright soils 0.02% (0.01%)
- Eckrant-Rock outcrop complex 0.00% (0.00%)
Types of C soils in herbaceous planted land use type in the Barton Springs Segment of Edwards Aquifer (percent in LULC in parenthesis).

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>Percentage</th>
<th>LULC Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brackett-Rock outcrop (Comfort or Real) complex</td>
<td>25.5%</td>
<td>4.54%</td>
</tr>
<tr>
<td>Bolar clay loam</td>
<td>23.8%</td>
<td>4.24%</td>
</tr>
<tr>
<td>Austin-Castephen complex</td>
<td>23.6%</td>
<td>4.20%</td>
</tr>
<tr>
<td>Volente silty clay loam</td>
<td>13.4%</td>
<td>2.38%</td>
</tr>
<tr>
<td>Rumple-Comfort association</td>
<td>6.66%</td>
<td>1.18%</td>
</tr>
<tr>
<td>Castephen clay loam</td>
<td>3.84%</td>
<td>0.68%</td>
</tr>
<tr>
<td>Austin silty clay</td>
<td>1.91%</td>
<td>0.33%</td>
</tr>
<tr>
<td>Castephen silty clay loam</td>
<td>0.93%</td>
<td>0.16%</td>
</tr>
<tr>
<td>Eddy soils and Urban land</td>
<td>0.12%</td>
<td>0.02%</td>
</tr>
<tr>
<td>Eddy gravelly loam</td>
<td>0.03%</td>
<td>0.00%</td>
</tr>
</tbody>
</table>

Types of B soils in herbaceous planted land use type in the Barton Springs Segment of Edwards Aquifer (percent in LULC in parenthesis).

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>Percentage</th>
<th>LULC Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sunev clay loam</td>
<td>55.6%</td>
<td>9.06%</td>
</tr>
<tr>
<td>Lewisville silty clay</td>
<td>30.1%</td>
<td>3.98%</td>
</tr>
<tr>
<td>Seawillow clay loam</td>
<td>16.7%</td>
<td>2.22%</td>
</tr>
<tr>
<td>Sunev silty clay loam</td>
<td>3.89%</td>
<td>0.51%</td>
</tr>
<tr>
<td>Oakalla silty clay loam</td>
<td>1.97%</td>
<td>0.26%</td>
</tr>
<tr>
<td>Boerne fine sandy loam</td>
<td>0.66%</td>
<td>0.08%</td>
</tr>
<tr>
<td>Patrick soils</td>
<td>0.66%</td>
<td>0.08%</td>
</tr>
<tr>
<td>Oakalla soils</td>
<td>0.51%</td>
<td>0.06%</td>
</tr>
</tbody>
</table>

Types of A soils in herbaceous planted land use type in the Barton Springs Segment of Edwards Aquifer (percent in LULC in parenthesis).

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>Percentage</th>
<th>LULC Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orif soils</td>
<td>81.1%</td>
<td>0.12%</td>
</tr>
<tr>
<td>Mixed alluvial land</td>
<td>18.8%</td>
<td>0.02%</td>
</tr>
</tbody>
</table>

Outdoor nursery

The soil selected for the nursery scenario was selected based on the overlap between the nursery of interest (Barton Springs Nursery) and soil extents (USDA 2006). Aerial photography (TWDB 2004) was used to identify the location of the nursery operation and the locations of the outdoor areas of production. Only one soil type overlapped with the nursery operation: Tarrant soils and urban land. Therefore, it was determined that this soil type was a representative soil that an outdoor nursery operation in the BSS would reside upon. Since all three outdoor nursery operations in the BSS are located within Travis County, soil parameters were obtained soil data mart information pertaining to Travis County (USDA 2006).
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Hooper, Cynthia
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Ward, Don
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REFERENCES


City of Austin Land Use data 2003 (ftp://coageoid01.ci.austin.tx.us/GIS-Data/Regional/coa_gis.html)


Overview

This appendix is intended to supplement the summary report submitted by the contractor under technical direction (TD) No. 3 (GSA Contract No. GS-00F-0019L, Order Number. EP06H000149). The SOW for TD3 indicated that seven optional scenarios may be required, depending on the existence of potential uses in the Barton Springs Segment. The scenarios included:

1. Forestry;
2. Row crops (Table 2-2b of USDA TR55);
3. Small grains (Table 2-2b of USDA TR55);
4. Close seeded legumes (Table 2-2b of USDA TR55);
5. Woods-grass combination (orchard or tree farm) (Table 2-2c of USDA TR55);
6. Meadow (Table 2-2c of USDA TR55); and
7. Cotton

For the seven optional generic scenarios, the contractor conducted preliminary background research on each of the suggested uses to determine the presence of the use site in the area of interest the level of significance of the use. The contractor provided an interim deliverable report documenting the preliminary research on 6 March 2006. The Agency directed the contractor to proceed based on the recommendations, but to also further investigate the need for the orchard scenario. The Agency indicated if the contractor can confirm these are in the contributing zone but not the recharge zone then document as such and do not develop these scenarios. If the crop is possibly in the recharge zone then the scenario may need to developed, even with a limited acreage. The contractor determined that the one (1) orchard located in the recharge zone based on land use (USGS 2003) is no longer active; the land has been converted to a Lowes home center.

According to GIS land use coverage from the Texas Commission on Environmental Quality and the City of Austin, agricultural land uses do exist extensively throughout the in the Barton Springs Recharge and Contributing Zones (hereafter referred to as the AOI or “Area of Interest”). However, most of this agricultural land is used for range land, livestock grazing, and pasture, according to the extension agents from Hays and Travis Counties. All extension agents indicated the prevailing trend of agricultural and range land being broken up and converted to residential and commercial development.

Eddie Garcia from Travis County indicated that there are no crops commercially grown and harvested in the AOI of Travis County. There may be some grazing but usually it’s not even enough pasture so that supplemental food must be purchased for the livestock. There is forested/wooded land but no forestry operations for planting and harvesting. The Nature Conservancy owns 4600 acres in the AOI and is managing it as a natural area. There are no
agricultural producers registered with the Farm Service Agency (FSA) in the Barton Springs AOI.

**Scenario Background Research**

1. **Forestry**

NASS data indicates that a small amount of Christmas trees are grown in Travis County (Table 10), however the extension agents from Travis and Hays Counties indicated that these crops are not grown the AOI. There is some cedar and juniper removal. These are considered pests and are removed and not sold (Perez 2006). There is a chemical that can be used for removing cedar, but no one uses it in the BSS; most people cut nuisance trees down (Davis 2006). Based on the information from local extension agents, this use was deemed outside the area of interest and was not developed.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cut Christmas trees</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>9</td>
</tr>
</tbody>
</table>

X = data not available, not applicable or withheld

2. **Row Crops**

NASS data indicates that a small amount of vegetable crops are the only row crops that are grown in Travis and Hays Counties (Table 11), however the extension agents from Travis and Hays Counties indicated that these crops are not grown the AOI commercially, only in residential gardens. There is one certified organic farm near Wimberly but not within the AOI (Perez 2006). The only vegetables are in home gardens (Davis 2006). Based on the information from local extension agents, this use was deemed outside the area of interest and was not developed.

<table>
<thead>
<tr>
<th>Crop</th>
<th>HAYS</th>
<th>TRAVIS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1997 Harvested Acres</td>
<td>2002 Harvested Acres</td>
</tr>
<tr>
<td>Land Used For Vegetables</td>
<td>13</td>
<td>11</td>
</tr>
<tr>
<td>Vegetables Harvested For Sale</td>
<td>24</td>
<td>39</td>
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<tr>
<td>Turnips</td>
<td>X</td>
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</tr>
<tr>
<td>Herbs, Fresh Cut</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td>Carrots</td>
<td>1</td>
<td>X</td>
</tr>
<tr>
<td>Dry Onions</td>
<td>X</td>
<td>1</td>
</tr>
<tr>
<td>Peppers, Bell</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Peppers, Chile (All Peppers - Excluding Bell)</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Tomatoes</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Okra</td>
<td>X</td>
<td>3</td>
</tr>
<tr>
<td>Cantaloups</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Watermelons</td>
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<td>X</td>
</tr>
<tr>
<td>Cucumbers And Pickles</td>
<td>1</td>
<td>X</td>
</tr>
<tr>
<td>Squash</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Beets</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

X = data not available, not applicable or withheld

### 3. Small Grains

NASS data indicate that corn, oats, sorghum, and wheat are grown extensively in Travis and Hays Counties (Table 12). According to Soil Data Mart, there are numerous soils in the BSS that are suitable for growing corn, grain sorghum, and wheat; however, Hays and Travis County extension agents from Travis and Hays Counties indicated that small grain crops are not cultivated in the BSS. In cases where small grains are planted such as winter wheat or oats they are used exclusively for harvesting from small plots from 5 to 15 acres (Davis 2006). All other grain crops like corn, sorghum, wheat, oats and milo are grown East of I-35 in the Blackland Prairie region (Perez 2006). Based on the information from local extension agents, this use was deemed outside the area of interest and was not developed.

<table>
<thead>
<tr>
<th>Crop</th>
<th>HAYS 1997 Harvested Acres</th>
<th>HAYS 2002 Harvested Acres</th>
<th>TRAVIS 1997 Harvested Acres</th>
<th>TRAVIS 2002 Harvested Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn For Grain</td>
<td>5915</td>
<td>3084</td>
<td>12139</td>
<td>12378</td>
</tr>
<tr>
<td>Oats For Grain</td>
<td>836</td>
<td>X</td>
<td>215</td>
<td>206</td>
</tr>
<tr>
<td>Sorghum For Grain</td>
<td>5406</td>
<td>1435</td>
<td>21298</td>
<td>14684</td>
</tr>
<tr>
<td>Wheat For Grain, All</td>
<td>4674</td>
<td>3527</td>
<td>4849</td>
<td>3320</td>
</tr>
<tr>
<td>Winter Wheat For Grain</td>
<td>X</td>
<td>3527</td>
<td>X</td>
<td>3320</td>
</tr>
<tr>
<td>Sweet Corn</td>
<td>1</td>
<td>1</td>
<td>X</td>
<td>3</td>
</tr>
</tbody>
</table>

X = data not available, not applicable or withheld

4. Close-seeded legumes

NASS data indicates that a small amount of close-seeded legumes are grown in Travis and Hays Counties (Table 13), however the extension agents from Travis and Hays Counties indicated that these crops are not grown in the AOI (Perez 2006; Davis 2006). Based on the limited extent of legumes in Hays and Travis counties and information from local extension agents, this use was deemed outside the area of interest and was not developed.


<table>
<thead>
<tr>
<th>Crop</th>
<th>HAYS 1997 Harvested Acres</th>
<th>HAYS 2002 Harvested Acres</th>
<th>TRAVIS 1997 Harvested Acres</th>
<th>TRAVIS 2002 Harvested Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peas, Green Southern (Cowpeas) - Blackeyed, Crowder, Etc.</td>
<td>X</td>
<td>1</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Snap Beans</td>
<td>X</td>
<td>4</td>
<td>X</td>
<td>1</td>
</tr>
</tbody>
</table>

X = data not available, not applicable or withheld

5. Orchard or Tree Farms

NASS data indicates that orchard crops are grown in Travis and Hays Counties (Table 14); however the extension agent from Travis County indicated that there are no orchards in the BSS. The extension agent from Hays County indicated that there is one location in the BSS where orchard crops are grown: the orchard at the Barsana Dham-Isdl Temple (on FM1826) where they...
grow persimmons, peaches, pecans, etc. These are grown for Pick-Your-Own and they use low toxicity IPM (Integrated Pest Management) practices there (Davis 2006). All orchard crops like peaches and pecans are not in the AOI but near the San Marcos and Blanco Rivers (Perez 2006). EFED reviewed the initial recommendation and directed the contractor to further investigate the need for the orchard scenario. The Agency indicated that if there is minimal acreage in the recharge zone (e.g., nurseries) that could contribute to exposures, then the scenario may be developed. Based on USGS (2003) land use data, the contractor identified one (1) orchard located in the recharge zone (Figure 15). Conversations with personnel in the City of Austin GIS department indicated the orchard is no longer active and has been rezoned for a Lowes® home center (COA, personal communication). Based on this information it was deemed that this orchard will not contribute to potential exposures in the BSS and therefore has not been developed.

<table>
<thead>
<tr>
<th>Crop</th>
<th>HAYS 1997 Total Acres</th>
<th>HAYS 2002 Total Acres</th>
<th>TRAVIS 1997 Total Acres</th>
<th>TRAVIS 2002 Total Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land In Orchards</td>
<td>260</td>
<td>290</td>
<td>1394</td>
<td>1793</td>
</tr>
<tr>
<td>Apples</td>
<td>X</td>
<td>10</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Pears, All</td>
<td>X</td>
<td>9</td>
<td>X</td>
<td>7</td>
</tr>
<tr>
<td>Apricots</td>
<td>X</td>
<td>16</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Peaches, All</td>
<td>X</td>
<td>76</td>
<td>X</td>
<td>22</td>
</tr>
<tr>
<td>Plums And Prunes</td>
<td>X</td>
<td>6</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Pecans</td>
<td>X</td>
<td>143</td>
<td>X</td>
<td>1720</td>
</tr>
<tr>
<td>Grapes</td>
<td>X</td>
<td>31</td>
<td>X</td>
<td>38</td>
</tr>
</tbody>
</table>

X = data not available, not applicable or withheld
Figure 15. Location of woody planted areas in the BSS segment based on land use data. Local contacts indicated orchards are not present or not active in the BSS. See description for more information.
6. Meadow

NASS Data indicates that hay of varying types is grown extensively in Travis and Hays Counties (Table 15). According to Soil Data Mart, there are a number of soils in the BSS that are suitable for growing improved bermudagrass. In addition, extension agents indicated that some hay crops are cultivated in the BSS. There is some cultivation of sorghum hay, and hay grazer, or sweet sorghum in the BSS. There is also some bermuda grass planted but this is permanent for grazing and not harvested (Perez 2006). Most of this type of crop is for livestock grazing (Davis 2006). Based on this information, this scenario was developed.

Table 15. NASS 1997/2002 census of agriculture for hay crops in Hays and Travis Counties, Texas (USDA 1997, 2002).

<table>
<thead>
<tr>
<th>Crop</th>
<th>HAYS 1997 Harvested Acres</th>
<th>HAYS 2002 Harvested Acres</th>
<th>TRAVIS 1997 Harvested Acres</th>
<th>TRAVIS 2002 Harvested Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hay - All Hay Including Alfalfa, Other Tame, Small Grain, And Wild</td>
<td>X</td>
<td>7657</td>
<td>X</td>
<td>20471</td>
</tr>
<tr>
<td>All Haylage, Grass Silage, And Greenchop</td>
<td>140</td>
<td>229</td>
<td>769</td>
<td>357</td>
</tr>
<tr>
<td>Forage - Land Used For All Hay And All Haylage, Grass Silage, And Greenchop</td>
<td>X</td>
<td>7855</td>
<td>X</td>
<td>20367</td>
</tr>
<tr>
<td>Other Haylage, Grass Silage, And Greenchop</td>
<td>X</td>
<td>229</td>
<td>X</td>
<td>357</td>
</tr>
<tr>
<td>Other Tame Hay</td>
<td>8287</td>
<td>5358</td>
<td>14020</td>
<td>16737</td>
</tr>
<tr>
<td>Small Grain Hay</td>
<td>600</td>
<td>X</td>
<td>943</td>
<td>2219</td>
</tr>
<tr>
<td>Wild Hay</td>
<td>840</td>
<td>1228</td>
<td>X</td>
<td>1411</td>
</tr>
<tr>
<td>Alfalfa Hay</td>
<td>65</td>
<td>X</td>
<td>X</td>
<td>104</td>
</tr>
</tbody>
</table>

X = data not available, not applicable or withheld

7. Cotton

NASS data indicates that cotton is grown in Travis County (Table 16). According to Soil Data Mart, there are many soils in the AOI that are suitable for growing cotton. However, the extension agents from Travis and Hays Counties indicated that this crop is not grown in the AOI. All cotton is grown East of I-35 (Perez 2006 and Davis 2006). Based on the information from local extension agents, this use was deemed outside the area of interest and was not developed.

<table>
<thead>
<tr>
<th>Crop</th>
<th>HAYS 1997 Harvested Acres</th>
<th>HAYS 2002 Harvested Acres</th>
<th>TRAVIS 1997 Harvested Acres</th>
<th>TRAVIS 2002 Harvested Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cotton, All</td>
<td>X</td>
<td>X</td>
<td>5661</td>
<td>2151</td>
</tr>
<tr>
<td>Upland Cotton</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>2151</td>
</tr>
</tbody>
</table>

X = data not available, not applicable or withheld

References


Contacts

**Davis, Bryan**
Texas Cooperative Extension (Hays County) County Extension Agent Agriculture and Natural Resources 512-393-2120
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**Garcia, Eddie**
NRCS - Soil Conservationist (Travis County) 512-459-1623 x3
Eddie.Garcia@tx.usda.gov

**Perez, Cresencio (Cris)**
NRCS - District Conservationist (Hays County) 512-392-4050 x3
cresencio.perez@tx.usda.gov
Appendix C. USGS Monitoring Data for Barton Springs Area.

Samples were collected by USGS from the 4 springs, from surface waters in the action area (creeks) and from ground water wells in and around the action area. Samples were later measured for carbaryl. Tables C.1, C.2, and C.3 contain detailed information of all samples collected and their measured concentrations of carbaryl in the springs, creeks and ground water wells. Figures 10 and 11 in the risk assessment contain locations of surface water sites and ground water wells which correspond to the site nicknames cited in Tables C.2 and C.3, respectively.

Samples were collected from the four springs between 2000 and 2005. During August and September of 2003, samples were collected every two weeks. From Mid June to December, 2004, samples were collected every three weeks. Stormflow sampling was also conducted in 2000, 2001, 2004 and 2005.

<table>
<thead>
<tr>
<th>pk_siteID</th>
<th>Site Nickname</th>
<th>SampleDate (year, month, date)</th>
<th>Symbol*</th>
<th>Carbaryl Conc. (ppb)</th>
<th># of Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>08155501</td>
<td>Eliza Spring</td>
<td>20000502</td>
<td></td>
<td>0.003</td>
<td>2</td>
</tr>
<tr>
<td>08155501</td>
<td>Eliza Spring</td>
<td>20010504</td>
<td></td>
<td>0.041</td>
<td>2</td>
</tr>
<tr>
<td>08155501</td>
<td>Eliza Spring</td>
<td>20010507</td>
<td></td>
<td>0.041</td>
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</tr>
<tr>
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<td>Eliza Spring</td>
<td>20010508</td>
<td></td>
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</tr>
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<td>20010510</td>
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<td></td>
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<td>Site Nickname</td>
<td>SampleDate (year, month, date)</td>
<td>Symbol</td>
<td>Carbaryl Conc. (ppb)</td>
<td># of Samples</td>
</tr>
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<td>---------------------</td>
<td>--------------------------------</td>
<td>--------</td>
<td>----------------------</td>
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</tr>
<tr>
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Table C.1. USGS targeted monitoring data for Barton Springs.

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* E means estimated; < means less than the reported amount (non-detection)

Table C.2. USGS monitoring data for creeks in and near action area.

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* E means estimated; < means less than the reported amount (non-detection)
** Flow weighted storm composite samples

### Table C.3. USGS monitoring data for ground water wells in and near action area.

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* E means estimated; < means less than the reported amount (non-detection)
Appendix D. Status and Life History of the Barton Springs Salamander.

D.1 Species Listing Status

The Barton Springs salamander was federally listed as an endangered species on May 30, 1997 (62 FR 23377-23392) by the U.S. Fish and Wildlife Service (USFWS or the Service) based on the following threats:

1. degradation of the water quality in Barton Springs as a result of urban expansion,
2. decreased quantity of water that feeds Barton Springs as a result of urban expansion,
3. modification of the salamander’s structural habitat,
4. inadequacy of existing regulatory mechanisms to protect the salamander and lack of a comprehensive plan to protect the Barton Springs watershed from increasing threats to water quality and quantity, and
5. the salamander’s extreme vulnerability to environmental degradation because of its restricted range in an entirely aquatic environment.

USFWS is the branch of the Department of Interior responsible for listing endangered amphibians, such as the Barton Springs salamander. The extent to which any these threats is considered to predominate is unknown and presumably their cumulative effect may be of primary concern.

D.2 Description and Taxonomy

The Barton Springs salamander (Figure D.1) is a member of the Family Plethodontidae (lungless salamanders). Texas species within the genus *Eurycea* inhabit springs, spring-runs, and water-bearing karst formations of the Edwards Aquifer (Chippindale, 1993). These salamanders are aquatic and neotenic, meaning they retain a larval, gill-breathing morphology throughout their lives. Neotenic salamanders, including the Barton Springs salamander, do not metamorphose into a terrestrial form. Rather, they live their entire life cycle in water, where they become sexually mature and eventually reproduce.
The Barton Springs salamander was first collected from Barton Springs in 1946 (Brown, 1950; Texas Natural History Collection specimens 6317-6321). Adults grow to approximately 2.5 to 3 inches (63-76 mm) in total length. Adult body morphology includes reduced eyes and elongate, spindly limbs indicative of a semi-subterranean lifestyle. The head is relatively broad and deep in lateral view, and the snout appears somewhat truncate when viewed from above. Three bright red, feathery gills are present on either side of the base of the head. The coloration on the salamander’s upper body varies from light to dark brown, purple, reddish brown, yellowish cream, or orange. The characteristic mottled salt-and-pepper color pattern on the upper body surface is due to brown or black melanophores (cells containing pigments called melanin) and silvery-white iridiophores (cells containing pigments containing guanine). The arrangement of these pigment cells is highly variable and can be widely dispersed in some Barton Springs salamanders, causing them to have an overall pale appearance. In other individuals, the melanophores may be dense, resulting in a dark brown appearance. The ventral side (underside) of the body is cream-colored and translucent, allowing some internal organs and developing eggs in females to be visible. The tail is relatively short with a well-developed dorsal (upper) fin and poorly developed ventral (lower) fin. The upper and lower mid-lines of the tail usually exhibit some degree of orange-yellow pigmentation. Juveniles closely resemble adults (Chippindale et al., 1993). Newly hatched larvae are about 0.5 inches (12 mm) in total length and may lack fully developed limbs or pigment (Chamberlain and O’Donnell, 2003).

D.3 Population Status and Distribution

The Barton Spring salamander has been found only at the four spring outlets that make up Barton Springs complex (Figure D.2). This species is considered to have one of the smallest geographical ranges of any vertebrate species in North America (Chippindale et al., 1993; Conant and Collins, 1998).

The salamander was first observed in Barton Springs Pool and Eliza Springs in the 1940s, Sunken Garden Springs in 1993 (Chippindale et al., 1993), and the intermittent Upper Barton Springs in 1997 (City of Austin, 1998).
The extent of the Barton Spring salamander’s range within the Barton Springs Segment of the Edwards Aquifer, and the degree of subsurface connection among these spring populations is unknown. However, observations of salamanders actively swimming into high flow areas from the spring openings, including Main Springs in Barton Springs Pool (USFWS, 2005), and the discovery of a more cave-adapted species (Austin blind salamander, *Eurycea waterlooensis*), suggest that the Barton Springs salamander is not entirely subterranean (triglobotic). The Barton Springs salamander appears to reproduce primarily in subterranean areas (*i.e.*, within the aquifer). Although salamander larvae are present in surface water year-round, very few eggs have been observed on the surface (Chamberlain and O’Donnell, 2003).

D.3.1 Survey Results

The City of Austin initiated salamander surveys in (1) Barton Springs Pool in 1993, (2) Old Mill Springs and Eliza Springs in 1995, and (3) Upper Barton Springs in 1997 (City of Austin, 1998, City of Austin, 1993-2003, unpublished data). Due to the inaccessibility of the aquifer and spring orifices, survey counts reflect the number of individuals observed in the spring pools and spring runs rather than total population census estimates (City of Austin, 2005a). Survey methods have varied to some degree, mainly in Barton Springs Pool, where the survey area gradually shifted from transects to the immediate area around the spring outlets where salamanders are most abundant (USFWS, 2005).

The results of the adult and juvenile salamander survey data are depicted in Figures D.3 and D.4, respectively. From 1997 to 2005 (years in which there are survey data for all four springs), the mean number of adult salamanders observed per year at all four springs combined ranged between 5 and 80. Further examination of the data shows a marked increase in the number of observed adults and juveniles in Eliza Spring, relative to the other springs, from mid-2003 to 2005. From 1997 until 2003, the largest mean number of adult and juvenile salamanders (15 and 14, respectively) were observed in Barton Springs Pool, followed by Old Mill Spring (13 and 8, respectively). However, in 2004 and 2005, the largest average number of adult and juvenile salamanders were observed in Eliza Springs (252 and 91, respectively), followed by Barton Springs Pool (35 and 21, respectively).
Increased numbers of observed adult and juvenile salamanders in Eliza Springs from 2003 to 2005 are believed to be due to habitat restoration efforts, initiated in Eliza Springs by the City of Austin biologists in the fall of 2002 (City of Austin, 2003). Following habitat restoration, observed numbers of salamanders began to increase in July 2003. The habitat restoration efforts at Eliza Springs included removal of debris from the drainage infrastructure to increase flow across the bottom of the spring pool and allow for more natural flushing and draining of the spring ecosystem. Removal of fine sediment exposed a layer of gravel and cobble that had previously been obscured, making it available as habitat for the salamanders. Several species of native aquatic plants, including water primrose (Ludwegia sp.), rush (Eleocharis sp.), and water hyssop (Bacopa sp.) were also successfully transplanted from Barton Creek into Eliza Springs to serve as cover and promote invertebrate prey species. In addition, mosquitofish and crayfish,
predators to the salamander, were removed from Eliza Springs. The net impact of the restoration efforts at Eliza Springs was the following: (1) to increase lateral water flow across the spring pool, thus reducing the amount of sediment and increasing the amount of loose rock substrate (habitat) available for the salamander and its forage base; and (2) to decrease the number of predators and other species that compete for available food. As a result of these efforts, mean numbers of adults and juveniles collected from Eliza Springs during 2004 increased by approximately 13-fold and 5-fold, respectively, as compared to total numbers collected during 2003. With the exception of an increase in the number of juvenile salamanders in Eliza Spring over the past two years, there does not appear to be any clear pattern in the number of young salamanders recorded by year or month over the past decade of survey results.

The majority of salamanders in Barton Springs Pool are found primarily in the immediate area of the spring outlets (USFWS, 2005). They have also been found to a lesser extent in the “beach” area, which includes an underwater concrete bench immediately adjacent to a pedestrian sidewalk on the north side of Barton Springs Pool. Salamanders are rarely seen in the deep end of the pool, which is often covered by sediment, or in the shallow end, which is almost entirely limestone and/or concrete, and thus not considered suitable habitat. Based on observations of salamanders in water depths ranging from <1 inch to >15 feet, it appears that water depth is not a determining factor in habitat selection. Although Barton Springs salamanders do not appear to have an obvious depth preference, constant water flow, stable temperatures, and rock substrates free of sediment are needed for suitable habitat. The survey area in Barton Springs Pool has gradually shifted from transects that included the beach and the deep end, to the intermediate area around the spring outlets where salamanders appear to be most abundant. Based on the comprehensive surveys conducted by the City of Austin and the Service, the number of estimated salamanders inhabiting the surface habitat in Barton Springs Pool may be negatively biased, with actual expected numbers of individuals that are three to five times greater than the number of individuals counted during the regular monthly surveys (City of Austin, 1998).

The Barton Springs Salamander Recovery Plan (USFWS, 2005) notes that numbers of salamanders at Old Mill Springs appear to be related to flow patterns and the presence of predatory fish. For example, a decrease in salamander numbers observed during the winter of 2002-2003 may have been due to the presence of Mexican tetras (Asyanax mexicanus), a non-native predatory fish (City of Austin, 2003). Review of the survey data also indicates a drop in numbers in Old Mill Springs in 2000, which is believed to be due to reduced water flow within the spring. According the City of Austin (2003), flow was extremely low in 2000; in fact, much of Old Mill Springs was dry in the spring/summer of 2000.

In 1997, biologists from the City of Austin and the USFWS discovered 14 adult salamanders at Upper Barton Springs, which flows intermittently. The number of salamanders found at this site in subsequent surveys has ranged from 0 to 14 (City of Austin, unpublished data). Given that salamanders are absent when this spring is dry, survey data indicate that salamander numbers are directly affected by surface flow. However, some monthly surveys at Upper Barton Springs have not found salamanders, even during periods when the spring was flowing (USFWS, 2005).
D.4 Habitat

All available information indicates that the Barton Springs salamander is restricted to the immediate vicinity of the four spring outlets of Barton Springs. Because the Barton Springs segment of the Edwards Aquifer and its contributing zone supply all of the water in the springs that make up the Barton Springs complex, the salamander may be affected by changes in water quality and quantity occurring in the Barton Springs watershed².

“Surface” habitat for the Barton Springs salamander refers to the spring pools and spring runs where the salamander is observed, as opposed to its potential subsurface aquifer habitat. The Barton Springs salamander experiences relatively stable aquatic environmental conditions. These conditions consist of perennially flowing spring water that is generally clear, has a neutral pH (~7), and cool average annual temperatures of 21 to 22 °C (~70-72 °F) (USFW, 2005). As is typical of ground water dominated systems, the springs exhibit a narrow temperature range (stenothermal). Flows of clean spring water with a relatively constant, cool temperature are essential to maintaining well-oxygenated water necessary for salamander respiration and survival (USFW, 2005). Dissolved oxygen (DO) concentrations in Barton Springs average approximately 6 mg/L (USFW, 2005) and are directly related to springflow. Higher DO concentrations occur during periods of high spring discharge (USFW, 2005).

The subterranean component of the Barton Springs salamander’s habitat may provide a location for reproduction, serve as refugium during high flow events or high sediment loads from surface sources in the surface habitat, and/or provide a migration pathway between the surface habitat areas (USFW, 2005).

Based on the survey results, Barton Springs salamanders appear to prefer clean, loose substrate for cover. They are found primarily under boulder, cobble, and gravel substrates, but may also be found in the vicinity of aquatic plants, leaf litter, and woody debris (USFW, 2005). In the main pool, City of Austin surveys indicate that salamanders are found primarily near the spring outlets. To a lesser extent, Barton Springs salamanders are also found in aquatic moss (*Amblystegium riparium*) that grows on bare rocks and on the walls surrounding Barton Springs Pool, Eliza Springs, and Old Mill Springs (City of Austin, 2003).

Historical records indicate a diversity of macrophytes once resided in Barton Springs Pool, including arrowhead (*Sagittaria platyphylla*), water primrose (*Ludwigia* spp.), wild celery (*Vallisneria americana*), cabomba (*Cabomba caroliniana*), water stargrass (*Heteranthera* sp.), southern naiad (*Najas guadalupensis*), and pondweed (*Potamogeton* sp.) (Alan Plummer Associates Inc., 2000 in USFW, 2005). In 1992, the dominant aquatic plant in the pool was the moss (*A. riparium*), an aquatic bryophyte ubiquitous in Central Texas springs. In addition to providing cover, moss and other aquatic plants harbor a variety and abundance of the aquatic invertebrates that salamanders eat.

² The “Barton Springs watershed” includes the contributing zone and recharge zone of the Barton Springs segment of Edwards Aquifer.
During the 1980s and 1990s, the majority of aquatic macrophytes disappeared from the Barton Springs Pool (USFWS, 2005), leaving primarily unvegetated limestone substrate and sediment as habitat. The disappearance of the aquatic macrophytes in the deep end of the pool appears to have resulted from the combined effects of flooding, dredging, and the mechanical dragging of the deep end with chains for sediment removal (USFWS, 2005). However, it is unclear how these activities and the related disappearance of aquatic macrophytes in Barton Springs Pool may have affected the salamander numbers because they pre-dated the survey efforts, which were initiated in 1993.

In addition to restoration efforts for Eliza Springs (previously discussed in Section D.3.1), efforts to reintroduce endemic plant species in Barton Springs Pool were initiated by the City of Austin in 1993. At that time, aquatic vegetation in Barton Springs Pool was limited to two small patches of Potamogeton, one patch of Sagittaria in the far deep end of the pool, and areas of Amblystegium near the discharge points. Sagittaria, Ludwigia, and Cabomba have been introduced into Barton Springs Pool in June 1993 and again in the fall of 1994. It is not possible to gauge the effect of these activities on salamander numbers because there were no historical survey data. Aquatic macrophytes currently found in Barton Springs Pool are limited to Sagittaria. Amblystegium is also common on limestone surfaces in the general vicinity of the main springs and various side springs.

Salamanders are most frequently found around the main spring outflows, hidden within a 2-8 cm (0.8 – 3.1 inches) deep zone of gravel and small rocks overlying a coarse sandy or bare limestone substrate (USFWS, 2005). These areas are visibly clear of fine silt or decomposed organic debris and appear to be kept clean by flowing spring water during medium to high aquifer levels. Abundant prey species for the salamander also inhabit these areas. Piles of woody debris in the vicinity of the main springs provide habitat for the salamander, as well as its prey base, after floods, when normal habitat may be covered with sediment. Suitable habitat can increase or decrease depending on a number of factors including springflows, abundance of aquatic macrophytes, sedimentation rates, and frequency of floods.

In addition, pool cleanings may affect the salamander and its habitat. During the cleanings, full drawdowns of the pool (removal of 4-5 feet of water) are limited to four times/year, when spring discharge exceeds 53 cfs (cubic feet/second) and Barton Creek floods. For the past two years, the water level has been partially lowered (by 18-24”) once per month when the flow exceeds 53 cfs. During this time, biologists clean sediment and debris from salamander habitat with garden hoses. Salamander habitat in Barton Springs Pool that is exposed during full drawdowns includes the area of fissures on the bedrock above the main spring outlets. The main spring outlets, which are located 10-16 feet below the top of the bedrock fissures, are not exposed during drawdowns as spring water continues to flow.

When discharge from Barton Springs Pool is lower than 54 cfs, the water level in Eliza Springs has the potential to drop below the surface substrate during a full drawdown. This is partially due to the presence of a concrete slab at the bottom of Eliza Springs, beneath the gravel and cobble. Flowing spring water into Eliza Springs must have adequate pressure to discharge through holes in the concrete bottom. When discharge is low and Barton Springs Pool is drawn down, the water level in Eliza Springs drops to below the surface substrate and salamanders are
stranded at the surface. The habitat beneath this concrete slab is dark and sediment laden, and thus considered as poor habitat. In general, the water level in Old Mill Springs does not drop below the surface substrate when the Pool is drawn down, unless there is very low discharge from the aquifer.

D.5  Life History and Ecology

Information on the life history and ecology of the Barton Springs salamander, including diet, respiration, reproduction, longevity, diseases, and predators is provided in Sections D.5.1 through D.5.6.

D.5.1  Diet

Barton Springs salamanders appear to be opportunistic predators of small, live aquatic invertebrates (USFWS, 2005). Chippindale et al. (1993) found amphipod remains in the stomachs of wild-caught salamanders. The gastro-intestinal tracts of 18 adult and juvenile Barton Springs salamanders and fecal pellets from 11 adult salamanders collected from Eliza Springs, Barton Springs Pool, and Sunken Garden Springs contained ostracods, copepods, chironomids, snails, amphipods, mayfly larvae, leeches, and adult rile beetles. The most prevalent organisms found in these samples were ostracods, amphipods, and chironomids (USFWS, 2005). The types of invertebrates found in the pools at Barton Springs are documented in the City of Austin’s Habitat Conservation Plan (1998).

D.5.2  Respiration

Primary respiration in neotenic salamanders is through the gills; however, a substantial amount of gas exchange occurs through the skin (Boutilier et al. 1992; Hillman and Withers 1979). They require moving water across their gills and bodies for respiration. Metabolic rates and oxygen consumption are highest in juveniles and decrease with increasing body size (Norris et al., 1963). Oxygenation of salamander eggs is critical to embryonic development since gas exchange and waste elimination occur through semipermeable membranes surrounding the embryo (Duellman and Trueb 1986).

D.5.3  Reproduction

Little is known about the reproductive biology of the Barton Springs salamander in the wild. The ability to view Barton Springs salamanders in their natural environment is limited because of the animal’s propensity to inhabit interstitial spaces under rocks and subterranean environments. Therefore, information regarding the reproductive biology of the Barton Springs salamander is based primarily on captive breeding populations maintained by the City of Austin, and extrapolations from closely related species. Although some aspects of the reproductive biology may be affected by the artificial environment in which they are maintained, information collected on the captive breeding population represents the best available information. When field data are available, the differences and similarities between the wild and captive populations are compared.
Barton Springs salamanders are not sexually dimorphic; however, gravid females can sometimes be distinguished by the presence of eggs which are visible through the translucent skin of the underside. Recent studies with captive individuals indicate that salamander eggs are 1.5 to 2.0 mm (0.06 to 0.08 inches) in diameter when they are laid. Young larvae develop and hatch in approximately 16 to 39 days (USFWS, 2005). Captive raised female salamanders have developed eggs within 11 to 17 months after hatching. One male also displayed courtship behavior (tail undulation) at one year from hatching (Chamberlain and O’Donnell, 2003). At sexual maturity, salamanders are generally at least 50 mm in total length (Chamberlain and O’Donnell, 2003). No clear pattern of reproductive activity has been recorded in the field or in the laboratory. It appears that salamanders can reproduce year-round, based on observations of gravid females, eggs, and larvae throughout the year in Barton Springs (USFWS, 2005). No relationship between breeding activity and environmental factors has been established to date.

The captive breeding program has observed clutch sizes ranging from 5 to 39 eggs, with an average of 22 eggs based on 32 clutches; individual captive females have produced up to 6 clutches per year (Chamberlain and O’Donnell, 2003). Of the 34 egg-laying events at the Dallas Aquarium, clutch size ranged from 10 to 55 (Lynn Ables, Dallas Aquarium, pers. comm., 2000). Females may lay all or only a few of their eggs, and in some cases, females may reabsorb their unlaid eggs within a few weeks after egg-laying (Chamberlain and O’Donnell, 2003). Currently, specific cues and/or environmental factors associated with clutch size and timing of courtship and reproduction have not been identified (USFWS, 2005).

Data regarding development and hatching of eggs are based almost exclusively on observations of the captive populations. In spite of relatively intensive survey efforts, only four eggs have been located in the wild. In four separate instances, a single egg was found near a spring orifice (USFWS, 2005). These observations combined with the visibility of the eggs to predators due to their lack of pigment (eggs are white) suggest the eggs are laid in the subterranean portion of the salamander’s habitat. Eggs are laid singly and receive no parental care (USFWS, 2005). Hatching of eggs in captivity has occurred within 16 to 39 days after eggs have been laid (Chamberlain and O’Donnell, 2003). Hatching success of a clutch is variable (10 - 100%), with means ranging from 26 to 57 percent (Chamberlain and O’Donnell, 2003). Based on information summarized in USFWS (2005), egg mortality in captivity has been attributed to (1) fungus (Chamberlain and O’Donnell, 2002 and 2003), (2) hydra (small invertebrates with stinging tentacles) (Lynn Ables, Dallas Aquarium, pers. comm., 2000), and (3) other factors, including infertility (Chamberlain and O’Donnell, 2003). Environmental conditions, water quality, adequate space, habitat heterogeneity, and food availability may also influence egg laying (Chamberlain and O’Donnell, 2003).

At hatch, juveniles measure 13 mm in total length (snout to tip of tail). After 4 months, juveniles ranged in total length from 13 to 38 mm (Chamberlain and O’Donnell, 2003). Growth rates in the wild, based on a limited mark-recapture dataset of 11 Barton Springs salamanders, ranged from 0.14 to 0.50 mm per day over a 30- to 57-day period (City of Austin, unpublished data). The available data suggest that Barton Springs salamanders could potentially reach full maturity within six months from hatching, although the sample size upon which these data are based is limited and additional research is warranted.
City of Austin biologists have generally found the first three months following hatching to be a critical period for juvenile survival (Chamberlain and O’Donnell, 2003). Of the 285 eggs laid in one breeding study, only 12 (4%) survived the first three months (Chamberlain and O’Donnell, 2003). Newly hatched larvae have sufficient yolk to sustain their nutritional needs for several days after hatch. Larvae feeding on prey items have been observed 11 to 15 days after hatching (Lynn Ables, Dallas Aquarium, pers. comm., 1999).

D.5.4 Longevity

The longevity of the Barton Springs salamander in the wild is unknown; however, salamanders in captivity have survived to at least 12 years (USFW, 2005).

D.5.5 Diseases

A limited number of physiological infections have been reported in the wild for the Barton Springs salamanders. Adult Barton Springs salamanders have been infected with trematodes (Clinostomum sp.) that invaded tissue near the salamander’s vent (Chamberlain and O’Donnell, 2002).

D.5.6 Predators

Predation on adult Barton Springs salamanders in the wild is expected to be minimal when adequate cover is available (USFW, 2005). Most of the potential predators native to the Barton Springs ecosystem are opportunistic feeders, and predation is unlikely unless the salamanders become exposed. Crayfish (Procambarus clarkii) and other large predatory invertebrates may prey on salamanders or on their larvae and eggs (Gamradt and Kats, 1996). Crayfish have been reported to be extremely abundant at times, with an apparent “crayfish bloom” occurring in the spring of 1995, when thousands of crayfish were found throughout the pool (USFWS, 2006). Predatory fish found at Barton Springs include mosquito fish (Gambusia affinis), longear sunfish (Lepomis megalotis), and largemouth bass (Micropterus salmoides). Mosquito fish have been known to prey on frog and salamander larvae in areas where the fish have been introduced (Gamradt and Kats, 1996; Goodsell and Kats, 1999; Lawler et al., 1999). Longear sunfish are known to prey on aquatic vertebrates, and largemouth bass are opportunistic predators that feed primarily on smaller fishes and crayfish. Mexican tetras are non-native fish and aggressive generalist predators that are occasionally found in Barton Creek, Barton Springs Pool, Upper Barton Springs, and Sunken Garden Springs (USFWS, 2005). In addition, green-throat darters (Etheostoma lepidum) have been known to prey upon small juvenile salamanders when no cover is available.

D.6 References


Arnold, S. 1977. The evolution of courtship behavior in New World salamanders with some comments on Old World salamandrids. Pages 141-183 in D. Taylor and S. Guttmann,


City of Austin. 1998. Final environmental assessment/habitat conservation plan for issuance of a section 10(a)(1)(B) permit for incidental take of the Barton Springs salamander (Eurycea sosorum) for the operation and maintenance of Barton Springs Pool and adjacent springs. Austin, Texas.


City of Austin. 2005a. Update of Barton Springs water quality data analysis. Austin,
Texas.


Appendix E. Stepwise Modeling Approach for the Barton Springs Salamander Endangered Species Assessment for Carbaryl.

1. Modify the PE4v01.pl shell to indicate daily time series (TSER) instead of the standard cumulative (TCUM) output in Record 40 of przm3.inp files.

2. Remove irrigation parameters from the TX_BSSTurf, TX_BSSNursury, and TX_BSSResidential scenarios by setting the IFLAG input in Record 20 to “0”.

3. Use the modified PE4 shell to run the TX_BSSTurf, TX_BSSNursury, TX_BSSOrchard, and TX_BSSRange scenarios with their respective maximum use pattern. Use the modified PE4 shell to run both the TX_BSSImpervious and the TX_BSSResidential scenarios for each of the maximum home lawn and flower bed use patterns.

4. Open the *.zts files with Microsoft Office Excel, fixing each column width to capture the appropriate data (allow eight character spaces beyond the decimal). Save the result as a Microsoft Office Excel Workbook (*.xls).

5. On a separate worksheet, list the values (expressed in hectares) for area of contributing and recharge zones (see cells B5 to B6 in Figure E1).

6. List the values (expressed in hectares) for area of each use scenario in the contributing zone and sum the values (see cells H2 to H8 and H10 in Figure E1).

7. List the values (expressed in hectares) for area of each use scenario in the recharge zone and sum the values (see cells N2 to N8 and N10 in Figure E1).

8. Calculate (imbedded in cell) the values (expressed in hectares) for non-cropped area in each zone (see cells B9 to B10 in Figure E1; formula e.g. B10=B6-N10).

9. Insert the value (expressed in µg/L) for the peak monitored base flow concentration (see cell B12 in Figure E1).

10. Insert the value for fraction of stream flow attributed to base flow (see cell B13 in Figure E1).

11. Copy the pesticide mass flux in runoff (RFLX; expressed as 10^{-5} g/cm^{2} or kg/ha) outputs for each PE4 run from the respective *.xls files converted from *.zts and paste them on the worksheet (see columns F, I, L, O, R, U, X, AA, and AD in Figures E1 and E2).

12. Copy the runoff flux (RUNF; expressed as cm) outputs for each PE4 run from the respective *.xls files converted from *.zts and paste them on the worksheet (see columns E, H, K, N, Q, T, W, Z, and AC in Figures E1 and E2).
13. Calculate daily residue mass in runoff (µg) from nursery, orchard, vineyard, pasture, and park use areas in the contributing zone (CZ) in separate columns, one for each use (see columns AF to AJ in Figure E2) using the formula:

\[
\text{Daily Mass in Runoff (µg)} = \text{RFLX (kg/ha)} \times \text{Use Area (ha)} \times 10^9 \text{ µg/kg}
\]

\[(e.g. \text{AF25} = \text{F25} \times \text{H2} \times 1000000000)\]

14. Calculate daily residue mass in runoff (µg) from residential areas in the contributing zone (CZ) assuming that 70% of residential areas are lawns (i.e., use areas) (see column AK in Figure E2) using the formula:

\[
\text{Daily Mass in Runoff (µg)} = \text{RFLX (kg/ha)} \times 70\% \times \text{Use Area (ha)} \times 10^9 \text{ µg/kg}
\]

\[(e.g. \text{AK25} = \text{U25} \times 0.7 \times \text{H7} \times 1000000000)\]

15. Calculate daily residue mass in runoff (µg) from commercial areas in the contributing zone (CZ) assuming that 4.4% of commercial areas are flower beds (i.e., use areas) (see column AL in Figure E2) using the formula:

\[
\text{Daily Mass in Runoff (µg)} = \text{RFLX (kg/ha)} \times 4.4\% \times \text{Use Area (ha)} \times 10^9 \text{ µg/kg}
\]

\[(e.g. \text{AL25} = \text{AA25} \times 0.044 \times \text{H8} \times 1000000000)\]

16. Calculate daily runoff mass (µg) from each use area in the recharge zone (RZ) in separate columns, one for each use (see columns AO to AU in Figure E2) using the three formulas in steps 13-15 above (first formula e.g. \(\text{AO25} = \text{F25} \times \text{NS2} \times 1000000000\)).

17. Calculate mass totals (µg) for each aquifer zone in separate columns (see columns AM and AV in Figures E2 and E3; formula e.g. \(\text{AM25} = \text{SUM(AF25:AL25)}\)).

18. Calculate daily runoff (L) from each use and non-use area in the CZ in separate columns, one for each PE4 run (see columns AX to BG in Figure E3) using the formula:

\[
\text{Daily Runoff (L)} = \text{RUNF (cm)} \times \text{Use/Non-use Area (ha)} \times 10^8 \text{ cm}^2/\text{ha} \times 10^{-3} \text{ L/cm}^3
\]

\[(e.g. \text{AX25} = \text{E25} \times \text{H2} \times 1000000000/1000)\]

19. Calculate daily runoff (L) from each use and non-use area in the RZ in separate columns, one for each PE4 run (see columns BJ to BS in Figures E3 to E4) using the formula above (formula e.g. \(\text{BS25} = \text{N25} \times \text{BS10} \times 1000000000/1000\)).

20. Calculate runoff totals (L) for each aquifer zone in separate columns (see columns BH and BT in Figures E3 and E4; formula e.g. \(\text{BH25} = \text{SUM(AX25:BG25)}\)).

21. In order to estimate base stream flow in the contributing zone:
a. Calculate the sum of total runoff (L) in the CZ (see cell T3 in Figure E1; formula e.g. T3=SUM($BH$17:$BH$10973)).

b. Calculate the number of days modeled (see cell T4 in Figure E1; formula e.g. T4=COUNT($CS17:$CS10973)).

c. Calculate the average daily flow in runoff (L/d) from the contributing zone (see cell T5 in Figure E1; formula e.g. T5=T3/T4).

d. Calculate base stream flow (L/d) (see cell T6 in Figure E1) using the formula:

$$\text{Base Stream Flow (L/d)} = \frac{\text{Base Stream Fraction} \times \text{Mean CZ Runoff Flow (L/d)}}{\text{CZ Runoff Fraction}}$$

[e.g. T6=$B$13*T5/(1-$B$13)]

22. Calculate daily runoff EECs (µg/L) for each aquifer zone in separate columns (see columns BV and CA in Figure E4) using the formula:

$$\text{Daily Runoff EEC (µg/L)} = \frac{\text{Daily Total Mass in Zone Runoff (µg)}}{\text{Daily Zone Runoff (L)}}$$

[e.g. CA25=IF(BT25=0, 0,AV25/BT25)]

23. Calculate the total daily CZ stream flow (L) in a separate column by summing the total daily runoff in the CZ (L) and the base stream flow (L) (see column BW in Figure E4; formula e.g. BW25 =$T$6+BH25).

24. Calculate the daily stream flow fraction from runoff (Stream Dilution Factor) in a separate column (see column BX in Figure E4; formula e.g. BX25=BH25/BW25).

25. Calculate daily stream EECs (µg/L) in the contributing zone (see column BY in Figure E4) using the formula:

$$\text{Daily CZ Stream EEC (µg/L)} = [\text{Stream Dilution Factor} \times \text{CZ Runoff EEC (µg/L)}] + [\text{Base Flow Dilution Factor} \times \text{Mean Base Flow Concentration (µg/L)}]$$

[e.g. BY25=BX25*BV25+(1-BX25)*$B$12]

26. Calculate the total daily flow into the Barton Springs (L) by summing the total daily CZ stream flow (L) and the total RZ runoff (L) (see column CC in Figure E4; formula e.g. CC25=BW25+BT25).

27. Calculate the fraction of flow in the Barton Springs from RZ runoff (RZ Flow Fraction; see column CD in Figure E4; formula e.g. CD25=BT25/CC25).

28. Calculate the fraction of flow in the Barton Springs from CZ stream flow (CZ Stream Flow Fraction; see column CE in Figure E4; formula e.g. CE25 =BW25/CC25).
29. Calculate daily EECs (µg/L) in the Barton Springs (see column CF in **Figure E4**) using the formula:

\[
\text{Daily Barton Springs EEC (µg/L)} = [\text{RZ Flow Fraction} \times \text{Daily RZ Runoff EEC (µg/L)}] + [\text{CZ Stream Flow Fraction} \times \text{Daily CZ Stream EEC (µg/L)}]
\]

(e.g. CF25=CD25*CA25+CE25*BY25)

30. Calculate rolling time weighted averages for the appropriate durations including 14-day, 21-day (see columns CH and CI in **Figure E4**), 30-day, 60-day, and 90-day (see columns CJ, CK, and CL in **Figure E5**) durations. Time weighted averages are calculated using the daily values from half of the duration preceding the day of interest and half of the duration after the day of interest. For example, the 14-day average on January 14 is calculated by averaging the daily values from January 8 to January 21. This calculation is repeated for each day and for each duration for the entire 30 years of daily values.

31. List the peak EEC and rolling 14-day, 21-day, 30-day, 60-day, and 90-day average EEC for each year between 1961 and 1990 [see columns CO to CT in **Figure E5**; formula e.g. CO25 =MAX(CF2939:CF3303)].

32. Calculate the 1-in-10-year return frequency for each duration [see row 49, CO to CT in **Figure E5**; formula e.g. CO49=PERCENTILE(CO17:CO46,0.9)].
Figure E1. Screen Shot of Columns A to Z of an Example Excel Worksheet for Estimate Calculation in Barton Springs.

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Figure E2. Screen Shot of Columns AA to AU of an Example Excel Worksheet for Estimate Calculation in Barton Springs.
Figure E3. Screen Shot of Columns AV to BN of an Example Excel Worksheet for Estimate Calculation in Barton Springs.
Figure E4. Screen Shot of Columns BO to CI of an Example Excel Worksheet for Estimate Calculation in Barton Springs.
Figure E5. Screen Shot of Columns CJ to DD of an Example Excel Worksheet for Estimate Calculation in Barton Springs.
PRZM Input Files for the Barton Springs Salamander Endangered Species Assessment of Carbaryl.

**Ornamentals Input File**
Output File: Car_nurs
Metfile: w13958.dvf
PRZM scenario: TX_BSSNursery_NoIrrig.txt
EXAMS environment file: pond298.exv
Chemical Name: Carbaryl

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**Peaches Input File**
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Metfile: w13958.dvf
PRZM scenario: TX_BSSOrchard.txt
EXAMS environment file: pond298.exv
Chemical Name: Carbaryl

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<td>Vapor Pressure</td>
<td>vapr</td>
<td>1.36e-7</td>
<td>torr</td>
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<td>mg/L</td>
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<td>kdp</td>
<td>21</td>
<td>days</td>
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Aerobic Aquatic Metabolism        kbacw    124.2 days  Half-life
An aerobic Aquatic Metabolism      kbacs    216.6 days  Half-life
Aerobic Soil Metabolism           asm      12  days  Half-life
Hydrolysis:                       pH 5      0  days  Half-Life
Hydrolysis:                       pH 7      12  days  Half-Life
Hydrolysis:                       pH 9      0.133  days  Half-life
Method:                           CAM      2  integer  See PRZM manual
Incorporation Depth:              DEPI     0 cm
Application Rate:                 TAPP     4.484 kg/ha
Application Efficiency:           APPEFF 0.95 fraction
Spray Drift                       DRFT     0.05 fraction of application rate applied to pond
Application Date                  Date 25-09 dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1                        interval 15 days  Set to 0 or delete line for single app.
Interval 2                        interval 60 days  Set to 0 or delete line for single app.
Record 17:                        FILTRAC 1
Record 18:                        FEXTRC 3.70
Flag for Index Res. Run           IR Pond
Flag for runoff calc.             RUNOFF none none, monthly or total(average of entire run)

**Vineyard Input File**

Output File: Car_orch
Metfile: w13958.dvf
PRZM scenario: TX_BSSOOrchard.txt
EXAMS environment file: pond298.exv
Chemical Name: Carbaryl

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Page 180 of 602
Rangeland Input File

Output File: Car_past

Metfile: w13958.dvf
PRZM scenario: TX_BSSRange.txt
EXAMS environment file: pond298.exv
Chemical Name: Carbaryl
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Application Efficiency: APPEFF 0.95 fraction
Spray Drift: DRFT 0.05 fraction of application rate applied to pond
Application Date: Date 28-04 dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1: interval 14 days Set to 0 or delete line for single app.

Record 17:
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IPSCND 3

Record 18:
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PLVKRT
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FEXTRC 3.70

Parks Input File

Output File: Car_turf

Metfile: w13958.dvf
PRZM scenario: TX_BSSTurf_NoIrrig.txt
EXAMS environment file: pond298.exv
Chemical Name: Carbaryl
Description

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<td>g/mol</td>
<td></td>
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<tr>
<td>henry</td>
<td>1.28e-8</td>
<td>atm-m^3/mol</td>
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</tr>
<tr>
<td>vapr</td>
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<td>torr</td>
<td></td>
</tr>
<tr>
<td>sol</td>
<td>32</td>
<td>mg/L</td>
<td></td>
</tr>
<tr>
<td>Kd</td>
<td></td>
<td>mg/L</td>
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</table>
### Residential Input File

**Output File:** Car_res

**Mefile:** w13958.dvf

**PRZM scenario:** TX_BSSResidential_NoIrrig.txt

**EXAMS environment file:** pond298.exv

**Chemical Name:** Carbaryl

**Description**

<table>
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<th>Value</th>
<th>Units</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
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<td>g/mol</td>
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<tr>
<td>IPSCND</td>
<td>3</td>
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<tr>
<td>UPTKF</td>
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<tr>
<td>PLDKRT</td>
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<tr>
<td>FEXTRC</td>
<td>3.70</td>
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</tbody>
</table>

<table>
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<th>IR</th>
<th>Pond</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flag for runoff calc.</td>
<td>RUNOFF</td>
<td>none</td>
</tr>
</tbody>
</table>

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**Koc**

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<thead>
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<th>Koc</th>
<th>198</th>
<th>mg/L</th>
</tr>
</thead>
</table>

**Photolysis half-life**

| kdp | 21 | days | Half-life |

**Aerobic Aquatic Metabolism**

| kbacw | 124.2 | days | Half-life |

**Anaerobic Aquatic Metabolism**

| kbacs | 216.6 | days | Half-life |

**Aerobic Soil Metabolism**

| asm | 12 | days | Half-life |

**Hydrolysis**

| pH 5 | 0 | days | Half-life |

**Hydrolysis**

| pH 7 | 12 | days | Half-life |

**Hydrolysis**

| pH 9 | 0.133 | days | Half-life |

**Method**

| CAM | 2 | integer | See PRZM manual |

**Incorporation Depth**

| DEPI | 0 | cm |

**Application Rate**

| TAPP | 9.37 | kg/ha |

**Application Efficiency**

| APPEFF | 0.99 | fraction |

**Spray Drift**

| DRFT | 0.01 | fraction of application rate applied to pond |

**Application Date**

| Date | 28-04 | dd/mm or dd/mmmm or dd-mm or dd-mmm |

| Interval 1 | interval 3 | days | Set to 0 or delete line for single app. |

| Interval 2 | interval 3 | days | Set to 0 or delete line for single app. |

| Interval 3 | interval 3 | days | Set to 0 or delete line for single app. |

| Interval 4 | interval 3 | days | Set to 0 or delete line for single app. |

| Interval 5 | interval 3 | days | Set to 0 or delete line for single app. |

| Interval 6 | interval 3 | days | Set to 0 or delete line for single app. |

| Interval 7 | interval 3 | days | Set to 0 or delete line for single app. |

| Interval 8 | interval 3 | days | Set to 0 or delete line for single app. |

| Interval 9 | interval 3 | days | Set to 0 or delete line for single app. |

| Interval 10 | interval 3 | days | Set to 0 or delete line for single app. |

| Interval 11 | interval 3 | days | Set to 0 or delete line for single app. |

| Interval 12 | interval 3 | days | Set to 0 or delete line for single app. |

| Interval 13 | interval 3 | days | Set to 0 or delete line for single app. |

| Interval 14 | interval 3 | days | Set to 0 or delete line for single app. |

| Interval 15 | interval 3 | days | Set to 0 or delete line for single app. |

| Interval 16 | interval 3 | days | Set to 0 or delete line for single app. |

| Interval 17 | interval 3 | days | Set to 0 or delete line for single app. |

| Interval 18 | interval 3 | days | Set to 0 or delete line for single app. |

| Interval 19 | interval 3 | days | Set to 0 or delete line for single app. |

| Interval 20 | interval 3 | days | Set to 0 or delete line for single app. |

| Interval 21 | interval 3 | days | Set to 0 or delete line for single app. |

| Interval 22 | interval 3 | days | Set to 0 or delete line for single app. |

| Interval 23 | interval 3 | days | Set to 0 or delete line for single app. |

| Interval 24 | interval 3 | days | Set to 0 or delete line for single app. |
Henry's Law Const.  Henry  1.28e-8  atm-m^3/mol
Vapor Pressure  Vap  1.36e-7  torr
Solubility  Sol  32  mg/L
Kd  Kd  mg/L
Koc  Koc  198  mg/L
Photolysis half-life  kdp  21  days  Half-life
Aerobic Aquatic Metabolism  kbacw  124.2  days  Half-life
Anaerobic Aquatic Metabolism  kbacs  216.6  days  Half-life
Aerobic Soil Metabolism  asm  12  days  Half-life
Hydrolysis:  pH 5  0  days  Half-life
Hydrolysis:  pH 7  12  days  Half-life
Hydrolysis:  pH 9  0.133  days  Half-life
Method:  CAM  2  integer  See PRZM manual
Incorporation Depth:  DEPI  0  cm
Application Rate:  TAPP  9.37  kg/ha
Application Efficiency:  APPEFF  0.99  fraction
Spray Drift  DRFT  0.01  fraction of application rate applied to pond
Application Date  Date  28-04 dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1  Interval 3  3  days  Set to 0 or delete line for single app.
Interval 2  Interval 4  3  days  Set to 0 or delete line for single app.
Interval 3  Interval 5  3  days  Set to 0 or delete line for single app.
Interval 4  Interval 6  3  days  Set to 0 or delete line for single app.
Interval 5  Interval 7  3  days  Set to 0 or delete line for single app.
Interval 6  Interval 8  3  days  Set to 0 or delete line for single app.
Interval 7  Interval 9  3  days  Set to 0 or delete line for single app.
Interval 8  Interval 10  3  days  Set to 0 or delete line for single app.
Interval 9  Interval 11  3  days  Set to 0 or delete line for single app.
Interval 10  Interval 12  3  days  Set to 0 or delete line for single app.
Interval 11  Interval 13  3  days  Set to 0 or delete line for single app.
Interval 12  Interval 14  3  days  Set to 0 or delete line for single app.
Interval 13  Interval 15  3  days  Set to 0 or delete line for single app.
Interval 14  Interval 16  3  days  Set to 0 or delete line for single app.
Interval 15  Interval 17  3  days  Set to 0 or delete line for single app.
Interval 16  Interval 18  3  days  Set to 0 or delete line for single app.
Interval 17  Interval 19  3  days  Set to 0 or delete line for single app.
Interval 18  Interval 20  3  days  Set to 0 or delete line for single app.
Interval 19  Interval 21  3  days  Set to 0 or delete line for single app.
Interval 20  Interval 22  3  days  Set to 0 or delete line for single app.
Interval 21  Interval 23  3  days  Set to 0 or delete line for single app.
Interval 22  Interval 24  3  days  Set to 0 or delete line for single app.
Interval 23  Record 17:  FILTRA
Interval 24  Record 18:  IPSCN1  1
                   UPTKF
                   PLVKRT
                   PLDKRT  0.187
                   FEXTRC  3.70
Flag for Index Res. Run  IR  Pond
Flag for runoff calc.  RUNOFF  none  none, monthly or total(average of entire run)

**Impervious Input File**

Output File: Car_imp
Metfile: w13958.dvf
PRZM scenario: TX_BSSImpervious.txt
EXAMS environment file: pond298.exv
Chemical Name: Carbaryl
Description
Variable Name | Value | Units | Comments
--- | --- | --- | ---
Molecular weight | mwt | 201.22 | g/mol
Henry's Law Const. | henry | 1.28e-8 | atm-m^3/mol
Vapor Pressure | vapr | 1.36e-7 | torr
Solubility | sol | 32 | mg/L
Kd | Kd | 98 | mg/L
Koc | Koc | 198 | mg/L
Photolysis half-life | kdp | 21 | days | Half-life
Aerobic Aquatic Metabolism | kbacw | 124.2 | days | Half-life
Anaerobic Aquatic Metabolism | kbacs | 216.6 | days | Half-life
Aerobic Soil Metabolism | asm | 12 | days | Half-life
Hydrolysis: | pH 5 | 0 | days | Half-life
Hydrolysis: | pH 7 | 12 | days | Half-life
Hydrolysis: | pH 9 | 0.133 | days | Half-life
Method: | CAM | 2 | integer | See PRZM manual
Incorporation Depth: | DEPI | 0 | cm
Application Rate: | TAPP | 9.37 | kg/ha
Application Efficiency: | APPEFF | 0.99 | fraction
Spray Drift | DRFT | 0.01 | fraction of application rate applied to pond
Application Date
Date | 28-04 | dd/mm or dd/mmm or dd-mm or dd-mmm
Interval 1
interval | 3 | days | Set to 0 or delete line for single app.
Interval 2
interval | 3 | days | Set to 0 or delete line for single app.
Interval 3
interval | 3 | days | Set to 0 or delete line for single app.
Interval 4
interval | 3 | days | Set to 0 or delete line for single app.
Interval 5
interval | 3 | days | Set to 0 or delete line for single app.
Interval 6
interval | 3 | days | Set to 0 or delete line for single app.
Interval 7
interval | 3 | days | Set to 0 or delete line for single app.
Interval 8
interval | 3 | days | Set to 0 or delete line for single app.
Interval 9
interval | 3 | days | Set to 0 or delete line for single app.
Interval 10
interval | 3 | days | Set to 0 or delete line for single app.
Interval 11
interval | 3 | days | Set to 0 or delete line for single app.
Interval 12
interval | 3 | days | Set to 0 or delete line for single app.
Interval 13
interval | 3 | days | Set to 0 or delete line for single app.
Interval 14
interval | 3 | days | Set to 0 or delete line for single app.
Interval 15
interval | 3 | days | Set to 0 or delete line for single app.
Interval 16
interval | 3 | days | Set to 0 or delete line for single app.
Interval 17
interval | 3 | days | Set to 0 or delete line for single app.
Interval 18
interval | 3 | days | Set to 0 or delete line for single app.
Interval 19
interval | 3 | days | Set to 0 or delete line for single app.
Interval 20
interval | 3 | days | Set to 0 or delete line for single app.
Interval 21
interval | 3 | days | Set to 0 or delete line for single app.
Interval 22
interval | 3 | days | Set to 0 or delete line for single app.
Interval 23
interval | 3 | days | Set to 0 or delete line for single app.
Interval 24
interval | 3 | days | Set to 0 or delete line for single app.
Record 17: FILTARA
IPSCND | 1
UPTKF
Record 18: PLVKRT
PLDKRT | 0.187
FEKTR | 3.70
Flag for Index Res. Run | IR | Pond
Flag for runoff calc. | RUNOFF | none | none, monthly or total(average of entire run)
Appendix F. Sensitivity Distribution Data.

Tables F.1-F.5 contain the 96-hour LC$_{50}$ data for fish and associated calculations used to derive the sensitivity distribution shown in Figure 14 of the risk assessment. Tables F.6-F.10 contain the 48- to 96-hour EC$_{50}$ data for invertebrates and associated calculations used to derive the sensitivity distribution shown in Figure 15 of the risk assessment.
Table F.1. Summary of 96 hour LC50 data for effects of carbaryl on freshwater fish. Data are from EFED's database of ecotoxicity data.

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Species Name</th>
<th>Mean LC50 (ppb)</th>
<th>Log 10 LC50</th>
<th>Lower Confidence (ppb)</th>
<th>Lower Log 10 LC50</th>
<th>Upper Confidence (ppb)</th>
<th>Upper Log 10 LC50</th>
<th>Test Substance (% a.i.)</th>
<th>MRID / Accession</th>
</tr>
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<tbody>
<tr>
<td>Carp</td>
<td>Cyprinus carpio</td>
<td>5280</td>
<td>3.72</td>
<td>3</td>
<td>4600</td>
<td>3.663</td>
<td>6000</td>
<td>3.778</td>
<td>99.5</td>
</tr>
<tr>
<td>Black bullhead</td>
<td>Ictalurus melas</td>
<td>2000</td>
<td>4.30</td>
<td>0</td>
<td>18000</td>
<td>4.255</td>
<td>24000</td>
<td>4.380</td>
<td>99.5</td>
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<td>Channel catfish</td>
<td>Ictalurus punctatus</td>
<td>7790</td>
<td>3.89</td>
<td>2</td>
<td>4700</td>
<td>3.672</td>
<td>12800</td>
<td>4.107</td>
<td>99.5</td>
</tr>
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<td>Green sunfish</td>
<td>Lepomis cyanellus</td>
<td>9460</td>
<td>3.97</td>
<td>6</td>
<td>7000</td>
<td>3.845</td>
<td>12800</td>
<td>4.107</td>
<td>99.5</td>
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<tr>
<td>Bluegill sunfish</td>
<td>Lepomis macrochirus</td>
<td>5047</td>
<td>3.70</td>
<td>3</td>
<td>4400</td>
<td>3.643</td>
<td>5800</td>
<td>3.763</td>
<td>99.5</td>
</tr>
<tr>
<td>Bluegill sunfish</td>
<td>Lepomis macrochirus</td>
<td>1400</td>
<td>4.14</td>
<td>6</td>
<td>7700</td>
<td>3.886</td>
<td>25200</td>
<td>4.401</td>
<td>99.9</td>
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<tr>
<td>Largemouth bass</td>
<td>Micropterus salmoides</td>
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<td>3.80</td>
<td>6</td>
<td>4400</td>
<td>3.643</td>
<td>9200</td>
<td>3.964</td>
<td>99.5</td>
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<tr>
<td>Cutthroat trout</td>
<td>Oncorhynchus clarki</td>
<td>970</td>
<td>2.98</td>
<td>7</td>
<td>770</td>
<td>2.886</td>
<td>1200</td>
<td>3.079</td>
<td>99.5</td>
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<td>Coho salmon</td>
<td>Oncorhynchus kisutch</td>
<td>2400</td>
<td>3.38</td>
<td>0</td>
<td>1860</td>
<td>3.270</td>
<td>3000</td>
<td>3.477</td>
<td>99.5</td>
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<tr>
<td>Rainbow trout</td>
<td>Oncorhynchus mykiss</td>
<td>3300</td>
<td>3.51</td>
<td>9</td>
<td>2700</td>
<td>3.431</td>
<td>4000</td>
<td>3.602</td>
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<tr>
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<td>9</td>
<td>800</td>
<td>2.903</td>
<td>1800</td>
<td>3.255</td>
<td>99.5</td>
</tr>
<tr>
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<td>0</td>
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<td>Pimephales promelas</td>
<td>7700</td>
<td>3.88</td>
<td>6</td>
<td>4800</td>
<td>3.681</td>
<td>12000</td>
<td>4.079</td>
<td>99.5</td>
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<tr>
<td>Black crappie</td>
<td>Pomoxis nigromaculatus</td>
<td>2600</td>
<td>3.41</td>
<td>5</td>
<td>1200</td>
<td>3.079</td>
<td>5700</td>
<td>3.756</td>
<td>99.5</td>
</tr>
<tr>
<td>Atlantic salmon</td>
<td>Salmo salar</td>
<td>250</td>
<td>2.39</td>
<td>8</td>
<td>120</td>
<td>2.079</td>
<td>790</td>
<td>2.898</td>
<td>99.5</td>
</tr>
<tr>
<td>Brown trout</td>
<td>Salmo trutta</td>
<td>6300</td>
<td>3.79</td>
<td>9</td>
<td>5500</td>
<td>3.740</td>
<td>7200</td>
<td>3.857</td>
<td>99.5</td>
</tr>
<tr>
<td>Brook trout</td>
<td>Salvelinus fontinalis</td>
<td>3000</td>
<td>3.47</td>
<td>7</td>
<td>2000</td>
<td>3.301</td>
<td>4500</td>
<td>3.653</td>
<td>99.5</td>
</tr>
<tr>
<td>Lake trout</td>
<td>Salvelinus namaycush</td>
<td>690</td>
<td>2.83</td>
<td>9</td>
<td>500</td>
<td>2.699</td>
<td>900</td>
<td>2.954</td>
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NR = not reported, NA = not applicable

Table F.2. Species values for LC50 (mean and upper and lower confidence intervals).

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<tr>
<th>Common Name</th>
<th>Species Name</th>
<th>Log10 Mean</th>
<th>Log10 Lower</th>
<th>Log10 Upper</th>
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<tbody>
<tr>
<td>Carp</td>
<td>Cyprinus carpio</td>
<td>3.723</td>
<td>3.663</td>
<td>3.778</td>
</tr>
</tbody>
</table>

Page 186 of 602
<table>
<thead>
<tr>
<th>Common Name</th>
<th>Genus Name</th>
<th>Log10 Mean</th>
<th>Mean LC50 (ppb)</th>
<th>Log10 lower</th>
<th>Lower LC50 (ppb)</th>
<th>Log 10 Upper</th>
<th>Upper LC50 (ppb)</th>
<th>Rank on curve</th>
</tr>
</thead>
<tbody>
<tr>
<td>carp</td>
<td>Cyprinus</td>
<td>3.7226</td>
<td>5280.0</td>
<td>3.6628</td>
<td>4600.0</td>
<td>3.7782</td>
<td>6000.0</td>
<td>0.56</td>
</tr>
<tr>
<td>catfish</td>
<td>Ictalurus</td>
<td>4.0963</td>
<td>12482.0</td>
<td>3.9637</td>
<td>9197.8</td>
<td>4.2437</td>
<td>17527.1</td>
<td>1.00</td>
</tr>
<tr>
<td>sunfish</td>
<td>Lepomis</td>
<td>3.9502</td>
<td>8917.4</td>
<td>3.8050</td>
<td>6383.1</td>
<td>4.0948</td>
<td>12439.8</td>
<td>0.89</td>
</tr>
<tr>
<td>bass</td>
<td>Micropterus</td>
<td>3.8062</td>
<td>6400.0</td>
<td>3.6435</td>
<td>4400.0</td>
<td>3.9638</td>
<td>9200.0</td>
<td>0.67</td>
</tr>
<tr>
<td>trout/salmon</td>
<td>Oncorhynchus</td>
<td>3.2615</td>
<td>1826.0</td>
<td>3.1318</td>
<td>1354.7</td>
<td>3.3823</td>
<td>2411.3</td>
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<tr>
<td>perch</td>
<td>Perca</td>
<td>2.5441</td>
<td>350.0</td>
<td>2.4472</td>
<td>280.0</td>
<td>2.6335</td>
<td>430.0</td>
<td>0.00</td>
</tr>
<tr>
<td>fathead minnow</td>
<td>Pimephales</td>
<td>3.8865</td>
<td>7700.0</td>
<td>3.6812</td>
<td>4800.0</td>
<td>4.0792</td>
<td>12000.0</td>
<td>0.78</td>
</tr>
<tr>
<td>crappie</td>
<td>Pomoxis</td>
<td>3.4150</td>
<td>2600.0</td>
<td>3.0792</td>
<td>1200.0</td>
<td>3.7559</td>
<td>5700.0</td>
<td>0.44</td>
</tr>
<tr>
<td>salmon/trout</td>
<td>Salmo</td>
<td>3.0986</td>
<td>1255.0</td>
<td>2.9098</td>
<td>812.4</td>
<td>3.3775</td>
<td>2385.0</td>
<td>0.11</td>
</tr>
<tr>
<td>trout</td>
<td>Salvelinus</td>
<td>3.1580</td>
<td>1438.7</td>
<td>3.0000</td>
<td>1000.0</td>
<td>3.3037</td>
<td>2012.5</td>
<td>0.22</td>
</tr>
</tbody>
</table>

Genus Mean for All: 3.4939
Genus Standard Deviation for all: 0.4838

Table F.4. Calculation of sensitivity distribution curve for fish exposed to carbaryl.

<table>
<thead>
<tr>
<th>Proportion</th>
<th>Zp</th>
<th>Log10 point</th>
<th>Point Estimate (ppb)</th>
<th>Log10 point</th>
<th>Point Estimate (ppb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.05</td>
<td>-1.645</td>
<td>2.698</td>
<td>498.9</td>
<td>2.533</td>
<td>341.0</td>
</tr>
<tr>
<td>0.10</td>
<td>-1.282</td>
<td>2.874</td>
<td>747.6</td>
<td>2.709</td>
<td>512.0</td>
</tr>
<tr>
<td>0.20</td>
<td>-0.842</td>
<td>3.087</td>
<td>1220.5</td>
<td>2.923</td>
<td>837.8</td>
</tr>
<tr>
<td>0.25</td>
<td>-0.675</td>
<td>3.168</td>
<td>1470.9</td>
<td>3.005</td>
<td>1010.5</td>
</tr>
<tr>
<td>0.30</td>
<td>-0.524</td>
<td>3.240</td>
<td>1739.4</td>
<td>3.078</td>
<td>1195.9</td>
</tr>
<tr>
<td>0.40</td>
<td>-0.253</td>
<td>3.371</td>
<td>2352.3</td>
<td>3.209</td>
<td>1619.7</td>
</tr>
<tr>
<td>0.50</td>
<td>0</td>
<td>3.494</td>
<td>3118.2</td>
<td>3.332</td>
<td>2149.9</td>
</tr>
<tr>
<td>0.60</td>
<td>0.253</td>
<td>3.616</td>
<td>4133.3</td>
<td>3.455</td>
<td>2853.6</td>
</tr>
<tr>
<td>0.70</td>
<td>0.524</td>
<td>3.747</td>
<td>5590.0</td>
<td>3.587</td>
<td>3864.8</td>
</tr>
</tbody>
</table>
\[ Z_p = \frac{\log_{10} \text{LC50} - \text{fish mean GMAV}}{(\text{fish std GMAV})} \]

### Table F.5. Sensitivity distribution for fish exposed to carbaryl based on mean and confidence intervals of 96-h LC50 data. Benchmarks for EECs which would result in LOC exceedances for LC50 data are also provided.

<table>
<thead>
<tr>
<th>Proportion</th>
<th>Mean Point Estimate of LC50 (ppb)</th>
<th>Benchmark Concentration* (ppb)</th>
<th>Lower Point Estimate of LC50 (ppb)</th>
<th>Benchmark Concentration* (ppb)</th>
<th>Upper Point Estimate of LC50 (ppb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.05</td>
<td>499</td>
<td>25</td>
<td>341</td>
<td>17</td>
<td>717</td>
</tr>
<tr>
<td>0.10</td>
<td>748</td>
<td>37</td>
<td>512</td>
<td>26</td>
<td>1,080</td>
</tr>
<tr>
<td>0.20</td>
<td>1,221</td>
<td>61</td>
<td>838</td>
<td>42</td>
<td>1,774</td>
</tr>
<tr>
<td>0.25</td>
<td>1,471</td>
<td>74</td>
<td>1,010</td>
<td>51</td>
<td>2,142</td>
</tr>
<tr>
<td>0.30</td>
<td>1,739</td>
<td>87</td>
<td>1,196</td>
<td>60</td>
<td>2,539</td>
</tr>
<tr>
<td>0.40</td>
<td>2,352</td>
<td>118</td>
<td>1,620</td>
<td>81</td>
<td>3,446</td>
</tr>
<tr>
<td>0.50</td>
<td>3,118</td>
<td>156</td>
<td>2,150</td>
<td>107</td>
<td>4,584</td>
</tr>
<tr>
<td>0.60</td>
<td>4,133</td>
<td>207</td>
<td>2,854</td>
<td>143</td>
<td>6,097</td>
</tr>
<tr>
<td>0.70</td>
<td>5,590</td>
<td>279</td>
<td>3,865</td>
<td>193</td>
<td>8,277</td>
</tr>
<tr>
<td>0.75</td>
<td>6,614</td>
<td>331</td>
<td>4,576</td>
<td>229</td>
<td>9,813</td>
</tr>
<tr>
<td>0.80</td>
<td>7,966</td>
<td>398</td>
<td>5,517</td>
<td>276</td>
<td>11,847</td>
</tr>
<tr>
<td>0.90</td>
<td>13,006</td>
<td>650</td>
<td>9,028</td>
<td>451</td>
<td>19,457</td>
</tr>
<tr>
<td>0.95</td>
<td>19,487</td>
<td>974</td>
<td>13,553</td>
<td>678</td>
<td>29,300</td>
</tr>
</tbody>
</table>

*LC50 x acute listed LOC. Units in ug/L. Represents EEC required to exceed LOC.
Table F.6. Summary of 48-hour and 96 hour EC50 data for effects of carbaryl on freshwater invertebrates. Data are from EFED's database of ecotoxicity data.

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Species Name</th>
<th>Mean EC50 (ppb)</th>
<th>Mean Log10 EC50</th>
<th>Lower Confidence EC50</th>
<th>Lower Log10 EC50</th>
<th>Upper Confidence EC50</th>
<th>Upper Log10 EC50</th>
<th>Test Subst ance (%) a.i.</th>
<th>Duration of exposure (h)</th>
<th>MRI D</th>
<th>Acce ssion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sowbug</td>
<td>Asellus breviceaudus</td>
<td>280</td>
<td>2.447</td>
<td>214</td>
<td>2.330</td>
<td>367</td>
<td>2.565</td>
<td>99.5</td>
<td>96</td>
<td>4009</td>
<td>8001</td>
</tr>
<tr>
<td>Stonefly</td>
<td>Claassenia sabulosa</td>
<td>5.6</td>
<td>0.748</td>
<td>3.9</td>
<td>0.591</td>
<td>8.7</td>
<td>0.940</td>
<td>99.5</td>
<td>96</td>
<td>4009</td>
<td>8001</td>
</tr>
<tr>
<td>Water flea</td>
<td>Daphnia magna</td>
<td>7.2</td>
<td>0.857</td>
<td>6.33</td>
<td>0.801</td>
<td>8.37</td>
<td>0.923</td>
<td>81.5</td>
<td>48</td>
<td>4239</td>
<td>7903</td>
</tr>
<tr>
<td>Water flea</td>
<td>Daphnia magna</td>
<td>5.6</td>
<td>0.748</td>
<td>2.7</td>
<td>0.431</td>
<td>12</td>
<td>1.079</td>
<td>99.5</td>
<td>48</td>
<td>4009</td>
<td>8001</td>
</tr>
<tr>
<td>Water flea</td>
<td>Daphnia pulex</td>
<td>6.4</td>
<td>0.806</td>
<td>NR</td>
<td>NA</td>
<td>NR</td>
<td>NA</td>
<td>99.5</td>
<td>48</td>
<td>4009</td>
<td>8001</td>
</tr>
<tr>
<td>Scud</td>
<td>Gammarus fasciatus</td>
<td>26</td>
<td>1.415</td>
<td>16</td>
<td>1.204</td>
<td>39</td>
<td>1.591</td>
<td>99.5</td>
<td>96</td>
<td>4009</td>
<td>8001</td>
</tr>
<tr>
<td>Scud</td>
<td>Gammarus lacustris</td>
<td>16</td>
<td>1.204</td>
<td>12</td>
<td>1.079</td>
<td>19</td>
<td>1.279</td>
<td>Tech</td>
<td>96</td>
<td>0500</td>
<td>9242</td>
</tr>
<tr>
<td>Scud</td>
<td>Gammarus pseudolimnaeus</td>
<td>8</td>
<td>0.903</td>
<td>4.9</td>
<td>0.690</td>
<td>13</td>
<td>1.114</td>
<td>99.5</td>
<td>48</td>
<td>4009</td>
<td>8001</td>
</tr>
<tr>
<td>Stonefly</td>
<td>Isogenus sp.</td>
<td>3.6</td>
<td>0.556</td>
<td>2.4</td>
<td>0.380</td>
<td>5.5</td>
<td>0.740</td>
<td>99.5</td>
<td>96</td>
<td>4009</td>
<td>8001</td>
</tr>
<tr>
<td>Crayfish</td>
<td>Procambarus sp.</td>
<td>1.9</td>
<td>0.279</td>
<td>1.1</td>
<td>0.041</td>
<td>3.1</td>
<td>0.491</td>
<td>99.5</td>
<td>96</td>
<td>4009</td>
<td>8001</td>
</tr>
<tr>
<td>Stonefly</td>
<td>Pteronarcella badi a</td>
<td>1.7</td>
<td>0.230</td>
<td>1.4</td>
<td>0.146</td>
<td>2.4</td>
<td>0.380</td>
<td>99.5</td>
<td>96</td>
<td>4009</td>
<td>8001</td>
</tr>
<tr>
<td>Water flea</td>
<td>Simocephalus serrulatus</td>
<td>7.6</td>
<td>0.881</td>
<td>6.2</td>
<td>0.792</td>
<td>9.4</td>
<td>0.973</td>
<td>99.5</td>
<td>48</td>
<td>4009</td>
<td>8001</td>
</tr>
</tbody>
</table>

NR = not reported, NA = not applicable

Table F.7. Species values for EC50 (mean and upper and lower confidence intervals).

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Species Name</th>
<th>Log10 Mean</th>
<th>Log10 Lower</th>
<th>Log10 Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sowbug</td>
<td>Asellus breviceaudus</td>
<td>2.447</td>
<td>2.330</td>
<td>2.565</td>
</tr>
<tr>
<td>Stonefly</td>
<td>Claassenia sabulosa</td>
<td>0.748</td>
<td>0.591</td>
<td>0.940</td>
</tr>
<tr>
<td>Water flea</td>
<td>Daphnia magna</td>
<td>0.803</td>
<td>0.616</td>
<td>1.001</td>
</tr>
<tr>
<td>Water flea</td>
<td>Daphnia pulex</td>
<td>1.111</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Common Name</td>
<td>Genus Name</td>
<td>Log10 Mean</td>
<td>Mean EC50</td>
<td>Log10 lower</td>
</tr>
<tr>
<td>-------------</td>
<td>---------------------</td>
<td>------------</td>
<td>-----------</td>
<td>-------------</td>
</tr>
<tr>
<td>sowbug</td>
<td>Asellus</td>
<td>2.4472</td>
<td>280.0</td>
<td>2.3304</td>
</tr>
<tr>
<td>stonefly</td>
<td>Claassenia</td>
<td>0.7482</td>
<td>5.6</td>
<td>0.5911</td>
</tr>
<tr>
<td>water flea</td>
<td>Daphnia</td>
<td>0.9567</td>
<td>9.1</td>
<td>0.6164</td>
</tr>
<tr>
<td>scud</td>
<td>Gammarus</td>
<td>1.0536</td>
<td>11.3</td>
<td>0.8847</td>
</tr>
<tr>
<td>stonefly</td>
<td>Isogenus</td>
<td>0.5563</td>
<td>3.6</td>
<td>0.3802</td>
</tr>
<tr>
<td>crayfish</td>
<td>Procambarus</td>
<td>0.2546</td>
<td>1.8</td>
<td>0.0938</td>
</tr>
<tr>
<td>water flea</td>
<td>Simocephalus</td>
<td>0.8808</td>
<td>7.6</td>
<td>0.7924</td>
</tr>
</tbody>
</table>

Genus Mean for All: 0.9853 46 0.8127 34 5 60 0.679

Genus Standard Deviation for all: 0.6985 103 0.7189 79 9 135

Table F.9. Calculation of sensitivity distribution curve for invertebrates exposed to carbaryl.

<table>
<thead>
<tr>
<th>Proportion</th>
<th>Zp</th>
<th>Log10 point</th>
<th>Point Estimate (ppb)</th>
<th>Log10 point</th>
<th>Point Estimate (ppb)</th>
<th>Log10 point</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.05</td>
<td>-1.645</td>
<td>-0.164</td>
<td>0.7</td>
<td>-0.370</td>
<td>0.4</td>
<td>0.9</td>
</tr>
<tr>
<td>0.10</td>
<td>-1.282</td>
<td>0.090</td>
<td>1.2</td>
<td>-0.109</td>
<td>0.8</td>
<td>0.9</td>
</tr>
<tr>
<td>0.20</td>
<td>-0.842</td>
<td>0.397</td>
<td>2.5</td>
<td>0.207</td>
<td>1.6</td>
<td>0.9</td>
</tr>
<tr>
<td>0.25</td>
<td>-0.675</td>
<td>0.514</td>
<td>3.3</td>
<td>0.328</td>
<td>2.1</td>
<td>0.9</td>
</tr>
<tr>
<td>0.30</td>
<td>-0.524</td>
<td>0.619</td>
<td>4.2</td>
<td>0.436</td>
<td>2.7</td>
<td>0.9</td>
</tr>
<tr>
<td>0.40</td>
<td>-0.253</td>
<td>0.809</td>
<td>6.4</td>
<td>0.631</td>
<td>4.3</td>
<td>0.9</td>
</tr>
<tr>
<td>0.50</td>
<td>0</td>
<td>0.985</td>
<td>9.7</td>
<td>0.813</td>
<td>6.5</td>
<td>1.0</td>
</tr>
</tbody>
</table>
\[ Z_p = (\log_{10} \text{LC50} - \text{invertebrate mean GMAV})/(\text{invertebrate std GMAV}) \]

<table>
<thead>
<tr>
<th>Proportion</th>
<th>Mean Point Estimate of EC50 (ppb)</th>
<th>Benchmark Concentration* (ppb)</th>
<th>Mean Point Estimate of EC50 (ppb)</th>
<th>Benchmark Concentration* (ppb)</th>
<th>Mean Point Estimate of EC50 (ppb)</th>
<th>Benchmark Concentration* (ppb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.05</td>
<td>0.69</td>
<td>0.03</td>
<td>0.43</td>
<td>0.02</td>
<td>1.01</td>
<td>0.05</td>
</tr>
<tr>
<td>0.10</td>
<td>1.23</td>
<td>0.06</td>
<td>0.78</td>
<td>0.04</td>
<td>1.78</td>
<td>0.09</td>
</tr>
<tr>
<td>0.20</td>
<td>2.50</td>
<td>0.12</td>
<td>1.61</td>
<td>0.08</td>
<td>3.54</td>
<td>0.18</td>
</tr>
<tr>
<td>0.25</td>
<td>3.27</td>
<td>0.16</td>
<td>2.13</td>
<td>0.11</td>
<td>4.60</td>
<td>0.23</td>
</tr>
<tr>
<td>0.30</td>
<td>4.16</td>
<td>0.21</td>
<td>2.73</td>
<td>0.14</td>
<td>5.82</td>
<td>0.29</td>
</tr>
<tr>
<td>0.40</td>
<td>6.44</td>
<td>0.32</td>
<td>4.27</td>
<td>0.21</td>
<td>8.90</td>
<td>0.45</td>
</tr>
<tr>
<td>0.50</td>
<td>9.67</td>
<td>0.48</td>
<td>6.50</td>
<td>0.32</td>
<td>13.23</td>
<td>0.66</td>
</tr>
<tr>
<td>0.60</td>
<td>14.52</td>
<td>0.73</td>
<td>9.88</td>
<td>0.49</td>
<td>19.66</td>
<td>0.98</td>
</tr>
<tr>
<td>0.70</td>
<td>22.46</td>
<td>1.12</td>
<td>15.47</td>
<td>0.77</td>
<td>30.05</td>
<td>1.50</td>
</tr>
<tr>
<td>0.75</td>
<td>28.63</td>
<td>1.43</td>
<td>19.86</td>
<td>0.99</td>
<td>38.06</td>
<td>1.90</td>
</tr>
<tr>
<td>0.80</td>
<td>37.45</td>
<td>1.87</td>
<td>26.18</td>
<td>1.31</td>
<td>49.43</td>
<td>2.47</td>
</tr>
<tr>
<td>0.90</td>
<td>76.00</td>
<td>3.80</td>
<td>54.24</td>
<td>2.71</td>
<td>98.44</td>
<td>4.92</td>
</tr>
<tr>
<td>------</td>
<td>-------</td>
<td>------</td>
<td>-------</td>
<td>------</td>
<td>-------</td>
<td>------</td>
</tr>
<tr>
<td>0.95</td>
<td>136.27</td>
<td>6.81</td>
<td>98.91</td>
<td>4.95</td>
<td>173.76</td>
<td>8.69</td>
</tr>
</tbody>
</table>

*EC50 x acute listed LOC. Units in ug/L. Represents EEC required to exceed LOC.*
Appendix G. The Risk Quotient Method and Levels of Concern.

The Risk Quotient Method is the means used by EFED to integrate the results of exposure and ecotoxicity data. For this method, Risk Quotients (RQs) are calculated by dividing exposure estimates by the acute and chronic ecotoxicity values (i.e., RQ = EXPOSURE/TOXICITY). These RQs are then compared to OPP's levels of concern (LOCs). These LOCs are criteria used by OPP to indicate potential risk to non-target organisms and the need to consider regulatory action. EFED has defined LOCs for acute risk, potential restricted use classification, and for endangered species.

The criteria indicate that a pesticide used as directed has the potential to cause adverse effects on non-target organisms. LOCs currently address the following risk presumption categories:

(1) acute - there is a potential for acute risk; 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, regulatory action may be warranted; and

(4) chronic risk - the potential for chronic risk is high, regulatory action may be warranted.

Currently, EFED does not perform assessments for chronic risk to plants, acute or chronic risks to non-target 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 RQs are derived from required studies. Examples of ecotoxicity values derived from short-term laboratory studies that assess acute effects are: (1) LC50 (fish and birds), (2) LD50 (birds and mammals), (3) EC50 (aquatic plants and aquatic invertebrates), and (4) EC25 (terrestrial plants). Examples of toxicity test effect levels derived from the results of long-term laboratory studies that assess chronic effects are: (1) the Lowest Observed Adverse Effect Concentration (LOAEC) (birds, fish, and aquatic invertebrates), and (2) the No Observed Adverse Effect Concentration (NOAEC) (birds, fish and aquatic invertebrates). The NOAEC is generally used as the ecotoxicity test value in assessing chronic effects. Risk presumptions, along with the corresponding RQs and LOCs are summarized in Table G-1.
<table>
<thead>
<tr>
<th>Risk Class</th>
<th>Risk Description</th>
<th>RQ</th>
<th>LOC</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Aquatic Animals (fish and invertebrates)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acute</td>
<td>Potential for effects to non-listed animals from acute exposures</td>
<td>Peak EEC/LC₅₀⁵</td>
<td>0.5</td>
</tr>
<tr>
<td>Acute Restricted Use</td>
<td>Potential for effects to animals from acute exposures</td>
<td>Peak EEC/LC₅₀⁵</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td>Risks may be mitigated through restricted use classification</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acute Listed Species</td>
<td>Listed species may be potentially affected by acute exposures</td>
<td>Peak EEC/LC₅₀⁵</td>
<td>0.05</td>
</tr>
<tr>
<td>Chronic</td>
<td>Potential for effects to non-listed and listed animals from chronic exposures</td>
<td>60-day EEC/NOEC (fish)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>21-day EEC/NOEC (invertebrates)</td>
<td></td>
</tr>
<tr>
<td><strong>Terrestrial Animals (mammals and birds)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acute</td>
<td>Potential for effects to non-listed animals from acute exposures</td>
<td>EEC²/LC₅₀ (Dietary)</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EEC/LD₅₀ (Dose)</td>
<td></td>
</tr>
<tr>
<td>Acute Restricted Use</td>
<td>Potential for effects to animals from acute exposures</td>
<td>EEC²/LC₅₀ (Dietary)</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td>Risks may be mitigated through restricted use classification</td>
<td>EEC/LD₅₀ (Dose)</td>
<td></td>
</tr>
<tr>
<td>Acute Listed Species</td>
<td>Listed species may be potentially affected by acute exposures</td>
<td>EEC²/LC₅₀ (Dietary)</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EEC/LD₅₀ (Dose)</td>
<td></td>
</tr>
<tr>
<td>Chronic</td>
<td>Potential for effects to non-listed and listed animals from chronic exposures</td>
<td>EEC²/NOAEC</td>
<td>1</td>
</tr>
<tr>
<td><strong>Plants</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Listed</td>
<td>Potential for effects to non-target, non-listed plants from exposures</td>
<td>EEC/ EC₂₅</td>
<td>1</td>
</tr>
<tr>
<td>Listed Plant</td>
<td>Potential for effects to non-target, listed plants from exposures</td>
<td>EEC/ NOEC</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>EEC/ EC₀₅</td>
<td></td>
</tr>
</tbody>
</table>

¹ LC₅₀ or EC₅₀. ² Based on upper bound Kenaga values.
Appendix H. List of citations accepted and rejected by ECOTOX criteria.

The citations in this appendix were accepted by ECOTOX. Citations include the ECOTOX Reference number. References in section H.1 those relevant to carbaryl which were acceptable in ECOTOX. References in section H.2 were those relevant to carbaryl which were not cited within the risk assessment. References in section H.3 those relevant to degredates of carbaryl which were cited within this risk assessment. References in section H.4 were those relevant to degredates of carbaryl which were not cited within the risk assessment. In order to be included in the ECOTOX database, papers must meet the following minimum criteria:

1. the toxic effects are related to single chemical exposure;
2. the toxic effects are on an aquatic or terrestrial plant or animal species;
3. there is a biological effect on live, whole organisms;
4. a concurrent environmental chemical concentration/dose or application rate is reported; and
5. there is an explicit duration of exposure.

Section H.5 includes the list of exclusion terms and descriptions for citations not accepted by ECOTOX. For carbaryl, there were 2,116 references that were not accepted by ECOTOX for one or more of the reasons included in section H.5. A full list of the citations reviewed and rejected by the criteria for ECOTOX is listed in section H.6.

H.1. ECOTOX accepted references, relevant to carbaryl, contained more sensitive endpoints than those cited in the IRED


17138 Brooke LT; (1991) "Results of Freshwater Exposures with the Chemicals Atrazine, Biphenyl, Butachlor, Carbaryl, Carbazole, Dibenzofuran, 3,3'-Dichlorobenzidine, Dichlorvos, 1,2-Epoxyethylbenzene Oxide, Isophor. "Ctr for Lake Superior Environ Stud


11521 Khangarot BS; Sehgal A; Bhasin MK; (1985) 'Man and Biosphere' - Studies on the Sikkim Himalayas. Part Toxicity of Selected Pesticides to Frog Tadpole Rana hexadactyla (Lesson). Acta Hydrochim Hydrobiol


H.2. ECOTOX accepted references, relevant to carbaryl, not utilized or cited within this risk assessment since endpoints were less sensitive than existing data.

   
   EcoReference No.: 13414
   Chemical of Concern: ES,CBL; Habitat: A; Effect Codes: BEH,MOR; Rejection Code: LITE EVAL CODED(CBL),OK(ES).

   
   EcoReference No.: 35543
   Chemical of Concern: CBL,MLN; Habitat: T; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(MLN,CBL).

   
   EcoReference No.: 73713
   Chemical of Concern: MOM,CPY,CBL,MP,AZ,ES,RSM,EFV,MVP; Habitat: T; Effect Codes: POP,MOR; Rejection Code: OK(MOM),TARGET(RSM).

   
   EcoReference No.: 35005
   Chemical of Concern: PRN,CBL,DDT; Habitat: T; Effect Codes: PHY,MOR,BCM; Rejection Code: LITE EVAL CODED(CBL),OK(AL CHEMS).

   
   EcoReference No.: 70966
   Chemical of Concern: IDC,CFP,EMMB,MFZ,TUZ,BFT,ZCYP,AZ,CPY,PSM,CYP,DM,EFV,ES,TDC,MOM,CBL,SS; Habitat: T; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(AZ,IDC,CFP,EMMB,MFZ,TUZ,BFT,ZCYP,CPY,PSM,CYP,DM,EFV,ES,TDC,MOM,CBL,SS).


EcoReference No.: 74894
Chemical of Concern: PPB,CYP,FNV,DDT,CBL; Habitat: T; Effect Codes: MOR; Rejection Code: NO MIXTURE(PPB),TARGET(CYP).


EcoReference No.: 68422
User Define 2: WASH,CALF,SENT
Chemical of Concern: CPY,CBL,MOM,MLN; Habitat: T; Effect Codes: PHY; Rejection Code: LITE EVAL CODED(CBL,DMT),OK(ES).


EcoReference No.: 75053
Chemical of Concern: ES,DMT,CBL; Habitat: T; Effect Codes: CEL; Rejection Code: LITE EVAL CODED(CBL,DMT),OK(ES).


EcoReference No.: 12316
Chemical of Concern: CBL; Habitat: A; Effect Codes: BEH,MOR,PHY; Rejection Code: LITE EVAL CODED (CBL).


EcoReference No.: 12863
Chemical of Concern: HCCH,TCF,TBC,ES,CBL; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL),OK(ALL CHEMS).


EcoReference No.: 7529
Chemical of Concern: CBL; Habitat: A; Effect Codes: BEH; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 12517
Chemical of Concern: CuS,CYF,MLT,CBF,FNT,MLN,TCF,CBL,ES,HCCH; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL,CBF,CYF),NO MIXTURE(MLT),NO ENDPOINT(CuS),OK(FNT,MLN,TCD,ES,HCCH).


EcoReference No.: 7901
Chemical of Concern: CBL; Habitat: A; Effect Codes: POP; Rejection Code: LITE EVAL CODED (CBL).


EcoReference No.: 5958
Chemical of Concern: CBL; Habitat: A; Effect Codes: GRO; Rejection Code: LITE EVAL CODED (CBL).


EcoReference No.: 5670
Chemical of Concern: CBL; Habitat: A; Effect Codes: CEL,PHY; Rejection Code: LITE EVAL CODED (CBL).


EcoReference No.: 499
Chemical of Concern: CBL; Habitat: A; Effect Codes: MOR,GRO,BEH; Rejection Code: LITE EVAL CODED (CBL).


EcoReference No.: 15589
Chemical of Concern: CBL; Habitat: A; Effect Codes: GRO,MOR,BEH; Rejection Code: LITE EVAL CODED (CBL).


EcoReference No.: 11126
Chemical of Concern: CBL; Habitat: A; Effect Codes: GRO,BEH; Rejection Code: LITE EVAL CODED (CBL).


EcoReference No.: 75423
Chemical of Concern: DMT,AZD,CBL,LCYT,CYP; Habitat: T; Effect Codes: PHY; Rejection Code: LITE EVAL CODED(AZD),OK(DMT,CYP).


EcoReference No.: 87551
Chemical of Concern: CBL; Habitat: T; Effect Codes: PHY,BCM; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 71393
Chemical of Concern: RSM,CBL,DDT,HCCH; Habitat: T; Effect Codes: MOR; Rejection Code: TARGET(RSM).


EcoReference No.: 74105
User Define 2: WASHT
Chemical of Concern: CHX,FTT,PPG,AZ,DZ,MOM,CBL,FNV,ES,MDT; Habitat: T; Effect Codes: MOR; Rejection Code: OK.


EcoReference No.: 6502
Chemical of Concern: DDT,24DXY,TNT,MLN,Hg,Zn,Cu,S,Cr,Pb,Cd,CHD,CBL,MXC; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL,CuS,OW-TRV-Cu),OK(ALL CHEMS).

EcoReference No.: 8293  
Chemical of Concern: CBL,CHD;  Habitat: A;  Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL)(CHD).


EcoReference No.: 5362  
Chemical of Concern: CHD,DEM,CBL;  Habitat: A;  Effect Codes: PHY; Rejection Code: LITE EVAL CODED(CBL)(OK(DEM),CHD),NO COC(OXD).


EcoReference No.: 20076  
Chemical of Concern: ADC,CBL,OML,PPX;  Habitat: A;  Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL,ADC)(OK(OML),PPX).


EcoReference No.: 87623  
Chemical of Concern: ES,CBL;  Habitat: T;  Effect Codes: GRO,BCM; Rejection Code: LITE EVAL CODED(CBL)(ES).


EcoReference No.: 20074  
Chemical of Concern: CBL;  Habitat: A;  Effect Codes: GRO,REP,POP; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 35750  
Chemical of Concern: CBL,ACP;  Habitat: T;  Effect Codes: POP,GRO; Rejection Code: LITE EVAL CODED(ACP,CBL).


EcoReference No.: 5649  
Chemical of Concern: CBL,DMT,HCCH,DDT;  Habitat: A;  Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL,DMT)(OK(HCCH,DDT)).


EcoReference No.: 10055  
Chemical of Concern: CBL,HCCH,MLN;  Habitat: A;  Effect Codes: MOR; Rejection Code:

EcoReference No.: 10380
Chemical of Concern: CBL,HCCH,MLN; Habitat: A; Effect Codes: PHY,MOR; Rejection Code: LITE EVAL CODED(CBL),OK(HCCH,MLN).


EcoReference No.: 88813


EcoReference No.: 88814
Chemical of Concern: CBL,DZ; Habitat: T; Effect Codes: POP; Rejection Code: LITE EVAL CODED(CBL,DZ).


EcoReference No.: 62051
Chemical of Concern: CdCl,CBL; Habitat: A; Effect Codes: BEH,BCM; Rejection Code: LITE EVAL CODED(CBL,CdCl).


EcoReference No.: 59334
Chemical of Concern: MOM,AZ,BFT,EFV,FP,FVL,CBL,TDC,MVP,Naled,TCF; Habitat: T; Effect Codes: MOR; Rejection Code: OK(MOM),TARGET(FVL).


EcoReference No.: 47469
Chemical of Concern: CBL; Habitat: T; Effect Codes: GRO,REP,BEH,BCM; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 14902
Chemical of Concern: CBL; Habitat: A; Effect Codes: BCM,POP; Rejection Code: LITE EVAL CODED(CBL).

EcoReference No.: 13270
Chemical of Concern: CBL,MLN; Habitat: A; Effect Codes: GRO,MOR; Rejection Code: LITE EVAL CODED(CBL),OK(MLN).


EcoReference No.: 4444
Chemical of Concern: CBL,MLN; Habitat: A; Effect Codes: PHY; Rejection Code: LITE EVAL CODED(CBL),OK(MLN).


EcoReference No.: 962
Chemical of Concern: CBL,HCCH,MLN; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL),OK(ALL CHEMS).


EcoReference No.: 4311
Chemical of Concern: CBF,CBL; Habitat: A; Effect Codes: BCM,MOR; Rejection Code: LITE EVAL CODED(CBL),OK(CBF).


EcoReference No.: 66392
Chemical of Concern: CBL; Habitat: A; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 13691
Chemical of Concern: CBL; Habitat: A; Effect Codes: MOR,GRO,PHY; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 86582
Chemical of Concern: CBL; Habitat: A; Effect Codes: CEL; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 83929

EcoReference No.: 87871
Chemical of Concern: CBL,CuS; Habitat: A; Effect Codes: GRO,MOR; Rejection Code: LITE EVAL CODED(CBL),OK(CuS).


EcoReference No.: 19649
Chemical of Concern: CBL,HCH,PCP,Se,Zn; Habitat: A; Effect Codes: PHY,POP; Rejection Code: LITE EVAL CODED(CBL,PCP),OK(Zn,HCH,Se).


EcoReference No.: 19649
Chemical of Concern: CBL,HCH,PCP,Se; Habitat: A; Effect Codes: PHY,POP; Rejection Code: LITE EVAL CODED(POP),OK(ALL CHEMS).


EcoReference No.: 88372
Chemical of Concern: CBL,CPY,DDT; Habitat: A; Effect Codes: PHY,POP; Rejection Code: LITE EVAL CODED(CPY,DDT).


EcoReference No.: 79785
Chemical of Concern: CPY,CBL,CYH,EFV,ADC; Habitat: T; Effect Codes: POP; Rejection Code: LITE EVAL CODED(CBL,ADC,EFV),OK(ALL CHEMS).


EcoReference No.: 62033
Chemical of Concern: Hg,Cd,CuS,Cr,Zn,Mn,Fe,Pb,Co,Ni,As,CBL,MLN,PRN,HCH,DM,ATZ,DU,PCP,PL,NaPCP ; Habitat: A; Effect Codes: POP; Rejection Code: LITE EVAL CODED(CuS),NO PUBL AS(PCP,NaPCP),OK(ALL CHEMS).


EcoReference No.: 62033
Chemical of Concern:
Hg,Cd,Cu,S,Zn,Mn,Fe,Pb,Co,Ni,As,CBL,CrAC,MLN,PRN,HCCH,DM,ATZ,Du,PL,MP;
Habitat: A; Effect Codes: POP; Rejection Code: LITE EVAL
CODED(MLN,CBL,ATZ,CuS,CrAC),NO PUBL AS(PCP,NaPCP),OK(ALL CHEMS).


EcoReference No.: 47680
Chemical of Concern: CBL; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 71731
Chemical of Concern: CBL; Habitat: A; Effect Codes: GRO,MOR; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 84844
Chemical of Concern: NHN,CBL; Habitat: A; Effect Codes: GRO,MOR; Rejection Code: LITE EVAL CODED(CBL),OK(NHN).


EcoReference No.: 82767
Chemical of Concern: CBL; Habitat: A; Effect Codes: GRO,MOR,POP; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 81455
Chemical of Concern: ATZ,CBL; Habitat: A; Effect Codes: GRO,MOR,POP; Rejection Code: LITE EVAL CODED(CBL,ATZ).


EcoReference No.: 86020
Chemical of Concern: CBL; Habitat: A; Effect Codes: GRO,MOR; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 86763
Chemical of Concern: CBL; Habitat: A; Effect Codes: POP,GRO,MOR; Rejection Code:

EcoReference No.: 82263
Chemical of Concern: CBL; Habitat: A; Effect Codes: POP,GRO,MOR; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 86764
Chemical of Concern: CBL; Habitat: A; Effect Codes: MOR,GRO,POP,BCM; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 68605
Chemical of Concern: PYT,PMR,CBL,MLN,PPB,CPY; Habitat: T; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL,MLN),OK(PYT,PMR,CPY),NO MIXTURE(PPB).


EcoReference No.: 79278
Chemical of Concern: CYH,FNV,PMR,CPY,MOM,EFV,CBL; Habitat: T; Effect Codes: PHY; Rejection Code: LITE EVAL CODED(EFY),OK(ALL CHEMS).


EcoReference No.: 63402
Chemical of Concern: CPY,CBL,MOM; Habitat: T; Effect Codes: POP; Rejection Code: OK.


EcoReference No.: 88111
Chemical of Concern: EP,DZ,CBL; Habitat: T; Effect Codes: POP; Rejection Code: OK(EP),LITE EVAL CODED(DZ,CBL).


EcoReference No.: 68895
Chemical of Concern: ACP,CBL,DZ; Habitat: T; Effect Codes: BCM,REP; Rejection Code: LITE EVAL CODED(DZ,CBL),OK(ALL CHEMS).

J. Herpetol. 33: 303-306.

EcoReference No.: 62240
Chemical of Concern: CBL; Habitat: A; Effect Codes: BEH; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 47778
Chemical of Concern: CBL; Habitat: A; Effect Codes: MOR,GRO; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 59759
Chemical of Concern: CBL; Habitat: A; Effect Codes: BEH; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 18158
Chemical of Concern: CBL; Habitat: A; Effect Codes: BEH; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 73007
Chemical of Concern: CBL; Habitat: A; Effect Codes: POP,MOR,GRO; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 72411
Chemical of Concern: NPY,CBL,CuS,PCP,PMR; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL,CuS,PCP),OK(NPY,PMR).


EcoReference No.: 87654
Chemical of Concern: CBL; Habitat: A; Effect Codes: MOR,GRO; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 71881
Chemical of Concern: CBL; Habitat: A; Effect Codes: MOR,BEH,POP; Rejection Code: LITE EVAL CODED(CBL).

EcoReference No.: 15031
Chemical of Concern: ACR,DNT,PL,4NP,2CP,OPHP,PCP,C8OH,RTN,CPH,NAPH,As,BMN,CBL; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL,NAPH,RTN,PCP),OK(ACR,DNT,PL,4NP,2CP,OPHP,PCP,CPH,AS,BMN),NO PUB AS(C8OH).

80. Brooke, L. T. (1991). Results of Freshwater Exposures with the Chemicals Atrazine, Biphenyl, Butachlor, Carbaryl, Carbazole, Dibenzofuran, 3,3'-Dichlorobenzidine, Dichlorvos, 1,2-Epoxyethylbenzene (Styrene Oxide), Isophorone, Isopropalin, Oxychlordane, Pentachloroanisole, Propoxur (Baygon), Tetrabromobisphenol A, 1,2,4,5-Tetrachlorobenzene, and 1,2,3-Trichloropropene to Selected Freshwater Organisms. *C.r. for Lake Superior Environ.Stud., Univ.of Wisconsin-Superior, Superior, WI* 110 p.

EcoReference No.: 17138
Chemical of Concern: ATZ,PCB,BTC,CBL,FRN,DDVP,ISO,CHDP,PPX,CBZ; Habitat: A; Effect Codes: GRO,MOR; Rejection Code: LITE EVAL CODED(CBL,ATZ),OK(ALL CHEMS).


EcoReference No.: 5722
Chemical of Concern: CBL,PPN,MLT,CBF; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBF,CBL,OK(CBF,MLT,PPN)).


EcoReference No.: 63713
Chemical of Concern: AZ,CYP,DZ,DMT,MP,MDT,PSM,OML,CBL,FTT,AMZ,PMR,ES,EFV,IMC,SS,PPG,DFZ,FYC,TUZ,MFZ,AZD; Habitat: T; Effect Codes: MOR,REP; Rejection Code: LITE EVAL CODED (AZ,DZ,CYP,DMT,MP,MDT,PSM,OML,CBL,FTT,AMZ,PMR,ES,EFV,IMC,SS,PPG,DFZ,FYC,TUZ,MFZ,AZD).


EcoReference No.: 9521
Chemical of Concern: CBL; Habitat: A; Effect Codes: GRO,MOR; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 63601

EcoReference No.: 73097
Chemical of Concern: EFV,MLN,ES,PMR,MOM,CBL,MP,PSM,AZD,PRN; Habitat: T; Effect Codes: POP,CBL,PHY; Rejection Code: LITE EVAL CODED(EFV,EFV,OK)(ALL CHEMS).


EcoReference No.: 4517
Chemical of Concern: CBL; Habitat: A; Effect Codes: MOR,GRO,ACC; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 35070
Chemical of Concern: CBL; Habitat: T; Effect Codes: PHY,BCM; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 35069
Chemical of Concern: CBL; Habitat: T; Effect Codes: GRO,REP; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 35068
Chemical of Concern: CBL; Habitat: T; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 17741
Chemical of Concern: CBL; Habitat: A; Effect Codes: GRO,BEH,MOR,ACC; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 646
Chemical of Concern: AZ,DS,HCC,MLN,MP,Naled,PRT,24DXY,CMPH,DMT,DU,PEB,PSM,NTP,TPX,CBL;

EcoReference No.: 3708
Chemical of Concern: DCB,DDT,EN,HPT,CBL,DLD,THP,CHD,RTN; Habitat: A; Effect Codes: GRO; Rejection Code: LITE EVAL CODED(DMT),OK(ALL CHEMS).


EcoReference No.: 75045
Chemical of Concern: SXD,DMT,CBL; Habitat: T; Effect Codes: POP; Rejection Code: LITE EVAL CODED(ALL CHEMS).


EcoReference No.: 2999
Chemical of Concern: CBL; Habitat: A; Effect Codes: MOR,CEL; Rejection Code: LITE EVAL CODED(ALL CHEMS).


EcoReference No.: 947
Chemical of Concern: CBL; Habitat: A; Effect Codes: CEL,MOR; Rejection Code: LITE EVAL CODED(ALL CHEMS).


EcoReference No.: 16485
Chemical of Concern: CBL; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(ALL CHEMS).


EcoReference No.: 88713
Chemical of Concern: CBL,MCB; Habitat: T; Effect Codes: POP; Rejection Code: LITE EVAL CODED(ALL CHEMS).


EcoReference No.: 86664
Chemical of Concern: PIM,CBF,ADC,CBL; Habitat: T; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(ALL CHEMS).

EcoReference No.: 61217
User Define 2: WASH,CALF,SENT
Chemical of Concern: BT,PRN,MLN,DZ,CBF,CBL
Endpoint: POP; Habitat: T; Rejection Code: LITE EVAL CODED(CBF).


EcoReference No.: 61217
Chemical of Concern: BT,PRN,MLN,DZ,CBF,CBL; Habitat: T; Effect Codes: POP; Rejection Code: LITE EVAL CODED(DZ,CBF),OK(ALL CHEMS).


EcoReference No.: 4624
Chemical of Concern: CBL; Habitat: A; Effect Codes: MOR,BEH; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 5073
Chemical of Concern: CBL; Habitat: A; Effect Codes: MOR,REP,GRO; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 3461
Chemical of Concern: CF,24DXY,C8OH,NP,CBL,ACC,PCP,RTN,MLN; Habitat: A; Effect Codes: PHY,MOR; Rejection Code: LITE EVAL CODED(CBL,C8OH,ACL),OK(ALL CHEMS).


EcoReference No.: 20097
Chemical of Concern: NP,ES,CBL,24DXY,STCH,PL,C8OH,CPP,FNV; Habitat: A; Effect Codes: MOR,BEH; Rejection Code: LITE EVAL CODED(CBL,C8OH),OK(ALL CHEMS).


EcoReference No.: 70337
Chemical of Concern: CBL; Habitat: T; Effect Codes: BCM,MOR,GRO; Rejection Code: LITE EVAL CODED(CBL).

EcoReference No.: 14034
Chemical of Concern: CPY,MOM,CBF,AZ,ADC,DCTP,MP,MLN,CBL; Habitat: A; Effect Codes: BCM,GRO,MOR; Rejection Code: LITE EVAL CODED(AZ,CBL,CBF,MOM,ADC,MLN),OK(CPY,DCTP,MP).


EcoReference No.: 40535
Chemical of Concern: PRN,EN,AND,D,DT,CBL; Habitat: T; Effect Codes: MOR,PHY; Rejection Code: LITE EVAL CODED(CBL),OK(ALL CHEMS).


EcoReference No.: 59374
Chemical of Concern: CBL; Habitat: T; Effect Codes: MOR,PHY,BEH,CEL; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 35083
Chemical of Concern: M,LCMBL; Habitat: T; Effect Codes: BCM,GRO; Rejection Code: LITE EVAL CODED(CBL),OK(MC,MLN).


EcoReference No.: 13614
Chemical of Concern: CBL,PPHD; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL),OK(PPHD).


EcoReference No.: 75125
Chemical of Concern: DMT,CBL,ES,PHSL; Habitat: T; Effect Codes: POP,GRO,PHY; Rejection Code: LITE EVAL CODED(DMT),OK(ALL CHEMS).


EcoReference No.: 80938
Chemical of Concern: CBL; Habitat: A; Effect Codes: POP; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 4096
Chemical of Concern: CBL; Habitat: A; Effect Codes: BCM,GRO; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 65262
Chemical of Concern: ADC,CBL,CYP; Habitat: T; Rejection Code: TARGET(CYP).


EcoReference No.: 63387
Chemical of Concern: AZ,CBL,MP,TCF,DMT,FNT; Habitat: T; Effect Codes: BEH,MOR,GRO,ACCPHY; Rejection Code: LITE EVAL CODED(AZ,CBL,DMT,OK(MP,TCF,FNT)).


EcoReference No.: 70193
Chemical of Concern: RSM,CBL,CYP; Habitat: T; Effect Codes: MOR; Rejection Code: TARGET(RSM,CYP).


EcoReference No.: 70503
Chemical of Concern: RSM,CBL; Habitat: T; Effect Codes: MOR; Rejection Code: TARGET(RSM).


EcoReference No.: 35102
Chemical of Concern: CBL; Habitat: T; Effect Codes: REP,MOR,GRO; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 74236
Chemical of Concern: CuS,ATZ,GYP,DZ,CBL; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CuS),OK(ALL CHEMS).

EcoReference No.: 74236
Chemical of Concern: ATZ,GYP,DZ,CBL,CuS; Habitat: A; Effect Codes: MOR, Rejection Code: LITE EVAL CODED(CBL,DZ,ATZ,CuS),OK(GYP).


EcoReference No.: 2519
Chemical of Concern: NaDBS,CBL,EPRN; Habitat: A; Effect Codes: MOR,CEL; Rejection Code: LITE EVAL CODED(CBL),OK(EPRN,NaDBS).


EcoReference No.: 7669
Chemical of Concern: ADC,MOM,CBP,CBL; Habitat: A; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(CBL,CBF,ADC,MOM).


EcoReference No.: 16312
Chemical of Concern: CBL; Habitat: A; Effect Codes: POP; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 16308
Chemical of Concern: CBL; Habitat: A; Effect Codes: POP; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 6426
Chemical of Concern: CBL; Habitat: A; Effect Codes: POP,MOR; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 35109
Chemical of Concern: CBL; Habitat: T; Effect Codes: GRO,MOR,BEH,BCM; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 35124
Chemical of Concern: CBL;  Habitat: T;  Effect Codes: REP,MOR,ACC,BEH;  Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 39897
Chemical of Concern: CBL,DDT;  Habitat: T;  Effect Codes: BCM;  Rejection Code: LITE EVAL CODED(CBL,OK(DDT)).


EcoReference No.: 39964
Chemical of Concern: CBL,DDT;  Habitat: A;  Effect Codes: MOR,BEH;  Rejection Code: LITE EVAL CODED(CBL,OK(DDT)).


EcoReference No.: 35125
Chemical of Concern: CBL;  Habitat: T;  Effect Codes: BEH,GRO,BCM,CEL,PHY;  Rejection Code: LITE EVAL CODED (CBL).


EcoReference No.: 70095
Chemical of Concern: BRSM,CBL,PRM,CPYM,FNT;  Habitat: T;  Effect Codes: MOR,REP,ACC;  Rejection Code: LITE EVAL CODED(BRSM,OK(ALL CHEMS)).


EcoReference No.: 35126
Chemical of Concern: CBL;  Habitat: T;  Effect Codes: REP,POP,MOR;  Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 13515
Chemical of Concern: CBL,MLN; Habitat: A; Effect Codes: MOR,CEL; Rejection Code: LITE EVAL CODED(CBL),OK(MLN).


EcoReference No.: 13723
Chemical of Concern: CBL; Habitat: A; Effect Codes: BEH; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 82540
Chemical of Concern: EMMB,MFZ,TUZ,CBL,TDC,MOM,ES,TMX,ACT,TAP,SS,AZD,AZ,Cpy,PSM,MLN,IDC,EFV,KLN; Habitat: T; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(AZ,EMMB,MFZ,TUZ,CBL,TDC,MOM,ES,TMX,ACT,TAP,SS,AZD,Cpy,PSM,MLN,IDC,EFV,KLN).


EcoReference No.: 86850
Chemical of Concern: CBL; Habitat: T; Effect Codes: BCM,CEL,PHY; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 20518
Chemical of Concern: FYT,CBL,PMR,DDVP,HCCH,ETHN,EN; Habitat: A; Effect Codes: ACC,BEH,PHY; Rejection Code: LITE EVAL CODED(CBL),OK(ALL CHEMS).


EcoReference No.: 12210
Chemical of Concern: CBL,MLN,TBT,PCP,DLD; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL,PCP),OK(ALL CHEMS).


EcoReference No.: 87650
Chemical of Concern: CBL; Habitat: A; Effect Codes: MOR,BEH,POP,GRO; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 88367
Chemical of Concern: CBL; Habitat: A; Effect Codes: POP; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 73088
User Define 2: NEW CSC,WASHT,CALFT
Chemical of Concern: PRN,CBL,ACP,AZ,CPY,MDT,MOM,DM,CPYM,FNT,TCF,CBL; Habitat: T; Effect Codes: MOR,REP; Rejection Code: OK.


EcoReference No.: 56161
Chemical of Concern: CBL,CuS,NYP,PCP,PRM; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(OW-TRV-Cu,PCP),OK(ALL CHEMS).


EcoReference No.: 56162
Chemical of Concern: CBL,CuS,NYP,PCP,PRM,NH; Habitat: A; Effect Codes: GRO,REP,MOR; Rejection Code: LITE EVAL CODED(CBL),OK(NH),NO MIXTURE(CuS,PCP,NYP,PRM),NO COC(DZ).


EcoReference No.: 77827
Chemical of Concern: NYP,CBL,CuS,PCP,PMR; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL),OK(ALL CHEMS).


EcoReference No.: 73668
Chemical of Concern: PCP,CBL,NYP,PMR,CuS; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(OW-TRV-Cu,PCP),OK(ALL CHEMS).


EcoReference No.: 81907
Chemical of Concern: LCYT,TLM,CBL,BDC,CPY,DZ,FNT,MLN; Habitat: T; Effect Codes: MOR,ACC,POP; Rejection Code: LITE EVAL CODED (ADC,CBL),NO ENDPOINT(DZ),OK(MLN).

162. Edge, V. E. and Casimir, M. (1976). Toxicity of Insecticides to Adult Australian Plague

EcoReference No.: 70906
Chemical of Concern: DZ,CBY,CBL,RSM; Habitat: T; Effect Codes: MOR; Rejection Code: TARGET(RSM).


EcoReference No.: 10812
User Define 2: TITLE MED,WASH,CALF
Chemical of Concern: ADC,CBL; Habitat: A; Effect Codes: PHY,MOR; Rejection Code: LITE EVAL CODED(ADC).


EcoReference No.: 11588
Chemical of Concern: CBL,ADC; Habitat: A; Effect Codes: MOR,BCM,CEL; Rejection Code: LITE EVAL CODED(CBL,ADC).


EcoReference No.: 10812
Chemical of Concern: ADC,CBL; Habitat: A; Effect Codes: PHY,MOR; Rejection Code: LITE EVAL CODED(CBL,ADC).


EcoReference No.: 40546
Chemical of Concern: PCP,CuS,CBL; Habitat: T; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CuS,PCP,CBL), OK(ALL CHEMS).


EcoReference No.: 40404
Chemical of Concern: CuS,PCP,CBL,CHD; Habitat: T; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL,CuS,PCP),OK(CHD).


EcoReference No.: 87555
Chemical of Concern: CBL; Habitat: T; Effect Codes: PHY; Rejection Code: LITE EVAL CODED(CBL).

EcoReference No.: 87553  
Chemical of Concern: CBL,DDVP,MLN; Habitat: T; Effect Codes: PHY,MOR,CEL; Rejection Code: LITE EVAL CODED(MLN,CBL),OK(DDVP).


EcoReference No.: 87869  
Chemical of Concern: CBL,MLN,DDVP; Habitat: T; Effect Codes: BCM,GRO,BEH,PHY,MOR; Rejection Code: LITE EVAL CODED(CBL,MLN),OK(DDVP).


EcoReference No.: 74880  
Chemical of Concern: DMT,PMR,CBL; Habitat: T; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(CBL,DMT),OK(PMR).


EcoReference No.: 75454  
Chemical of Concern: CBL,DMT,PMR; Habitat: T; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(CBL,OK(DMT,PMR).


EcoReference No.: 15592  
Chemical of Concern: CBL,FNT; Habitat: A; Effect Codes: MOR,GRO,BEH; Rejection Code: LITE EVAL CODED(CBL,OK(FNT).


EcoReference No.: 88960  
Chemical of Concern: CBL; Habitat: A; Effect Codes: MOR,BEH,PHY,GRO; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 88959  
Chemical of Concern: CBL,VNL; Habitat: AT; Effect Codes: GRO,MOR,PHY,BEH,BCM; Rejection Code: LITE EVAL CODED(CBL).

EcoReference No.: 6830
Chemical of Concern: ATN, AND, MLN, PPX, CBL, DLD, HCCH, PRN, DDT; Habitat: A; Effect Codes: BCM, PHY; Rejection Code: LITE EVAL CODED(CBL, ATN), OK(ALL CHEMS).


EcoReference No.: 74106
User Define 2: WASHT
Chemical of Concern: TLF, TVP, CBL, ACP, MOM, ES, DZ, CPY; Habitat: T; Effect Codes: MOR, POP, BEH; Rejection Code: OK.


EcoReference No.: 39974
Chemical of Concern: CBL; Habitat: T; Effect Codes: GRO, BCM, ACC, BEH; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 11059
Chemical of Concern: AMSV, PL, 24DP, CBL; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL, AMSV), OK(PL, 24DP).


EcoReference No.: 74574
Chemical of Concern: ADC, CBL; Habitat: T; Effect Codes: BEH, BCM, MOR; Rejection Code: LITE EVAL CODED(CBL, ADC).


EcoReference No.: 86765
Chemical of Concern: CBL; Habitat: T; Effect Codes: BEH, PHY, MOR, GRO, CEL; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 87098
Chemical of Concern: CBL, ADC; Habitat: T; Effect Codes: BCM, BEH, MOR, GRO; Rejection Code: LITE EVAL CODED (CBL, ADC).

EcoReference No.: 87150
Chemical of Concern: CBL,ADC; Habitat: T; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(ADC,CBL).


EcoReference No.: 88956
Chemical of Concern: MP, HCB,Zn,Pb,Cr,Cu,Cd, DMT,EN,DLD, AND,PAH,24DXY,MLN,HCB,DDT,ES,CBL; Habitat: T; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(CBL,MLN),OK(ALL CHEMS).


EcoReference No.: 7775
Chemical of Concern: DDT, PRN, CBL, DDVP, PPX, MLN, DZ, AND, CPY, ATN, HCC, DLD; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL,DZ,ATN),OK(ALL CHEMS).


EcoReference No.: 74540
Chemical of Concern: DZ, DDT, CBL, CBF, MLN, CYR, FMP, FTT, PPM, PAQT Endpoint: MOR; Habitat: A; Rejection Code: LITE EVAL CODED(CBF).


EcoReference No.: 12261
Chemical of Concern: CBL; Habitat: A; Effect Codes: MOR, ACC; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 7293
Chemical of Concern: ADC, PPX, PRN, MLN, ETN, DDVP, MP, CBF, CBL; Habitat: A; Effect Codes: MOR, BCM; Rejection Code: LITE EVAL CODED(CBL,CBF,ADC),OK(ALL CHEMS).


EcoReference No.: 11322
Chemical of Concern: NAP, PAH, CBL; Habitat: A; Effect Codes: BEH; Rejection Code: LITE EVAL CODED(CBL,NAP).


EcoReference No.: 75357
Chemical of Concern: DLD,MLN,CBF,MOM,CBL,AZ; Habitat: T; Effect Codes: CEL,PHY; Rejection Code: LITE EVAL CODED(CBL,AZ),OK(ALL CHEMS).


EcoReference No.: 2828
Chemical of Concern: MXC,FTNTH,CBL; Habitat: A; Effect Codes: BEH; Rejection Code: LITE EVAL CODED(CBL),OK(MXC,FTNTH).


EcoReference No.: 15291
Chemical of Concern: CBL,MLN,DDT; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL),OK(DDT,MLN).


EcoReference No.: 18726
Chemical of Concern: CBL,ADC; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL,ADC).


EcoReference No.: 12859
User Define 2: ECOTOX MED,WASH,CALF,CORE
Chemical of Concern: MOM,ACC,BMC,BMN,CBL,DS,DZ,MLN,PMR; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(MOM).


EcoReference No.: 12859
Chemical of Concern: MOM,ACC,BMC,BMN,CBL,DS,DZ,MLN,PMR,ACL,C8OH,DZ; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(DZ,C8OH,MOM,ACL),OK(ALL CHEMS).


EcoReference No.: 12859
Chemical of Concern: MOM,ACC,BMC,BMN,CBL,CPY,DS,DZ,MLN,PMR,C8OH,ACL; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL
CODED(CBL,DZ,C8OH,MOM,ACL),OK(ALL CHEMS).


EcoReference No.: 12447
Chemical of Concern: NY6,PCP,SLA,NAPH,C8OH,PL,BZO,PAH,CBL; Habitat: A; Effect Codes: MOR,BEH; Rejection Code: LITE EVAL CODED(CBL,NAPH,C8OH,PCP).


EcoReference No.: 64443
Chemical of Concern: TFY,FPP,CYP,DDT,IMC,CPY,DZ,DMT,CBL,RTN,PMR,FNV,BFT,CBF,DLD,EN,AND,FPN; Habitat: T; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBF,TARGET(DMT,RTN,CYP),OK(ALL CHEMS).


EcoReference No.: 36760
Chemical of Concern: CBL; Habitat: T; Effect Codes: POP,BCM; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 14305
Chemical of Concern: CBL; Habitat: A; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 14303
Chemical of Concern: CBL; Habitat: A; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 4345
Chemical of Concern: CBL; Habitat: A; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 2686
Chemical of Concern: PL,NH,CdCl,HgCl2,CBL; Habitat: A; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(CBL),OK(PL,NH,CdCl,HgCl2).

EcoReference No.: 14762
Chemical of Concern: CBL; Habitat: A; Effect Codes: GRO,MOR,POP; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 4766
Chemical of Concern: CBL; Habitat: A; Effect Codes: POP,PHY,MOR,BCM,BEH; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 40416
Chemical of Concern: TPM,PCP,CHD,CBL; Habitat: T; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(PCP,CBL),OK(ALL CHEMS).


EcoReference No.: 8716
Chemical of Concern: NaPCP,CuS,CBL; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(ALL CHEMS).


EcoReference No.: 87642
Chemical of Concern: CBL,CPY; Habitat: T; Effect Codes: PHY,BCM,BEH; Rejection Code: LITE EVAL CODED(CPY).


EcoReference No.: 86768
Chemical of Concern: CPY,CBL; Habitat: T; Effect Codes: PHY,BEH; Rejection Code: LITE EVAL CODED(CPY).


EcoReference No.: 15652
Chemical of Concern: CBL,HCC; Habitat: A; Effect Codes: MOR,GRO,PHY,BEH;
Rejection Code: LITE EVAL CODED(CBL),OK(HCCH).


EcoReference No.: 73696
User Define: WASHT,CALFT,CORE
Chemical of Concern: MOM,DZ,PMR,FNV,CBL,PSM; Habitat: T; Effect Codes: MOR,REP; Rejection Code: OK.


EcoReference No.: 49731
Chemical of Concern: CBL,CPY,DMT; Habitat: T; Effect Codes: GRO,REP; Rejection Code: LITE EVAL CODED(DMT,CBL),OK(CPY).


EcoReference No.: 64549
User Define: WASHT,CALFT
Chemical of Concern: CBL,CPY,DMT; Habitat: T; Rejection Code: TARGET(DMT).


EcoReference No.: 87867
Chemical of Concern: CBL,THM; Habitat: T; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(CBL),OK(THM).


EcoReference No.: 81473
Chemical of Concern: CBL,ES; Habitat: T; Effect Codes: PHY,BEH; Rejection Code: LITE EVAL CODED(CBL),OK(ES).


EcoReference No.: 86759
Chemical of Concern: CBL; Habitat: A; Effect Codes: PHY,BEH,MOR; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 64569
Chemical of Concern: CBF,CPY,PMR,SS,CYF,CBL; Habitat: T; Effect Codes: PHY; Rejection Code: LITE EVAL CODED(CYF,CBF),OK(ALL CHEMS).

EcoReference No.: 2948
Chemical of Concern: CBL; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 10440
Chemical of Concern: CBL,CY,ABT,DZ,FNT,MLN, Habitat: A; Effect Codes: MOR,POP; Rejection Code: LITE EVAL CODED(DZ),OK(ALL CHEMS).


EcoReference No.: 16374
Chemical of Concern: CBL; Habitat: A; Effect Codes: MOR,GRO; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 3941
Chemical of Concern: CBL; Habitat: A; Effect Codes: REP,GRO,MOR; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 3939
Chemical of Concern: CBL; Habitat: A; Effect Codes: POP; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 17178
Chemical of Concern: CBL; Habitat: A; Effect Codes: GRO,MOR; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 17470
Chemical of Concern: ODZ,CBL,TBC,DZ,FNTH,FNT; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL,DZ),OK(ALL CHEMS).


EcoReference No.: 4118
Chemical of Concern: CBL; Habitat: A; Effect Codes: GRO,MOR,REP; Rejection Code:
LITE EVAL CODED(CBL).


EcoReference No.: 7128
Chemical of Concern: CBL; Habitat: A; Effect Codes: GRO,MOR; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 75186
Chemical of Concern: CBL; Habitat: A; Effect Codes: POP,GRO; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 35206
Chemical of Concern: CBL; Habitat: T; Effect Codes: MOR,ACC,BEH,REP; Rejection Code: LITE EVAL CODED (CBL).


EcoReference No.: 7796
Chemical of Concern: CBL,MLN,EDT,DLD; Habitat: A; Effect Codes: MOR,PHY; Rejection Code: LITE EVAL CODED(CBL),OK(MLN,EDT,DLD).


EcoReference No.: 5146
Chemical of Concern: 24DXY,CBL,CPY,MLN,DDT,EN; Habitat: A; Effect Codes: BEH; Rejection Code: LITE EVAL CODED(CBL),OK(ALL CHEMS).


EcoReference No.: 67674
Chemical of Concern: AZ,CBL; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED (AZ,CBL),OK(ALL CHEMS).


EcoReference No.: 75455
Chemical of Concern: DMT,CBL,FNV; Habitat: T; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(CBL),OK(DMT,FNV).

EcoReference No.: 984
Chemical of Concern: CuS,CBL,DZ,TBC,FNTH,ZnS,BTC,TBC,CdCl,ODZ; Habitat: A; Effect Codes: MOR,PHY; Rejection Code: LITE EVAL CODED(CBL,DZ,CuS),OK(ALL CHEMS).


EcoReference No.: 17295
Chemical of Concern: CBL,CuS; Habitat: A; Effect Codes: POP; Rejection Code: LITE EVAL CODED(CBL,CuS).


EcoReference No.: 16370
Chemical of Concern: CBL; Habitat: A; Effect Codes: POP; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 70899
Chemical of Concern: RSM,CBL,HCH,CYP,DZ; Habitat: T; Effect Codes: MOR; Rejection Code: TARGET(CYP,RSM).


EcoReference No.: 35214
Chemical of Concern: SZ,DDT,DZ,PCB,ALD,ATZ,CBL,DLD,EN,HCH,PRN,PCP,TPP,DMT; Habitat: T; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL,DZ,ATZ,ODZ),OK(ALL CHEMS).


EcoReference No.: 87852
Chemical of Concern: CBL,PPX,DM; Habitat: T; Effect Codes: BEH; Rejection Code: LITE EVAL CODED(CBL),OK(PPX,DM).


EcoReference No.: 11267
Chemical of Concern: CBL; Habitat: A; Effect Codes: GRO,POP,MOR; Rejection Code: LITE EVAL CODED(CBL).

EcoReference No.: 88812


EcoReference No.: 88815
Chemical of Concern: CBL,CYF,FPP,TCF,ACP,DZ,FVL,CY,P,PMR; Habitat: T; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL,DZ),OK(ALL CHEMS).


EcoReference No.: 88817
Chemical of Concern: CPY,DZ,IZF,CBL; Habitat: T; Effect Codes: POP; Rejection Code: LITE EVAL CODED(CBL,DZ),OK(CPY,IZF).


EcoReference No.: 88904
Chemical of Concern: MCB,FNP,MP,CBL,FN,PM; Habitat: T; Effect Codes: POP; Rejection Code: LITE EVAL CODED(CBL),OK(ALL CHEMS).


EcoReference No.: 11596
Chemical of Concern: TMP,FNT,CBL,PRN,FNTH,PPX,MLN; Habitat: A; Effect Codes: PHY,MOR; Rejection Code: LITE EVAL CODED(CBL),OK(ALL CHEMS).


EcoReference No.: 79285
Chemical of Concern: FPP,CYH,BFT,CBL,EFV,ACP; Habitat: T; Effect Codes: POP; Rejection Code: LITE EVAL CODED(BFT,EFV),OK(ALL CHEMS).


EcoReference No.: 3490
Chemical of Concern: CBL,EPRN; Habitat: A; Effect Codes: GRO; Rejection Code: LITE EVAL CODED(CBL),OK(EPRN).


EcoReference No.: 70674
Chemical of Concern: RSM,CBL; Habitat: T; Effect Codes: MOR; Rejection Code: TARGET(RSM).


EcoReference No.: 50180
Chemical of Concern: CBL; Habitat: T; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 50181
Chemical of Concern: PRT,ADC,PMR,PRN,PAQT,ACP,Naled,MLN,HCH,HPT,FNF,EN,ES,TMP,MTAS,MTM, MOM,AND,ATZ,BMY,DCP,CBL,Captan,CPY,TBO,DLD,DU,FNT,HZ,AS,SZ,MANEB; Habitat: T; Effect Codes: MOR,BEH; Rejection Code: LITE EVAL CODED(ADC,ACP,MLN,MTAS,MTM,MOM,CBL,Captan,DZ,SZ),OK(AL CHEMS).


EcoReference No.: 35243
Chemical of Concern: 24DXY,ABT,ADC,AMTL,AND,ATZ,Captan,CFB,CBL,Cd,Cr,DDT,DLD,DMT,DS,DU,DZ, ES,ETN,FNT,HCH,Hg,HPT,MCBP,MLN,MP,MRX,MTAS,MTM,Naled,Pb,PCB,PCL,PCP,PQT,PRN,PRT,PYN,RSN,RTN,SZ,TFM,THM,TVP,TXP,Zn,ZnP,As,AS,OXD; Habitat: T; Effect Codes: MOR; Rejection Code: LITE EVAL CODED (MTAS,CBL,DZ,ATZ,CFB,ADC,MOM,DMT,SZ,ZnP,RTN,RSN,MCPB,PCP,PRT),OK(AL CHEMS).


EcoReference No.: 70632
User Define 2: REPS,WASHT,CALFT,CORE,SENT
Chemical of Concern: SZ,CBL,DZ,PRN,ES,NH,MOM,DMT; Habitat: T; Effect Codes: MOR,REP,POP; Rejection Code: TARGET(DMT).


EcoReference No.: 35249
Chemical of Concern: ACP,CBL,DZ,DMT,EN,HCH,MLN,MOM,Naled,PRN,PMR,PSM,SPS,TMP,TPX,AMTL, ATZ,BMN,MCPA,24DXY,DMB,GYP,PAQT,PCL,PRO,PPN,TFN,ALSV; Habitat: T; Effect Codes: MOR,GRO,DVP; Rejection Code: LITE EVAL CODED(MOM,DMT,DMB,ALSV),OK (ALL CHEMS except BMN,MCPA-MIXTURE).


EcoReference No.: 35249
Chemical of Concern: ACP,CBL,DZ,DMT,EN,HCC,MLN,MOM,Naled,PRN,PMR,PSM,SPS,TMP,TPX,ATZ,BMN,MCPA,2,4DXY,DMB,GYP,PAQT,PCL,PRO,PPN,TFN,ALSv; Habitat: T; Effect Codes: MOR,GRO; Rejection Code: LITE EVAL CODED(CBL,ACP,PRO,DZ,ATZ,MOM,DMT,DMB,ALSv),OK(ALL CHEMS),NO MIXTURE(BMN,MCPA).


EcoReference No.: 10954
Chemical of Concern: NYP,NAP,N,CBL; Habitat: A; Effect Codes: MOR,BEH,PHY,GRO; Rejection Code: LITE EVAL CODED(CBL,N,NAP),OK(NYP).


EcoReference No.: 14399
Chemical of Concern: ACL,CBL,Naled,TBT,CuS,NaPCP; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(NaPCP,PCP),NO CONTROL(CuS).


EcoReference No.: 78022
Chemical of Concern: CBL; Habitat: A; Effect Codes: BEH; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 37215
Chemical of Concern: CBL; Habitat: T; Effect Codes: POP,BEH; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 88884
Chemical of Concern: CBL; Habitat: T; Effect Codes: GRO,MOR,PHY,BEH; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 71346
Chemical of Concern:
PNB, DDT, SZ, ATZ, DU, RTN, FBM, MRX, PPZ, THM, CBL, 24DXY, Maneb, Zineb, Captan, Nabam, Folpet; Habitat: T; Effect Codes: CEL; Rejection Code: LITE EVAL CODED(PTN, OK(ALL CHEMS))// NO TUMOR(PILOT)\/


EcoReference No.: 71346
Chemical of Concern:
DU, PNB, DDT, SZ, ATZ, RTN, FBM, MRX, PPZ, THM, CBL, 24DXY, Maneb, Zineb, Captan, Nabam, Folpet; Habitat: T; Effect Codes: CEL; Rejection Code: LITE EVAL CODED(CBL, SZ, ATZ, RTN, PPZ), OK(ALL CHEMS).


EcoReference No.: 82542
Chemical of Concern: MFZ, TUZ, CBL, FPP; Habitat: T; Effect Codes: REP, MOR; Rejection Code: LITE EVAL CODED(MFZ, TUZ, CBL, FPP).


EcoReference No.: 11081
Chemical of Concern: DDT, MLN, CBL; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL,OK(DDT, MLN)).


EcoReference No.: 18189
Chemical of Concern: CBL; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 76665
Chemical of Concern: CYP, ES, CBL; Habitat: A; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(CBL, CYP),OK(ES).


EcoReference No.: 67984
Chemical of Concern: CaPS, BMY, CBD, CTN, MZB, FRM, IPD, MLX, Cu, PCZ, TDM, VCZ, Zineb, Ziram, CuOH, AZ, CBL, CPY, DZ, DMT, ES, MLN, MDT, DCF; Habitat: T; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CaPS), OK(ALL CHEMS).

EcoReference No.: 87624
Chemical of Concern: CBL,MP; Habitat: A; Effect Codes: MOR,PHY,BEH; Rejection Code: LITE EVAL CODED(CBL),OK(MP).


EcoReference No.: 17176
Chemical of Concern: CBL; Habitat: A; Effect Codes: MOR,BCM,CEL; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 5182
Chemical of Concern: DDT,ES,FNT,MLN,PMR,HCCH,DLD,CBL; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL),OK(ALL CHEMS).


EcoReference No.: 87812
Chemical of Concern: DEM,CBL; Habitat: A; Effect Codes: BEH,PHY,MOR; Rejection Code: LITE EVAL CODED(CBL),OK(DEM).


EcoReference No.: 50679
Chemical of Concern: ATZ,CBL,CYH; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL,ATZ),OK(CYH).


EcoReference No.: 88917
Chemical of Concern: CBL,MLN; Habitat: T; Effect Codes: MOR,PHY,BCM,ACC; Rejection Code: LITE EVAL CODED(CBL,MLN).


EcoReference No.: 7174
Chemical of Concern: CBL,PMR,NYP,Cu; Habitat: A; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(CBL,Cu),OK(PMR,NYP).

EcoReference No.: 14918  
Chemical of Concern: Cd,HgCl2,PL,PCP,CuCl,Cu,Cy,CL; Habitat: A; Effect Codes: BEH; Rejection Code: LITE EVAL CODED(CBL,CuCl,OW-TRV-,PCP),OK(CPY,HgCl2,Cd,PL).


EcoReference No.: 75351  
Chemical of Concern: DMT,AZD,CBL,ES,CFV; Habitat: T; Effect Codes: POP,PHY; Rejection Code: LITE EVAL CODED(CYF,AZD,FVL),OK(ALL CHEMS).


EcoReference No.: 59922  
Chemical of Concern: CBL,PRT; Habitat: A; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(PRT,CBL).


EcoReference No.: 66397  
Chemical of Concern: CBL,PRT; Habitat: A; Effect Codes: BCM,MOR; Rejection Code: LITE EVAL CODED(CYT,PRT).


EcoReference No.: 68291  
Chemical of Concern: CBL,PRT; Habitat: A; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(CBL,PRT).


EcoReference No.: 20373  
Chemical of Concern: CBL; Habitat: A; Effect Codes: MOR,CEL,GRO; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 5264  
Chemical of Concern: DDT,ES,HCCH,DLD,CBL; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL),OK(ALL CHEMS).

EcoReference No.: 70266
Chemical of Concern: RSM,HCCH,CBL; **Habitat**: T; **Effect Codes**: MOR; **Rejection Code**: TARGET(RSM).


EcoReference No.: 35291
Chemical of Concern: CBL; **Habitat**: T; **Effect Codes**: GRO,MOR,BEH,REP,POP; **Rejection Code**: LITE EVAL CODED (CBL).


EcoReference No.: 18412
Chemical of Concern: PPX,CBL,AD,CCBF,MLN,PRN; **Habitat**: A; **Effect Codes**: BCM,CEL,MOR; **Rejection Code**: LITE EVAL CODED(CBL,CFB,ADC),OK(ALL CHEMS).


EcoReference No.: 2164
Chemical of Concern: CBL,DZ,MLN,FNT; **Habitat**: A; **Effect Codes**: ACC; **Rejection Code**: LITE EVAL CODED(CBL,DZ),OK(MLN,FNT).


EcoReference No.: 15807
Chemical of Concern: CBL; **Habitat**: A; **Effect Codes**: ACC,MOR; **Rejection Code**: LITE EVAL CODED(CBL).


EcoReference No.: 74123
User Define 2: WASHT
Chemical of Concern: CBL,ES,PFF,DLD,MOM,TVP ; **Habitat**: T; **Effect Codes**: BCM,MOR; **Rejection Code**: OK.


EcoReference No.: 6267
Chemical of Concern: CBL,DDT,PPX,MLN,ATN,DDVP,CPY,DLD,CBF; **Habitat**: A; **Effect Codes**: MOR,BCM; **Rejection Code**: LITE EVAL CODED(CBL,CFB,ATN),OK(ALL CHEMS).


EcoReference No.: 63336
Chemical of Concern: PYX,PFF,CBL,DDT,PMR,PRN; Habitat: A; Effect Codes: BCM,MOR,PHY; Rejection Code: LITE EVAL CODED(CBL),OK(ALL CHEMS).


EcoReference No.: 522
Chemical of Concern: AZ,CBL,CMPH,HCC,HMLN,TX,P,AND,DLD,DDT,MXC,HPT,CHD,EN; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 14166
Chemical of Concern: CBL,MLN; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL),OK(MLN).


EcoReference No.: 17912
Chemical of Concern: CBL; Habitat: A; Effect Codes: BCM,REP,MOR,GRO; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 6999
Chemical of Concern: CBF,CBL,MLN,PPHD; Habitat: A; Effect Codes: MOR,GRO; Rejection Code: LITE EVAL CODED(CBL,CFB),OK(MLN,PPHD).


EcoReference No.: 67617
Chemical of Concern: DZ,PPHD,MLN,FNT,CBL; Habitat: A; Effect Codes: REP,GRO; Rejection Code: LITE EVAL CODED(MLN,DZ,CBL),OK(PPHD,FNT).


EcoReference No.: 9935
Chemical of Concern: PPHD,DZ,FNT,CBL,MLN; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(MLN,CBL,DZ),OK(PPHD,FNT).


EcoReference No.: 18804
Chemical of Concern: AND,CBL; Habitat: A; Effect Codes: MOR,CEL; Rejection Code:
LITE EVAL CODED(CBL),OK(AND).


EcoReference No.: 4450
Chemical of Concern: AND,CBL; Habitat: A; Effect Codes: MOR,BEH,PHY; Rejection Code: LITE EVAL CODED(CBL),OK(AND).


EcoReference No.: 11521
Chemical of Concern: CBF,CBL,DMT,HCCH,MLN,PCB,EN,CBD,NaPCP; Habitat: A; Effect Codes: MOR,PHY; Rejection Code: LITE EVAL CODED(CBL),CBF,DMT,NaPCP),OK(ALL CHEMS).


EcoReference No.: 86943
Chemical of Concern: CBL; Habitat: T; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 85496
Chemical of Concern: DDVP,ETN,CBL,DMT,MLN,DZ,PRN; Habitat: T; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(MLN,CBL,DZ),OK(ALL CHEMS).


EcoReference No.: 13301
Chemical of Concern: CBL,MLN,ES; Habitat: A; Effect Codes: MOR,CEL; Rejection Code: LITE EVAL CODED(CBL),OK(MLN,ES).


EcoReference No.: 70527
Chemical of Concern: PNB,CBL,DCNA,SXD,FPP,MLN,KFAT,CHX,DZ,DCF,TPM,GYPI,MYC,PAQT,MZB,DM M,TFN,FML,ADC,DLN,CTN; Habitat: T; Effect Codes: POP,GRO; Rejection Code: LITE EVAL CODED(DZ,DCNA,SXD,CBL),OK(ALL CHEMS).


EcoReference No.: 64755
Chemical of Concern: ACP,CBL,CYP,AZD,IMC; Habitat: T; Effect Codes: PHY,GRO; Rejection Code: LITE EVAL CODED(ACP),OK TARGET(CBL).

EcoReference No.: 74137
User Define 2: WASHT
Chemical of Concern: CPYM,FNT,MP,FNTH,DZ,CY,PRN,MLN,PSM,MDT,DDVP,TVP,CBL,BDC,PIRM,PIM, MOM; Habitat: T; Effect Codes: MOR; Rejection Code: OK.


EcoReference No.: 5783
Chemical of Concern: CBL; Habitat: A; Effect Codes: CEL; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 6909
Chemical of Concern: CBL; Habitat: A; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 14108
Chemical of Concern: CBL; Habitat: A; Effect Codes: CEL,PHY; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 45759
Chemical of Concern: CBL; Habitat: A; Effect Codes: ACC,PHY; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 6091
Chemical of Concern: CBL; Habitat: A; Effect Codes: MOR,PHY; Rejection Code: LITE EVAL CODED (CBL).


EcoReference No.: 39605
Chemical of Concern: CBL, HCCH; Habitat: T; Effect Codes: BCM, PHY; Rejection Code: LITE EVAL CODED(CBL), OK(HCCH).


EcoReference No.: 87649
Chemical of Concern: CBL, ES; Habitat: A; Effect Codes: REP, BEH, MOR, GRO; Rejection Code: LITE EVAL CODED(CBL), OK(ES).


EcoReference No.: 87655
Chemical of Concern: MOM, CBF, CBL, AZ, ES, DLD, MLN; Habitat: T; Effect Codes: MOR, GRO, CEL; Rejection Code: LITE EVAL CODED(CBL, MOM, MLN), OK(CBF, AZ, ES).


EcoReference No.: 13870
Chemical of Concern: CBL; Habitat: A; Effect Codes: MOR, CEL; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 87556
Chemical of Concern: CBL; Habitat: T; Effect Codes: BCM, GRO, CEL; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 4888
Chemical of Concern: PPX, CBL; Habitat: A; Effect Codes: MOR, BEH; Rejection Code: LITE EVAL CODED(CBL), OK(PPX).


EcoReference No.: 18931
Chemical of Concern: CBL, PCP; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL, PCP).


EcoReference No.: 82520
Chemical of Concern: CBF,CBL; Habitat: A; Effect Codes: GRO,MOR,PHY,BEH; Rejection Code: LITE EVAL CODED(CBL),OK(CBF).


EcoReference No.: 82537
Chemical of Concern: MFZ,CBL,FNV,EFV,CPY,MP,AZ; Habitat: T; Effect Codes: MOR,P0P,PHY; Rejection Code: LITE EVAL CODED(MFZ),OK(ALL CHEMS).


EcoReference No.: 86940
Chemical of Concern: CBL,MLN; Habitat: T; Effect Codes: GRO,REP; Rejection Code: LITE EVAL CODED(MLN,CBL).


EcoReference No.: 37664
Chemical of Concern: CBL,MLN; Habitat: T; Rejection Code: LITE EVAL CODED(CBL,MLN).


EcoReference No.: 7558
Chemical of Concern: PPX,CBL; Habitat: A; Effect Codes: BCM,MOR,PHY; Rejection Code: LITE EVAL CODED(CBL),OK(PPX).


EcoReference No.: 78182
Chemical of Concern: ALSV,DZ,PYN,CBL,ACP,CPY; Habitat: T; Effect Codes: POP; Rejection Code: LITE EVAL CODED(ALSV),OK(ALL CHEMS).


EcoReference No.: 37706
Chemical of Concern: CBL,MLN; Habitat: T; Rejection Code: LITE EVAL CODED(MLN,CBL).


EcoReference No.: 6020
Chemical of Concern: CBL,DMT,DDT; Habitat: A; Effect Codes: MOR,PHY,GRO,BEH; Rejection Code: LITE EVAL CODED(CBL),OK(DDT,DMT).

EcoReference No.: 3296
Chemical of Concern: HXZ,GYP,MZB,PAQT,ES,MLN,PPX,CBL,DLD,HCCH,FNTH,CBF,ACP; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL,ACP,CBF),OK(ALL CHEMS), NO COC(EFV).


EcoReference No.: 3175
Chemical of Concern: PCP,MP,CHD,CBL,24DXY,TBF; Habitat: A; Effect Codes: BEH; Rejection Code: LITE EVAL CODED(CBL,PCP),OK(ALL CHEMS).


EcoReference No.: 71949
Chemical of Concern: CBL,ALSV; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL),OK(ALSV).


EcoReference No.: 8127
Chemical of Concern: MXY,CBL,MLN,TFN; Habitat: A; Effect Codes: GRO,MOR; Rejection Code: LITE EVAL CODED(CBL),OK(MLN,MXY,TFN).


EcoReference No.: 88033
Chemical of Concern: CBL; Habitat: T; Effect Codes: PHY,MOR; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 2993
Chemical of Concern: CBL,PRN; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL),OK(PRN).


EcoReference No.: 3278
Chemical of Concern: CBL; Habitat: A; Effect Codes: PHY,ACC,MOR; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 7846
Chemical of Concern: DDT,CBL,DLD; Habitat: A; Effect Codes: PHY,MOR; Rejection Code: LITE EVAL CODED(CBL),OK(DLD,DDT).


EcoReference No.: 18935
Chemical of Concern: HCCH,PCB,PCP,ADC,DLD,CBL,PRN,DDT,BAP; Habitat: A; Effect Codes: ACC,MOR; Rejection Code: LITE EVAL CODED(CBL,ADC,PCP),OK(ALL CHEMS).


EcoReference No.: 610
Chemical of Concern: AZ,CBL,HCCH,MLN,MP,TX; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL),OK(ALL CHEMS).


EcoReference No.: 70542
Chemical of Concern: RSM,DZ,CBL; Habitat: T; Effect Codes: MOR,BEH; Rejection Code: LITE EVAL CODED(RSM),OK(ALL CHEMS).


EcoReference No.: 70794
Chemical of Concern: PNB,CBL,TXP,DZ,ACP,CAPTAN,MLN,GYP; Habitat: T; Effect Codes: GRO,BCM; Rejection Code: LITE EVAL CODED(DZ,CBL,ACP),OK(ALL CHEMS),NO MIXTURE(CAPTAN).


EcoReference No.: 15240
Chemical of Concern: PPX,TMP,CY,CBL,MLN; Habitat: A; Effect Codes: GRO; Rejection Code: LITE EVAL CODED(CBL),OK(ALL CHEMS).


EcoReference No.: 5131
Chemical of Concern: CBL, MLN, ABT, PPX; Habitat: A; Effect Codes: POP; Rejection Code: LITE EVAL CODED(CBL), OK(ALL CHEMS).


EcoReference No.: 87669
Chemical of Concern: CHD, FNT, CBL; Habitat: T; Effect Codes: GRO, BCM, PHY, CEL; Rejection Code: LITE EVAL CODED(CBL), OK(CHD, FNT).


EcoReference No.: 62600
Chemical of Concern: 2IN, EB, DINO, DCF, Cu, ES, MOM, CBL, FNV, PHSL, CYP, DM, DMT, MLN, CPY, MP, FNTH, DVP, PPHD, FVL, ACP, MZB, CBD; Habitat: T; Effect Codes: MOR; Rejection Code: OK TARGET(DMT, MLN, FVL, CYP).


EcoReference No.: 62601
Chemical of Concern: MOM, PHSL, PPHD, CBL, CPY, DDVP, DCF, DMT, ES, FNT, MLN; Habitat: T; Effect Codes: MOR, POP; Rejection Code: OK TARGET(DMT).


EcoReference No.: 14048
Chemical of Concern: CBL; Habitat: A; Effect Codes: MOR, BEH, BCM; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 67983
Chemical of Concern: PPX, CPY, CBL, FNT, MOM; Habitat: T; Effect Codes: MOR, ACC; Rejection Code: LITE EVAL CODED(MOM).


EcoReference No.: 10697
Chemical of Concern: CBL; Habitat: A; Effect Codes: MOR, PHY, GRO; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 6797
Chemical of Concern: EDT, RSM, SZ, 2,4-DXY, ACP, ACR, ADC, ATM, ATZ, AZ, BS, CaPS, Captan, CBF, CBL, CM PH, COTC, CPY, CuS, DBN, DFZ, DMB, DMT, DOD, DPDP, DS, DU, DZ, FO, GY, HCCH, HXZ, IG S, LNR, MBZ, MCPB, MDT, MLN, MTT, MOM, MP, MTL, NaN3, Naed, OYZ, PCP, PEB, PAQT, PRT, PSM, Folpet, PYN, CYT, DMM, EFS, NAA, NTMP, PMR, PPB, TFN, WFN, RSM, RTN, ALSV, Se, DBAC, Zn, As, MTNP, DCB, MTAS, OXD; Habitat: A; Effect Codes: MOR, PHY; Rejection Code: LITE EVAL. CODED(CBL, MTAS, MTNP, DCB, DZ, IGS, ATZ, MTL, MTT, CBF, ADC, MOM, PPB, SZ, DMT, WFN, RTN, CuS, DOD, NaN3, DMB, RSM, CaPS, MCPB, NaPCP, PCP, AMSV, ALSV, PRT, ATM, CQT, ATN, DBAC), OK(ALLE CHEMS).


EcoReference No.: 77571
Chemical of Concern: CaPS, CBL; Habitat: T; Effect Codes: ACC; Rejection Code: LITE EVAL CODED(CaPS), OK(CBL).


EcoReference No.: 87559
Chemical of Concern: PMR, CYP, CBL, MOM, PRN, DZ; Habitat: T; Effect Codes: MOR, PHY; Rejection Code: LITE EVAL CODED(CBL, DZ, MOM), OK(PMR, CYP, PRN).


EcoReference No.: 71105
User Define 2: WASHT, CALFT
Chemical of Concern: ALD, DLD, HPT, EN, CHD, MP, Naed, DMT, AZ, MLN, CBL; Habitat: T; Effect Codes: MOR; Rejection Code: OK(ALLE CHEMS), OK TARGET(DMT, MLN).


EcoReference No.: 12182
Chemical of Concern: ACL, CBL, MLN; Habitat: A; Effect Codes: MOR, PHY, BCM, CEL; Rejection Code: LITE EVAL CODED(CBL, ACL), OK(MLN).


EcoReference No.: 5810
Chemical of Concern: CBL, PCP, CP, NP, PL, FNT, 4NP, AN; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL, PCP), OK(ALLE CHEMS).

EcoReference No.: 88952
Chemical of Concern: CPY, CBF, PSM, MLN, CBL, PMR; Habitat: T; Effect Codes: POP, BCM; Rejection Code: LITE EVAL CODED(CBL, MLN), OK(CPY, CBF, PSM, MP, PMR), OK TARGET(MLN).


EcoReference No.: 52121
Chemical of Concern: CdCl, CBL, NaPCP; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL, NaPCP), OK(CaCl).


EcoReference No.: 52121
Chemical of Concern: Cd, CBL, NaPCP; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL, NaPCP).


EcoReference No.: 74542
Chemical of Concern: CBF, CBL; Habitat: A; Effect Codes: GRO; Rejection Code: LITE EVAL CODED(CBL, CBF).


EcoReference No.: 66427
Chemical of Concern: MTPN, ACR, CPY, FNTN, MLN, TMP, DFZ, Captan, ATZ, DDT, HCCH, CBL, PPX, PMR, TXP; Habitat: A; Effect Codes: GRO; Rejection Code: LITE EVAL CODED(MLN, CBL, MTPN, ATZ), OK(ALL CHEMS).


EcoReference No.: 85946
Chemical of Concern: CBL; Habitat: A; Effect Codes: GRO, MOR, CEL; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 86760
Chemical of Concern: CBL; Habitat: A; Effect Codes: POP, MOR, GRO; Rejection Code: LITE EVAL CODED(CBL).

EcoReference No.: 52354
Chemical of Concern: CBL; Habitat: A; Effect Codes: MOR,ACC,BCM; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 60846
Chemical of Concern: CBL,MP; Habitat: A; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(CBL),OK(MP).


EcoReference No.: 38043
Chemical of Concern: DCTP,DZ,CBL,PRM,PPHD,MTM,PRN,PRT,MP,CMPH,MVP,MLN,DMT,DDVP; Habitat: T; Effect Codes: BCM,GRO; Rejection Code: LITE EVAL CODED(DZ,CBL),NO ENDPOINT(DCTP,PRM,PPHD,MTM,PRN,PRT,MP,CMPH,MVP,MLN,DMT,DDVP).


EcoReference No.: 66555
Chemical of Concern: CYF,IMC,CPY,CBL; Habitat: T; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CYF),OK(IMC,CPY,CBL),NO ENDPOINT(FPN).


EcoReference No.: 66555
Chemical of Concern: CYF,IMC,CPY,CBL,FPN; Habitat: T; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CYF),OK(IMC,CPY,CBL),NO ENDPOINT(FPN).


EcoReference No.: 62642
Chemical of Concern: CYF,FPN,IMC,CBL,CPY; Habitat: T; Effect Codes: GRO,MOR; Rejection Code: LITE EVAL CODED(CYF,FPN),OK(ALL CHEMS).


EcoReference No.: 38050
Chemical of Concern: CBL; Habitat: T; Effect Codes: ACC,MOR,BCM; Rejection Code: LITE EVAL CODED(CBL).

EcoReference No.: 2719
Chemical of Concern: PPX,CBL,TXP,ES,DDT,PRN,AZ; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL),NO ENDPOINT(AZ),OK(PPX,TXP,ES,DDT,PRN).


EcoReference No.: 2156
Chemical of Concern: MRX,DCTP,DMT,PPHD,MLN,MP,CBL,EN,DDT,Naled; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL,DMT),OK(ALL CHEMS).


EcoReference No.: 87557
Chemical of Concern: CBL; Habitat: T; Effect Codes: GRO,PHY,REP,MOR; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 6587
Chemical of Concern: CBL,DZ,MLN; Habitat: A; Effect Codes: PHY,POP; Rejection Code: LITE EVAL CODED(CBL),OK(MLN),NO ENDPOINT(DZ).


EcoReference No.: 87865
Chemical of Concern: CBL,MDT,FNV,GYP; Habitat: T; Effect Codes: MOR,GRO,BCM; Rejection Code: LITE EVAL CODED(CBL),OK(MDT,FNV,GYP).


EcoReference No.: 69821
Chemical of Concern: ACYP,DM,PRM,HCH,CBL,MOM,MLN,Captan,LNR,GYP,PDM,BT,DTM,24DXY,MCP A,TEP,PDM,PCH,DDVP,THM,DOD; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL,MLN,MOM,DTM),OK(ALL CHEMS).


EcoReference No.: 19880
Chemical of Concern: NAPH,C8OH,TOL,MOL,CBL,ETHN; Habitat: A; Effect Codes: MOR,GRO; Rejection Code: LITE EVAL CODED(CBL,NAPH,C8OH),OK(ALL CHEMS).

EcoReference No.: 2665
Chemical of Concern: AZ,CBL,HCCH,DDT,EN,CHD,PRN,HPT,TEX,MO; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL),OK(ALL CHEMS).


EcoReference No.: 2093
Chemical of Concern: AZ,CBL,CPY,HCCH,MLN,MP,DZ; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL,DZ),OK(ALL CHEMS).


EcoReference No.: 5806
Chemical of Concern: CBL,ES,MLN; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL),OK(ES,MLN).


EcoReference No.: 2798
Chemical of Concern: AZ,CBL,CPY,HCCH,MLN,MP; Habitat: A; Effect Codes: MOR; Rejection Code: NO ENDPOINT(AZ),LITE EVAL CODED(CBL).


EcoReference No.: 70616
Chemical of Concern: RSM,CYP,CBL; Habitat: T; Effect Codes: MOR; Rejection Code: TARGET(CYP,RSM).


EcoReference No.: 63983
Chemical of Concern: MCPPP,DMB,24DXY,MCPA,DMT,CBL,MZZ,TDF,PCZ,QT,C,EPH,BMN,PN; Habitat: T; Effect Codes: REP,MOR,POP; Rejection Code: LITE EVAL CODED(DMT,PCZ,DMB,TDF),OK(ALL CHEMS).


EcoReference No.: 52644
Chemical of Concern: CBL; Habitat: T; Effect Codes: GRO,MOR,BEH; Rejection Code: LITE EVAL CODED(CBL).

EcoReference No.: 40469
Chemical of Concern: PL,4NP,PAH,DLD,CBL; Habitat: T; Effect Codes: GRO,REP,MOR; Rejection Code: LITE EVAL CODED(CBL),OK(ALL CHEMS).


EcoReference No.: 40417
Chemical of Concern: PL,4NP,CBL,PAH; Habitat: T; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL),OK(ALL CHEMS).


EcoReference No.: 40578
Chemical of Concern: Cd,Ni,Pb,Zn,PAH,Cu,S,CuCl,NAPH,CuN,PL,CBL,PCP,AMSV,ETHB,DCB; Habitat: T; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL,DCB,NAPH,CuCl,CuS,PCP,AMSV),OK(ALL CHEMS).


EcoReference No.: 40495
Chemical of Concern: PAH,PCP,4NP,2CP,NP,CBL,PL,DPDP,FA,ACE,AMSV; Habitat: T; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(PCP).


EcoReference No.: 40495
Chemical of Concern: PAH,PCP,4NP,2CP,NP,CBL,PL,DPDP,FA,ACE,AMSV,ETHB; Habitat: T; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(AMSV).


EcoReference No.: 40495
Chemical of Concern: PAH,PCP,4NP,2CP,CBL,PL,DPDP,FA,ACE,AMSV,ETHB,NAPH,NP,TOL,BNZ,DCB; Habitat: T; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(DCB,NAPH,PCP,AMSV,CBL),OK(ALL CHEMS).

EcoReference No.: 73554
User Define 2: WASHT,CALFT
Chemical of Concern: HCCH,CBF,CPY,CBL ; Habitat: T; Rejection Code: LITE EVAL CODED(CBF).


EcoReference No.: 4891
Chemical of Concern: CBL,MP,PRT,DZ,TFN,TXP,DFZ; Habitat: A; Effect Codes: REP,MOR; Rejection Code: LITE EVAL CODED(CBL,DZ,PRT),OK(ALL CHEMS).


EcoReference No.: 79763
Chemical of Concern: TBO,CBF,ES,CBL,EFV,MP; Habitat: T; Effect Codes: POP; Rejection Code: LITE EVAL CODED(EFV),OK(ALL CHEMS).


EcoReference No.: 79759
Chemical of Concern: MLN,ACP,EFV,CBL,CBF,CPY; Habitat: T; Effect Codes: POP; Rejection Code: LITE EVAL CODED(EFV),OK(ALL CHEMS).


EcoReference No.: 74964
Chemical of Concern: DMT,MLN,CBL,TCF; Habitat: A; Effect Codes: REP; Rejection Code: LITE EVAL CODED(DMT,MLN,CBL).


EcoReference No.: 72745
Chemical of Concern: ATZ,CBL,24DXY,PRN; Habitat: A; Effect Codes: PHY,CEL,BCM,BEH; Rejection Code: LITE EVAL CODED(CBL,ATZ),OK(24DXY,PRN).


EcoReference No.: 17878
Chemical of Concern: AgN,ZnS,CBL,Se,DZ,K2Cr207,CPH; Habitat: A; Effect Codes: MOR,GRO; Rejection Code: LITE EVAL CODED(CBL,DZ),OK(ALL CHEMS).


EcoReference No.: 5313
Chemical of Concern: CBL,DZ,ZnS,Se,NaCr,CPY,AgN; Habitat: A; Effect Codes: GRO,MOR; Rejection Code: LITE EVAL CODED(CBL,DZ,NaCr),OK(ALL CHEMS).


EcoReference No.: 88395
Chemical of Concern: CBL; Habitat: A; Effect Codes: POP,PHY; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 69311
Chemical of Concern: DLD,CYP,CBL,AZD; Habitat: T; Effect Codes: PHY,POP; Rejection Code: LITE EVAL CODED(AZD,CYP),OK(ALL CHEMS).


EcoReference No.: 12422
Chemical of Concern: ES,CBL,PPHD; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL),OK(ES,PPHD).


EcoReference No.: 11541
Chemical of Concern: DDVP,CBL; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL),OK(DDVP).


EcoReference No.: 3590
Chemical of Concern: ACR,ATZ,MXC,BTC,CuS,CBL,24DXY,PL,PAH; Habitat: A; Effect Codes: REP,MOR; Rejection Code: LITE EVAL CODED(CBL,ATZ,CuS,OW-TRV-Cu),OK(ALL CHEMS).


EcoReference No.: 64394
Chemical of Concern: CBL; Habitat: T; Effect Codes: PHY; Rejection Code: LITE EVAL CODED(CBL).

EcoReference No.: 83211
Chemical of Concern: 4AP,DCF,AND,ES,TXP,HCCH,MLN,PRN,SBDA,CBL,CBF,ALD; Habitat: T; Effect Codes: MOR,BEH; Rejection Code: LITE EVAL CODED(4AP),OK(ALL CHEMS).


EcoReference No.: 79800
Chemical of Concern: BFT,MP,CBF,CFY,FNF,CPY,EFV,DZ,CBL,PMR,LCYT; Habitat: T; Effect Codes: POP; Rejection Code: LITE EVAL CODED(BFT,CFY,EFV),OK(ALL CHEMS).


EcoReference No.: 11334
Chemical of Concern: CBL,MLN,CuS,AsO5,Ni,Cd,Se,Pb,Cr,TXP,Zn; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL,CuS,OW-TRV-Cu,AsO5),OK(Cd,Ni,Zn,MLN,TXP),NO MIXTURE(Ag,Cr,Se).


EcoReference No.: 10709
Chemical of Concern: CBL,DMT; Habitat: A; Effect Codes: MOR,PHY,BCM; Rejection Code: LITE EVAL CODED(CBL,DMT).


EcoReference No.: 87646
Chemical of Concern: CBL; Habitat: T; Effect Codes: REP; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 87648
Chemical of Concern: CBL; Habitat: T; Effect Codes: GRO,BCM,CEL,REP,BEH; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 18621
Chemical of Concern: ACR,ATZ,AZ,CBF,CBL,DMT,FMP,HCCH,MLT,MOM,MP,Cd,ADC-DDT,MXC,OML,TB C,CuCl,Cr,PPX,Zn,Hg; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(MLT,CBF,ADC,MOM,DMT,CuCl),OK(ALL CHEMS).

EcoReference No.: 18621
Chemical of Concern: CBF, ADC, DDT, MP, MXP, FMC, HCC, DMT, AZ, PPX, OML, TBC, MOM, CBL, ACR, ATZ, MLT, CD, Zn, CuCl, Hg, Cr; Habitat: A; Effect Codes: MOR; Rejection Codes: LITE EVAL CODED(CBL, AZ, ATZ, MLT, CBF, ADC, MOM, DMT, CuCl), OK(ALL CHEMS).


EcoReference No.: 9659
Chemical of Concern: CBF, ADC, PPX; Habitat: A; Effect Codes: MOR; Rejection Codes: LITE EVAL CODED(CBL, ADC), OK(PPX).


EcoReference No.: 3917
Chemical of Concern: CBF, CBL, PMR, FNT; Habitat: A; Effect Codes: MOR; Rejection Codes: LITE EVAL CODED(CBF, CBL), OK(PMR, FNT).


EcoReference No.: 3916
Chemical of Concern: CBF, CBL, PMR, FNT; Habitat: A; Effect Codes: MOR; Rejection Codes: LITE EVAL CODED(CBF, CBL), OK(PMR).


EcoReference No.: 5819
Chemical of Concern: CBF, CBL; Habitat: A; Effect Codes: MOR, PHY; Rejection Codes: LITE EVAL CODED(CBF, CBL).


EcoReference No.: 13800
Chemical of Concern: ACL, CBL, 24DXY, SZ, CBF, ATZ, BMN, TPR, MBZ, GYP, TET, MTC, IZT, DMM, PCL, CSF, HX Z; Habitat: A; Effect Codes: PHY, POP; Rejection Codes: LITE EVAL CODED(CBL, ATZ, CBF, MTL, SZ, PCZ, ACL), OK(ALL CHEMS).


EcoReference No.: 62451
Chemical of Concern: CBL,TBR; Habitat: A; Effect Codes: MOR, Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 19944
Chemical of Concern: CBL; Habitat: A; Effect Codes: MOR, CEL; Rejection Code: LITE EVAL CODED (CBL).


EcoReference No.: 10775
Chemical of Concern: CBL,CY,PCP,Cd; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL,PCP),OK(CPY,Cd).


EcoReference No.: 16510
Chemical of Concern: CBL,C8OH; Habitat: A; Effect Codes: MOR,GRO; Rejection Code: LITE EVAL CODED(CBL,C8OH).


EcoReference No.: 87558
Chemical of Concern: CBL; Habitat: T; Effect Codes: MOR,GRO,BCM,PHY; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 73699
User Define 2: WASHT,CALFT,CORE
Chemical of Concern: MOM,CBL,PMR,CPY,MP; Habitat: T; Effect Codes: MOR; Rejection Code: OK.


EcoReference No.: 63915
Chemical of Concern:
MOM,PFF,CBF,AZ,PSM,EPRN,MLN,Naled,FNT,CPY,ACP,MTM,MDT,CBL,CYP;
Habitat: T; Effect Codes: POP,MOR,GRO; Rejection Code: LITE EVAL CODED(MLN,MTM,CBL,ACP,AZ),NO CONTROL(MOM,CBF,CYP),OK(PFF,PSM,EPRN,Naled,FNT,MDT).


EcoReference No.: 7625
Chemical of Concern: SZ,ATZ,CBL,LNR,DLD,AND,Hg,Pb,PCB,CuS,Zn; Habitat: A; Effect Codes: POP; Rejection Code: LITE EVAL CODED(CBL,ATZ,SZ,CuS),OK(ALL CHEMS).


EcoReference No.: 89076
Chemical of Concern: CBL; Habitat: T; Effect Codes: CEL,BEH,PHY,GRO,REP,MOR; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 72049
Chemical of Concern: CBL; Habitat: T; Effect Codes: BEH; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 38415
Chemical of Concern: CBL; Habitat: T; Effect Codes: GRO,BCM,BEH; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 75774
Chemical of Concern: CYP,CBL,DMT,ES,DEM,MLN,DDVP,MP,DCM; Habitat: T; Effect Codes: MOR,POP; Rejection Code: LITE EVAL CODED(CYP,CBL,MLN),OK(ALL CHEMS).


EcoReference No.: 53393
Chemical of Concern: CBL; Habitat: T; Effect Codes: BCM,GRO; Rejection Code: LITE
EVAL CODED(CBL).


EcoReference No.: 87554  
Chemical of Concern: HCCH,CBL; Habitat: T; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(CBL),OK(HCCH).


EcoReference No.: 3807  
Chemical of Concern: CBL; Habitat: A; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 13230  
Chemical of Concern: CBL; Habitat: A; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 4312  
Chemical of Concern: CBL; Habitat: A; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 87640  
Chemical of Concern: CBL; Habitat: A; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 44303  
Chemical of Concern: CBL,CHD,DLD,PMA; Habitat: T; Effect Codes: POP; Rejection Code: LITE EVAL CODED(CBL),OK(ALL CHEMS).


EcoReference No.: 10502  
Chemical of Concern: CBL; Habitat: A; Effect Codes: MOR,BCM; Rejection Code: LITE EVAL CODED(CBL).

EcoReference No.: 77559
Chemical of Concern: CYP,MAL,AZD,CBL,CYP,PRT; Habitat: T; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CYP),OK(ALL CHEMS).


EcoReference No.: 12642
Chemical of Concern: CBL; Habitat: A; Effect Codes: PHY; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 11217
Chemical of Concern: CBL; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 450
Chemical of Concern: CBL; Habitat: A; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 10584
Chemical of Concern: CBL; Habitat: A; Effect Codes: PHY,MOR,BCM; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 3724
Chemical of Concern: CBL,DDT,FNV,PPHD; Habitat: A; Effect Codes: MOR,PHY; Rejection Code: LITE EVAL CODED(CBL),OK(DDT,FNV,PPHD).


EcoReference No.: 5539
Chemical of Concern: MLN,DDT,CBL; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL),OK(MLN,DDT).


EcoReference No.: 87560
Chemical of Concern: CBL; Habitat: T; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 3988
Chemical of Concern: CBL; Habitat: A; Effect Codes: PHY; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 3993
Chemical of Concern: CBL,MP,AND; Habitat: A; Effect Codes: BCM,PHY; Rejection Code: LITE EVAL CODED(CBL),OK(MP,AND).


EcoReference No.: 3992
Chemical of Concern: CBL,AND,MP; Habitat: A; Effect Codes: PHY,BCM; Rejection Code: LITE EVAL CODED(CBL),OK(AND,MP).


EcoReference No.: 87653
Chemical of Concern: ES,MP,CBL; Habitat: T; Effect Codes: POP,MOR; Rejection Code: LITE EVAL CODED(CBL),OK(ES,MP).


EcoReference No.: 86767
Chemical of Concern: DZ,CBL,MLN,GYP; Habitat: A; Effect Codes: MOR,GRO; Rejection Code: LITE EVAL CODED(CBL,MLN,DZ),OK(GYP).


EcoReference No.: 89112
Chemical of Concern: CBL,MLN,GYP,24DXY; Habitat: A; Effect Codes: MOR,POP; Rejection Code: LITE EVAL CODED(CBL,MLN),OK(GYP,24DXY).


EcoReference No.: 70872
Chemical of Concern: CBL; Habitat: A; Effect Codes: MOR,GRO,BEH; Rejection Code:

EcoReference No.: 70015
Chemical of Concern: RSM,SZ,CPY,CBL,PYT,PMR,DMT; Habitat: T; Effect Codes: MOR; Rejection Code: NO ENDPOINT(PMR,DMT),TARGET(RSM).


EcoReference No.: 42996
Chemical of Concern: BZO,MCRE,PL,SCA,CBL; Habitat: T; Effect Codes: REP; Rejection Code: LITE EVAL CODED(BZO,CBL,SCA),OK(ALL CHEMS).


EcoReference No.: 13544
Chemical of Concern: DLD,MLN,DDT,CBL; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL),OK(MLN,DDT,DLD).


EcoReference No.: 60409
Chemical of Concern: CBL; Habitat: T; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 87667
Chemical of Concern: CBL; Habitat: T; Effect Codes: BEH,BCM,PHY; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 53641
Chemical of Concern: CBL,CBF; Habitat: T; Effect Codes: BEH,GRO; Rejection Code: LITE EVAL CODED(CBF,CBL).


EcoReference No.: 84742
Chemical of Concern: CBL,DZ,THM; Habitat: T; Effect Codes: MOR,REP,GRO; Rejection Code: LITE EVAL CODED(CBL,DZ),OK(THM).

Roberts, B. L. and Dorough, H. W. (1984). Relative Toxicities of Chemicals to the

EcoReference No.: 40531
Chemical of Concern: DU,FNV,ES,FNF,FML,NCTN,CBD,MLN,PRN,Captan,TPM,PPB,DCTP,ACP,BMY,MBZ,P AQ,T,BNZ,CH31,TFN,NaN03,AZ,24DXY,NE,Co,Pb,CuS,DDT,PAH,JDMD,MPM,CYP,PMR, CBF,AD,AC,MOM,CBL,PPX,CYP,HCN,HTC; Habitat: T; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(ADC,CBL,NCTN,CBF,MOM,PPB,CuS,CYP),OK(ALL CHEMS).


EcoReference No.: 35406
Chemical of Concern: CBL; Habitat: T; Effect Codes: BEH,GRO,BCM; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 71723
Chemical of Concern: ATZ,CBL,ES; Habitat: A; Effect Codes: BEH,MOR,GRO; Rejection Code: LITE EVAL CODED(CBL,ATZ),OK(ES).


EcoReference No.: 20191
Chemical of Concern: MOL,ETHN,CBL,PL,PAQT,Cd,Hg,Mn,Cr,Cu; Habitat: A; Effect Codes: PHY; Rejection Code: LITE EVAL CODED(CBL,Cu),OK(ALL CHEMS).


EcoReference No.: 87851
Chemical of Concern: CBL,PPX; Habitat: T; Effect Codes: BEH,BCM,GRO; Rejection Code: LITE EVAL CODED(CBL),OK(PPX).


EcoReference No.: 7662
Chemical of Concern: CBL; Habitat: A; Effect Codes: CEL,GRO,MOR,POP; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 86941
Chemical of Concern: CBL,MLN,MP; Habitat: T; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(MLN,CBL),OK(MP).

EcoReference No.: 81396
Chemical of Concern: CBL; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 74456
Chemical of Concern: MOM,CBL,FNV,DMT,PMR,PFF,CYP,DFZ; Habitat: T; Effect Codes: MOR; Rejection Code: OK TARGET(DMT,CYP).


EcoReference No.: 66373
Chemical of Concern: CBL; Habitat: AT; Effect Codes: BCM,MOR; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 86761
Chemical of Concern: CBL; Habitat: AT; Effect Codes: MOR,BCM; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 65895
Chemical of Concern: CBL,MP; Habitat: A; Effect Codes: MOR,PHY; Rejection Code: LITE EVAL CODED(CBL),OK(MP).


EcoReference No.: 63490
Chemical of Concern:
SZ,ATZ,DU,HFP,MCPP,PYD,FYP,BT,MTL,PDM,CBL,MTSM,AMTL,CQTC,DPP1,MCPP1, Habit: T; Effect Codes: MOR,REP,GRO; Rejection Code: LITE EVAL CODED(SZ,MTL,ATZ,CQTC),NO MIXTURE(MCPP1,DPP1),OK(ALL CHEMS).


EcoReference No.: 70278
User Define 2: REPS,WASHT,CALFT,CORE,SENT
Chemical of Concern: SZ,CBL,ACP,AMZ,DM,FNT,THM,MZB,BMC,CQTC; Habitat: T; Effect Codes: MOR,REP; Rejection Code: LITE EVAL CODED(SZ).

EcoReference No.: 70278
Chemical of Concern: SZ,CBL,ACP,AMZ,AZ,DM,FNT,THM,MZB,BMC,CQTC; Habitat: T; Effect Codes: MOR,REP; Rejection Code: LITE EVAL CODED(SZ,CQTC),OK(ALL CHEMS).


EcoReference No.: 70629
Chemical of Concern: RSM,CYP,CBL; Habitat: T; Effect Codes: POP; Rejection Code: TARGET(CYP,RSM).


EcoReference No.: 885
Chemical of Concern: SZ,EDT,24DXY,AZ,CBL,CMPH,CPI,DBN,DMB,DMP,DS,DU,DZ,HCC,MLN,MLT,Naled,PAQT,PRT,TFN,RTN,NaNd,ATN,OXD; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL,AZ,DZ,MLT,SZ,DM,RTN,NaNd,DMB,PRT,ATN),OK(ALL CHEMS).


EcoReference No.: 887
Chemical of Concern: AZ,MLN,CBL,CMPH,CPI,DS,HCC,MLN,Naled,PRT,PSM,ATN,DZ,OXD; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL,DZ,PRT,ATN),OK(ALL CHEMS).


EcoReference No.: 889
Chemical of Concern: 24DXY,AZ,CBL,CPI,DBN,DMP,DS,DU,DZ,HCC,MLN,MLT,Naled,PYN,TFN,RTN,As,NaNd,ATN,OXD; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL,DZ,MLT,RTN,NaNd,ATN),OK(ALL CHEMS).


EcoReference No.: 5194
Chemical of Concern: DDT,CBL,ES,MLN,PMR; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL),OK(ALL CHEMS).

Sappington, L. C., Mayer, F. L., Dwyer, F. J., Buckler, D. R., Jones, J. R., and Ellersieck, M.

EcoReference No.: 65396
Chemical of Concern: CuS,PMR,CBL,PCP,NYP; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL,CuS,PCP),OK(PMR,NYP).


EcoReference No.: 10047
Chemical of Concern: CBL; Habitat: A; Effect Codes: MOR,BCM; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 11556
Chemical of Concern: CBL; Habitat: A; Effect Codes: PHY; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 466
Chemical of Concern: CBL; Habitat: A; Effect Codes: BCM,PHY; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 639
Chemical of Concern: CBL,FNT; Habitat: A; Effect Codes: PHY,REP; Rejection Code: LITE EVAL CODED(CBL),OK(FNT).


EcoReference No.: 88911
Chemical of Concern: CBL,MLN; Habitat: A; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(CBL,MLN).


EcoReference No.: 18418
Chemical of Concern: MLN,PRN,PHSL,CBL; Habitat: A; Effect Codes: MOR,BCM; Rejection Code: LITE EVAL CODED(CBL),OK(ALL CHEMS).


EcoReference No.: 53973
Chemical of Concern: PNB, CBL, DZ, ES, CTN, CAPTAN, BMY, FNV, SXD, DCF, MLN, BT, TFN, ACR, MANEB, EPT C; Habitat: T; Effect Codes: BCM, GRO; Rejection Code: LITE EVAL CODED(DZ), OK(ALL CHEMS).


EcoReference No.: 54011
Chemical of Concern: ATZ, CBL, ACP, GYP, HXZ, PCL, FNT, MP, PAQT, TCF; Habitat: T; Effect Codes: GRO, BEH, ACC; Rejection Code: LITE EVAL CODED(CBL, AZ, ACP), NO ENDPOINT(ATZ), OK(GYP, HXZ, PCL, FNT, MP, PAQT, TCF).


EcoReference No.: 11799
Chemical of Concern: BDC, CBL, MLN, FNT, PMR; Habitat: A; Effect Codes: MOR, PHY; Rejection Code: LITE EVAL CODED(CBL), OK(ALL CHEMS).


EcoReference No.: 88676
Chemical of Concern: Du, BMY, ANTV, ACP, ADC, CBL, CBF, DMT, Maneb, ETU, FMU, MOM, PPX; Habitat: T; Effect Codes: CEL, PHY; Rejection Code: LITE EVAL CODED(CBL, ETU, Maneb), NO ENDPOINT(MOM), OK(ALL CHEMS), NO COC(MTAS).


EcoReference No.: 80963
Chemical of Concern: ES, CBL; Habitat: A; Effect Codes: BCM, MOR; Rejection Code: LITE EVAL CODED(CBL), OK(ES).


EcoReference No.: 62322
Chemical of Concern: CBL; Habitat: A; Effect Codes: MOR, GRO; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 11221
Chemical of Concern: CBL, HCCH, FNT; Habitat: A; Effect Codes: GRO, REP, POP; Rejection Code: LITE EVAL CODED(CBL), OK(HCCH, FNT).

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EcoReference No.: 69472
Chemical of Concern: DMT, MLN, CBL, RTN, DZ; Habitat: A; Effect Codes: MOR, GRO, BEH; Rejection Code: LITE EVAL CODED(CBL, DZ, MLN), OK(DMT, RTN).


EcoReference No.: 17796
Chemical of Concern: CBL; Habitat: A; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 88807
Chemical of Concern: CBL, ES; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL), OK(ES).


EcoReference No.: 87647
Chemical of Concern: CBL; Habitat: A; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 16170
Chemical of Concern: CBL; Habitat: A; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 17100
Chemical of Concern: CBL; Habitat: A; Effect Codes: PHY; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 9838
Chemical of Concern: CBL; Habitat: A; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 54092
Chemical of Concern: CBL; Habitat: T; Effect Codes: BCM, CEL; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 10111
Chemical of Concern: CBL; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 87625
Chemical of Concern: CBL; Habitat: A; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 82708
Chemical of Concern: CBL; Habitat: A; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 17128
Chemical of Concern: CBF, CBL; Habitat: A; Effect Codes: MOR, BEH, PHY; Rejection Code: LITE EVAL CODED(CBL, CBF).


EcoReference No.: 11010
Chemical of Concern: CBL, ES; Habitat: A; Effect Codes: MOR, PHY; Rejection Code: LITE EVAL CODED(CBL, OK, ES).


EcoReference No.: 4596
Chemical of Concern: PPHD, AND, CBL; Habitat: A; Effect Codes: MOR, BEH; Rejection Code: LITE EVAL CODED(CBL, OK, PPHD, AND).


EcoReference No.: 87856
Chemical of Concern: CBL; Habitat: T; Effect Codes: PHY, GRO; Rejection Code: LITE EVAL CODED(CBL).

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EcoReference No.: 19508
Chemical of Concern: CBL; Habit: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 10898
Chemical of Concern: CBL,PRT; Habit: A; Effect Codes: MOR,BCM; Rejection Code: LITE EVAL CODED(CBL,PRT).


EcoReference No.: 12090
Chemical of Concern: CBL; Habit: A; Effect Codes: BCM,PHY; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 12375
Chemical of Concern: CBL,PRT; Habit: A; Effect Codes: REP,MOR; Rejection Code: LITE EVAL CODED(CBL,PRT).


EcoReference No.: 5095
Chemical of Concern: CBL,PPB; Habit: A; Effect Codes: PHY,BCM,CEL; Rejection Code: LITE EVAL CODED(CBL,PPB).


EcoReference No.: 65606
Chemical of Concern: CBL,ADC,TCF,PRT; Habit: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(ADC,CBL,PRT,OK(ALL CHEMS)).


EcoReference No.: 917
Chemical of Concern: CBL,PRT,ADC,TCF; Habit: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL,ADC,PRT,OK(TCF)).


EcoReference No.: 74220
Chemical of Concern: MLN,CBL; Habit: A; Effect Codes: MOR,BCM; Rejection Code:
LITE EVAL CODED(MLN,CBL).


EcoReference No.: 3108
Chemical of Concern: CBL; Habitat: A; Effect Codes: BCM,PHY; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 3971
Chemical of Concern: CBL,MLN,ES; Habitat: A; Effect Codes: MOR,BCM; Rejection Code: LITE EVAL CODED(CBL),OK(MLN,ES).


EcoReference No.: 9
Chemical of Concern: ES,PRT,TDC,CBL,DZ,CBYP; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL,DZ,CB,FPT),OK(ALL CHEMS).


EcoReference No.: 74591
Chemical of Concern: CBF,CBP,DZ,CBL,ES,TDC,PRT; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL,DZ,CBF,PRT),OK(CPY,ES),OK TARGET(TDC).


EcoReference No.: 74591
Chemical of Concern: CBF,CBP,DZ,CBL,ES,TDC,PRT
Endpoint: MOR; Habitat: A; Rejection Code: LITE EVAL CODED(CBF).


EcoReference No.: 74591
Chemical of Concern: CBF,CBP,DZ,CBL,ES,TDC,PRT; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(DZ,CBF,PRT),OK(ALL CHEMS).


EcoReference No.: 8101
Chemical of Concern: CBL,MLN; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL),OK(MLN).

EcoReference No.: 86935
Chemical of Concern: CBL; Habitat: A; Effect Codes: PHY,CEL; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 14285
Chemical of Concern: CBL,MLN,PRN; Habitat: A; Effect Codes: GRO,PHY,CEL; Rejection Code: LITE EVAL CODED(CBL),OK(MLN,PRN).


EcoReference No.: 54372
Chemical of Concern: CBL,CBF; Habitat: T; Effect Codes: GRO,BCM,BEH; Rejection Code: LITE EVAL CODED(CBF,CBL).


EcoReference No.: 74587
Chemical of Concern: CBF,DMT,CBL; Habitat: T; Effect Codes: MOR,GRO,BCM; Rejection Code: LITE EVAL CODED(CBF,DMT,CBL).


EcoReference No.: 41604
Chemical of Concern: ES,MLN,DDVP,CBL,DMT,PRN,EN,PPHD; Habitat: T; Effect Codes: PHY; Rejection Code: LITE EVAL CODED(CBL,DMT,MLN,ES,DDVP,PRN,EN).


EcoReference No.: 88283
Chemical of Concern: CBL,MOM,EFV,TUZ,IMC,EMMB; Habitat: T; Effect Codes: PHY,MOR; Rejection Code: LITE EVAL CODED(MOM,CBL),OK(ALL CHEMS).


EcoReference No.: 54410
Chemical of Concern: MOM,EFV,PMR,TDCCBL; Habitat: T; Effect Codes: POP; Rejection Code: LITE EVAL CODED(EFV,MOM),OK(ALL CHEMS).


EcoReference No.: 2251
Chemical of Concern: 24DXY,CBL,DU,DZ; Habitat: A; Effect Codes: PHY; Rejection Code: NO ENDPOINT(DZ),LITE EVAL CODED(CBL).


EcoReference No.: 38925
Chemical of Concern: ADC,OML,CBF,CBL,PRN,KMDC; Habitat: T; Effect Codes: MOR,BEH,PHY; Rejection Code: LITE EVAL CODED(CBL),OK(ALL CHEMS).


EcoReference No.: 26089
Chemical of Concern: MBZ,CBL,DZ,ES,MLN,CBF,DEM,MVP,CTN,MZB,MANEB,TFN; Habitat: T; Effect Codes: GRO; Rejection Code: LITE EVAL CODED(DZ),OK(ALL CHEMS).


EcoReference No.: 4825
Chemical of Concern: CBL; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 38979
Chemical of Concern: CBF,DDT,PCB,CBL,MP; Habitat: T; Effect Codes: BCM,CEL,GRO,PHY; Rejection Code: LITE EVAL CODED(CBF,CBL),OK(ALL CHEMS).


EcoReference No.: 4953
Chemical of Concern: CBL,MP; Habitat: A; Effect Codes: BEH,MOR; Rejection Code: LITE EVAL CODED(CBL),OK(MP).


EcoReference No.: 74715
Chemical of Concern: ADC,PPHD,CBL,PRT,AZD,DMT; Habitat: T; Effect Codes: POP; Rejection Code: LITE EVAL CODED(ADC,AZD,DMT).


EcoReference No.: 17386
Chemical of Concern: DDT,PPHD,MP,CBL; Habitat: A; Effect Codes: BCM,MOR; Rejection Code: LITE EVAL CODED(CBL),OK(DDT,PPHD,MP).


EcoReference No.: 87671
Chemical of Concern: CBL,ATZ,SZ,TDF,DCZ,PCP; Habitat: T; Effect Codes: MOR,PHY; Rejection Code: LITE EVAL CODED(CBL),SZ,OK(ALL CHEMS).


EcoReference No.: 39027
Chemical of Concern: CBL; Habitat: T; Effect Codes: REP,MOR,CEL,GRO; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 39026
Chemical of Concern: CBL; Habitat: T; Effect Codes: MOR,GRO,CEL; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 75424
Chemical of Concern: DMT,CBL; Habitat: T; Effect Codes: BEH; Rejection Code: LITE EVAL CODED(CBL),OK(DMT).


EcoReference No.: 7275
Chemical of Concern: CBL; Habitat: A; Effect Codes: POP; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 87857
Chemical of Concern: CBL; Habitat: T; Effect Codes: BCM,PHY,BEH; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 87668

EcoReference No.: 45610
Chemical of Concern: HCCH,ES,EN,DDT,CBL,PRT; Habitat: T; Effect Codes: POP,GRO; Rejection Code: LITE EVAL CODED(CBL,PRT),OK(ALL CHEMS).


EcoReference No.: 20421
Chemical of Concern: MP,ES,CBF,CPY,EFX,TDC,MTM,MLN,FNV,CYF,FNT,CBL,24DXY,MCPA,BTC,FZFB,TBC,ODZ,MZB; Habitat: AT; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL,MTM,MLN,CYP,CYF),OK(ALL CHEMS).


EcoReference No.: 87565
Chemical of Concern: EN,PPHD,CBL,DEM; Habitat: A; Effect Codes: PHY; Rejection Code: LITE EVAL CODED(CBL),OK(EN,PPHD,DEM).


EcoReference No.: 4969
Chemical of Concern: CBL; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 573
Chemical of Concern: CBL; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 72765
Chemical of Concern: CBL; Habitat: A; Effect Codes: MOR,GRO; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 16303

EcoReference No.: 16311
Chemical of Concern: CBL; Habitat: A; Effect Codes: POP; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 9787
Chemical of Concern: CBL; Habitat: A; Effect Codes: POP; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 16314
Chemical of Concern: CBL; Habitat: A; Effect Codes: POP; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 13808
Chemical of Concern: CBL; Habitat: A; Effect Codes: POP; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 16307
Chemical of Concern: CBL; Habitat: A; Effect Codes: POP; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 16309
Chemical of Concern: CBL,ACP; Habitat: A; Effect Codes: POP; Rejection Code: LITE EVAL CODED(CBL,ACP).


EcoReference No.: 39134  
Chemical of Concern: TXP,CBL; Habit: T; Effect Codes: GRO,F,M; Rejection Code: LITE EVAL CODED(CBL),OK(TXP).


EcoReference No.: 13053  
Chemical of Concern: CBL; Habit: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 86766  
Chemical of Concern: CBL; Habit: A; Effect Codes: PHY,REP,MOR,BCM; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 65841  
Chemical of Concern: CBL,DMT; Habit: A; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(BCM,EMT).


EcoReference No.: 71890  
Chemical of Concern: CBL,DMT; Habit: A; Effect Codes: BCM,CEL; Rejection Code: LITE EVAL CODED(BCM,DMT).


EcoReference No.: 71686  
Chemical of Concern: CBL,DMT; Habit: A; Effect Codes: REP,BCM,MOR; Rejection Code: LITE EVAL CODED(CBL,DMT).


EcoReference No.: 64128  
Chemical of Concern: MFZ,DFZ,TUZ,CBL; Habit: T; Effect Codes: GRO,MOR,REP; Rejection Code: LITE EVAL CODED(MFZ,DFZ,TUZ,CBL).


EcoReference No.: 64129
Chemical of Concern: MFZ,CBL,TUZ; Habitat: T; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(MFZ,CBL,TUZ).


EcoReference No.: 20057
Chemical of Concern: Cd,CuS,CBL,HCCH,MP,CPH,NaPCP,HgCl2,Zn,Cr,PRN,PbN,THM; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL,CuS,NaPCP),OK(ALL CHEMS).


EcoReference No.: 87672
Chemical of Concern: CBF,CBL; Habitat: T; Effect Codes: POP; Rejection Code: LITE EVAL CODED(CBL),OK(CBF).


EcoReference No.: 8039
Chemical of Concern: TXP,Nabam,CBL,DCB,Du,PL,CBZ,DDT,DZ; Habitat: A; Effect Codes: MOR,POP; Rejection Code: LITE EVAL CODED(CBL,DCB,DZ),OK(ALL CHEMS).


EcoReference No.: 75195
Chemical of Concern: ACL,HOX,4AP,FML,Egy,CBL,TEG,BMN; Habitat: AT; Effect Codes: MOR,GRO,BEH,BCM,CEL; Rejection Code: LITE EVAL CODED(CBL),OK(HOX,FML,EGY,TEG,BMN),NO COC(ADC,CBF,MTAS),NO CONTROL(ACL,4AP).


EcoReference No.: 87644
Chemical of Concern: ES,MP,CBL; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL),OK(ALL CHEMS).


EcoReference No.: 4550
Chemical of Concern: CBL; Habitat: A; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(CBL).

EcoReference No.: 7375
Chemical of Concern: ABT,CBF,CBL,THM,ES,HPT,CHD,AND,HCC,HCH,PHSL,DZ,DML,CVT,DDVP,MLN,FNT;
Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(MLN,CBL,DZ),OK(ALL CHEMS).


EcoReference No.: 15179
Chemical of Concern: HPT,CBF,CBL,CHD,DML,HCC,ES,DDVP,MLN,FNT,AND,DZ,PHSL,ABJ;
Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL,DZ,CBF,DML),OK(ALL CHEMS),NO COC(OXD).


EcoReference No.: 12980
Chemical of Concern: DEM,DDVP,CBF,CHD,AND,CBL;
Habitat: A; Effect Codes: PHY,BCM,MOR;
Rejection Code: LITE EVAL CODED(CBF,CBL),OK(ALL CHEMS).


EcoReference No.: 10385
Chemical of Concern: DDVP,Cd,PL,CBL,MLN,CBF,CuS,DEM,CHD,NaPCP;
Habitat: A; Effect Codes: MOR,GRO;
Rejection Code: LITE EVAL CODED(CBF,CBL,CuS),OK(ALL CHEMS).


EcoReference No.: 10575
Chemical of Concern: NaPCP,CHD,Cd,CuS,Zn,HgCl2,ABT,CBF,HCC,DDVP,CBL,PL,ES,MLN,SA,AND;
Habitat: A; Effect Codes: MOR;
Rejection Code: LITE EVAL CODED(CBF,CBL,CuS),OK(ALL CHEMS).


EcoReference No.: 17639
Chemical of Concern: Cu2O,SZ,Cd,PCP,CBL,ATZ;
Habitat: A; Effect Codes: PHY,POP;
Rejection Code: LITE EVAL CODED(CBF,ATZ,SZ,PCP,Cu2O),OK(Cd).

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EcoReference No.: 40121  
Chemical of Concern: CBL,24D: Habitat: T; Effect Codes: BCM,CEL,MOR,PHY; Rejection Code: LITE EVAL CODED(CBL),OK(24D).


EcoReference No.: 3244  
Chemical of Concern: EN,CBL; Habitat: A; Effect Codes: CEL,PHY; Rejection Code: LITE EVAL CODED(CBL),OK(EN).


EcoReference No.: 74169  
Chemical of Concern: MOM,EFV,ES,CBL,RTN; Habitat: T; Effect Codes: PHY,POP,ACC,MOR; Rejection Code: LITE EVAL CODED(EFV,MOM),OK(ALL CHEMS).


EcoReference No.: 5297  
Chemical of Concern: CBL,EP,MP,PRT,TBC,PMR; Habitat: A; Effect Codes: GRO; Rejection Code: LITE EVAL CODED(CBL,PRT),OK(ALL CHEMS).


EcoReference No.: 88816  
Chemical of Concern: CBL,CYH,TCF,CYF,DZ,ACP; Habitat: T; Effect Codes: POP; Rejection Code: LITE EVAL CODED(CBL,DZ),OK(ALL CHEMS).


EcoReference No.: 39322  
Chemical of Concern: CBL; Habitat: T; Effect Codes: BCM,GRO,MOR,REP; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 39323  
Chemical of Concern: CBL; Habitat: T; Effect Codes: REP,GRO,MOR; Rejection Code: LITE EVAL CODED(CBL).

EcoReference No.: 61096
Chemical of Concern: CBL, DDT, MLN, PRN; Habitat: A; Effect Codes: GRO, MOR; Rejection Code: LITE EVAL CODED(CBL, MLN), OK(DDT, PRN).


EcoReference No.: 8232
Chemical of Concern: DDT, CBL, MLN, PRN; Habitat: A; Effect Codes: GRO; Rejection Code: LITE EVAL CODED(CBL), OK(DDT, MLN, PRN).


EcoReference No.: 6302
Chemical of Concern: CBL; Habitat: A; Effect Codes: BEH; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 73709
User Define 2: WASHT, CALFT
Chemical of Concern: MOM, CBF, CBL; Habitat: T; Effect Codes: POP; Rejection Code: OK.


EcoReference No.: 55506
Chemical of Concern: Cd, Hg, Zn, CBL, HCCH, PCP, Se; Habitat: A; Effect Codes: MOR, BCM; Rejection Code: LITE EVAL CODED(CBL, PCP), OK(Cd, Hg, Zn, HCCH, Se).


EcoReference No.: 17714
Chemical of Concern: FA, FNV, CBL; Habitat: A; Effect Codes: PHY; Rejection Code: LITE EVAL CODED(CBL), OK(FA, FNV).


EcoReference No.: 35515
Chemical of Concern: CYP, PMR, DM, PHSL, AZ, CBL, DMT; Habitat: T; Effect Codes: BCM; Rejection Code: LITE EVAL CODED(DMT, CYP, CBL).

EcoReference No.: 8046
Chemical of Concern: DDT,PRN,HCH,DDT,CBL,MLN; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL) OK(ALL CHEMS).


EcoReference No.: 11074
Chemical of Concern: CBL; Habitat: A; Effect Codes: CEL,GRO; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 44270
Chemical of Concern: PHSL,MOM,CBL,AZ,FNV,DMT; Habitat: T; Effect Codes: PHY; Rejection Code: LITE EVAL CODED(AZ,DMT,MOM),OK(PHSL,CBL,FNV).


EcoReference No.: 74343
Chemical of Concern: MOM,CBL,FNV,DMT,PHSL; Habitat: T; Effect Codes: PHY; Rejection Code: LITE EVAL CODED(MOM,DMT),OK(ALL CHEMS).


EcoReference No.: 9184
Chemical of Concern: 24DXY,CBL,DZ,MLN,IAA,AND,DLDDDT; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBL,IAA,DZ),OK(ALL CHEMS).


EcoReference No.: 70125
Chemical of Concern: RSM,CBL; Habitat: T; Effect Codes: MOR; Rejection Code: TARGET(RSM).


EcoReference No.: 73599
Chemical of Concern: MOM,PMR,CYP,CYT,BFT,TMT,FVL,DZ,CPY,MP,CBL,TDC,DDVP,SPS,TLM,MLN,FNV; Habitat: T; Effect Codes: MOR; Rejection Code: OK TARGET(MLN,FVL,CYP).


EcoReference No.: 70497
User Define 2: REPS,WASH,CALF,CORE,SENT
Chemical of Concern: PNB,DZ,CBL,MOM,SEN; Habitat: T; Effect Codes: BCM,PHY; Rejection Code: TARGET(SXD).

EcoReference No.: 70497
Chemical of Concern: CAPTAN, MANEB, ZINEB, MEB, MLN, PMR, BT, SXD, TFN, DZ, CBL, PNB. Habitat: T; Effect Codes: BCM, PHY; Rejection Code: LITE EVAL CODED(DZ), TARGET(SXD), OK(ALL CHEMS).


EcoReference No.: 15683
Chemical of Concern: CBL; Habitat: A; Effect Codes: MOR, GRO, BEH; Rejection Code: LITE EVAL CODED(CBL).


EcoReference No.: 71145
Chemical of Concern: DDT, CBL, HCC, PMR, CYP, DM, TMT; Habitat: T; Effect Codes: MOR; Rejection Code: TARGET(CYP).


EcoReference No.: 71366
Chemical of Concern: PCB, DZ, Hg, CBL, CYP, PNB, BDC, BMY, DMB; Habitat: T; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(DMB), OK(ALL CHEMS)/NO SPECIES(PCB).


EcoReference No.: 12399
Chemical of Concern: CBL; Habitat: A; Effect Codes: PHY, MOR, BEH, ACC; Rejection Code: LITE EVAL CODED (CBL).

Acceptable for ECOTOX but not OPP


Chemical of Concern: CBL, CBF; Habitat: T; Rejection Code: NO CONC.


EcoReference No.: 12706
Chemical of Concern: CuS, CBL, HCC, MLN, DDT, PIRM; Habitat: A; Effect Codes: POP; Rejection Code: NO ABSTRACT(ALL CHEMS).

   EcoReference No.: 44263
   Chemical of Concern: CBL,CPY,CYP,MTM; Habitat: T; Effect Codes: REP,GRO,CEL; Rejection Code: NO ENDPOINT(ALL CHEMS).


   EcoReference No.: 71944
   Chemical of Concern: CBL,CPY; Habitat: A; Effect Codes: MOR; Rejection Code: NO CONTROL(CBL,CPY).


   EcoReference No.: 77561
   Chemical of Concern: CBF,DMT,FVL,CBL,BMY; Habitat: T; Effect Codes: POP,MOR; Rejection Code: NO ENDPOINT(FVL),MIXTURE(DMT,CBL,BMY,CBF),TARGET(CBL).


   EcoReference No.: 70656
   Chemical of Concern: PNB,CBL,CHD,DZ; Habitat: T; Effect Codes: PHY; Rejection Code: TARGET(DZ).


   EcoReference No.: 74837
   Chemical of Concern: CBF,CBL,DMT; Habitat: A; Effect Codes: GRO,MOR,PHY; Rejection Code: NO ENDPOINT(ALL CHEMS).


   EcoReference No.: 9257
   Chemical of Concern: CBL; Habitat: A; Effect Codes: MOR,GRO,PHY; Rejection Code: NO CONTROL(CBL).


   EcoReference No.: 73713
   Chemical of Concern: MOM,CPY,CBL,MP,AZ,ES,RSM,EFV,MVP; Habitat: T; Effect Codes: POP,MOR; Rejection Code: OK(MOM),TARGET(RSM,EFV).


EcoReference No.: 3986
Chemical of Concern: CBL,CHD; **Habitat:** A; **Effect Codes:** ACC; **Rejection Code:** NO CONTROL,ENDPOINT(ALL CHEMS).


EcoReference No.: 74984
Chemical of Concern: PPB,CYP,FNV,DIT,CBL; **Habitat:** T; **Effect Codes:** MOR; **Rejection Code:** NO MIXTURE(PPB),TARGET(CYP,CBL).


Chemical of Concern: MCPB,MCPA,HCCCH,PRN,EN,CBL,DZ,PPN; **Habitat:** A; **Rejection Code:** NO ABSTRACT.


Chemical of Concern: CBL; **Habitat:** A; **Rejection Code:** NO CONC.


EcoReference No.: 3113
Chemical of Concern: PYT,CBL; **Habitat:** A; **Rejection Code:** NO FOREIGN.


EcoReference No.: 88829
Chemical of Concern: CBL,EP; **Habitat:** T; **Effect Codes:** POP; **Rejection Code:** NO ENDPOINT(EP,CBL).


Chemical of Concern: MOM,ADC,CBF,CBL,MCB; **Habitat:** T; **Rejection Code:** NO IN VITRO.


EcoReference No.: 68114
Chemical of Concern: ALSV,Cu,CPY,CBL; Habitat: T; Effect Codes: MOR; Rejection Code: NO ENDPOINT(ALL CHEMS).


EcoReference No.: 27777
Chemical of Concern: CBL; Habitat: T; Rejection Code: NO GENETIC,TARGET(CBL).


EcoReference No.: 44264
Chemical of Concern: CBL; Habitat: T; Effect Codes: CEL; Rejection Code: NO ENDPOINT(CBL).


EcoReference No.: 75291
Chemical of Concern: CPY,CBL,DDT,MLN,MOM; Habitat: T; Effect Codes: CEL; Rejection Code: NO ENDPOINT(ALL CHEMS).


EcoReference No.: 44248
Chemical of Concern: CBL; Habitat: T; Effect Codes: CEL,REP; Rejection Code: NO ENDPOINT(CBL).


Chemical of Concern: CBL,MOM,MP,MLN,DZ,CHD,ES,Captan; Habitat: T; Rejection Code: NO CONTROL(ALL CHEMS).


EcoReference No.: 35652
Chemical of Concern: CBL; Habitat: T; Effect Codes: ACC; Rejection Code: NO ENDPOINT(CBL).


EcoReference No.: 12517
Chemical of Concern: CBF,FNT,MLN,TCF,CBL,ES,HCCH,CuS,MLT; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBF),NO MIXTURE(MLT),OK(CBL),NO ENDPOINT(CuS).


EcoReference No.: 283
User Define 2: ECOTOX MED,WASH,CALF, CORE
Chemical of Concern: CBL,CPY,DS,DZ,MLN,PRT,ADC; Habitat: A; Effect Codes: MOR;
Rejection Code: NO FOREIGN.


EcoReference No.: 11260
Chemical of Concern: CBL,ES; Habitat: A; Effect Codes: CEL,PHY; Rejection Code: NO ENDPOINT(CBL,ES).


EcoReference No.: 11306
Chemical of Concern: ES,CBL; Habitat: A; Effect Codes: BCM; Rejection Code: NO ENDPOINT(CBL,ES).


EcoReference No.: 12459
Chemical of Concern: CBL; Habitat: A; Effect Codes: BCM; Rejection Code: NO ENDPOINT(CBL).


EcoReference No.: 4046
Chemical of Concern: CBL,MLN; Habitat: A; Effect Codes: BEH,GRO,PHY,BCM;

EcoReference No.: 59316
Chemical of Concern: CBL; Habitat: T; Rejection Code: NO FOREIGN.


EcoReference No.: 75423
Chemical of Concern: DMT, AZ, DZ, CBL, LCYT, CYP; Habitat: T; Effect Codes: PHY; Rejection Code: LITE EVAL CODED(AZ), OK(CBL, LCYT), NO MIXTURE(DMT, CYP), TARGET(CBL).


EcoReference No.: 70351
Chemical of Concern: DZ, CPY, EN, CBL, ES; Habitat: T; Rejection Code: TARGET(DZ).


EcoReference No.: 70733
Chemical of Concern: SZ, CBL; Habitat: T; Effect Codes: GRO, POP, BEH, BCM; Rejection Code: NO ENDPOINT(ALL CHEMS).


EcoReference No.: 79379
Chemical of Concern: DFM, CBL; Habitat: T; Effect Codes: ACC; Rejection Code: NO ENDPOINT(DFM).


EcoReference No.: 78830
Chemical of Concern: PRT, CBL; Habitat: T; Effect Codes: ACC; Rejection Code: NO ENDPOINT(PRT, CBL), TARGET(CBL).


EcoReference No.: 74105
Chemical of Concern: CHX, FTT, PPG, AZ, DZ, MOM, CBL, FN, ES, MDT; Habitat: T; Effect Codes: MOR; Rejection Code: TARGET(DZ).


Chemical of Concern: CBL; Habitat: T; Rejection Code: NO SPECIES, NO TOX DATA.


EcoReference No.: 15678
Chemical of Concern: CBL; Habitat: A; Effect Codes: POP; Rejection Code: NO ENDPOINT(CBL).


EcoReference No.: 86936
Chemical of Concern: CBL; Habitat: T; Effect Codes: CEL; Rejection Code: NO ENDPOINT(CBL).


Chemical of Concern: CBL; Habitat: T; Rejection Code: NO IN VITRO.


EcoReference No.: 60982
Chemical of Concern: DDT,HCC,ES,EN,AND,DMT,PRN,MP,MLN,PPHD,CBL,Cu,Captan,FNT; Habitat: A; Effect Codes: MOR,BEH,CEL,GRO,REP; Rejection Code: OK(PRN),NO SURVEY(DDT,HCC,ES,EN,AND,DMT,MP,MLN,PPHD,CBL,Cu,Captan,FNT).


Chemical of Concern: CBL; Habitat: T; Rejection Code: NO MIXTURE, SPECIES.


Chemical of Concern: PIM,MOM,TBO,EFV,DM,MB,TCF,PPHN,ADC,AZ,CBL,DZ,FNT,ES,PMR,DU,ATZ,GYP, PAQT,BMN,SZ,CPY,DDVP,TDC,BDC; Habitat: T; Rejection Code: NO TOX DATA.


Chemical of Concern: PIM,MOM,TBO,EFV,DM,MB,TCF,PPHN,ADC,AZ,CBL,DZ,FNT,ES,PMR,DU,ATZ,GYP, PAQT,BMN,SZ,CPY,DDVP,TDC,BDC; Habitat: T; Rejection Code: NO TOX DATA.


Chemical of Concern: PIM, MOM, TBO, EFV, DM, MB, TCF, PHN, ADC, AZ, CBL, DZ, FNT, ES, PMR, DU, ATZ, GYP, PAQT, BMN, SZ, CPY, DDVP, TDC, BDC; Habitat: T; Rejection Code: NO TOX DATA.


Chemical of Concern: CBL; Habitat: T; Rejection Code: NO ARCHIVE.


Chemical of Concern: TRL, CYC, VNT, BTY, MXC, GFS, AND, CBL, MLT, EPTC; Habitat: T; Rejection Code: NO BACTERIA.


EcoReference No.: 30146
Chemical of Concern: BT, DPP1, CBL; Habitat: T; Rejection Code: NO FOREIGN.


EcoReference No.: 59334
Chemical of Concern: MOM, AZ, BFT, EFV, FPP, FVL, CBL, TDC, MVP, Naed, TCF; Habitat: T; Effect Codes: MOR; Rejection Code: OK(MOM), TARGET(FVL, BFT, EFV).


Chemical of Concern: CBL; Habitat: A; Rejection Code: NO DURATION.


EcoReference No.: 71631
Chemical of Concern: HCCH, DLD, DZ, CBL; Habitat: T; Rejection Code: NO FOREIGN.


EcoReference No.: 70123
Chemical of Concern: EN,ES,DLD,TXP,Hg,Cd,PCB,DDT,HCCCH,AND,As,CBL; Habitat: A; Rejection Code: NO SOURCE.


EcoReference No.: 4311
User Define 2: ECOTOX MED,WASH,CALF
Chemical of Concern: CBF,CBL,MP; Habitat: A; Effect Codes: BCM,MOR; Rejection Code: NO CONTROL.


EcoReference No.: 30665
Chemical of Concern: SZ,CBL; Habitat: A; Rejection Code: NO FOREIGN.


EcoReference No.: 7603
Chemical of Concern: EDT,CBL,MLN,CFY,Cu,CuS,RTN,NaN3,ATM,CFY; Habitat: A; Effect Codes: MOR; Rejection Code: NO CONTROL(ALL CHEMS).


Chemical of Concern: PCP,CBL; Habitat: A; Rejection Code: NO IN VITRO.


EcoReference No.: 71348
Chemical of Concern: CPY,CBL,DZ; Habitat: T; Rejection Code: TARGET(DZ).


EcoReference No.: 5589
Chemical of Concern: CBL,HCCCH,FNTH; Habitat: A; Effect Codes: MOR,REP; Rejection Code: NO FOREIGN (ALL CHEMS).


EcoReference No.: 6776

Chemical of Concern: CBL, HCCH; Habitat: A; Rejection Code: NO FOREIGN.


EcoReference No.: 6191
Chemical of Concern: CBL; Habitat: A; Effect Codes: PHY, BCM, MOR; Rejection Code: NO FOREIGN(CBL).


EcoReference No.: 62033
Chemical of Concern: Hg, Cd, Cu, S, CrAC, Zn, Mn, Fe, Pb, Co, Ni, As, CBL, MLN, PRN, HCCH, DM, ATZ, DU, PL; Habitat: A; Effect Codes: POP; Rejection Code: LITE EVAL CODED(ATZ, CuS, CrAC), NO PUBL AS(PCM, NaPCC), OK(ALL CHEMS).


EcoReference No.: 30772
Chemical of Concern: ATZ, CBL; Habitat: T; Rejection Code: NO FOREIGN.


EcoReference No.: 81455
Chemical of Concern: ATZ, CBL; Habitat: AT; Effect Codes: GRO, MOR; Rejection Code: LITE EVAL CODED(ATZ), OK(ALL CHEMS).


EcoReference No.: 30264
Chemical of Concern: MLH, CBL; Habitat: T; Effect Codes: GRO; Rejection Code: OK(MLH), NO COC(FAME), TARGET(CBL).


EcoReference No.: 68605
User Define 2: NEW PPB
Chemical of Concern: PYT, PMR, CBL, MLN, PPB; Habitat: T; Effect Codes: MOR; Rejection Code: NO MIXTURE(PPB).


Chemical of Concern: CPY,MP,CFY,CF,EFV,EFV,PMR,MOM,TDC,CBL; Habitat: T; Rejection Code: NO DURATION(CPY,EFV,TARGET-ALL CHEMS).


EcoReference No.: 2192
Chemical of Concern: ATZ,CBL,HgCl2,DLD,PRN,Maneb; Habitat: A; Effect Codes: MOR; Rejection Code: NO CONTROL(ALL CHEMS).


EcoReference No.: 76482
Chemical of Concern: DM,TCF,CBL,ES,MDT,MLX,EPH,PHSL,AMZ,Captan,DOD,Zineb,FRM,PCZ; Habitat: T; Effect Codes: MOR; Rejection Code: NO CONTROL(ALL CHEMS),TARGET(CBL).


Chemical of Concern: CBL; Habitat: T; Rejection Code: NO IN VITRO.


EcoReference No.: 72033
Chemical of Concern: CBL,DDT,AND,PYN,DZ,PPB,PRN,MP,ACP; Habitat: T; Rejection Code: NO REVIEW.


EcoReference No.: 87381
Chemical of Concern: DLD,AND,PPB,CBL; Habitat: T; Effect Codes: PHY,ACC,MOR; Rejection Code: NO CONTROL(CBL,DLD,AND,PPB).


EcoReference No.: 39905
Chemical of Concern: PPB,CBL; Habitat: T; Effect Codes: MOR; Rejection Code: NO CONTROL,MIXTURE(PPB),OK(CBL),TARGET(CBL).


EcoReference No.: 75568
Chemical of Concern: BDF, WFN, DFM, CBL; **Habitat:** T; **Rejection Code:** NO ENDPOINT, CONTROL (ALL CHEMS).


Chemical of Concern: CBL; **Habitat:** A; **Rejection Code:** NO MIXTURE, CONC.


Chemical of Concern: ATZ, CBL; **Habitat:** A; **Rejection Code:** NO EFFLUENT.


Chemical of Concern: CBL; **Habitat:** T; **Rejection Code:** NO CONC, SEDIMENT.


Chemical of Concern: CBL; **Habitat:** AT; **Rejection Code:** NO TOXICANT, SEDIMENT, CONC.


EcoReference No.: 7453
Chemical of Concern: CBL, HCH, Cr, CN, FUR, CuS, BZO, As, Ni, Cd, Se, ATZ, Pb, AMSV; **Habitat:** A; **Effect Codes:** POP; **Rejection Code:** NO FOREIGN (ALL CHEMS), LITE EVAL CODED (OW-TRV-Cu).


EcoReference No.: 7453
Chemical of Concern: CBL, HCH, Cr, CN, FUR, CuS, BZO, As, Ni, Cd, Se, ATZ, Pb; **Habitat:** A; **Effect Codes:** POP; **Rejection Code:** NO FOREIGN, LITE EVAL CODED (OW-TRV-Cu).


EcoReference No.: 7453
Chemical of Concern:

EcoReference No.: 7453
Chemical of Concern:
CBL,HCC,NaCr,CN,FUR,CuS,BZO,As,Ni,Cd,Se,ATZ,Pb,AMSV,NaBr,Ag,NaID,C8OH,DCB; Habitat: A; Effect Codes: POP; Rejection Code: NO FOREIGN(ALL CHEMS),LITE EVAL CODED(OW-TRV-Cu).


EcoReference No.: 7453
Chemical of Concern:
CBL,HCC,NaCr,CN,FUR,CuS,BZO,As,Ni,Cd,Se,ATZ,Pb,AMSV,NaBr,Ag,NaID,C8OH,DCB; Habitat: A; Effect Codes: POP; Rejection Code: NO FOREIGN(ALL CHEMS),LITE EVAL CODED(OW-TRV-Cu).

96. Bringmann, G. and Kuhn, R. (1978). Limiting Values for the Noxious Effects of Water Pollutant Material to Blue Algae (Microcystis aeruginosa) and Green Algae (Scenedesmus quadricauda) in Cell Propagation Inhibition Tests (Grenzwerte der Schadwirkung Wassergefährdender Stoffe Gegen Blaualgen (Microcystis aeruginosa) und Grunalgen (Scenedesmus quadricauda) im Zellvermehrungshemmtest). *Vom Wasser* 50: 45-60.

EcoReference No.: 19121
Chemical of Concern: ATZ,CBL,HCC,Cr,CN,FUR,CuS,BZO,As,Ni,Zn,Ag,Cd,Pb,AMSV;
Habitat: A; Effect Codes: POP; Rejection Code: NO FOREIGN(ALL CHEMS),LITE EVAL CODED(OW-TRV-Cu).


EcoReference No.: 19121
Chemical of Concern: ATZ,CBL,HCC,Cr,CN,FUR,CuS,BZO,As,Ni,Zn,Ag,Cd,Pb ;
Habitat: A; Effect Codes: POP; Rejection Code: NO FOREIGN,LITE EVAL CODED(OW-TRV-Cu).


EcoReference No.: 19121
Chemical of Concern: ATZ,CBL,HCC,NaCr,CN,FUR,CuS,BZO,As,Ni,Zn,Ag,Cd,Pb,AMSV,NaBr,Se,NaID,C8O

EcoReference No.: 19121
Chemical of Concern:
ATZ, CBL, HCCH, NaCr, CN, FUR, CuS, BZO, As, Ni, Zn, Ag, Cd, Pb, AMSV, NaBr, Se, NaID, C8O
H, DCB; Habitat: A; Effect Codes: POP; Rejection Code: NO FOREIGN(ALL CHEMS), LITE EVAL CODED(OW-TRV-Cu).


EcoReference No.: 19121
Chemical of Concern:
ATZ, CBL, HCCH, NaCr, CN, FUR, CuS, BZO, As, Ni, Zn, Ag, Cd, Pb, AMSV, NaBr, Se, NaID, C8O
H, DCB; Habitat: A; Effect Codes: POP; Rejection Code: NO FOREIGN(ALL CHEMS), LITE EVAL CODED(OW-TRV-Cu).


EcoReference No.: 15134
Chemical of Concern:
Be, Cd, Ag, CuS, Ni, SFL, HgCl2, ATZ, LNR, Pb, CN, DNT, 24DC, FRN, PL, CBZ, MCRE, ETHB, FUR, NBZ, HTH, 3CE, NP, AN, CBL, CF, HCCH, ATC, Urea, CTC, Cr, Cu, BZO, As, Se, AMSV;
Habitat: A; Effect Codes: POP; Rejection Code: NO ENDPOINT(ALL CHEMS).


EcoReference No.: 15134
Chemical of Concern:
Be, Cd, Ag, CuS, Ni, SFL, HgCl2, ATZ, LNR, Pb, CN, DNT, 24DC, FRN, PL, CBZ, MCRE, ETHB, FUR, NBZ, HTH, 3CE, NP, AN, CBL, CF, HCCH, ATC, Urea, CTC, NaCr, Cu, BZO, As, Se, AMSV, NaBr, NaID, C8OH, DCB; Habitat: A; Effect Codes: POP; Rejection Code: NO ENDPOINT(ALL CHEMS).


EcoReference No.: 15134
Chemical of Concern:
Be, Cd, Ag, CuS, Ni, SFL, HgCl2, ATZ, LNR, Pb, CN, DNT, 24DC, FRN, PL, CBZ, MCRE, ETHB, FUR

EcoReference No.: 15134
Chemical of Concern: Be,Cd,Ag,Cu,Si,FSL,HgCl₂,ATZ,LNR,Pb,CN,DNT,24DC,FRN,PL,CBZ,MCRE,ETHB,FUR,NBZ,PHTH,3CE,NP,AN,CBL,CF,HCC,ATC,Urea,CTC,NaCr,Cu,BZO,As,Se,AMSV,NaBr,NaID,C₈OH,DCB; Habitat: A; Effect Codes: POP; Rejection Code: NO ENDPOINT(ALL CHEMS).


EcoReference No.: 2463
Chemical of Concern: ATZ,CBL,HCC,FUR,Cu,AMSV; Habitat: A; Effect Codes: MOR; Rejection Code: NO FOREIGN.


EcoReference No.: 58990
Chemical of Concern: DZ,HCC,MLN,EN,DLD,DDT,Ag,Cd,CBL; Habitat: A; Effect Codes: MOR; Rejection Code: NO FOREIGN.


Chemical of Concern: CBL; Habitat: A; Rejection Code: NO ABSTRACT(CBL).


EcoReference No.: 63529
Chemical of Concern: CBL; Habitat: T; Rejection Code: NO FOREIGN.


EcoReference No.: 74683
Chemical of Concern: PCB,PAH,MRX,DDT,EN,ES,MZ,CF,HCC,MLN,FNT,MP,NH,AL,CBF,CBL,CN,Cd,As,Ps,Br,Hg; Habitat: A; Rejection Code: NO REVIEW,RESIDUE,EFFECT.


Chemical of Concern: 24DXY, ATZ, CBL, DZ; Habitat: A; Effect Codes: POP; Rejection Code: NO ENDPOINT (ALL CHEMS).


EcoReference No.: 2188
Chemical of Concern: AZ, CBL, DZ, HCC, MLN, Naled, PSM, 24DXY, DS, DU, PEB, Folpet, RTN, FBM, CHD, DEM, T XP, MRX, ETN, DZ, AND, MCPA, HPT, DDT, DDVP, EN, CBL, MXC, OX; Habitat: A; Effect Codes: NOC, GRO, MOR, BEH, PHY; Rejection Code: NO CONTROL (ALL CHEMS).


EcoReference No.: 2188
Chemical of Concern: AZ, CBL, DZ, HCC, MLN, Naled, PSM, 24DXY, DS, DU, PEB, Folpet, RTN, FBM, CHD, DEM, T XP, MRX, ETN, DZ, AND, MCPA, HPT, DDT, DDVP, EN, CBL, MXC, OX; Habitat: A; Effect Codes: NOC, GRO, MOR, BEH, PHY; Rejection Code: NO CONTROL (ALL CHEMS).


EcoReference No.: 646
Chemical of Concern: AZ, DS, HCC, MLN, MP, Naled, PRT, 24DXY, CMPH, DMT, DU, PEB, PSM, NTP, TXP, CBL; Habitat: A; Effect Codes: BEH, POP, MOR, GRO, ACC, SYS; Rejection Code: LITE EVAL CODED (PRT), OK (AZ), NO ENDPOINT (DMT).


Chemical of Concern: CBL; Habitat: A; Rejection Code: NO SPECIES.


Chemical of Concern: CBL; Habitat: T; Rejection Code: NO ABSTRACT, NO ENDPOINT (CBL).


EcoReference No.: 72128
Chemical of Concern: 24DXY, ATZ, ACR, DMB, GYP, DU, CBL; Habitat: T; Rejection Code: NO REVIEW.


EcoReference No.: 36066
Chemical of Concern: CBL; Habitat: T; Effect Codes: REP,ACC; Rejection Code: NO ENDPOINT,CONTROL,ABSTRACT.


Chemical of Concern: PCB,As,EN,CHD,TFN,PPZ,CHP,PRN,MXC,ACR,AND,ATZ,BOR,BTY,Captan,CBL, CPP,24DB,DDT,DZ,DLD,DS,FNF,FTNH,CFB,HPT,EPTC,HCC,LN,MLN,MCPB; Habitat: T; Rejection Code: NO MIXTURE,EFFECT,SPECIES(PCB).


EcoReference No.: 3461
Chemical of Concern: CBL,MLN,ACL,RTN,NP,PCP; Habitat: A; Effect Codes: PHY,BEH; Rejection Code: NO ENDPOINT(ALL CHEMS).


Chemical of Concern: CBL; Habitat: T; Rejection Code: NO FOREIGN,MIXTURE.


EcoReference No.: 87754
Chemical of Concern: CBL; Habitat: T; Effect Codes: PHY; Rejection Code: NO ENDPOINT(CBL).


EcoReference No.: 942
Chemical of Concern: CPY,MP,AZ,DCTP,CBL,CFB,DDT,TP,MRX,MLN,MOM,ADC; Habitat: A; Effect Codes: MOR; Rejection Code: NO CONTROL(ALL CHEMS).


Chemical of Concern: CBL; Habitat: T; Rejection Code: NO IN VITRO(CBL).


Chemical of Concern: ADC,MVP,CFB,CBL,DDVP,MCB; Habitat: T; Rejection Code: NO IN VITRO(CBL,CFB,DDVP,MCB,MVP,ADC).

EcoReference No.: 36092
Chemical of Concern: CBL; Habitat: T; Effect Codes: ACC,PHY; Rejection Code: NO ENDPOINT(CBL).


Chemical of Concern: CBL; Habitat: T; Rejection Code: NO IN VITRO.


EcoReference No.: 59127
Chemical of Concern: PCP,CBL; Habitat: T; Effect Codes: ACC,BCM; Rejection Code: NO pH,ERE/NO ENDPOINT(PCP).


EcoReference No.: 849
Chemical of Concern: CBL,MLT,TXP,PPN; Habitat: A; Effect Codes: MOR; Rejection Code: NO CONTROL(ALL CHEMS).


EcoReference No.: 15241
Chemical of Concern: CBL,HCC; Habitat: A; Effect Codes: ACC,POP; Rejection Code: NO ENDPOINT(ALL CHEMS).


Chemical of Concern: CBL,24DC; Habitat: T; Rejection Code: NO SPECIES(CBL,24DC).


EcoReference No.: 87859
Chemical of Concern: CBL,HCC; Habitat: T; Effect Codes: CEL; Rejection Code: NO MIXTURE(CBL,HCC).


EcoReference No.: 9297
Chemical of Concern: DDT,PRN,HCC,CBL,MLN,DZ; Habitat: A; Effect Codes: MOR; Rejection Code: NO CONTROL(ALL CHEMS).

EcoReference No.: 36134
Chemical of Concern: CBL; Habitat: T; Effect Codes: ACC; Rejection Code: NO CONTROL,ENDPOINT(CBL).


EcoReference No.: 80756
Chemical of Concern: AKTMD,CBL; Habitat: T; Effect Codes: BCM; Rejection Code: NO CONTROL(ALL CHEMS).


EcoReference No.: 78987
Chemical of Concern: DFZ,ALSV,ETN,PRB,CBL,FTT,FO,CPY,DCF,CuOH,DMT,AZD,CuS,FMB,BMY,MLN,PPG,FNB,CFP,AZ; Habitat: T; Effect Codes: POP,MOR; Rejection Code: OK(CuOH,CuS,FNB,BMY,CPY,PRB,CBL,FTT,FO,DCF,DMT,AZD),TARGET(MLN,AZ,CBL),NO MIXTURE(ETN).


EcoReference No.: 78988
Chemical of Concern: DFZ,ALSV,ETN,PRB,CBL,FTT,FO,CPY,DCF,CuOH,AZD,CuS,FBM,BMY,MLN,PPG,FNB,CFP; Habitat: T; Effect Codes: REP,MOR; Rejection Code: OK(DFZ,PRB,FTT,F0,CPY,DCF,AZD,CuS,FBM,BMY,PPG,FNB,CFP),NO MIXTURE(ALSV,ETN,CuOH),OK TARGET(CBL,MLN).


EcoReference No.: 87652
Chemical of Concern: CBL,MLN; Habitat: T; Effect Codes: POP; Rejection Code: NO ENDPOINT(TARGET-CBL,MLN).


EcoReference No.: 2248
Chemical of Concern: CBL,MLN,DDT; Habitat: A; Effect Codes: GRO,ACC; Rejection Code: NO ENDPOINT(ALL CHEMS).


EcoReference No.: 45160
Chemical of Concern: CBL, PbAC, PCP, DLD, DDT, HCCH, Cd, HgCl2; Habitat: A; Effect Codes: PHY; Rejection Code: NO CONTROL, ENDPOINT (ALL CHEMS).


Chemical of Concern: CBL; Habitat: A; Effect Codes: BCM; Rejection Code: NO IN VITRO.


Chemical of Concern: CBL; Habitat: A; Rejection Code: NO IN VITRO.


Chemical of Concern: CBL; Habitat: A; Rejection Code: NO REVIEW.


EcoReference No.: 8797
Chemical of Concern: CBL, MLN, DDT, AND; Habitat: A; Effect Codes: PHY; Rejection Code: NO ENDPOINT (ALL CHEMS).


EcoReference No.: 88445
Chemical of Concern: CBL, MOM, MZB; Habitat: T; Rejection Code: NO REVIEW (CBL, MOM, MZB).


Chemical of Concern: CBL; Habitat: T; Rejection Code: NO ABSTRACT.


Chemical of Concern: CBL; Habitat: T; Rejection Code: NO HUMAN HEALTH (CBL).


EcoReference No.: 74236
Chemical of Concern: ATZ, GYP, DZ, CBL; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED (ATZ, CuS), OK (ALL CHEMS).


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EcoReference No.: 64042  
Chemical of Concern: CBL; Habitat: T; Effect Codes: POP; Rejection Code: NO ENDPOINT(CBL).


EcoReference No.: 15421  
Chemical of Concern: CBL,MP,PCP; Habitat: A; Effect Codes: POP; Rejection Code: NO CONTROL,ENDPOINT(ALL CHEMS).


EcoReference No.: 87656  
Chemical of Concern: CBL; Habitat: T; Rejection Code: NO REVIEW(ALL CHEMS).


EcoReference No.: 10337  
Chemical of Concern: DDT,HCC,DL,D,DU,MLN,24DXY,CBL,DBN,DZ,MLT,PAQT,PYN,TFN,CuS; Habitat: A; Effect Codes: MOR,ACC,REP; Rejection Code: NO CONTROL(ALL CHEMS).


EcoReference No.: 2871  
Chemical of Concern: MLN,DBN,24DXY,BS,CBL,DMT,DU,DZ,HCC,MLT,Naled,SZ,TFN,ADC,CHD,TXP,TC F,CuS,PAQT,MCB,AND,PYN,HPT,DL,D,HPR,DDT,PNTH,FNF,MP,BTY,NSM,RT N,AMS,VT,Cu,ATN,MCX,DDVP,DBM,DBAC; Habitat: A; Effect Codes: MOR,BCM; Rejection Code: NO CONTROL(ALL CHEMS).


EcoReference No.: 72145  
Chemical of Concern: AZ,CPY,DZ,DMT,MLN,PRN,PSM,CBL,CF; Habitat: T; Rejection Code: NO REVIEW.


Chemical of Concern: TBO,MP,MLN,DS,ACP,AZ,CBL,CF,CPY,DCTP,DMT,OML,TBC; Habitat: T; Rejection Code: NO MODELING.

EcoReference No.: 7985
Chemical of Concern: CBL; Habitat: A; Effect Codes: POP; Rejection Code: NO ENDPOINT(CBL).


Chemical of Concern: MLO,CBL; Habitat: T; Rejection Code: NO HUMAN HEALTH.


EcoReference No.: 14348
Chemical of Concern: TXP,AND,MLN,24DXY,PCP,CBL,HCCH,PRN,DDT,PAQT; Habitat: A; Effect Codes: GRO,MOR; Rejection Code: NO CONTROL,ENDPOINT(PCP,CBL).


EcoReference No.: 13938
Chemical of Concern: TXP,CBL,MLN,PCP,PL,DDT; Habitat: A; Effect Codes: GRO; Rejection Code: NO CONTROL,ENDPOINT(ALL CHEMS).


EcoReference No.: 70191
Chemical of Concern: PIRM,CMPH,ADC,PMR,RSM,CBL,DZ; Habitat: T; Effect Codes: MOR; Rejection Code: NO REVIEW(ALL CHEMS).


EcoReference No.: 87552
Chemical of Concern: TDM,TEZ,PCZ,TDF,BMY,TBA,TBM,THM,TCM,DFC,DDVP,Naled,CBL; Habitat: T; Rejection Code: NO REVIEW(ALL CHEMS).


EcoReference No.: 63795
Chemical of Concern: CBL,MLT; Habitat: T; Effect Codes: PHY,POP; Rejection Code: NO MIXTURE(MLT),TARGET(CBL).


EcoReference No.: 4811
Chemical of Concern: AND,DDT,DDL,TCF,EN,AZ,HCCH,PRN,TXP,DBAC,CBL,DU,CBZ,DCB,OPHP,Nabam,P L; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(DBAC),NO ENDPOINT(DCB).

Chemical of Concern: CBL; Habitat: A; Rejection Code: NO ABSTRACT(CBL).


Chemical of Concern: CBL; Habitat: A; Rejection Code: NO SOURCE.


Chemical of Concern: MP,CBL; Habitat: A; Rejection Code: NO DURATION.


Chemical of Concern: CBL; Habitat: T; Rejection Code: NO IN VITRO.


EcoReference No.: 35123
Chemical of Concern: AND,BRSM,CHD,CBL,CYP,DDT,DCM,DEM,DZ,DDVP,DMT,EN,ES,FNT,FNV,HPT,HC CH,MLN,MXC,PRN,MP,PMR,PYN; Habitat: T; Effect Codes: MOR; Rejection Code: NO CONTROL(ALL CHEMS).


Chemical of Concern: BRSM,RSM,CBL,PYN; Habitat: T; Rejection Code: NO SPECIES.


EcoReference No.: 88413
Chemical of Concern: CBL,AND,EN,DLD,HPT,CHD,HCCH,MLN,TPX,DDT,DS,AZ,MXC; Habitat: T; Effect Codes: MOR,REP,ACC; Rejection Code: NO ENDPOINT(ALL CHEMS).


EcoReference No.: 75778
Chemical of Concern: DMT,MLN,HCCH,PPHD,CBL,MP,LCYT,DCM,CYP,FPP,FNV,PYN,ES; Habitat: T; Effect Codes: MOR; Rejection Code: NO CONTROL(ALL CHEMS).

EcoReference No.: 3758
Chemical of Concern: CBL, NaPCP; Habitat: A; Effect Codes: GRO; Rejection Code: NO ENDPOINT(ALL CHEMS).


EcoReference No.: 5941
Chemical of Concern: PNB, 24DXY, AZ, CBL, DMT, HCCH, MLN, MP, THM, PCP, PCB, EPRN, MCPB, MCPA, AND, DT, FNT, EN, ES, DLD; Habitat: A; Effect Codes: POP; Rejection Code: NO ENDPOINT(ALL CHEMS)/NO SPECIES(PCB).


EcoReference No.: 48751
Chemical of Concern: DMB, CBL; Habitat: A; Rejection Code: NO REVIEW, NO REFS CHECKED.


EcoReference No.: 83380
Chemical of Concern: Se, Ag, Ald, DLD, As, Ba, Cd, CBL, CTC, CN, 24DXY, EN, Pb, HCCH, Hg, MXC, MPRN, PRN, PCB; Habitat: A; Rejection Code: NO SPECIES, MIXTURE, SURVEY.


Chemical of Concern: CBL; Habitat: T; Rejection Code: NO MIXTURE, OM, pH, CONTROL, CONCS, ERE.


Chemical of Concern: CBL; Habitat: A; Rejection Code: NO ABSTRACT(CBL).


Chemical of Concern: CBL; Habitat: A; Rejection Code: NO ABSTRACT(CBL).

EcoReference No.: 88907
Chemical of Concern: CBL,DNT; Habitat: T; Effect Codes: MOR; Rejection Code: NO CONTROL(ALL CHEMS).


EcoReference No.: 19530
Chemical of Concern: CBL; Habitat: A; Effect Codes: POP; Rejection Code: NO ABSTRACT(CBL).


EcoReference No.: 73145
Chemical of Concern: PRN,CBL,AZ,ACP,DM; Habitat: T; Effect Codes: POP; Rejection Code: TARGET(ACP,AZ,CBL).


EcoReference No.: 73088
Chemical of Concern: PRN,CBL,ACP,AZ,CPY,MDT,MOM,DM,CPYM,FNT,TCF,CBL; Habitat: T; Effect Codes: MOR,REP; Rejection Code: OK TARGET(ACP,AZ,CBL).


EcoReference No.: 73431
Chemical of Concern: CBL,ACP,CPY,DCNA; Habitat: T; Rejection Code: NO FOREIGN.


EcoReference No.: 88981
Chemical of Concern: ES,EN,PRN,MLN,DZ,HCC,DDT,CBL; Habitat: T; Effect Codes: POP; Rejection Code: NO ENDPOINT(ALL CHEMS).


EcoReference No.: 56162
Chemical of Concern: CBL,CuS,NYP,PCP,PRM,NH,DZ; Habitat: A; Effect Codes:
GRO, REP, MOR; Rejection Code: OK(CBL,NH), NO MIXTURE(CuS,PCP,NYP,PRM), NO COC(DZ).


EcoReference No.: 81907
Chemical of Concern: LCYT, TLM, CBL, BDC, CPY, DZ, FNT, MLN; Habitat: T; Effect Codes: MOR, ACC, POP; Rejection Code: NO ENDPOINT(DZ).


EcoReference No.: 88906
Chemical of Concern: CBL; Habitat: T; Effect Codes: GRO, MOR, CEL, PHY; Rejection Code: NO CONTROL(CBL).


EcoReference No.: 76518
Chemical of Concern: DFZ, PIM, Captan, ES, CBL, AZ, CHX, CPY, PHSL, DOD; Habitat: T; Effect Codes: POP; Rejection Code: NO ENDPOINT, CONTROL(ALL CHEMS, TARGET-CBL).


EcoReference No.: 88727
Chemical of Concern: ETN, Naled, FNV, PRN, ES, OML, PPHD, MTM, MOM, MVP, MLN, DCF, CBL, DZ, AZ, DMT; Habitat: T; Effect Codes: POP, GRO; Rejection Code: OK(ALL CHEMS), OK TARGET(MOM, CBL).


EcoReference No.: 70906
Chemical of Concern: DZ, CPY, CBL, RSM; Habitat: T; Effect Codes: MOR; Rejection Code: TARGET(RSM, DZ).


EcoReference No.: 71768
Chemical of Concern: CBL, DZ; Habitat: T; Effect Codes: POP; Rejection Code: NO ENDPOINT(ALL CHEMS).

EcoReference No.: 71768
Chemical of Concern: CBL,DZ; Habitat: T; Effect Codes: POP; Rejection Code: NO ENDPOINT(ALL CHEMS).


EcoReference No.: 41178
Chemical of Concern: DLD,CBL; Habitat: T; Effect Codes: REP,GRO; Rejection Code: NO ENDPOINT(ALL CHEMS).


EcoReference No.: 72101
Chemical of Concern: SZ,CBL,ATZ,Ziram,PPX; Habitat: T; Effect Codes: PHY; Rejection Code: NO IN VITRO(SZ,CBL,PPX,ATZ),OK(Ziram).


EcoReference No.: 25479
Chemical of Concern: CBL,DZ,PPN; Habitat: T; Effect Codes: BCM,POP; Rejection Code: NO ENDPOINT(ALL CHEMS),TARGET(CBL).


EcoReference No.: 78950
Chemical of Concern: CYP,FNL,MP,CPY,CBL,MOM,EN,PF; Habitat: T; Effect Codes: MOR; Rejection Code: OK(ALL CHEMS),NO COC(Br2),TARGET(CBL,MOM).


EcoReference No.: 70599
Chemical of Concern: RSM,DZ,PRN,DLD,AND,END,ES,CBL,DDT; Habitat: T; Rejection Code: NO REVIEW,NO REFS CHECKED.


Chemical of Concern: PMR,DM,ES,PRN,DDT,CBL,PYT; Habitat: T; Rejection Code: NO REVIEW,NO REFS CHECKED.


EcoReference No.: 63845
Chemical of Concern: BFT,CBL,MP; Habitat: T; Rejection Code: TARGET(BFT).

206. Elmanlouk, T. H., Philpot, R. M., and Bend, J. R. (1977). Separation of Two forms of Cytochrome P-450 from Hepatic Microsomes of 1,2,3,4-Dibenzanthracene (DBA) Pretreated

Chemical of Concern: CBL; **Habitat**: A; **Rejection Code**: NO ABSTRACT.


EcoReference No.: 88519
Chemical of Concern: CBL, AZ; **Habitat**: T; **Effect Codes**: POP; **Rejection Code**: NO CONTROL(TARGET-CBL, AZ).


EcoReference No.: 88962
Chemical of Concern: CBL; **Habitat**: T; **Effect Codes**: MOR, PHY, BCM, BEH; **Rejection Code**: NO CONTROL(CBL).


Chemical of Concern: CBL; **Habitat**: T; **Rejection Code**: NO CONTROL(CBL).


EcoReference No.: 2350
Chemical of Concern: CBL; **Habitat**: A; **Effect Codes**: PHY; **Rejection Code**: NO ABSTRACT(CBL).


EcoReference No.: 77201
Chemical of Concern: CBL, DZ; **Habitat**: T; **Effect Codes**: PHY, GRO; **Rejection Code**: NO ENDPOINT(DZ, CBL)//NO DIET, COC.


EcoReference No.: 74106
Chemical of Concern: TLF, TVP, CBL, ACP, MOM, ES, DZ, CPY; **Habitat**: T; **Effect Codes**: MOR, POP, BEH; **Rejection Code**: OK(ALL CHEMS), OK TARGET(DZ, ACP, CBL).


EcoReference No.: 16192
Chemical of Concern: CBL; **Habitat**: A; **Effect Codes**: MOR, GRO, PHY, BCM; **Rejection Code**: NO ENDPOINT(CBL).

Chemical of Concern: Maneb,DOD,CuOH,CBL;  Habitat: T; Rejection Code: NO ABSTRACT.


EcoReference No.: 76858
Chemical of Concern: MCPB,CBL,SZ,DQT,MP,Ziram,DMT,PCP,Folpt,Captan,MCPA,MLN,DZ,AND,EN,ES; Habitat: T; Rejection Code: NO REVIEW.


EcoReference No.: 87663
Chemical of Concern: CBL; Habitat: T; Effect Codes: MOR,PHY,ACC; Rejection Code: NO CONTROL(CBL).


Chemical of Concern: CBL,ADC; Habitat: T; Rejection Code: NO IN VITRO(CBL,ADC).


EcoReference No.: 72265
Chemical of Concern: HCCH,CBL,FNT,MXC; Habitat: T; Effect Codes: MOR; Rejection Code: NO CONTROL(TARGET-CBL).


EcoReference No.: 73931
Chemical of Concern: MTL,GYP,SXD,HFP,PCP,ATZ,ACR,BTC,DU,CPP,BSF,PAQT,CBL; Habitat: A; Effect Codes: GRO; Rejection Code: NO CONTROL(ALL CHEMS).


Chemical of Concern: CBL; Habitat: T; Rejection Code: NO IN VITRO,NO BACTERIA.


EcoReference No.: 59846
Chemical of Concern: 24DXY,CBL,MLN; Habitat: A; Effect Codes: BCM,BEH; Rejection Code: NO CONTROL(MLN,CBL,24DXY).


Chemical of Concern: CBL; Habitat: A; Rejection Code: NO ABSTRACT(CBL).


Chemical of Concern: CBL; Habitat: A; Rejection Code: NO CONC.


EcoReference No.: 74540
Chemical of Concern: DZ,DDT,CBL,CBF,MLN,CYR,FMP,FTT,PPM,PAQT; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBF),OK(DDT,CYR,FMP,FTT,PPM,PAQT),NO REVIEW(DZ,CBL,MLN).


User 1 Abbreviation: www.sciencedirect.com (1995-Present)
EcoReference No.: 74540
Chemical of Concern: DZ,DDT,CBL,CBF,MLN,CYR,FMP,FTT,PPM,PAQT; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CBF),OK(ALL CHEMS),NO REVIEW(DZ).


EcoReference No.: 30076
Chemical of Concern: 24DXY,CBL; Habitat: T; Rejection Code: NO FOREIGN.


EcoReference No.: 8065
Chemical of Concern: NAA,IAA,CN,CuS,24DXY,AN,BZD,CBL; Habitat: A; Effect Codes: MOR; Rejection Code: NO CONTROL(ALL CHEMS).


EcoReference No.: 87526
Chemical of Concern: ES,CBL,CPY,CPY,EFV,FNV,PMR,HCC,TEM,ATZ,LNR,GFS,BNZ,Cu,PAH,LPS,PCP,CBD,Cd,TBT; Habitat: A; Rejection Code: NO REVIEW(ALL CHEMS).

Chemical of Concern: CBL; Habitat: T; Rejection Code: No Mixture-Field, Non-English, NO MIXTURE.


EcoReference No.: 3781 Chemical of Concern: AN, PAH, PCP, PCB, AND, NP, CBL; Habitat: AT; Effect Codes: ACC; Rejection Code: NO ENDPOINT, CONTROL (ALL CHEMS).


EcoReference No.: 36729 Chemical of Concern: AND, CHD, DDT, DLD, ES, EN, HPT, HCCCH, TXP, DZ, PRN, As, Cu, CBL, NAPH, PAH, PCP, CN, PQT, PPB, PPHD, Zineb, MRX, ABT, DMT, DS, FNT, PSM, Naled, OXD, THM, HCCCH, MLN, MP, FPN, ETN; Habitat: T; Effect Codes: MOR; Rejection Code: NO CONTROL (ALL CHEMS).


EcoReference No.: 6932 Chemical of Concern: CBL; Habitat: A; Rejection Code: NO FOREIGN.


EcoReference No.: 69589 Chemical of Concern: ATZ, SZ, CBL, FMP, PMR, LNR; Habitat: T; Effect Codes: ACC; Rejection Code: NO ENDPOINT, CONTROL (MTL), TARGET (ATZ, SZ, CBL).


EcoReference No.: 36745 Chemical of Concern: DZ, ADC, AND, AZ, BMY, HCCCH, CBL, CHD, CPY, CPYM, CMPH, DDT, DMB, DLD, DMT, DU, ES, EN, ETN, MLN, MTZ, MXC, MRX, PPHD, PCL, TXP, TPR, TFL, PCB; Habitat: AT; Rejection Code: NO REVIEW, NO TITLES, NO REFS CHECKED.


EcoReference No.: 64443 Chemical of Concern: TFY, FPP, CYP, DDT, IMC, CPY, DZ, DMT, CBL, RTN, PMR, FNV, BFT, CBF, DLD, EN, AND, FP N; Habitat: T; Effect Codes: MOR; Rejection Code: LITE EVAL CODED (CBF), OK TARGET (DMT, RTN, CYP, BFT, FPN, DZ), OK (ALL CHEMS).

Chemical of Concern: MTL,CBL,DU,GYP,MLN; Habitat: T; Rejection Code: NO IN VITRO.


EcoReference No.: 70833
Chemical of Concern: DDT,CBL,DLD,CPY; Habitat: T; Rejection Code: NO REVIEW.


Chemical of Concern: ABT,PPX,CBL,MP,PRN,MLN,DDT,DLD,FNT,H,DDVP,FNT,DDVP,CPY; Habitat: T; Rejection Code: NO REVIEW(ALL CHEMS).


EcoReference No.: 11297
Chemical of Concern: PCP,24DXY,BZO,CYP,PNB,ATZ,CBL,DBN,HCC,NAPH; Habitat: A; Effect Codes: ACC; Rejection Code: NO CONTROL(ALL CHEMS).


EcoReference No.: 88476
Chemical of Concern: CBL; Habitat: T; Effect Codes: BCM; Rejection Code: NO IN VITRO(CBL).


Chemical of Concern: CBL; Habitat: A; Rejection Code: NO SOURCE(CBL).


EcoReference No.: 13352
Chemical of Concern: CBL,MP; Habitat: A; Rejection Code: NO MIXTURE.


EcoReference No.: 17838
Chemical of Concern: CBL,MP; Habitat: A; Effect Codes: BCM; Rejection Code: NO ENDPOINT(CBL).

EcoReference No.: 4768
Chemical of Concern: CBL; Habitat: A; Effect Codes: POP; Rejection Code: NO ENDPOINT(CBL).


EcoReference No.: 4767
Chemical of Concern: CBL; Habitat: A; Effect Codes: POP; Rejection Code: NO ENDPOINT(CBL).


EcoReference No.: 11294
Chemical of Concern: CBL; Habitat: A; Effect Codes: POP; Rejection Code: NO ENDPOINT(CBL).


EcoReference No.: 4769
Chemical of Concern: CBL; Habitat: A; Rejection Code: NO PUBL AS.


EcoReference No.: 68365
Chemical of Concern: HCH,Zn,Cu,PCP,CBL; Habitat: A; Effect Codes: BCM; Rejection Code: OK(HCH,Zn),NO CONTROL(Cu,PCP,CBL).


EcoReference No.: 68365
Chemical of Concern: HCH,Zn,Cu,PCP,CBL; Habitat: A; Effect Codes: BCM; Rejection Code: OK(HCH,Zn),NO CONTROL(Cu,PCP,CBL).


EcoReference No.: 5617
Chemical of Concern: CBL,DMT; Habitat: A; Effect Codes: CEL; Rejection Code: NO
ENDPOINT(DMT,CBL).


EcoReference No.: 40795
Chemical of Concern: IAA,CBL; Habitat: T; Effect Codes: POP; Rejection Code: NO ENDPOINT(IAA,CBL).


EcoReference No.: 73696
Chemical of Concern: MOM,DZ,PMR,FNV,CBL,PSM; Habitat: T; Effect Codes: MOR,REP; Rejection Code: TARGET(DZ).


EcoReference No.: 82778
Chemical of Concern: MLSS,MOM,Naled,MLK,FVL,DMT,SBDA,CBL,FO,CPY,ACP,FTT; Habitat: T; Effect Codes: GRO,REP,POP; Rejection Code: NO MIXTURE(ALL CHEMS),TARGET(CBL).


EcoReference No.: 49690
Chemical of Concern: CBL; Habitat: A; Rejection Code: NO REFS CHECKED,NO REVIEW.


EcoReference No.: 77552
Chemical of Concern: CaPS,EPH,CBL; Habitat: T; Effect Codes: GRO,POP; Rejection Code: OK(EPH),NO MIXTURE(CBL),CONC(CaPS),TARGET(CBL).


EcoReference No.: 49712
Chemical of Concern: DFM,CBL; Habitat: T; Effect Codes: MOR,BEH; Rejection Code: NO CONTROL,ENDPOINT(DFM).


EcoReference No.: 6861
Chemical of Concern: CBL; Habitat: A; Effect Codes: BCM; Rejection Code: NO FOREIGN(CBL).

EcoReference No.: 8852
Chemical of Concern: DZ,NP,CBL; Habitat: A; Effect Codes: REP,MOR,POP; Rejection Code: NO ENDPOINT(ALL CHEMS).


EcoReference No.: 86598
Chemical of Concern: DZ,CPE,NS,CBL,MLN,EP; Habitat: A; Rejection Code: NO MIXTURE.


EcoReference No.: 77606
Chemical of Concern: CaPS,CBL; Habitat: T; Effect Codes: PHY; Rejection Code: NO ENDPOINT(ALL CHEMS),TARGET(CBL).


Chemical of Concern: DDVP,PRN,MP,CBL; Habitat: T; Rejection Code: NO IN VITRO.


Chemical of Concern: CBL; Habitat: A; Rejection Code: NO IN VITRO.


EcoReference No.: 57161
Chemical of Concern: DLD,DZ,HPT,DAT,CBL,FNTH,ES,DEM,EP; Habitat: T; Effect Codes: PHY,CEL; Rejection Code: NO OM, pH//NO ENDPOINT(ALL CHEMS).


EcoReference No.: 13286
Chemical of Concern: ES,HCCH,CBL; Habitat: A; Effect Codes: ACC; Rejection Code: NO CONTROL,ENDPOINT(ALL CHEMS).


Chemical of Concern: CBL; Habitat: A; Rejection Code: NO DURATION.


Chemical of Concern: CBL; Habitat: T; Rejection Code: NO CONC.

EcoReference No.: 86457
Chemical of Concern: DFM, WFN, CPC, DPC, CBL; Habitat: T; Effect Codes: PHY, BEH, MOR; Rejection Code: NO CONTROL (ALL CHEMS).


EcoReference No.: 3877
Chemical of Concern: CBL; Habitat: A; Rejection Code: NO FOREIGN.


EcoReference No.: 70501
Chemical of Concern: RSM, DDT, CBL, MOM, BDC, BFT, ACP, CHT, FPP, CYF, FVL, CYP, PMR, FNV; Habitat: T; Effect Codes: MOR, PHY; Rejection Code: NO ENDPOINT (ALL CHEMS, TARGET (BFT, CYF, ACP, CBL, MOM).


EcoReference No.: 25150
Chemical of Concern: RSM, OML, ACP, CPY, DMT, CBL; Habitat: T; Effect Codes: PHY, GRO; Rejection Code: NO ENDPOINT (ALL CHEMS, TARGET (CBL).


EcoReference No.: 10440
Chemical of Concern: MLN, DZ, ABT, FNT, CPY, CBL; Habitat: A; Effect Codes: MOR, POP; Rejection Code: LITE EVAL CODED (DZ), OK (ABT, FNT, CPY), NO ENDPOINT (CBL, MLN).


EcoReference No.: 12620
Chemical of Concern: CBL; Habitat: A; Effect Codes: POP, SYS; Rejection Code: NO ENDPOINT (CBL).


EcoReference No.: 8964
Chemical of Concern: CBL; Habitat: A; Rejection Code: NO FOREIGN, NO QSAR.


EcoReference No.: 839
Chemical of Concern: CBL; Habitat: A; Effect Codes: POP; Rejection Code: NO ENDPOINT(CBL).


EcoReference No.: 3111
Chemical of Concern: CBL; Habitat: A; Effect Codes: POP; Rejection Code: NO ENDPOINT(CBL).


EcoReference No.: 8962
Chemical of Concern: CBL; Habitat: A; Effect Codes: POP; Rejection Code: NO ENDPOINT(CBL).


EcoReference No.: 8879
Chemical of Concern: CBL; Habitat: A; Effect Codes: POP; Rejection Code: NO ENDPOINT(CBL).


EcoReference No.: 3007
Chemical of Concern: CBL; Habitat: A; Effect Codes: POP; Rejection Code: NO ENDPOINT(CBL).


Chemical of Concern: MOM,CBL; Habitat: T; Rejection Code: NO SOURCE.


EcoReference No.: 5145
Chemical of Concern: 24DXY,CBL,CPY,MLN,DDT,EN; Habitat: A; Effect Codes: BEH; Rejection Code: NO CONTROL(CBL).


EcoReference No.: 5147
Chemical of Concern: DDT,CBL,EN,MLN; Habitat: A; Effect Codes: BEH; Rejection
Code: NO ENDPOINT (ALL CHEMS).


EcoReference No.: 5010
Chemical of Concern: CrCl3,NaCN,CBL; Habitat: A; Effect Codes: ACC; Rejection Code: NO CONTROL, ENDPOINT (ALL CHEMS).


EcoReference No.: 70979
Chemical of Concern: PRN,CBL,DLD,AND,DZ,EN,CHD,DDT,ES,HPT,MLN,MOM,CPY,CBF,Naled,AZ,DMT; Habitat: T; Effect Codes: MOR; Rejection Code: NO ENDPOINT (ALL CHEMS, TARGET-AZ, TARGET-CBL, MLN, MOM).


EcoReference No.: 9038
Chemical of Concern: CBL,DDT,EN,DLD,AND,PRN,MP,DZ,MOM,RTN,ATN,FBM,Ziram,FNT,ANZ,NaPCP,Zn; Habitat: A; Effect Codes: MOR; Rejection Code: NO CONTROL (ALL CHEMS).


EcoReference No.: 5761
Chemical of Concern: DDT,TPN,FNTH,240XY,PRN,PAQT,CBL,YPN,Zineb,CZE,FBM,PPX,PPX,MOM,ES,TBC,MLN,FE,SZ,NaPCP,Captan,AND,DZ,ETN,FLAC,PPn,FNT,RTN,EN,CBL; Habitat: A; Effect Codes: MOR; Rejection Code: NO FOREIGN, CONTROL (ALL CHEMS).


EcoReference No.: 59146
User Define 2: REPS,WASH,CALF,CORE,SENT
Chemical of Concern: SZ,CBL,PHMD; Habitat: T; Effect Codes: MOR,POP,PHY; Rejection Code: NO CONTROL (SZ, PHMD).


EcoReference No.: 59146
Chemical of Concern: AMTL,ACP,PHMD,AMZ,PMR,SZ,CBL,MOM,MZB; Habitat: T; Effect Codes: MOR,POP,PHY; Rejection Code: NO CONTROL(SZ,PHMD), NO ENDPOINT(ALL CHEMS).


EcoReference No.: 86757
Chemical of Concern: MCB,MAL,CBL; Habitat: T; Effect Codes: MOR; Rejection Code: NO MIXTURE(CBL,MCB).


EcoReference No.: 70678
Chemical of Concern: PNB,Pb,DDT,ES,CHD,HCCCH,TXP,AND,EN,DLD,CBL,PRN,CPY; Habitat: T; Rejection Code: NO COC, NO REVIEW.


Chemical of Concern: CBL; Habitat: T; Rejection Code: NO TOXICANT.


Chemical of Concern: CBL; Habitat: A; Rejection Code: NO MIXTURE, ENDPOINT(CBL).


Chemical of Concern: CBL,Cu; Habitat: A; Rejection Code: NO ABSTRACT(CBL,Cu).


EcoReference No.: 70899
Chemical of Concern: RSM,CBL,HCCCH,CYP,DZ; Habitat: T; Effect Codes: MOR; Rejection Code: TARGET(CYP,RSM,DZ).


EcoReference No.: 7999
Chemical of Concern: DDT,CBL; Habitat: A; Effect Codes: MOR; Rejection Code: NO ABSTRACT(ALL CHEMS).


EcoReference No.: 40492
Chemical of Concern: PCP,MDT,ES,PPX,CHD,CBL,Captan,CuS; Habitat: T; Effect Codes: MOR; Rejection Code: OK(EcoSSL)//NO CONTROL(ALL CHEMS).


EcoReference No.: 68963
Chemical of Concern: CBL; Habitat: T; Rejection Code: NO FOREIGN.


EcoReference No.: 87757
Chemical of Concern: CBL,PPX,DM; Habitat: T; Effect Codes: BEH; Rejection Code: NO ENDPOINT(ALL CHEMS).


Chemical of Concern: CBL; Habitat: T; Rejection Code: NO MIXTURE, CONTROL, 1 CONC, ERE.


EcoReference No.: 88824
Chemical of Concern: CPY,CBL; Habitat: T; Effect Codes: POP; Rejection Code: NO ENDPOINT(CPY,TARGET-CBL).


EcoReference No.: 88825
Chemical of Concern: FPP,CPY,ACP,CBL,CYF; Habitat: T; Effect Codes: POP; Rejection Code: NO ENDPOINT(FPP,CPY,TARGET-ACP,CBL,CYF).


EcoReference No.: 88821
Chemical of Concern: CPY,FVL,ACP,CYF,CBL,DZ,EFV; Habitat: T; Effect Codes: MOR; Rejection Code: NO ENDPOINT(CPY,TARGET-ALL CHEMS).


EcoReference No.: 88827
Chemical of Concern: CBL; Habitat: T; Effect Codes: POP; Rejection Code: NO ENDPOINT(CBL).


EcoReference No.: 88828
Chemical of Concern: CBL,CPY; Habitat: T; Effect Codes: POP; Rejection Code: NO ENDPOINT(CPY,CBL).


EcoReference No.: 88823
Chemical of Concern: DZ,CBL,IZF,CYF,ACP,TCF,CPY,PMR; Habitat: T; Effect Codes: POP; Rejection Code: NO ENDPOINT(ALL CHEMS).


EcoReference No.: 936
Chemical of Concern: AZ,DDT,HCCH,DLD,CBL,EN; Habitat: A; Effect Codes: MOR; Rejection Code: NO CONTROL(ALL CHEMS).


EcoReference No.: 8001
Chemical of Concern: AND,CBL,MP; Habitat: A; Effect Codes: POP,MOR,GRO; Rejection Code: NO ENDPOINT(ALL CHEMS).


EcoReference No.: 79045
Chemical of Concern: PRT,NAPH,PMR,ES,DCB,PSM,DS,DZ,CBF,CBL; Habitat: T; Effect Codes: MOR; Rejection Code: OK(ALL CHEMS),OK TARGET(PRT,DZ,NAPH,DCB).


EcoReference No.: 79774
Chemical of Concern: ACP,CYH,CBL,ADC,FPP; Habitat: T; Effect Codes: POP; Rejection Code: OK TARGET(ACP,ADC,CBL).


EcoReference No.: 50152
Chemical of Concern: CBL; Habitat: A; Rejection Code: NO METHODS.

Del Etil-Paration Y Carbaril Sobre Estudios Tempranos Del Desarrollo Del Erizo De Mar. 

EcoReference No.: 16045
Chemical of Concern: CBL; Habitat: A; Rejection Code: NO ABSTRACT,FOREIGN(CBL).


EcoReference No.: 72263
Chemical of Concern: PRN,ES,CPY,DZ,CBL,DLD,RSM,DDT; Habitat: T; Rejection Code: NO REVIEW.


EcoReference No.: 59468
Chemical of Concern: CBL; Habitat: T; Rejection Code: NO FOREIGN.


Chemical of Concern: CBL; Habitat: A; Rejection Code: NO SEDIMENT,SURVEY.


Chemical of Concern: CBL; Habitat: T; Rejection Code: NO REVIEW(CBL).


Chemical of Concern: CPY,PRN,CBL; Habitat: AT; Rejection Code: NO SPECIES,NO BACTERIA.


EcoReference No.: 62777
Chemical of Concern: DZ,CBL; Habitat: A; Rejection Code: NO BACTERIA.


EcoReference No.: 6128
Chemical of Concern: CBL,DZ; Habitat: A; Effect Codes: MOR,GRO; Rejection Code: NO FOREIGN.

EcoReference No.: 6128
Chemical of Concern: CBL,DZ; Habitat: A; Effect Codes: MOR,GRO; Rejection Code: NO FOREIGN(ALL CHEMS).


EcoReference No.: 70632
Chemical of Concern: SZ,CBL,DZ,PRN,ES,NH,MOM,DMT; Habitat: T; Effect Codes: MOR,REP,POP; Rejection Code: TARGET(DMT,DZ).


EcoReference No.: 42198
Chemical of Concern: NAA,CBL,NAD KNPH; Habitat: T; Effect Codes: POP,PHY; Rejection Code: NO ENDPOINT(ALL CHEMS).


EcoReference No.: 76474
Chemical of Concern: PCZ,PMR,PRN,CYP,TDF,CBL; Habitat: T; Rejection Code: NO FOREIGN(PCZ,PMR,PRN,CYP,TDF,CBL).


EcoReference No.: 35249
Chemical of Concern: ACP,CBL,DZ,DMT,EN,HCCH,MLN,MOM,Naled,PRN,PMR,PSM,SPS,TMP,TPX,AMTL, ATZ,BMN,MCPA,24DXY,DMG,GYP,PAQT,PCL,PRO,PPN,TFN,ALSV; Habitat: T; Effect Codes: MOR,GRO,DVP; Rejection Code: LITE EVAL CODED(ATZ,MOM,DMT,DMG,ALS),(ALL CHEMS except BMN,MCPA-MIXTURE).


EcoReference No.: 70472
Chemical of Concern: SZ,CBL,ATZ; Habitat: T; Rejection Code: NO REVIEW,NO REFS CHECKED.


Chemical of Concern: CBL; Habitat: T; Rejection Code: NO MIXTURE,SURVEY.

EcoReference No.: 14399
Chemical of Concern: ACL,CBL,Naled,TBT,CuS,NaPCP; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(NaPCP),NO CONTROL(CuS,ACL,CBL,TBT,Naled).


EcoReference No.: 76444
Chemical of Concern: PMR,CBL; Habitat: T; Effect Codes: POP; Rejection Code: OK(ALL CHEMS),NO COC(DOD),TARGET(CBL).


EcoReference No.: 17646
Chemical of Concern: CBL; Habitat: A; Effect Codes: CEL; Rejection Code: NO ENDPOINT(CBL).


EcoReference No.: 50331
Chemical of Concern: CBL; Habitat: T; Effect Codes: ACC,PHY; Rejection Code: NO ENDPOINT(CONTROL(CBL)).


EcoReference No.: 88830
Chemical of Concern: CBL,CPY,PSM,DMT,FVL; Habitat: T; Effect Codes: POP; Rejection Code: NO ENDPOINT(ALL CHEMS,TARGET-CBL,DMT,FVL).


Chemical of Concern: CBL; Habitat: T; Rejection Code: NO MIXTURE.


Chemical of Concern: MOM,EFV,PSM,CBL,ES; Habitat: T; Rejection Code: NO CONC,TARGET(MOM).


EcoReference No.: 37218
Chemical of Concern: CBL; Habitat: T; Effect Codes: ACC; Rejection Code: NO
ENDPOINT(CBL).


EcoReference No.: 87676  
Chemical of Concern: CBL; Habitat: T; Effect Codes: ACC,PHY; Rejection Code: NO CONTROL,ENDPOINT(CBL).


EcoReference No.: 7806  
Chemical of Concern: CBL; Habitat: A; Effect Codes: GRO,CEL; Rejection Code: NO FOREIGN(CBL).


EcoReference No.: 71346  
Chemical of Concern: DU,PNB,DDT,SZ,ATZ,RTN,FBM,MRX,PPZ,THM,CBL,24DXY,Maneb,Zineb,Captan,Nabam,Folpet; Habitat: T; Effect Codes: CEL; Rejection Code: LITE EVAL CODED(ATZ,RTN,PPZ),OK(ALL CHEMS).


Chemical of Concern: CYF,FVL,CBL,BFT; Habitat: T; Rejection Code: NO REVIEW,NO REFS CHECKED.


Chemical of Concern: CBL; Habitat: T; Rejection Code: NO ARCHIVE.


EcoReference No.: 9590  
Chemical of Concern: CBL; Habitat: A; Rejection Code: NO FOREIGN(CBL).


Chemical of Concern: CBL; Habitat: T; Rejection Code: NO COC(MTL).

EcoReference No.: 37263
Chemical of Concern: CBL; Habitat: T; Effect Codes: ACC; Rejection Code: NO ENDPOINT(ALL CHEMS).


Chemical of Concern: PCB,PCP,DDT,CBL,HCH,PAH; Habitat: T; Rejection Code: NO ENDPOINT(ALL CHEMS).


EcoReference No.: 76934
Chemical of Concern: CPY,MLN,PSM,DZ,DMT,CBL,PIM,MOM,ES,IMC,TMX,BFT; Habitat: T; Effect Codes: MOR; Rejection Code: TARGET(BFT,DZ).


EcoReference No.: 67984
Chemical of Concern: CaPS,BMY,CBD,CTN,MZB,FRM,IPD,MLX,Cu,PCZ,TDM,VCZ,Zineb,Ziram,CuOH,AZ,CBL,CPY,DZ,DMT,ES,MLN,MDT,DCF; Habitat: T; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CaPS),OK(ALL CHEMS),OK TARGET(DZ).


EcoReference No.: 2837
Chemical of Concern: Naled,CBL,CPY,DZ,DMT,ATM,ABT,PPX,PSM; Habitat: A; Effect Codes: BEH,POP; Rejection Code: NO ENDPOINT(ALL CHEMS).


EcoReference No.: 4589
Chemical of Concern: CBL,ES; Habitat: A; Effect Codes: PHY,CEL; Rejection Code: NO ENDPOINT(ALL CHEMS).


EcoReference No.: 11510
Chemical of Concern: ES,CBL; Habitat: A; Effect Codes: CEL; Rejection Code: NO ENDPOINT(ES,CBL).


EcoReference No.: 124

Chemical of Concern: CBL,BTC,CBF; Habitat: T; Rejection Code: NO BACTERIA.


Chemical of Concern: CBL,MLN,DZ; Rejection Code: NO SPECIES.


Chemical of Concern: CBL; Habitat: A; Rejection Code: NO PUBL AS.


EcoReference No.: 35280
Chemical of Concern: CBL; Habitat: T; Effect Codes: MOR; Rejection Code: NO ENDPOINT(CBL).


EcoReference No.: 71980
Chemical of Concern: CBL; Habitat: A; Effect Codes: ACC; Rejection Code: NO ENDPOINT(CBL).


EcoReference No.: 50679
Chemical of Concern: ATZ,CBL,CYH; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(ATZ),OK(ALL CHEMS).


EcoReference No.: 77611
Chemical of Concern: TDF,CBL,AZ; Habitat: T; Effect Codes: POP; Rejection Code: OK(CBL,AZ),NO CONC(TDF),TARGET(AZ,CBL).

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EcoReference No.: 70839
Chemical of Concern: SZ,PNB,CBL,DZ,PRN,CBF,ADC,DCNA,PHMD;  Habitat: T;  Rejection Code: NO REVIEW,NO REFS CHECKED.

EcoReference No.: 666
Chemical of Concern: EDT,RSM,Captan,CBF,CBL,DFZ,PSM,24DXY,ACP,ACR,AZ,BS,Captan,CMPH,CY,DDN,DMB,DNT,DPDP,DS,DZ,FO,GYP,HCCH,HXZ,MDT,MLN,MLT,MOM,MP,Naled, OYZ,PR,TZ,TBC,TPR,As,Pb;  Habitat: A;  Effect Codes: MOR,ITX,BEH;  Rejection Code: NO PUBL AS.

EcoReference No.: 70074
Chemical of Concern: 24DXY,ABT,ACL,ADC,AMTL,AMTR,AND,ASM,ATN,ATZ,AZ,BFL,BMC,BMN,BS,BTY,Captan,CBL,CCA,CHD,CMPH,CPP,CY,CQTC,CTHM,Cu,CuFRA,DBN,DCB,DCNA,D DD,DDT,DDVP,DEM,DINO,DDL,DMB,DMT,DOD,DP1,DQTBr,DS,DZ,EDT,EN,EP,EPTC,ES,ETN,FLAC,FMU,FNF,FNT,FNTH,Folpet,HCCH,HPT,LNR,Maneb,MCB,MCPA, MCPB,MCPP1MDT,MLH,MLN,MLT,MRX,MTP,MVP,MXN,Naed,NPM,PB,PCH,PCL,PCP,PEB,PHMD,PHSL,PM,T,PPD,PNP,PPX,PT,PRT,PYN,PY,Z,RN,SFT,SID,SZ,TCF,TFN,THM,TRB,TRL,TRP,VNT,Zineb;  Habitat: T;  Effect Codes: MOR;  Rejection Code: NO PUBL AS(24DXY,ABT,ACL,AMTL,AMTR,ASM,ATN,AZ,BFL,BMC,BMN,BS,BTY,CCA,CMP H,CPP,CY,CQTC,CTHM,DMB,DCB,DCNA,DDT,DINO,DOD,DP1,DQTBr,DU,EDT,EN,EP,EPTC,ES,FMU,FNF,FNT,Folpet,HCCH,HPT,LNR,MCB,MCPP1MDT,MLH,MLN,MX N,Naed,NPM,Pb,PCH,PCL,PEB,PHSL,PPX,PT,PRT,PYN,PY,Z,RN,SFT,SID,SZ,TCF,TFN,THM,TRB,TRL,TRP,VNT,Zineb;  Habitat: T;  Effect Codes: MOR;  Rejection Code: NO PUBL.

EcoReference No.: 88039
Chemical of Concern: CBL;  Habitat: T;  Effect Codes: CEL;  Rejection Code: NO ENDPOINT(CBL).

EcoReference No.: 68523
Chemical of Concern: CBL,AND;  Habitat: A;  Effect Codes: BCM;  Rejection Code: NO CONC(AND,CBL).

EcoReference No.: 34029
Chemical of Concern: SZ,PRN,CBL,DZ,Cu;  Habitat: T;  Rejection Code: NO TOX DATA.

EcoReference No.: 547
Chemical of Concern: ATZ,CBL,HCCH,ACL,FUR,BZO,AMS,APAC,C8OH,DCB,Se;
Habitat: A; Effect Codes: MOR; Rejection Code: NO FOREIGN,CONTROL(ALL CHEMS).


EcoReference No.: 6691
Chemical of Concern: DMT,CBL; Habitat: A; Effect Codes: BCM; Rejection Code: NO FOREIGN.


EcoReference No.: 68937
Chemical of Concern: CBL; Habitat: T; Rejection Code: NO FOREIGN.


EcoReference No.: 70277
Chemical of Concern: PMR,CYR,PYX,PTP,FNTH,DDVP,RSM,CBL; Habitat: T; Effect Codes: POP; Rejection Code: NO CONTROL(ALL CHEMS),MIXTURE(DDVP,FNTH,FNT,RSM).


EcoReference No.: 12524
Chemical of Concern: HCC,H,CBL,TFN,FNT,TBC,MLT,PNB,DZ,DLD; Habitat: A; Effect Codes: ACC,GRO; Rejection Code: NO CONTROL(ALL CHEMS).


EcoReference No.: 11600
Chemical of Concern: DZ,FNT,PRN,PPX,CBL,MOM; Habitat: A; Effect Codes: BCM,MOR,BEH,PHY; Rejection Code: NO ENDPOINT(ALL CHEMS).


EcoReference No.: 15599
Chemical of Concern: DLD,DZ,MLT,FNT,CBL,TBC,PNB,HCCH,TFN; Habitat: A; Effect
Codes: MOR,ACC; Rejection Code: NO CONTROL(ALL CHEMS).


EcoReference No.: 10750
Chemical of Concern: HCCH,MLT,TFN,CBL,DLD,DZ,TBC,PNB; Habitat: A; Effect Codes: ACC,BCM,GRO; Rejection Code: NO CONTROL(ALL CHEMS).


EcoReference No.: 59925
Chemical of Concern: PNB,DZ,MLT,TBC,HCCH,TFN,FNT,CBL,DLD; Habitat: A; Effect Codes: ACC,MOR; Rejection Code: NO CONTROL(ALL CHEMS).


Chemical of Concern: CBL; Habitat: A; Rejection Code: NO EFFECT.


EcoReference No.: 87267
Chemical of Concern: PPN,PCH,PRT,NaN3,FMU,DU,DZ,CBL,CPP; Habitat: T; Effect Codes: POP; Rejection Code: NO ENDPOINT(ALL CHEMS).


EcoReference No.: 59932
Chemical of Concern: MLN,CBL; Habitat: A; Effect Codes: CEL; Rejection Code: NO ENDPOINT(CBL,MLN).


EcoReference No.: 70488
Chemical of Concern: PNB,CBL,EN,MANE; Habitat: T; Effect Codes: REP,MOR; Rejection Code: NO ENDPOINT(CBL,OK(EN,PNB).


Chemical of Concern: CBL; Habitat: T; Rejection Code: NO CONC,NO DURATION.


EcoReference No.: 50919
Chemical of Concern: CBL,DDT; Habitat: T; Effect Codes: BCM; Rejection Code: NO ENDPOINT(ALL CHEMS).

EcoReference No.: 86932
Chemical of Concern: CBL,ES,EP,CFB,ADC; Habitat: T; Effect Codes: POP,MOR,BEH; Rejection Code: NO ENDPOINT(ALL CHEMS).


EcoReference No.: 82011
Chemical of Concern: ES,CBL; Habitat: A; Effect Codes: CEL; Rejection Code: NO ENDPOINT,STATS(ALL CHEMS).


Chemical of Concern: DZ,CBL; Habitat: A; Rejection Code: NO DURATION.


Chemical of Concern: PHSL,CBL; Habitat: T; Rejection Code: NO CONC(ALL CHEMS).


EcoReference No.: 3706
Chemical of Concern: CBL,MLN,ES; Habitat: A; Effect Codes: CEL; Rejection Code: NO ENDPOINT(ALL CHEMS).


EcoReference No.: 106
Chemical of Concern: CBL,MLN,ES; Habitat: A; Effect Codes: CEL; Rejection Code: NO ENDPOINT(ALL CHEMS).


EcoReference No.: 89101
Chemical of Concern: ES,MLN,CBL; Habitat: A; Effect Codes: CEL,REP; Rejection Code: NO ENDPOINT(ES,MLN,CBL).


EcoReference No.: 2387
Chemical of Concern: ES,MLN,CBL; Habitat: A; Effect Codes: BCM; Rejection Code: NO ENDPOINT(ALL CHEMS).


EcoReference No.: 3426
Chemical of Concern: MLN,ES,CBL; Habitat: A; Effect Codes: MOR,GRO,PHY; Rejection Code: NO ENDPOINT(ALL CHEMS).


EcoReference No.: 50944
Chemical of Concern: CBL,PAH; Habitat: T; Rejection Code: NO FOREIGN.


EcoReference No.: 74315
Chemical of Concern: MOM,MP,CBL,PPN; Habitat: T; Effect Codes: PHY,POP,GRO; Rejection Code: NO MIXTURE(MOM),TARGET(CBL).


EcoReference No.: 2890
Chemical of Concern: CBL,DZ,CHD,HCCH,MLN,CuS,DDT,DLD,NaPCP; Habitat: A; Effect Codes: MOR,PHY; Rejection Code: NO CONTROL(ALL CHEMS).


Chemical of Concern: CBL; Habitat: T; Rejection Code: NO MIXTURE.


Chemical of Concern: MLT,CBL,CBF,MLN,MP,TXP,PDM,PPN,ACP,Sn; Habitat: T; Rejection Code: NO CONC.


EcoReference No.: 51026
Chemical of Concern: AND,AL,NH,As,ATZ,Ba,BNZ,Be,Cd,CBL,CTC,CHD,C1,C2,CBZ,CF,CPH,CPY,Cr,Co,cu,Cn,DDT,DZ,TCDD,DCB,DDP,DLD,DMB,DXN,EDT,ES,EN,ETHB,FN,FML,HPT,HCCH,Fe,Pb,Mn,Hg,PRN,Mo,NAPH,PAH,Ni,NBZ,NCB,PCB,PCP,PL,PHTH,Se,Ag,CS,Sn,TOL,TX P,TPH,TCE,V,Zn; Habitat: A; Rejection Code: NO REVIEW,NO REFS CHECKED.


EcoReference No.: 37516
Chemical of Concern: PRN,CBL; Habitat: T; Effect Codes: ACC,BCM; Rejection Code: NO CONTROL(ALL CHEMS),NO ENDPOINT(CBL).

EcoReference No.: 87643
Chemical of Concern: CBL; Habitat: T; Effect Codes: BCM; Rejection Code: NO CONTROL(CBL).


EcoReference No.: 74137
Chemical of Concern: CPYM,FNT,MP,FNTH,DZ,Cpy,PRN,MLN,PSM,MDT,DDVP,TVP,CBL,BDC,PIRM,PIM, MOM; Habitat: T; Effect Codes: MOR; Rejection Code: TARGET(MLN,DZ).


EcoReference No.: 7828
Chemical of Concern: CBL,HCC,H,DLD; Habitat: A; Effect Codes: BCM; Rejection Code: NO FOREIGN(CBL,DLD,HCC).


EcoReference No.: 8889
Chemical of Concern: CBL; Habitat: A; Effect Codes: ACC,MOR; Rejection Code: NO CONTROL(CBL).


EcoReference No.: 602
Chemical of Concern: CBL,Cpy,HCC,MLN,MP,Naled,ABT,FNT,EN,ES,DDT,HPT,MXC,TPX,AND,CHD,PR N,DLD; Habitat: A; Effect Codes: MOR; Rejection Code: NO CONTROL(ALL CHEMS).


EcoReference No.: 87750
Chemical of Concern: CBL; Habitat: T; Effect Codes: PHY,MOR,BCM; Rejection Code: NO ENDPOINT(CBL).


EcoReference No.: 6547
Chemical of Concern: CBL; Habitat: A; Effect Codes: MOR,PHY; Rejection Code: NO CONTROL(CBL).

EcoReference No.: 6133
Chemical of Concern: CBL,MLT; Habit: A; Rejection Code: NO FOREIGN,NO CONTROL(ALL CHEMS).


EcoReference No.: 6133
LITE Eval Status: NO FOREIGN
ECOTOX Status: A CBL,MLT; Effect Codes: A


Chemical of Concern: CBL,HCC; Habit: T; Rejection Code: NO ABSTRACT(ALL CHEMS).


EcoReference No.: 8894
Chemical of Concern: DDT,PRN,CBL,AND; Habit: A; Effect Codes: MOR,PHY; Rejection Code: NO CONTROL(ALL CHEMS).


Chemical of Concern: DZ,CBL,HCC; Habit: T; Rejection Code: NO DURATION.


EcoReference No.: 84917
Chemical of Concern: DZ,HCCH,CBL,CAPTAN; Habit: T; Effect Codes: MOR,GRO; Rejection Code: NO CONTROL(ALL CHEMS).


EcoReference No.: 87546
Chemical of Concern: AZ,CBL,DMT,MLN,ADC,DZ,Captan,ATZ,MTM,ACP,MZB,PCB ; Habit: T; Rejection Code: NO REVIEW.


EcoReference No.: 10885
Chemical of Concern: ES,CBL; Habit: A; Effect Codes: CEL; Rejection Code: NO ENDPOINT(ALL CHEMS).


EcoReference No.: 10069
Chemical of Concern: ES,CBL; Habitat: A; Effect Codes: PHY,REP,GRO; Rejection Code: NO ENDPOINT(ALL CHEMS).


EcoReference No.: 4309
Chemical of Concern: ES,CBL; Habitat: A; Effect Codes: CEL; Rejection Code: NO ENDPOINT(ALL CHEMS).


EcoReference No.: 12068
Chemical of Concern: CBL,ES; Habitat: A; Effect Codes: CEL; Rejection Code: NO ENDPOINT(ALL CHEMS).


EcoReference No.: 72015
Chemical of Concern: CBL,PRM,MTM; Habitat: T; Effect Codes: MOR,REP,GRO; Rejection Code: TARGET(CBL,MTM).


EcoReference No.: 6548
Chemical of Concern: DS,DZ,HCC,H,CBL,DLD,DMT,DDT,FNT,MLN,Captan,ALSV; Habitat: A; Effect Codes: MOR; Rejection Code: NO ENDPOINT(ALL CHEMS).


EcoReference No.: 82310
Chemical of Concern: ES,CBL; Habitat: A; Effect Codes: MOR,BEH,PHY; Rejection Code: NO CONTROL(CBL,ES).


EcoReference No.: 40851
User Define 2: WASH,CALF,MED
Chemical of Concern: CBL,DMT,HCC,MLN,DDT,ES,PRN,PPHD,DDVP,TCF,TPX; Habitat: T; Effect Codes: REP; Rejection Code: NO ENDPOINT(ALL CHEMS).

Alternatives to the Acute Fish Test. *Chemosphere* 30: 2087-2102.

EcoReference No.: 16033
Chemical of Concern: CBL,MLN,UREA; Habitat: A; Effect Codes: MOR,GRO,PHY; Rejection Code: NO IN VITRO(CBL,MLN).


Chemical of Concern: CBL; Habitat: T; Rejection Code: NO TOXICANT.


Chemical of Concern: MLT,BMY,CBL,TBC,CBF,MP,DCPA,24DC,BSF,MLN,MCPA,PCZ; Habitat: T; Rejection Code: NO SPECIES.


EcoReference No.: 82537
Chemical of Concern: MFZ,CBL,FNV,EFV,CPY,MP,AZ; Habitat: T; Effect Codes: MOR,POP,PHY; Rejection Code: LITE EVAL CODED(MFZ),NO ENDPOINT(FNV),PUBL AS(EFV,MP,CPY),MIXTURE(AZ,TARGET-CBL).


EcoReference No.: 3725
Chemical of Concern: CBL,MXC,ABT,CPYM; Habitat: A; Effect Codes: MOR; Rejection Code: NO ENDPOINT,CONTROL(ALL CHEMS).


EcoReference No.: 86611
Chemical of Concern: CBL,MLN; Habitat: T; Effect Codes: PHY,ACC,BCM; Rejection Code: NO CONTROL,ENDPOINT(CBL,MLN).


EcoReference No.: 77207
Chemical of Concern: ES,DLD,DDT,PMDSM,FNT,DZ,CPY,CPYM,MLN,CBL,PPX,BFT,PMR,DM,ACT,HMN; Habitat: T; Effect Codes: MOR; Rejection Code: TARGET(BFT,DZ).


Chemical of Concern: Ag,Zn,Cd,CBL; **Habitat**: A; **Rejection Code**: NO MIXTURE.


EcoReference No.: 78182
Chemical of Concern: ALSV,DZ,PYN,CBL,ACP,CPY; **Habitat**: T; **Effect Codes**: POP; **Rejection Code**: LITE EVAL CODED(ALSV),OK(ALL CHEMS),OK TARGET(DZ).


EcoReference No.: 5345
Chemical of Concern: ACR,CBL,ODZ,TBC,DZ,ES,BTC; **Habitat**: A; **Effect Codes**: PHY; **Rejection Code**: NO FOREIGN(ALL CHEMS).


EcoReference No.: 8020
Chemical of Concern: DDT,MP,AZ,CBL; **Habitat**: A; **Effect Codes**: MOR; **Rejection Code**: NO CONTROL,NO ENDPOINT(ALL CHEMS).


EcoReference No.: 16464
Chemical of Concern: CBL,DDT; **Habitat**: T; **Rejection Code**: NOT EcoSSL SPECIES,TARGET(CBL).


EcoReference No.: 37713
Chemical of Concern: DZ,CBL,PRT; **Habitat**: AT; **Effect Codes**: MOR; **Rejection Code**: NO ENDPOINT(ALL CHEMS).


EcoReference No.: 37713
Chemical of Concern: DZ,CBL,PRT; **Habitat**: AT; **Effect Codes**: MOR; **Rejection Code**: NO ENDPOINT(ALL CHEMS).


Chemical of Concern: MCB,ADC,CBL,MDT,AZ,MLN,PHSL,FMA; **Habitat**: T; **Rejection

EcoReference No.: 15989
Chemical of Concern:
AZ,Capta,CBL,CMPH,HCC,HMLN,Naled,SZ,PNB,ACL,WFN,FUR,DPC,RTN,Na3,PCP,
NaPCP,AsAC,ACL,ATZ,Se,Zn,DZ,PYPG;  Habitat: A;  Effect Codes: MOR,BEH;
Rejection Code: NO CONTROL(ALL CHEMS).

Density, and Sex on DDT Bioaccumulation and Toxicity in the Marine Polychaete Neanthes

Chemical of Concern: CBL; Habitat: A; Rejection Code: NO SEDIMENT.

Rhipicephalus appendiculatus to Cholinesterase Inhibiting Acaricides. PANS (Pest

EcoReference No.: 72641
Chemical of Concern: CBL,CY,DZ; Habitat: T; Effect Codes: MOR; Rejection Code:
TARGET(DZ).

432. Lowe, J. I. (1967). Effects of Prolonged Exposure to Sevin on an Estuarine Fish, Leiostomus

EcoReference No.: 629
Chemical of Concern: CBL; Habitat: A; Effect Codes: GRO,MOR; Rejection Code: NO
ENDPOINT(CBL).

Bioactivation of Naphthalene Derivatives in Lens Culture and In Vivo. In: S.Lerman and
R.C.Tripathi (Eds.), Ocular Toxicology, 1st Congr.of the Int.Soc.of Ocular Toxicology, June

EcoReference No.: 83784
Chemical of Concern: NAPH,CBL; Habitat: T; Effect Codes: CEL; Rejection Code: NO
ENDPOINT(NAPH).

434. Lucena, J. J., Hernandez, L. E., Olmos, S., Carpena-Ruiz, R. O., Fragoso, M. A. C., and Van,
contaminated with mercury. <Book> developments in plant and soil sciences; optimization of

Chemical of Concern: CBL; Habitat: T; Rejection Code: No Mixture-Field, Control,
Duration, Cones, Ere,NO MIXTURE,SURVEY.

Photosynthetic Energy Conservation III. Inhibition of Photophosphorylation in Spinach

Chemical of Concern: CBL; Habitat: T; Rejection Code: NO MEDIA, OM, pH,NO IN
VITRO.

EcoReference No.: 75609
Chemical of Concern: BDF,WFN,DFM,CBL; Habitat: T; Effect Codes: MOR; Rejection Code: NO CONTROL,ENDPOINT(DFM).


Chemical of Concern: CBL; Habitat: T; Rejection Code: No Conc.


EcoReference No.: 9125
Chemical of Concern: FML,TOL,AN,CBL,BNZ; Habitat: A; Effect Codes: MOR,BHY; Rejection Code: NO CONTROL(ALLE CHEMS).


EcoReference No.: 5370
Chemical of Concern: DMT,CBL,DZ,MLN; Habitat: A; Effect Codes: MOR; Rejection Code: NO FOREIGN(CBL,DZ,MLN,DMT).


Chemical of Concern: CBL; Habitat: A; Rejection Code: NO SURVEY.


EcoReference No.: 46240
Chemical of Concern: CBL,HCCH; Habitat: T; Rejection Code: NO FOREIGN.


EcoReference No.: 70188
Chemical of Concern: SZ,MTL,PHMD,CBL; Habitat: T; Effect Codes: POP; Rejection Code: NO FOREIGN.


EcoReference No.: 19935
Chemical of Concern: CBL,RTN,24DC,DCB,DDT,3CE,4CE,PL; Habitat: A; Effect Codes:

EcoReference No.: 70542
Chemical of Concern: RSM,DZ,CBL; Habitat: T; Effect Codes: MOR,BEH; Rejection Code: LITE EVAL CODED(RSM),OK(ALL CHEMS),OK TARGET(DZ).


EcoReference No.: 15148
Chemical of Concern: PNB,24DXY,Captan,CBL,DOD,HCC,MLN,NYP,CST,WFN,FUR,Cu,CuS,NaN3,CuCl,PCP,ACL,ATM,Se,DA,AC,Zn,DZ,Pb,DCB,IAA; Habitat: A; Effect Codes: MOR,BEH; Rejection Code: NO CONTROL(ALL CHEMS).


Chemical of Concern: CBL; Habitat: T; Rejection Code: NO IN VITRO.


EcoReference No.: 37794
Chemical of Concern: PCB,DDT,HCC,DLD,CBL,DZ,CHD,MRX,TCDD,DXN; Habitat: T; Effect Codes: BCM; Rejection Code: No Oral (TRV)//NO RESIDUE//NO Endpoint(ALL CHEMS).


Chemical of Concern: CBL,24DXY; Habitat: A; Rejection Code: NO SPECIES,COC(MTL),NO BACTERIA.


Chemical of Concern: CBL; Habitat: T; Rejection Code: NO DURATION,NO SURVEY.


EcoReference No.: 79757
Chemical of Concern: AMTR,SZ,ATZ,CBL; Habitat: A; Rejection Code: NO FOREIGN.

Maine Forest Serv., Dep. of Conservation (1980). Effects of Carbaryl (Sevin) on Brook Trout

EcoReference No.: 16310  
Chemical of Concern: CBL; Habitat: A; Rejection Code: NO REVIEW.


EcoReference No.: 16304  
Chemical of Concern: CBL; Habitat: A; Rejection Code: NO REVIEW.


Chemical of Concern: CBL; Habitat: T; Rejection Code: NO REVIEW, NO REFS CHECKED.


Chemical of Concern: CBL; Habitat: A; Rejection Code: NO REVIEW.


EcoReference No.: 87664  
Chemical of Concern: CBL; Habitat: T; Effect Codes: ACC,PHY; Rejection Code: NO CONTROL, ENDPOINT(CBL).


EcoReference No.: 62600  
Chemical of Concern: 2INEB,DINO,DCF,Cu,ES,MOM,CBL,FNV,PHSL,CYP,DM,DMT,MLN,CPY,MP,FNTH,D DVP,PPHD,FVL,ACP,MIZ,CBD; Habitat: T; Effect Codes: MOR; Rejection Code: OK TARGET(DMT,MLN,FVL,CYP,ACP,CBL).


EcoReference No.: 67219  
Chemical of Concern: TDF,PPHD,DMT,ES,DDVP,FNV,CYP,DM,MP,FNTH,MLN,PHSL,CBL,FVL,CYP,AZD,FS TAI,Captan,Ziram,MIZ,DCO,DINO,Cu,CTN,DCF; Habitat: T; Effect Codes: MOR; Rejection Code: NO CONTROL(ALL CHEMS),TARGET(MLN,CBL).


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4: 123-135 (RUS).

EcoReference No.: 72441
Chemical of Concern: CBL; Habitat: T; Rejection Code: NO FOREIGN.


EcoReference No.: 67982
Chemical of Concern: MOM,CBL,PIRM,FNT,CPY,DCF,FNV,PPX,DZ; Habitat: T; Effect Codes: MOR,ACC; Rejection Code: NO DURATION,ENDPOINT(DZ),NO ENDPOINT(MOM),TARGET(CBL).


EcoReference No.: 35334
Chemical of Concern: CBL,PPX,PIRM,PXY,FNT,CPY,MOM,DCF,DZ; Habitat: T; Effect Codes: MOR; Rejection Code: NO ENDPOINT(DZ,MOM),OK TARGET(PPX,CBL,FNT,CPY,PIRM,DCF,FNV).


EcoReference No.: 10656
Chemical of Concern: CI,TFM,CBL,PMR,ATM,MLN,CuS,RTN,Cu; Habitat: A; Effect Codes: MOR; Rejection Code: NO CONTROL(ALL CHEMS),LITE EVAL CODED(OW-TRV-Cu).


EcoReference No.: 73698
Chemical of Concern: MOM,IMC,LCYT,CYF,DMT,AV,ACP,CBL,CPYM,PSPL; Habitat: T; Effect Codes: MOR; Rejection Code: OK(ALL CHEMS),OK TARGET(ACP,CBL).


Chemical of Concern: TRB,CBL; Habitat: T; Rejection Code: NO SPECIES.


EcoReference No.: 46104
Chemical of Concern: CBL; Habitat: T; Rejection Code: NO FOREIGN.


EcoReference No.: 18576
Chemical of Concern: CBL,Pb; Habitat: A; Effect Codes: BCM; Rejection Code: NO

Chemical of Concern: CBL; Habitat: T; Rejection Code: NO ABSTRACT(CBL).


Chemical of Concern: CBL; Habitat: A; Rejection Code: NO MIXTURE.


EcoReference No.: 72642
Chemical of Concern: PSM,ETN,CBL,CMPH,CPTY,DZ,DCTP; Habitat: T; Effect Codes: MOR; Rejection Code: NO DURATION(ALL CHEMS),NO COC(MTAS).


EcoReference No.: 70421
Chemical of Concern: AND,CHD,DDT,DLD,ES,EN,HPT,TEXP,DZ,CPTY,PRN,CBL,ACL,ATZ,Cu,EDT,SZ,As,AZ,MLN; Habitat: A; Effect Codes: MOR; Rejection Code: NO CONTROL(ALL CHEMS).


EcoReference No.: 20679
Chemical of Concern: EDT,TEXP,CBL,DDT,CPY,EN,CLD; Habitat: A; Rejection Code: NO REVIEW; NO REFS CHECKED.


EcoReference No.: 88040
Chemical of Concern: TDC,CBF,MLN,CBL,CFY; Habitat: T; Effect Codes: MOR; Rejection Code: NO CONTROL(ALL CHEMS,TARGET-CBL,MLN,TDC).


Chemical of Concern: CBL,FZFB; Habitat: T; Rejection Code: NO IN VITRO(ALL CHEMS).


EcoReference No.: 87542
Chemical of Concern: TFN,ACL,TEXP,ES,HPT,MLN,HCCH,AZ,EN,DZ,CBL,Captan,ATZ,PCB,Cl,Hg,Zn,Ni,Pb,Cr,Cu,Cd; Habitat: A; Rejection Code: NO REVIEW.

EcoReference No.: 88394
Chemical of Concern: CBL; Habitat: A; Effect Codes: POP,BCM,PHY; Rejection Code: NO ENDPOINT(CBL).


EcoReference No.: 75296
Chemical of Concern: CYP,FNV,CFB,CBL; Habitat: A; Effect Codes: GRO; Rejection Code: NO ENDPOINT(ALL CHEMS).


EcoReference No.: 6870
Chemical of Concern: SZ,CBL; Habitat: A; Effect Codes: PHY; Rejection Code: NO ENDPOINT(SZ).


EcoReference No.: 46437
Chemical of Concern: DS,PRT,CBL; Habitat: T; Effect Codes: ACC,POP; Rejection Code: NO ENDPOINT(ALL CHEMS),TARGET(CBL).


EcoReference No.: 52174
Chemical of Concern: CBL,DZ,MLN; Habitat: T; Rejection Code: Not Ecossl Species/TARGET(MLN,DZ,CBL).


EcoReference No.: 66427
Chemical of Concern: MTPN,ACR,CPR,FNTL,MLN,TEMP,DFZ,Captan,ATZ,DDT,HCC,CL,PPX,PMR,TXP; Habitat: A; Effect Codes: GRO; Rejection Code: LITE EVAL CODED(ATZ).


EcoReference No.: 69363
Chemical of Concern: DZ,CBL,CPY,MLN; Habitat: T; Effect Codes: POP; Rejection Code: OK TARGET(DZ),OK(ALL CHEMS).


EcoReference No.: 72392
Chemical of Concern: Cu,S,Zn,Nabam,Maneb,MXC,PNB,Captan,CBL;  Habitat: T;  Effect Codes: POP,MOR;  Rejection Code: NO ENDPOINT(CBL).


EcoReference No.: 44272
Chemical of Concern: ES,CBF,SZ,CBL
User Define 2: REPS,WASH,CALF,CORE,SENT;  Habitat: T;  Effect Codes: BCM;  Rejection Code: NO ENDPOINT(ALL CHEMS).


EcoReference No.: 2797
Chemical of Concern: CBL,DZ,HCCh,MLN,PPB,PYN,RTN,ATN,AND,DDT,DDL,MXC,As
Habitat: A;  Effect Codes: MOR;  Rejection Code: NO CONTROL(ALL CHEMS).


EcoReference No.: 28068
Chemical of Concern: CBL;  Habitat: T;  Rejection Code: NO FOREIGN.


EcoReference No.: 70030
Chemical of Concern: MTPN,Cpy,Zineb,Maneb,BMY,CHD,TXP,MOM,CBF,CBL,DZ,TMP,FNTH,RSM;
Habitat: T;  Effect Codes: POP,REP;  Rejection Code: NO ENDPOINT(ALL CHEMS).


Chemical of Concern: CBL;  Habitat: T;  Rejection Code: NO MIXTURE,CONC,SURVEY.


EcoReference No.: 75485
Chemical of Concern: DFT,DFM,CBL;  Habitat: T;  Effect Codes: MOR;  Rejection Code: NO CONTROL,ENDPOINT(ALL CHEMS).


EcoReference No.: 70107
Chemical of Concern: SZ,HCCh,ATZ,PL,DDT,PCP,CBL,24DXY,SXD,IZP,DMB;  Habitat: T;  Rejection Code: NO REVIEW.


Chemical of Concern: CBL; Habitat: T; Rejection Code: NO IN VITRO.


Chemical of Concern: CBL; Habitat: T; Rejection Code: NO DURATION,SURVEY.


EcoReference No.: 8151
Chemical of Concern: PRN,CHD,CBL; Habitat: A; Effect Codes: PHY,GRO; Rejection Code: NO ENDPOINT(ALI CHEMS).


EcoReference No.: 82021
Chemical of Concern: PRB,EMMB,THO,ACT,EFX,TDL,PIM,PHSL,PIRM,DMT,FNTH,MLN,DDVP,ACT,LUF,TCF,CYP,ES,SS,IMC,FV,PMR,CBL,MOM,ALP,FNT,MDT,CPY,FF,DZ,BFT; Habitat: T; Effect Codes: MOR; Rejection Code: TARGET(DZ).


EcoReference No.: 9103
Chemical of Concern: CBL,MLN; Habitat: A; Effect Codes: BEH; Rejection Code: NO ENDPOINT(CBL,MLN).


EcoReference No.: 38043
Chemical of Concern: DCTP,DZ,CBL,PIRM,PPHD,MTM,PRN,PRT,MP,CMPH,MVP,MLN,DMT,DDVP; Habitat: T; Effect Codes: BCM,GRO; Rejection Code: LITE EVAL CODED(DZ,CBL),NO ENDPOINT(DCTP,PIRM,PPHD,MTM,PRN,PRT,MP,CMPH,MVP,MLN,DMT,DDVP).


EcoReference No.: 83781
Chemical of Concern: ADC,DZ,CBL,PRN,CPY,FNTH; Habitat: T; Effect Codes: BEH,PHY; Rejection Code: NO ENDPOINT(ALI CHEMS).

Mostert, M. A., Schoeman, A. S., and Van der Merwe, M. (2002). The Relative Toxicities of
Insecticides to Earthworms of the Pheretima Group (Oligochaeta). *Pest Manag. Sci.* 58: 446-450.

EcoReference No.: 66555
Chemical of Concern: CYF, IMC, CPY, CBL; Habitat: T; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(CYF),OK(IMC,CPY,CBL),NO ENDPOINT(FPN).


Chemical of Concern: CBL; Habitat: T; Rejection Code: NO SPECIES.


EcoReference No.: 5158
Chemical of Concern: ABT, EPRN, HCCH, MP, CBF, FNT, CBL; Habitat: A; Effect Codes: POP; Rejection Code: NO ENDPOINT(ALL CHEMS).


EcoReference No.: 4277
Chemical of Concern: CBL, CPY, FNT; Habitat: A; Effect Codes: POP; Rejection Code: NO ENDPOINT(CBL).


EcoReference No.: 72195
Chemical of Concern: ATZ, CBL; Habitat: T; Rejection Code: NO FOREIGN.


Chemical of Concern:
MCPB, CBL, CPY, DZ, MLN, ACR, ATZ, BFL, BTY, CZE, LNR, MTL, MBZ, PDM, PRO, SZ, TET, TFN; Habitat: A; Rejection Code: NO REVIEW, REFS CHECKED.


Chemical of Concern: MOM, CBF, ADC, CBL, BMY, PPX, TRL; Habitat: T; Rejection Code: NO CONC, NO DURATION.


EcoReference No.: 6587
Chemical of Concern: CBL, DZ, MLN; Habitat: A; Effect Codes: PHY, POP; Rejection
Code: OK(CBL,MLN),NO ENDPOINT(DZ).


Chemical of Concern: DM,LCYT,CYP,FNV,FPP,MP,CPY,PPHD,ES,MLN,FNT,HCCH,FNTH,DMT,CBL; Habitat: A; Rejection Code: NO CONC.


EcoReference No.: 2798
Chemical of Concern: AZ,CBL,CPY,HCCH,MLN,MP; Habitat: A; Effect Codes: MOR; Rejection Code: NO ENDPOINT(AZ),LITE EVAL CODED(CBL).


Chemical of Concern: MTL,ATZ,CBL,DU,MTL,PDM,TDZ; Habitat: T; Rejection Code: NO SPECIES, TOX DATA.


EcoReference No.: 67313
Chemical of Concern: CBL; Habitat: A; Rejection Code: NO REVIEW.


EcoReference No.: 82896
Chemical of Concern: OML,MOM,CBL,PPX,ADC,ES,PAH,PCB,TCDD; Habitat: AT; Rejection Code: NO REVIEW,COC(ASCN).


Chemical of Concern: CBL; Habitat: T; Rejection Code: NO MIXTURE.


EcoReference No.: 63983
Chemical of Concern: MCPP1,DMB,24DXY,MCRA,DMT,CBL,MZB,TDF,PCZ,CQTC,EPH,BMN,PIM; Habitat: T; Effect Codes: REP,MOR,POP; Rejection Code: LITE EVAL CODED(DMT,PCZ,DMB,TDF),NO MIXTURE(MCPP1),OK(44DXY,MCRA,MZB,EPH,BMN,PIM),OK TARGET(CQTC,CBL).

Chemical of Concern: CBL; Habitat: A; Rejection Code: NO SOURCE.


EcoReference No.: 68899
Chemical of Concern: BNZ,CBL,Se,DDT,AND,NH,ATZ,CHD,Cu,DLDE,ES,EN,HPT,HCC,HPRN,PCP,TXP,Zn;
Habitat: A; Rejection Code: NO REVIEW, NO REFS CHECKED.


EcoReference No.: 88822
Chemical of Concern: CBL,PCP; Habitat: T; Effect Codes: MOR,BEH; Rejection Code: NO ENDPOINT(TARGET-CBL).


EcoReference No.: 7874
Chemical of Concern: CBL,PCP; Habitat: A; Effect Codes: MOR; Rejection Code: NO FOREIGN.


EcoReference No.: 7595
Chemical of Concern: CBL,NaPCP; Habitat: A; Effect Codes: MOR; Rejection Code: NO FOREIGN(ALL CHEMS).


EcoReference No.: 10258
Chemical of Concern: 3CE,AC,AMTL,AMTR,AND,As,ATZ,BMC,BS,Captan,CBL,CPA,CPY,CTN,Cu,DBN,DCP A,DRT,DDVP,DLDE,DMB,DMP,DSM,DU,DZ,EDB,EDC,EN,ETC,ES,ETN,Fe,FLAC,FML,FNT,FNH,HCC,Hg,HPT,LNR,MCAP,MCB,MCPP1,MDT,MLN,MOM,MP,MT AS,NALED,Ni,NTCN,OPHP,Ph,Pc,PCB,PCP,PCZ,PDB,PHMD,PHSL,PHT,MPT,PNB,PPX,P PZ,PRN,PSM,PyN,SFL,STREP,SZ,TBC,TFN,TMH,TFX,TP,E,TPH,TPM,TRN,Zn; Habitat: A; Effect Codes: MOR; Rejection Code: NO CONTROL(ALL CHEMS)/ NO RESIDUE.


EcoReference No.: 15570
Chemical of Concern: CBL,DZ,MLN,PSM,NaPCP,ETN,FNT; Habitat: A; Effect Codes:

EcoReference No.: 7119
Chemical of Concern: CBL,DZ,MLN; Habitat: A; Effect Codes: MOR; Rejection Code: NO FOREIGN(ALL CHEMS).


EcoReference No.: 15192
Chemical of Concern: ATZ,Captan,CBL,CTN,DBN,DMB,DMT,DU,DZ,HCC,H,LNR,MLN,MP,PMT,PSM,SZ,24DXY,MCPB,NaPCP,PPZ,ZIRAM,PRN,MP,MLN,ETN,DDT,DDL,MCPA,Zn; Habitat: A; Effect Codes: MOR; Rejection Code: NO FOREIGN(ALL CHEMS).


EcoReference No.: 9158
Chemical of Concern: AMTR,AND,CBL,CTN,CuOH,CuS,CZE,DCF,DDT,DDVP,DEM,DINO,DMT,DOD,DZ,EN,ES,ETN,FNT,Folpet,HCC,MFT,MOM,MP,NPH,PAQT,PCP,PEB,PHMD,PHSL,PPN,PRN,PYN,RTN,TBC,TCF,TDE,TFN,Zineb,Ziram,Zn; Habitat: A; Effect Codes: PHY,GRO; Rejection Code: NO FOREIGN,CONTROL(ALL CHEMS).


EcoReference No.: 89085
Chemical of Concern: MZB,DDVP,CBL,DZ,Captan,MOM,PHSL,AZ,BMY,CAP; Habitat: T; Rejection Code: NO FOREIGN(ALL CHEMS).


Chemical of Concern: CBF,CBL,MXC,PMR; Habitat: T; Rejection Code: NO DURATION(CBF,MXC,PMR-TARGET-CBL).


Chemical of Concern: CBL,CBF; Habitat: T; Rejection Code: NO DURATION(CBF,TARGET-CBL).


EcoReference No.: 79760
Chemical of Concern: EFV,CFB,CY,CBL; Habitat: T; Effect Codes: POP; Rejection Code: OK(ALL CHEMS),OK TARGET(EFV).

EcoReference No.: 79758
Chemical of Concern: CYH, MP, EFV, DMT, CYF, CBL, ACP, CBF, CPY, BFT, MLN; Habitat: T; Effect Codes: POP; Rejection Code: TARGET(EFV, CYF, BFT, ACP, CBL).


EcoReference No.: 79290
Chemical of Concern: TBO, CBF, EFV, MP, CBL, ES; Habitat: T; Effect Codes: POP; Rejection Code: TARGET(EFV).


EcoReference No.: 88851
Chemical of Concern: CBF, CBL; Habitat: T; Effect Codes: POP; Rejection Code: OK(CBF), NO MIXTURE(TARGET-CBL).


EcoReference No.: 79808
Chemical of Concern: TBO, EFV, CBF, CBL; Habitat: T; Effect Codes: POP; Rejection Code: TARGET(EFV).


EcoReference No.: 79807
Chemical of Concern: TBO, EFV, CBF, CBL; Habitat: T; Effect Codes: POP; Rejection Code: TARGET(EFV).


EcoReference No.: 79806
Chemical of Concern: CBF, CBL, MP, CPY, DMT, CYF, MLN, MXC, CYH; Habitat: T; Effect Codes: POP; Rejection Code: TARGET(CYF).


EcoReference No.: 79805
Chemical of Concern: CBF, EFV, ES, CYH, CBL, DMT; Habitat: T; Effect Codes: POP; Rejection Code: TARGET(EFV).

EcoReference No.: 72745
Chemical of Concern: ATZ,CBL,24DXY,PRN; Habitat: A; Effect Codes: PHY,CEL,BCM,BEH; Rejection Code: LITE EVAL CODED(ATZ),OK(ALL CHEMS).


EcoReference No.: 65536
Chemical of Concern: CBL; Habitat: A; Rejection Code: NO ABS,NO ABSTRACT.


EcoReference No.: 70475
Chemical of Concern: PNB,PHTH,TCDD,DXN,TOL,Cd,DDT,Cr,Al,As,Pb,Hg,Mo,Ni,Ag,YVL,PAH,BNZ,HCC H,CBL,AND,CHD,DLD; Habitat: T; Rejection Code: NO REVIEW,NO REFS CHECKED.


EcoReference No.: 77470
Chemical of Concern: DMB,AMTL,ATZ,AZ,CBL,CBF,DDT,DMB,GYP,HCC,HXZ,MLN,MXC,PCZ,SZ,TXP,24 DXY; Habitat: AT; Rejection Code: NO REVIEW.


Chemical of Concern: ADC,CBF,MOM,CBL,PPX; Habitat: T; Rejection Code: NO IN VITRO, DURATION.


Chemical of Concern: PCP,CBL; Habitat: A; Rejection Code: NO IN VITRO.


EcoReference No.: 83771
Chemical of Concern: NAPH,CBL; Habitat: T; Effect Codes: BCM; Rejection Code: NO ENDPOINT(ALL CHEMS).


Chemical of Concern: CBL; Habitat: T; Rejection Code: NO PUBL AS.


EcoReference No.: 344
Chemical of Concern:
4AP,24DXY,ACL,ACP,ACR,Ag,AKTMD,ALSV,APAC,AQS,AsAC,ASCN,ATM,ATN,ATZ,AZ,BBN,BDF,BFT,BMC,BML,BMN,Br2,BrCl,BRSM,BS,BT,CaPS,Captan,CBF,CBL,CFE,CFRE,CLNB,CLP,CMPH, CPC,CPY,CQTC,CrACCTN,CTZ,Cu,CuFRA,CuO,CuOT,CuTE,CuS,CYD,CYF,CYP,CYT,DTB,DCNA,DDAC,DDAC,DFT,DFZ,DIIS,DKGNa,DM,DMB,DMM,DMP,DMT,DOD,DPC,DPDP,DPPI,DPPI,DP2,DS,DS,DU,DZ,DM,EFL,EFS,EFV,EP,FHX,FAME,FMP,FO,Folpet,FPN,FPP,FTN,FVL,GTN,GYP,HCHC,HDZ,HXZ,IALS,IPD,IZP,KAFFD,LMR,MB,MBZ,MCPP,MCPP,MTD,MDFD,MFX,MFZ,UGK,MLN,MLT,MOM,MP,MTA,MTB,MTL,MTM,MTA,NaBr,Naled,Naph,NFZ,NPP,OTN,OXF,OXT,0Y4,PCZ,PCP,FDM,PRM,PTM,PNB,PPB,PPG,PPM,PPZ,PQ,PRT,PRR,PSM,PYN,PYZ,PSM,RTN,RSM,SSM,TDF,TCBT,TCBT,TCMTB,TCMTB,TCMTB,TDF,TDZ,TET,TFN,TFR,TPR,TRB,WFN,ZnP,PRO; Habitat: AT; Effect Codes: MOR,POP,PHY,GRO,REP; Rejection Code: NO EFED (344).


Chemical of Concern: CBL; Habitat: T; Rejection Code: NO TOXICANT.


Chemical of Concern: SZ,CBL,DZ,ES,HCHC,PRN,CQTC,MTAS,MANEB; Habitat: T; Rejection Code: NO DURATION(ALL CHEMS).


EcoReference No.: 74322
Chemical of Concern: ATZ,MTL,DPDP,BMY,CBL; Habitat: T; Effect Codes: REP,MOR; Rejection Code: LITE EVAL CODED(ATZ),OK(MLT,PCP,DPDP),NO ENDPOINT(CBL,BMY).


EcoReference No.: 79800
Chemical of Concern: BFT,MP,CBF,CYF,FNF,CPY,EFV,DZ,CBL,PRM,LCYT; Habitat: T; Effect Codes: POP; Rejection Code: LITE EVAL CODED(BFT,CYF,EFV),OK(ALL CHEMS),OK TARGET(DZ).

EcoReference No.: 13587
Chemical of Concern: CBL; Habitat: A; Effect Codes: POP; Rejection Code: NO ENDPOINT(CBL).


EcoReference No.: 18621
Chemical of Concern: ACR,ATZ,AZ,CBF,CBL,DMT,FMP,HCC,MLT,MOM,MP,Cd,ADC,DDT,MXC,OML,TB C,CuCl,Cr,PPX,Zn,Hg; Habitat: A; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(ATZ,MLT,CBF,ADC,MOM,DMT,CuCl),OK(ALL CHEMS).


EcoReference No.: 78294
Chemical of Concern: ATZ,PRN,DZ,Captan,CBL,MLN,24DXY,TPX,MXC; Habitat: A; Effect Codes: GRO; Rejection Code: NO ENDPOINT(ALL CHEMS).


EcoReference No.: 75575
Chemical of Concern: BDF,WFN,DFM,CBL; Habitat: T; Rejection Code: NO MIXTURE.


EcoReference No.: 88885
Chemical of Concern: DEM,ES,CBL; Habitat: A; Effect Codes: MOR,BCM,PHY; Rejection Code: NO COC(OXD),OK(ES),NO CONTROL(DEM,CBL).


EcoReference No.: 75150
Chemical of Concern: ES,CBL; Habitat: T; Rejection Code: NO MIXTURE,ENDPOINT(ES,CBL).


EcoReference No.: 88808
Chemical of Concern: EPRN,MP,PHSL,CBL,CBF,MLN,DMT,DDVP; Habitat: A; Rejection Code: NO REVIEW(ALL CHEMS).

Chemical of Concern: CBL; Habitat: T; Rejection Code: NO ENDPOINT(CBL).


EcoReference No.: 67585  
Chemical of Concern: HCH,DDE,PCB,DLD,CBL,AND,24D; Habitat: AT; Effect Codes: ACC; Rejection Code: NO MIXTURE,EFFECT,ENDPOINT(ALL CHEMS).


EcoReference No.: 67587  
Chemical of Concern: CBL; Habitat: A; Rejection Code: NO MIXTURE.


Chemical of Concern: CBL,CPY,PMR,PPHD,MLN,ES,HCH,TBA,MZB,ZIRAM,THM,TPM,ACP; Habitat: T; Rejection Code: NO MIXTURE.


EcoReference No.: 87846  
Chemical of Concern: AZ,MCB,MOM,CBL; Habitat: T; Effect Codes: BEH,BCM; Rejection Code: NO IN VITRO(AZ,MOM,CBL),OK(MCB).


Chemical of Concern: CBL,PL; Habitat: A; Rejection Code: NO ABSTRACT(CBL,PL).


EcoReference No.: 5160  
Chemical of Concern: ZN,AZ,CBL,CPY,HCH,HPT,NaPCP,FNT,MLN,Naled,CuS; Habitat: A; Effect Codes: MOR,BEH; Rejection Code: NO ENDPOINT(CuS,NaPCP,AZ,CBL).


EcoReference No.: 53156  
Chemical of Concern: EDT,AND,A1,NH,PAH,Sn,As,ATZ,Ba,BNZ,BZD,Be,Cd,CBL,CTC,CHD,CI,CI2,CPY,Cr,Co,Cu,CN,DDE,DZ,CBZ,CPH,DLD,ES,EN,FA,HPT,HCH,HCCP,Fe,ISO,Pb,Mn,Hg,Mo,NAP H,Ni,NBZ,NP,PCB,PRN,PNB,PCP,PL,Se,Ag,SZ,TCDD,TOL,TXP,V,Zn; Habitat: A; Rejection Code: NO REVIEW,NO REFS CHECKED.

EcoReference No.: 59603
Chemical of Concern: PMR,CBL,DM; Habitat: T; Effect Codes: POP; Rejection Code: NO CONTROL(ALL CHEMS).


Chemical of Concern: CBL; Habitat: A; Rejection Code: ABSTRACT,NO TOX DATA(CBL).


Chemical of Concern: CBL; Habitat: A; Rejection Code: NO ABSTRACT(CBL).


Chemical of Concern: PMR,CYP,AZ,CBL,PYT; Habitat: T; Rejection Code: NO ABSTRACT.


EcoReference No.: 11611
Chemical of Concern: CBL; Habitat: A; Rejection Code: NO FOREIGN(CBL).


EcoReference No.: 38365
Chemical of Concern: CBL; Habitat: T; Effect Codes: ACC; Rejection Code: NO ENDPOINT,NO CONTROL,NO DURATION(CBL).


EcoReference No.: 67606
Chemical of Concern: As,CBL; Habitat: A; Rejection Code: NO SPECIES.


EcoReference No.: 43504
Chemical of Concern: SZ,BMC,CBL,DU,Captan,MLN,TFN,GYP,DCPA,BMY,MANE,MANEB; Habitat: T; Effect Codes: BCM; Rejection Code: NO ENDPOINT(ALL CHEMS).


EcoReference No.: 77472
Chemical of Concern: DMB,24DXY,PCZ,DZ,FRM,TDF,CYP,PDM,CTN,BMY,CBL,BDC,EP; Habitat: T; Rejection Code: NO REVIEW.


EcoReference No.: 63915
Chemical of Concern: MOM,PFF,CBF,AZ,PSM,EPRN,MLN,Naled,FNT,CPY,ACP,MTM,MDT,CBL,CYP; Habitat: T; Effect Codes: POP,MOR,GRO; Rejection Code: NO CONTROL(MOM,CBF,CYP).


EcoReference No.: 7625
Chemical of Concern: SZ,ATZ,CBL,LNR,DLD,AND,Hg,Pb,PCB,Cu,S,Zn; Habitat: A; Effect Codes: POP; Rejection Code: LITE EVAL CODED(ATZ,SZ,Cu,S),OK(ALL CHEMS).


EcoReference No.: 84915
Chemical of Concern: DZ,CBL,CBF,ADC; Habitat: T; Effect Codes: GRO; Rejection Code: NO ENDPOINT(DZ).


EcoReference No.: 84915
Chemical of Concern: PPHD,DCTP,CBL,PRN,MP,PSM,DZ,CBL,CBF,ADC,MTM; Habitat: T; Effect Codes: GRO; Rejection Code: NO ENDPOINT(ALL CHEMS).


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EcoReference No.: 87661
Chemical of Concern: CBL; Habitat: T; Rejection Code: NO FOREIGN(CBL).


Chemical of Concern: CBL; Habitat: A; Rejection Code: NO TOXICANT.


EcoReference No.: 57361
Chemical of Concern: CBL; Habitat: A; Rejection Code: NO REVIEW.


EcoReference No.: 78524
Chemical of Concern: Cr,Zn,Cd,Se,CBL; Habitat: A; Effect Codes: ACC,PHY; Rejection Code: NO ENDPOINT,CONTROL(ALL CHEMS).


EcoReference No.: 67306
Chemical of Concern: DDT,HCCH,ES,MP,MLN,CBL; Habitat: A; Effect Codes: PHY; Rejection Code: NO ENDPOINT(ALL CHEMS).


EcoReference No.: 88806
Chemical of Concern: CBL,HCCH; Habitat: T; Effect Codes: BCM; Rejection Code: NO ENDPOINT(CBL,HCCH).


EcoReference No.: 10569
Chemical of Concern: DMT,ES,MP,DDT,CBL,HCCH; Habitat: A; Effect Codes: PHY; Rejection Code: NO ENDPOINT(ALL CHEMS).


EcoReference No.: 60086
Chemical of Concern: ES,MLN,CBL; Habitat: A; Effect Codes: BEH,GRO; Rejection Code: NO ENDPOINT(CBL,MLN,ES).


EcoReference No.: 88971
Chemical of Concern: ES,MLN,CBL; Habitat: A; Effect Codes: BEH,PHY; Rejection Code: NO ENDPOINT(ES,MLN,CBL).


EcoReference No.: 7249
Chemical of Concern: CBL,HPT,PHSL; Habitat: A; Effect Codes: BEH,MOR; Rejection Code: NO CONTROL(ALL CHEMS).


EcoReference No.: 89072
Chemical of Concern: MLO,MLN,CBL,PRN; Habitat: T; Effect Codes: BCM,PHY; Rejection Code: NO ENDPOINT(ALL CHEMS),NO CONTROL,IN VITRO(MLO,CBL,PRN),MIXTURE(MLN).


Chemical of Concern: CBL; Habitat: A; Rejection Code: NO PUBL AS.


EcoReference No.: 14039
Chemical of Concern: CBL; Habitat: A; Effect Codes: GRO,BEH; Rejection Code: NO ENDPOINT.


EcoReference No.: 17071
Chemical of Concern: CBL; Habitat: A; Rejection Code: NO ABSTRACT.


EcoReference No.: 10519
Chemical of Concern: HCCH,CBL,MLN; Habitat: A; Rejection Code: NO DURATION.


EcoReference No.: 6369
Chemical of Concern: CBL; Habitat: A; Effect Codes: MOR; Rejection Code: NO ENDPOINT(CBL).

of Rodent and Human Erythrocyte Acetylcholinesterase by Carbofuran and Carbaryl. 

Chemical of Concern: CBF,CBL; Habitat: T; Rejection Code: NO IN 
VITRO,DURATION,HUMAN HEALTH.


EcoReference No.: 72313 
Chemical of Concern: CBL,CBY,DZ,HCC,DRT; Habitat: T; Effect Codes: MOR; 
Rejection Code: TARGET(DZ).

*Pesticides* 23: 32F-32I.

Chemical of Concern: 
SZ,AND,CHL,CBL,CBP,DZ,EN,HPT,ATZ,MOM,ADF,CBF,DMT,DMB,ATN; Habitat: T; 
Rejection Code: NO TOX DATA.


EcoReference No.: 14969 
Chemical of Concern: 
CBL,DMT,HCC,MLN,MP,DDT,PRN,DLD,DDV,SMT,AND,PH,OXD; Habitat: A; 
Effect Codes: MOR; Rejection Code: NO CONTROL(ALL CHEMS).


EcoReference No.: 88826 
Chemical of Concern: DZ,CBL,FPP; Habitat: T; Effect Codes: MOR; Rejection Code: NO 
ENDPOINT(DZ,CBL,FPP).


Chemical of Concern: CBL; Habitat: A; Rejection Code: NO DURATION.

597. Rennison, B. D. and Hadler, M. R. (1975). Field Trials of Difenacoum Against Warfarin- 

EcoReference No.: 86459 
Chemical of Concern: WFN,DFM,CBL; Habitat: T; Effect Codes: MOR; Rejection Code: 
NO CONTROL,ENDPOINT(DFM).

598. Rettich, F. (1980). Residual Toxicity of Wall-Sprayed Organophosphates, Carbamates and 
Pyrethroids to Mosquito Culex piiiens molestus Forskal. 

EcoReference No.: 70015 
Chemical of Concern: RSM,SZ,CBP,CBL,PMR,DMT; Habitat: T; Effect Codes: MOR; 
Rejection Code: NO ENDPOINT,CONTROL(ALL CHEMS),TARGET(CBL).

599. Rettich, F. (1977). The Susceptibility of Mosquito Larvae to Eighteen Insecticides in

EcoReference No.: 2914
Chemical of Concern: DLD,TCF,MXC,HCCH,MLN,CBL,DZ,CPY,DDT,FNTH,DDVP,PPX,FNT,TMP; Habitat: A; Effect Codes: MOR; Rejection Code: NO CONTROL(ALL CHEMS).


EcoReference No.: 53614
Chemical of Concern: ACP,CBL; Habitat: T; Effect Codes: MOR,BEH,PHY,POP; Rejection Code: NO ENDPOINT(ACP).


EcoReference No.: 40531
Chemical of Concern: DU,FNV,ES,FNF,FML,NCTN,CBD,MLN,PRN,Captan,TPM,PPB,DCTP,ACP,BMY,MBZ,P AQ,T,BNZ,CH3I,TFN,NaN03,AZ,24DXY,NP,Cd,Fb,CuS,DDT,PAH,IMD,DDM,CYP,PMR, CBF,ADC,MOM,CBL,PPX,CY,NHN,CTC; Habitat: T; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(ACP,CBL,NCTN,CBF,MOM,PPB,CuS,CYP),OK(ALL CHEMS).


EcoReference No.: 6291
Chemical of Concern: CBL,ES,ETHN; Habitat: A; Effect Codes: MOR,PHY; Rejection Code: NO ENDPOINT(ALL CHEMS).


Chemical of Concern: TRL,HCCH,DLD,DDT,AND,Folpet,PQT,DQTBr,CBL,Maneb,THM,ZINEB,ZIRAM,Captan ; Habitat: T; Rejection Code: NO IN VITRO.


EcoReference No.: 71723
Chemical of Concern: ATZ,CBL,ES; Habitat: A; Effect Codes: BEH,MOR,GRO; Rejection Code: LITE EVAL CODED(ATZ),OK(ALL CHEMS).


EcoReference No.: 86458
Chemical of Concern: DFM,BDF,CBL;  Habitat: T;  Effect Codes: MOR,GRO,BEH,PHY; Rejection Code: NO CONTROL(ALL CHEMS).


EcoReference No.: 30419
Chemical of Concern: CBL;  Habitat: AT;  Rejection Code: NO ENGLISH(ALL CHEMS).


EcoReference No.: 88726
Chemical of Concern: EFV,CYF,PMR,MTM,CYP,MOM,ES,CBL,MLN,DZ,MP,AZ,FVL,MVP,DMT,MXC,OXD, Naled;  Habitat: T;  Effect Codes: POP;  Rejection Code: OK TARGET(ALL CHEMS).


Chemical of Concern: CBL;  Habitat: T;  Rejection Code: NO TOXICANT.


EcoReference No.: 71476
Chemical of Concern: CBL,DLD,EN,HCCH,DDT,AND,PRN,TXP,DZ;  Habitat: T;  Effect Codes: POP,MOR;  Rejection Code: TARGET(DZ).


EcoReference No.: 13285
Chemical of Concern: HCCH,MLN,ES,CBL;  Habitat: A;  Effect Codes: ACC;  Rejection Code: NO ENDPOINT(ALL CHEMS).


EcoReference No.: 14725
Chemical of Concern: CBF,CBL,DMT,ES;  Habitat: A;  Effect Codes: POP;  Rejection Code: NO ENDPOINT(ALL CHEMS).


EcoReference No.: 72298
Chemical of Concern: SZ,ACL,CBL;  Habitat: T;  Effect Codes: REP;  Rejection Code: NO ENDPOINT(TARGET-SZ,TARGET-ACL,CBL).


EcoReference No.: 72330
Chemical of Concern: SZ,ACL,CBL;  Habitat: T;  Effect Codes: REP;  Rejection Code: NO
ENDPOINT(TARGET-SZ,TARGET-ACL,CBL).


Chemical of Concern: 24D,24DC,CBL; Habitat: T; Rejection Code: NO TOX DATA.


Chemical of Concern: DDT,CBL,MLN,Captan; Habitat: T; Rejection Code: NO ENDPOINT(DDT,Captan,TARGET-CBL,MLN).


EcoReference No.: 40117
Chemical of Concern: CBL; Habitat: T; Effect Codes: MOR,BCM; Rejection Code: NO CONTROL(CBL).


EcoReference No.: 63490
Chemical of Concern: SZ,ATZ,DU,HFP,MCPP1,PYD,FXP,BT,MTL,PDM,CBL,MTSM,AMTL,CQTC,DPP1; Habitat: T; Effect Codes: MOR,REP,GRO; Rejection Code: LITE EVAL CODED(MTL,SZ,ATZ,CQTC),NO MIXTURE(MCPP1,DPP1),TARGET(CBL).


EcoReference No.: 88444
Chemical of Concern: CBL,MPN,PSM,PRN,MLN,DZ; Habitat: A; Rejection Code: NO REVIEW(CBL,MPN,PSM,PRN,MLN,DZ).


EcoReference No.: 888
Chemical of Concern: 24DXY,CBL,DBN,DU,DZ,HCH,MLN,Naled,CYT,PYN,TFN,RTN,As; Habitat: A; Effect Codes: PHY; Rejection Code: NO CONTROL(ALL CHEMS).


EcoReference No.: 15574
Chemical of Concern: MOM,CBL,TFN,ACP; Habitat: A; Effect Codes: MOR; Rejection Code: NO PUBL AS(MOM),NO CONTROL(ALL CHEMS).

621. Sangha, G. K. (1971). Environmental Effects of Carbamate Insecticides as Assayed in the

Chemical of Concern: DDT,PPX,CBL,CFD,ADC; Habitat: A; Rejection Code: NO ABSTRACT.


Chemical of Concern: CBL; Habitat: T; Rejection Code: NO IN VITRO.


EcoReference No.: 80752
Chemical of Concern: PTR,FNT,CBL; Habitat: T; Effect Codes: BCM; Rejection Code: NO ENDPOINT(ALL CHEMS).


Chemical of Concern:
ADC,TBC,CBL,MOM,ABT,PRN,ACP,PRT,PPHD,FNF,DZ,ETN,FTH,TCF,AZ,PHSL,MLN,MP,Naled,DMT,DS,CPY; Habitat: T; Rejection Code: NO IN VITRO.


EcoReference No.: 9686
Chemical of Concern: EN,CBL; Habitat: A; Effect Codes: MOR,PHY,BEH; Rejection Code: NO CONTROL(ALL CHEMS).


EcoReference No.: 15242
Chemical of Concern: CBL; Habitat: A; Effect Codes: ACC; Rejection Code: NO ENDPOINT(CBL).


EcoReference No.: 15243
Chemical of Concern: CBL; Habitat: A; Effect Codes: ACC; Rejection Code: NO ENDPOINT(CBL).


EcoReference No.: 88470
Chemical of Concern: Cd,Zn,CuCl,Pb,MLN,CBL,PRN,PHSL; Habitat: AT; Effect Codes: BCM; Rejection Code: NO ENDPOINT,CONTROL(ALL CHEMS).

EcoReference No.: 38655
Chemical of Concern: Ziram,AN,BZO,BZC,Captan,THM,ZINEB,CYT,SFL,MAL,MRX,ACL,MLN,ABT,CBZ,MC B,CBL,CMPH,HCCH,EN,AND,ES,NP,TCF,CPY,DDVP,PPHD,DCTP,PS,PRT,DMT,AS,P SM,ETN,DEM,DZ,FNTH,MP,NCTN; Habitat: T; Effect Codes: MOR; Rejection Code: NO CONTROL(ALL CHEMS),NO COC(4AP).


EcoReference No.: 35426
Chemical of Concern: ADC,CST,MOM,CPC,ZnP,DOD,MLN,Cu,AQS,CuCO,RSM,ACL,4AP,DZ,As,IAA,CBL; Habitat: T; Effect Codes: MOR; Rejection Code: NO CONTROL(ALL CHEMS).


EcoReference No.: 38656
Chemical of Concern: RSM,TBT,CBL,EN,PAH,ACL,PL,ES,AND,DZ,CPY,Sb,Pb,Zn,Cu,Tl,DLD,HCCH,APAC,4 AP; Habitat: T; Effect Codes: MOR; Rejection Code: NO CONTROL(ALL CHEMS).


EcoReference No.: 38656
Chemical of Concern: RSM,TBT,CBL,EN,PAH,ACL,PL,ES,AND,DZ,CPY,Sb,Pb,Zn,Cu,Tl,DLD,HCCH,APAC,4 AP; Habitat: T; Effect Codes: MOR; Rejection Code: NO CONTROL(ALL CHEMS).


EcoReference No.: 53945
Chemical of Concern: CBL; Habitat: A; Rejection Code: NO TOX DATA.


EcoReference No.: 74836
Chemical of Concern: CBF,PYT,MTM,ACP,CPY,DEM,MLN,CBL,FNV,PAQT,GYP; Habitat: T; Effect Codes: PHY; Rejection Code: NO ENDPOINT(ALL CHEMS).


EcoReference No.: 88676  
Chemical of Concern:  
Du,BMY,ANTV,ACP,ADC,CBL,CBF,DMT,Maneb,ETU,FMU,MOM,PPX; **Habitat:** T;  
**Effect Codes:** CEL,PHY; **Rejection Code:** OK(ALLE CHEMS),NO COC(MTAS).


EcoReference No.: 69496  
Chemical of Concern: CBL; **Habitat:** T; **Rejection Code:** NO FOREIGN.


EcoReference No.: 71074  
Chemical of Concern: DDT,EN,CBL,ES,DZ,TXP,HPT,MLN; **Habitat:** T; **Effect Codes:** POP; **Rejection Code:** OK(ALLE CHEMS),OK TARGET(DZ,MLN).


EcoReference No.: 6775  
Chemical of Concern: CBL,HCH; **Habitat:** A; **Rejection Code:** NO FOREIGN(HCCH,CBL).


EcoReference No.: 7254  
Chemical of Concern: CBL,HCH; **Habitat:** A; **Effect Codes:** GRO,REP; **Rejection Code:** NO FOREIGN(CBL,HCH).


EcoReference No.: 84377  
Chemical of Concern: NCTN,ATZ,CAPTAN,CBL,CBF,CPY,DSMA,FOLPET,MSMA,PRN,PCB,PMR; **Habitat:** T; **Effect Codes:** ACC; **Rejection Code:** NO CONTROL(ALLE CHEMS).


EcoReference No.: 88947  
Chemical of Concern: MLN,PMR,PRN,MOM,CBL,DDT,DLD,NCTN,CPY,CBF; **Habitat:** T; **Effect Codes:** ACC; **Rejection Code:** NO CONTROL(ALLE CHEMS).

EcoReference No.: 6867
Chemical of Concern: ABT,CBL,DDT,HCC; Habitat: A; Effect Codes: MOR; Rejection Code: NO CONTROL(ALL CHEMS).


EcoReference No.: 70597
Chemical of Concern: PNB,DDT,HCC,DZ,CHD,DL,DLD,END,HPT,TPX,PRN,CBL,AND,CTC,DBAC,MANE; Habitat: T; Rejection Code: NO REVIEW,NO REFS CHECKED.


Chemical of Concern: MVP,CBF,CBL,DZ,HCC,PRN,CY,DDT,DLD,EN,ETN; Habitat: AT; Rejection Code: NO FATE.


Chemical of Concern: CBF,MVP,CBL,DZ,CY,EN,ETN,PRN,DDT,HCC; Habitat: A; Rejection Code: NO FATE,NO TOX DATA.


EcoReference No.: 72637
Chemical of Concern: PRN,DZ,CBL,HCC,TPX,CY; Habitat: T; Effect Codes: MOR; Rejection Code: TARGET(DZ).


EcoReference No.: 72320
Chemical of Concern: CBL,DZ; Habitat: T; Effect Codes: MOR; Rejection Code: TARGET(DZ).


Chemical of Concern: CBL; Habitat: A; Rejection Code: NO IN VITRO.


EcoReference No.: 7170
Chemical of Concern: CBL,HCC; Habitat: A; Rejection Code: NO

Chemical of Concern: PCP,PL,CBL; *Habitat: T; Rejection Code: NO IN VITRO.*


Chemical of Concern: PNB,CAPTAN,Cu,Hg,CBL; *Habitat: T; Rejection Code: NO TOX DATA.*


Chemical of Concern: CBL; *Habitat: A; Rejection Code: NO REVIEW(ALL CHEMS).*


EcoReference No.: 8982
Chemical of Concern: CBL; *Habitat: A; Effect Codes: POP,PHY; Rejection Code: NO ENDPOINT(CBL).*


EcoReference No.: 8713
Chemical of Concern: DDT,DLD,CBL,MXC; *Habitat: A; Effect Codes: ACC,POP,PHY; Rejection Code: NO ENDPOINT(ALL CHEMS).*


EcoReference No.: 87631
Chemical of Concern: CYP,FNV,PMR,FYT,DM,FVL,PHSL,ES,DTT,FNT,CBL,ACP; *Habitat: T; Effect Codes: POP,GRO,PHY; Rejection Code: OK(ALL CHEMS),OK TARGET(ACP).*


EcoReference No.: 75555
Chemical of Concern: CPY,CBL,ACP,ES,DM,DMT,PPHD,FNV,CYP; *Habitat: T; Rejection Code: NO MIXTURE(ALL CHEMS),TARGET(CBL).*


Chemical of Concern: CBL; *Habitat: A; Rejection Code: NO MODELING(CBL).*

EcoReference No.: 83309
Chemical of Concern: DM,NSM,ADC,CBL,PRT,CYP,PMR,FNV; Habitat: A; Rejection Code: NO REVIEW,COC(SCA).


Chemical of Concern: CBL; Habitat: T; Rejection Code: NO IN VITRO.


EcoReference No.: 78641
Chemical of Concern: NaN3,CBL; Habitat: A; Effect Codes: BCM,PHY; Rejection Code: NO ENDPOINT(ALL CHEMS).


EcoReference No.: 73111
Chemical of Concern: CBL; Habitat: T; Effect Codes: BEH; Rejection Code: NO ENDPOINT(CBL).


EcoReference No.: 60139
Chemical of Concern: ES,CBL; Habitat: A; Effect Codes: CEL; Rejection Code: NO ENDPOINT(ES,CBL).


EcoReference No.: 70474
Chemical of Concern: SZ,PNB,ATZ,PCP,DDT,AND,DLD,HPT,EN,CHD,ES,DZ,PRN,CBL,FRN,MLT,ADC,CBF,CLNB; Habitat: T; Rejection Code: NO REVIEW,NO REFS CHECKED.


EcoReference No.: 79178
Chemical of Concern: CYP,CBL; Habitat: T; Effect Codes: BCM; Rejection Code: NO MIXTURE(CBL),OK(CYP).

and Malathion to Freshwater Teleosts, Channa punctatus (Bloch) and Heteropneustes fossilis (Bloch). *Toxicol.Lett.* 20: 271-276.

EcoReference No.: 11346
Chemical of Concern: CBL,MLN; Habitat: A; Effect Codes: MOR; Rejection Code: NO CONTROL(CBL,MLN).


Chemical of Concern: CBL,ES,MLN; Habitat: A; Rejection Code: NO ABSTRACT.


Chemical of Concern: CBL,ES,MLN; Habitat: A; Rejection Code: NO ABSTRACT.


Chemical of Concern: DDT,DLD,CBL,PRN; Habitat: T; Rejection Code: NO IN VITRO.


EcoReference No.: 38808
Chemical of Concern: CBL; Habitat: T; Effect Codes: BEH,MOR,PHY; Rejection Code: NO CONTROL,ENDPOINT(CBL).


EcoReference No.: 72685
Chemical of Concern: CBL; Habitat: T; Effect Codes: REP,GRO; Rejection Code: NO ENDPOINT(CBL).


EcoReference No.: 38810
Chemical of Concern: CBL; Habitat: T; Effect Codes: BEH,PHY,MOR,CEL; Rejection Code: NO ENDPOINT(CBL).


Chemical of Concern: CBL; Habitat: T; Rejection Code: NO TOXICANT.


EcoReference No.: 2941
Chemical of Concern: DDT,PRN,CBL,MLN; Habitat: A; Effect Codes: GRO,CEL,MOR; Rejection Code: NO ENDPOINT(ALL CHEMS).

EcoReference No.: 35454
Chemical of Concern: MLN,MP,CBL,DZ,MVP,24DX,PRN,ATZ,CFB; Habitat: T; Effect Codes: MOR; Rejection Code: NO ENDPOINT(ALL CHEMS,TARGET-MLN),NO MIXTURE(ATZ).


EcoReference No.: 14837
Chemical of Concern: CBL; Habitat: A; Rejection Code: NO FOREIGN.


EcoReference No.: 54385
Chemical of Concern: CBL; Habitat: T; Rejection Code: No Ecossl Chem,TARGET(CBL).


EcoReference No.: 44403
Chemical of Concern: DDT,CBL; Habitat: T; Effect Codes: POP; Rejection Code: NO OM,NO ENDPOINT(CBL).


EcoReference No.: 87547
Chemical of Concern: Ba,Cd,CBL,DDT,ATN,AND,CTC,CF,3CE,PCB,Mn,Co,Pb,Hg; Habitat: AT; Rejection Code: NO REVIEW(ALL CHEMS).


EcoReference No.: 77569
Chemical of Concern: CaPS,FNTH,AZ,DMT,PRN,DEM,ES,CBL,DDT,DLD; Habitat: T; Effect Codes: MOR; Rejection Code: NO CONTROL(ALL CHEMS),MIXTURE(PR,N,DMT,ES,AZ,FNTH).


EcoReference No.: 2251
Chemical of Concern: 24DX,Y,CBL,DU,DZ; Habitat: A; Effect Codes: PHY; Rejection Code: NO ENDPOINT(DZ),LITE EVAL CODED(CBL).


EcoReference No.: 65949
Chemical of Concern: CBL; Habitat: A; Rejection Code: NO SPECIES.

EcoReference No.: 5550
Chemical of Concern: 24DXY,CBL,RTN,DLD,PCP; Habitat: A; Effect Codes: MOR; Rejection Code: NO CONTROL(ALL CHEMS).


EcoReference No.: 6058
Chemical of Concern: DLD,CBL,RTN,PCP; Habitat: A; Effect Codes: MOR,ACC,BCM; Rejection Code: NO ABSTRACT(ALL CHEMS).


Chemical of Concern: CBL; Habitat: A; Rejection Code: NO METABOLISM,NO CONC,NO SURVEY.


EcoReference No.: 17422
Chemical of Concern: NAPH,CBL; Habitat: A; Effect Codes: MOR,GRO; Rejection Code: NO ENDPOINT(NAPH,CBL).


EcoReference No.: 74718
Chemical of Concern: CBL; Habitat: T; Effect Codes: POP,BCM,BEH,PHY; Rejection Code: NO ENDPOINT,CONTROL(CBL),NO COC(MTM,CFM,ADC).


Chemical of Concern: CBL; Habitat: T; Effect Codes: BCM,MOR; Rejection Code: NO MIXTURE.


Chemical of Concern: TDF,Captan,CPY,AZ,DOD,CBL,FUZ; Habitat: T; Rejection Code: NO MIXTURE.


EcoReference No.: 38931
Chemical of Concern: RSM,CBL,CHD,CPY,DDT,DZ,DLD,EN,HCCCH,DMB,DZM; Habitat: T; Effect Codes: MOR; Rejection Code: NO CONTROL(ALL CHEMS,TARGET-DZ,CBL).


EcoReference No.: 5197
Chemical of Concern: PMR,MXC,CYP,DZ,CBL; Habitat: A; Effect Codes: MOR; Rejection Code: OK(PMR),NO CONTROL,ENDPOINT(DZ,MXC,CYP,CBL).


EcoReference No.: 11480
Chemical of Concern: DDT,HPT,CPY,MLN,TMP,CBL,MOM,PPX,PMR,RSM; Habitat: A; Effect Codes: MOR,GRO; Rejection Code: NO ENDPOINT(ALL CHEMS).


Chemical of Concern: CBL; Habitat: A; Rejection Code: NO SURVEY.


EcoReference No.: 87751
Chemical of Concern: CBL; Habitat: T; Effect Codes: MOR; Rejection Code: NO CONTROL(CBL).


EcoReference No.: 12850
Chemical of Concern: CBL; Habitat: AT; Effect Codes: ACC,GRO; Rejection Code: NO ENDPOINT(CBL).


EcoReference No.: 18147
Chemical of Concern: CBL; Habitat: A; Effect Codes: MOR; Rejection Code: NO CONTROL(CBL).


EcoReference No.: 69740
Chemical of Concern: CBL,AND,PBO,DEF,RTN,TMP; Habitat: A; Effect Codes: MOR,BCM; Rejection Code: NO MIXTURE(PBO,DEF),NO CONTROL(AND,CBL,RTN,TMP).

Chemical of Concern: CBL; Habitat: T; Rejection Code: NO BACTERIA(CBL).


EcoReference No.: 67347
Chemical of Concern: CBL; Habitat: T; Rejection Code: NO FOREIGN.


EcoReference No.: 69529
Chemical of Concern: PCP,DDT,DD,D,EN,HTP,TPX,CBL,NAPH,PAH,PL,ATZ,TBT,NH,Cd,Cu,Hg,Zn; Habitat: A; Rejection Code: NO REVIEW.


EcoReference No.: 58201
Chemical of Concern: CBL; Habitat: T; Rejection Code: NO FOREIGN.


EcoReference No.: 15244
Chemical of Concern: CBL; Habitat: A; Effect Codes: POP,MOR; Rejection Code: NO ENDPOINT(CBL).


Chemical of Concern: CBL; Habitat: T; Rejection Code: NO IN VITRO.


EcoReference No.: 70610
Chemical of Concern: CBL,ATZ,PPZ; Habitat: T; Rejection Code: NO REVIEW.


EcoReference No.: 17548
Chemical of Concern: CBL,MLN,BHC; Habitat: A; Effect Codes: MOR; Rejection Code: NO CONTROL(ALL CHEMS).

EcoReference No.: 62502
Chemical of Concern: DDT, DLD, CBL, PRN, TPE; Habitat: T; Effect Codes: GRO, BCM; Rejection Code: OK Coded ISSI (DLD); Coded CCK (DDT), NO ENDPOINT (CBL).


EcoReference No.: 39097
Chemical of Concern: CBL; Habitat: T; Effect Codes: ACC, GRO; Rejection Code: NO ENDPOINT (CBL).


EcoReference No.: 74733
Chemical of Concern: TBT, CBL, ADC, CBF; Habitat: T; Rejection Code: NO REVIEW.


EcoReference No.: 40474
Chemical of Concern: CBL, HCC, AND, AZ, DDT, DLD, MOM, EN, PRN, MP, DS, CBF, DZ, CPY, CHD, PRT, FNT, AD C, FNF, HPT; Habitat: T; Effect Codes: MOR; Rejection Code: NO ENDPOINT (ALL CHEMS).


EcoReference No.: 831
Chemical of Concern: CBL; Habitat: A; Effect Codes: MOR; Rejection Code: NO ABSTRACT (CBL).


EcoReference No.: 60161
Chemical of Concern: CBL; Habitat: A; Rejection Code: NO FOREIGN.

717. Tizio, R., Trippi, V. S., Trione, S. O., and Almelaons, G. (1961). Studies on Rooting in Grapevine Cuttings. IV. Action of 2,4-D, 2,4,5-T, NAA and IAA, Alone or in Combination and with or Without Addition of Sucrose, on Rooting Capacity (Estudios Sobre Enraizamiento en vid. IV. Efecto de los Acidos 2,4-Diclorofenoxiacético, 2,4,5-Triclorofenoxiacético, Naftalenacetico e indol-3-acetico y Combinaciones de los Mismos y con Sacarosa, Sobre la Capacidad de Enraizamiento). *Phyton (B.Aires) 17:* 15-19.


EcoReference No.: 16301
Chemical of Concern: CBL; Habitat: A; Rejection Code: NO PUBL AS.


EcoReference No.: 6666
Chemical of Concern: 24DC, AND, DDT, CBL; Habitat: A; Effect Codes: ACC; Rejection Code: NO FOREIGN (AND, DDT, 24DC, CBL).


EcoReference No.: 12497
Chemical of Concern: Captan, CBL, DZ, HCCH, CuS, CuCl, CrA, NaLS, CdCl, AgN, PL, BNZ, PbN, PbAc, FML, AND, 3C, CF, MnCl, ZnCl2, DDT, FeCl3, CrO3, HgCl2, PRN, CTC, Sc, Zn, C8OH; Habitat: A; Effect Codes: MOR; Rejection Code: NO FOREIGN (ALL CHEMS).


EcoReference No.: 75521
Chemical of Concern: BDF, CPy, PMR, CBL; Habitat: T; Rejection Code: NO REVIEW.


EcoReference No.: 87657
Chemical of Concern: CBL; Habitat: T; Rejection Code: NO FOREIGN (CBL).


EcoReference No.: 75195
Chemical of Concern: ACL, HOX, 4AP, FML, EGY, CBL, TEG, BMN; Habitat: AT; Effect Codes: MOR, GRO, BEH, BCM, CEL; Rejection Code: OK (CBL, HOX, FML, EGY, TEG, BMN), NO COC (ADC, CBF, MTAS), NO CONTROL (ACL, 4AP).


EcoReference No.: 88595
Chemical of Concern: CBL, ADC; Habitat: T; Effect Codes: MOR; Rejection Code: NO CONTROL (ADC, CBL), NO INHALE (ADC).


EcoReference No.: 74980
Chemical of Concern: CBF, CBL; Habitat: A; Effect Codes: MOR, CEL; Rejection Code: NO CONTROL, ENDPOINT (ALL CHEMS).

EcoReference No.: 11856
Chemical of Concern: ACR,BTC,CBL; Habitat: A; Effect Codes: POP,CEL; Rejection Code: NO ENDPOINT(ALL CHEMS).


EcoReference No.: 79821
Chemical of Concern: DQT,CPP,MAL,MCPA,THM,TPE,BMY,CBL,DZM,MOM,PRT,ACR,PQT,PRN; Habitat: T; Effect Codes: MOR; Rejection Code: OK(MOM,CBL,PRT,ACR,PQT),NO ENDPOINT(DZM).


Chemical of Concern: CBF,CBL,BMY,CBD; Habitat: T; Rejection Code: NO REVIEW.


EcoReference No.: 6726
Chemical of Concern: Captan,EPN,CD,SZ CI2,CBL,MLN; Habitat: A; Effect Codes: BEH,MOR; Rejection Code: NO CONTROL(ALL CHEMS).


EcoReference No.: 55198
Chemical of Concern: CBL,DZ,MLN,NCTN; Habitat: T; Rejection Code: Not Ecossl Species/TARGET(MLN,DZ,NCTN,CBL).


Chemical of Concern: ES,CBL; Habitat: T; Rejection Code: NO TOX DATA.


EcoReference No.: 7708
Chemical of Concern: DEM,CBL,CHD; Habitat: A; Effect Codes: ACC; Rejection Code: NO CONTROL,ENDPOINT(ALL CHEMS).


EcoReference No.: 67523


Chemical of Concern: EPRN, CHD, CBL; Habit: A; Effect Codes: ACC, BCM; Rejection Code: NO CONTROL, ENDPOINT (ALL CHEMS).

Chemical of Concern: ATZ, CBL, SZ, PCP, Cu2O, Cd; Habit: A; Effect Codes: PHY, POP; Rejection Code: LITE EVAL CODED (ATZ, SZ, PCP, Cu2O), OK (ALL CHEMS).

Chemical of Concern: TXP, MRX, AND, CBL, DLD, DDT, MP, MLN; Habit: A; Effect Codes: POP, PHY; Rejection Code: NO ENDPOINT (ALL CHEMS).

Chemical of Concern: CBL, PCB; Habit: T; Rejection Code: NO ABSTRACT.

Chemical of Concern: PRT, CBL; Habit: T; Rejection Code: NO IN VITRO.

Chemical of Concern: ABT, MLN, PPX, MXC, CBL, DDT; Habit: A; Effect Codes: MOR; Rejection Code: NO ENDPOINT (ALL CHEMS).

Chemical of Concern: CBL; Habit: A; Rejection Code: NO FOREIGN.
EcoReference No.: 87755
Chemical of Concern: CBL; Habitat: T; Effect Codes: BCM,CEL; Rejection Code: NO ENDPOINT(CBL).


Chemical of Concern: CBL, BDF, PAH, PCB, WFN, MLN; Habitat: AT; Rejection Code: NO REVIEW(ALL CHEMS).


Chemical of Concern: CBL; Habitat: A; Rejection Code: NO CONC, NO SURVEY.


EcoReference No.: 88800
Chemical of Concern: PMR, CYF, BFT, CBF, AZ, LCYT, MTM, MP, CBL; Habitat: T; Effect Codes: POP; Rejection Code: OK TARGET(CBL, MTM), OK(ALL CHEMS).


EcoReference No.: 88801
Chemical of Concern: PMR, CYF, BFT, CBF, LCYT, MTM, MP, CBL; Habitat: T; Effect Codes: POP; Rejection Code: OK TARGET(CBL, MTM), OK(ALL CHEMS).


Chemical of Concern: CBL; Habitat: A; Rejection Code: NO CONC.


EcoReference No.: 83831
Chemical of Concern: DBN, DMB, ASAC, ACR, ATZ, DZ, AND, AMTL, CBL, CBF, CZE, 24DXY, DDT, DLD, DU, ES, E N, FMU, FNF, HPT, LNR, MXC, PRN, MBZ, MLT, MSMA, PAQT, PRT, PCL, PMT, PCH, PPZ, SZ, TXP, TFN; Habitat: A; Rejection Code: NO SPECIES.


EcoReference No.: 67428
Chemical of Concern: CBL; Habitat: A; Rejection Code: NO SPECIES.


EcoReference No.: 15370
Chemical of Concern: CBL, MLN; Habitat: A; Effect Codes: MOR; Rejection Code: NO ENDPOINT(CBL, MLN).

EcoReference No.: 19577
Chemical of Concern: 24DX,Y, PCL, ATZ, AMTR, CZE, PRO, EDT, AND, HCC, DDT, DLD, EN, DDVP, ACR, BMC, CAP, DS, MLN, PRN, PRT, CBL, CBF, CuS, Cu, DMB, DU, Hg, PYZ; Habitat: AT; Rejection Code: NO REVIEW, NO REFS CHECKED.


EcoReference No.: 89171
Chemical of Concern: TVP, Naled, FNT, MLN, CBL, PPX; Habitat: AT; Rejection Code: NO ENDPOINT(ALL CHEMS).


EcoReference No.: 15997
Chemical of Concern: MLN, DDT, CBL; Habitat: A; Effect Codes: PHY, MOR, GRO; Rejection Code: NO ENDPOINT(ALL CHEMS).


EcoReference No.: 15998
Chemical of Concern: CBL, DDT, MLN; Habitat: A; Effect Codes: BEH, GRO; Rejection Code: NO ENDPOINT(ALL CHEMS).


EcoReference No.: 8754
Chemical of Concern: DDT, MLN, PRN, CBL; Habitat: A; Effect Codes: GRO, BEH, MOR, PHY; Rejection Code: NO ENDPOINT(ALL CHEMS).


Chemical of Concern: CBL; Habitat: T; Effect Codes: ACC; Rejection Code: ARCHIVE, NO SOURCE(ALL CHEMS).


Chemical of Concern: CBL; Habitat: A; Rejection Code: NO IN VITRO.

EcoReference No.: 88032
Chemical of Concern: NAPHCBL; Habitat: T; Effect Codes: PHY; Rejection Code: OK(NAPH),NO CONTROL(CBL).


EcoReference No.: 18488
Chemical of Concern: SZ,CBL; Habitat: A; Effect Codes: POP; Rejection Code: NO ENDPOINT(ALL CHEMS).


Chemical of Concern: CBL,DDT; Habitat: T; Rejection Code: NO REVIEW(ALL CHEMS).


EcoReference No.: 42292
Chemical of Concern: CBL; Habitat: T; Effect Codes: GRO,ACC; Rejection Code: NO CONTROL,ENDPOINT(TARGET-CBL).


Chemical of Concern: CBL; Habitat: T; Rejection Code: NO HUMAN HEALTH.


Chemical of Concern: CBL; Habitat: T; Rejection Code: NO IN VITRO(CBL).


EcoReference No.: 13956
Chemical of Concern: FNTH,FNT,CMPH,CBL,MXC,MCB,CBP,RSM; Habitat: A; Effect Codes: MOR; Rejection Code: NO ENDPOINT(RSM,MCB,MXC,CBL,FNTH),OK(FNT,CPY,CMPH).


EcoReference No.: 58751
Chemical of Concern: CBL; Habitat: T; Rejection Code: NO FOREIGN(CBL).

EcoReference No.: 58783
Chemical of Concern: NaPCP, DDT, HCCH, PRN, CBL; Habitat: A; Effect Codes: GRO; Rejection Code: NO ENDPOINT (ALL CHEMS).


EcoReference No.: 5618
Chemical of Concern: CBL, DDT, TCF, FNT, ACP; Habitat: A; Effect Codes: MOR; Rejection Code: NO CONTROL (ALL CHEMS).


EcoReference No.: 74724
Chemical of Concern: FMP, CBF, ADC, OML, CBL; Habitat: T; Effect Codes: POP; Rejection Code: NO ENDPOINT (ALL CHEMS).


Chemical of Concern: CBL; Habitat: A; Rejection Code: NO MIXTURE, OIL.


EcoReference No.: 81425
Chemical of Concern: ATZ, CBL, BFT, HXZ, PMR, PCP, Cu; Habitat: A; Rejection Code: NO REVIEW, MODELING.


EcoReference No.: 8765
Chemical of Concern: CBL; Habitat: A; Rejection Code: NO FOREIGN.


Chemical of Concern: CBL; Habitat: A; Rejection Code: NO SURVEY.


Chemical of Concern: PAQT, TFN, CBL, ES, EFV, CTN; Habitat: T; Rejection Code: NO MIXTURE.


Chemical of Concern: EFV, PAQT, TFN, CTN, CBL, ES; Habitat: T; Rejection Code: NO MIXTURE.

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EcoReference No.: 15271
Chemical of Concern: DZ,CBL; Habitat: A; Rejection Code: NO COC(DZ).


EcoReference No.: 13643
Chemical of Concern: CBL,MLN,MOM,PRN; Habitat: A; Effect Codes: MOR,PHY; Rejection Code: NO CONTROL(MOM),NO CONC(CBL,MLN,PRN).


EcoReference No.: 8570
Chemical of Concern: ACP,Captan,CBL,CTN,DMT,DS,DZ,FO,HXZ,MTD,MLN,MOM,PPG,PSM,TET,CYP,FVL,PMR,TFR,Cu,CuS,PCP,IZP,MCPP1; Habitat: A; Effect Codes: MOR; Rejection Code: NO FOREIGN(ALL CHEMS).


EcoReference No.: 88497
Chemical of Concern: ACP,CBL,DMT,MTM,EFV,MTAS; Habitat: T; Effect Codes: MOR; Rejection Code: NO ENDPOINT(MTAS),OK TARGET(ACP,CBL,DMT,MTM,EFV).


EcoReference No.: 57587
Chemical of Concern: DDT,CBL; Habitat: T; Effect Codes: GRO,PHY,POP; Rejection Code: NO OM,pH,TARGET(CBL).


EcoReference No.: 73599
Chemical of Concern: MOM,PMR,CYP,CYT,BFT,TMT,FVL,DZ,CPY,MP,CBL,TDC,DDVP,SPS,TLM,MLN,FNV; Habitat: T; Effect Codes: MOR; Rejection Code: OK TARGET(MLN,FVL,CYP,DZ),TARGET(BFT).


Chemical of Concern: CBL; Habitat: T; Rejection Code: NO DURATION,NO SURVEY.

EcoReference No.: 39507
Chemical of Concern: CBL; Habitat: T; Effect Codes: PHY,MOR; Rejection Code: NO ENDPOINT(CBL).


EcoReference No.: 71281
Chemical of Concern: CBL; Habitat: T; Effect Codes: ACC,GRO; Rejection Code: NO COC(IODN),TARGET(CBL).


EcoReference No.: 71366
Chemical of Concern: PCB,DZ,Hg,CBL,CPY,BDC,BMY,DMB; Habitat: T; Effect Codes: MOR; Rejection Code: LITE EVAL CODED(DZ,DMB),OK(ALL CHEMS),OK TARGET(CBL).


EcoReference No.: 35539
Chemical of Concern: CBL; Habitat: T; Effect Codes: BCM; Rejection Code: NO ENDPOINT(ALL CHEMS).

H.3. ECOTOX accepted references, relevant to carbaryl degredates, cited within the risk assessment or used for deriving species sensitivity distributions

H.4. ECOTOX accepted references, relevant to carbaryl degredates, not utilized or cited within this risk assessment

H.5. List of exclusion terms utilized for reviewing studies considered for ECOTOX database

**Review**—all toxicity tests reported elsewhere. If the publication is applicable to one of the ECOTOX databases, the bibliography is skimmed and any applicable articles are ordered.

**Methods**—no usable toxicity tests. Reports of methods of conducting tests, determination or purification of chemicals, etc. Methods publications are selected to be ordered for the ECOTOX toxicology methods information file (Methfile).
Modeling only, no new organism exposure data. Modeling studies may report original toxicity tests performed as comparisons or as a basis for extrapolation; order the paper if it is not clear from the abstract.

Other ambient conditions--effects on organisms from changes in conditions other than addition of chemicals, including radioactivity, ultraviolet light (UV), temperature, pH, salinity, dissolved oxygen (DO), or other water, air, or soil parameters.

Biological Toxicant--includes venoms, fungal toxins, Bacillus thuringiensis, other plant, animal, or microbial extracts or toxins.

Drug--testing for drug effects and side-effects.

Effluent, sewage, or polluted runoff.

Mixture--no single chemical tests reported.

Nutrient studies--in situ chemicals tested as nutrients.

No Species--no organism present or tested or unable to verify a species or exposure of dead organism.

In Vitro studies, including exposure of cell cultures and excised tissues.

Bacteria as test organism, including Microtox tests, or other microbial organisms.

Yeast as a test organism is historically not coded in ECOTOX.

No Toxicity Data--publications which are not toxicology studies.

Human Health effects; studies with human subjects or with animal subjects as surrogates for human health risk assessment.

No Concentration--no usable dose or concentration reported; identified after examination of full paper. Includes lead-shot studies which lack dose information or give only number of pellets. Concentrations reported only in log units are not coded.

Sediment Concentration--chemical concentration reported in sediment only. Sediment studies are coded for AQUIRE only if a water concentration of the added chemical is also reported; order the publication if unclear from the abstract.

No Duration reported, identified after examination of full paper.

Incident papers--reports of animal deaths by poison, etc. Lacks usable concentration or duration or both.

Survey studies--measuring amounts of chemical present, but no usable quantification of exposure. Lacks either usable concentration or duration or both.

Fate: Studies reporting only what happens to the chemical in abiotic matrices

Food Studies, no chemical and effects information are reported

PUBL AS, author has results were published in a different format. For example, may be used for a Ph.D. dissertation when the same results were also published in a peer-reviewed journal.

NON-ENGLISH or FORE, paper was published in a foreign language.
H6. ECOTOX rejected references.

1. 1989). 104 WEEK CHRONIC TOXICITY AND ONCOGENICITY STUDY WITH 1,3-DICHLOROPROPAN-2-OL IN THE RAT (PART 1) WITH COVER LETTER DATED 080389. EPA/OTS; Doc #89-890000058. Rejection Code: NO COC.


   Rejection Code: FATE.

13. 1996). Carbaryl effects on sperm: Combination Toxicology. Food and Chemical Toxicology 34: 1191.
   Rejection Code: MIXTURE.

   Rejection Code: METABOLISM.

15. 1982). DETERMINATION OF ACUTE TOXICITY TO FISH OF SHELL CHEMICAL, II.
   (NOTE: THIS DOCUMENT IS UNREADABLE). EPA/OTS; Doc #878210130.
   Rejection Code: NO SOURCE.

   (INCLUDING TETRAHYDROTHIOPHENE 1,1-DIOXIDE), WITH COVER LETTER DATED 2/7/84. EPA/OTS; Doc #FYI-OTS-0794-1002.
   Rejection Code: NO COC.

17. 1982). DETERMINATION OF ACUTE TOXICITY TO FISH OF SHELL CHEMICALS. I.
   (NOTE: THIS DOCUMENT IS UNREADABLE). EPA/OTS; Doc #878210129.
   Rejection Code: NO SOURCE, NO COC.

   Rejection Code: METHODS.

   BY DIRECT REUSE SYSTEM (CONTRACT NO. DADA-17-73-C-3013) (FINAL REPORT). EPA/OTS; Doc #40-8069226.
   Rejection Code: METHODS.

   EPA/OTS; Doc #86-890000038.
   Rejection Code: NO TOX DATA.

   DISCHARGES IN NEARSHORE MARINE WATERS (VOLUME I & II) WITH COVER LETTER DATED 091187. EPA/OTS; Doc #FYI-AX-0987-0451.
   Rejection Code: FATE.

22. 1990). ENDANGERMENT ASSESSMENT FOR NECCO PARK NIAGARA FALLS, NEW 
   YORK (FINAL REPORT) WITH ATTACHED APPENDIX, COVER SHEET AND LETTER DATED 013090. EPA/OTS; Doc #86-900000075.
   Rejection Code: SURVEY.

23. 2000). EVALUATION OF VINYL FLUORIDE IN THE IN VITRO ASSAY FOR 
   CHROMOSOME ABERATIONS IN CHINESE HAMSTER OVARY (CHO) CELLS 
   WITH COVER LETTER DATED 102286. EPA/OTS; Doc #86870000006.
   Rejection Code: IN VITRO.

24. 1989). FATE AND EFFECTS OF PRODUCED WATER DISCHARGES IN NEARSHORE
   Rejection Code: SURVEY.

   Rejection Code: SURVEY.

27. 1996). INACTIVE RANCHO CORDOVA TEST SITE, RANCHO CORDOVA, CA - TECHNICAL MEMORANDUM, FLUX CHAMBER, ADMINISTRATION AREA, WITH COVER LETTER DATED 7/24/96. EPA/OTS; Doc #86960000518.
   Rejection Code: SURVEY.

   Rejection Code: SURVEY.

   Rejection Code: SURVEY.

   Rejection Code: SURVEY.

   Rejection Code: NO COC.

   Rejection Code: NO COC.

   Rejection Code: INHALE.

   Rejection Code: NO COC.


40. 1990). LETTER FROM HOECHST CELANESE CORP TO US EPA REGARDING SUBMISSION OF STUDY AND DATA FOR 1,5-NAPHTHALENEDISULFONIC ACID, 2-(4,5-DIHYDRO-3-METHYL-5-* WITH ATTACHMENTS (SANITIZED). EPA/OTS; Doc #89-910000040. Rejection Code: NO COC.

41. 1990). LETTER FROM NATL PAINT & COATINGS ASSN TO USEPA SUBMITTING STUDIES ON SEVERAL SOLVENTS WITH ATTACHMENTS. EPA/OTS; Doc #86-910000031. Rejection Code: NO COC.

42. 1991). LETTER SUBMITTING MULTIPLE ENCLOSED STUDIES ON MULTIPLE CHEMICALS WITH ATTACHMENTS. EPA/OTS; Doc #86-920000742. Rejection Code: NO COC.


44. 1984). METABOIC FATE OF (U-14C) HYDROQUINONE ADMINISTERED BY GAVAGE TO MALE FISCHER 344 RATS WITH COVER LETTER. EPA/OTS; Doc #878214473. Rejection Code: NO COC.


Rejection Code: METHODS.

47. 1982). MUTAGENIC ACTIVITY OF BENZENAMINE, 4-CHLORO-2-NITRO IN THE SALMONELLA/MICROSOME ASSAY. EPA/OTS; Doc #878220271.

Rejection Code: BACTERIA.

48. 2000). ORGANO BROMIDES IODIDES AND FLUORIDES CLASS STUDY WITH COVER LETTER DATED 07/01/81. EPA/OTS; Doc #40-8134106.

Rejection Code: NO COC.


Rejection Code: NO TOX DATA.

50. 1989). PETITIONERS AND EXHIBITS TO PETITIONERS MEMORANDUMS IN SUPPORT OF THEIR MOTION FOR A REMAND WITH ATTACHMENTS AND COVER LETTER DATED 012389. EPA/OTS; Doc #86-890000094.

Rejection Code: NO TOX DATA.

51. 1994). PHARMACOKINETIC PROFILE OF DODECAMETHYLPTENASILOXANE IN RATS FOLLOWING ORAL ADMINISTRATION, WITH COVER LETTER DATED 4/20/94. EPA/OTS; Doc #86940001447.

Rejection Code: METABOLISM, NO COC.


Rejection Code: INHALE.


Rejection Code: NO COC.


Rejection Code: NO COC.


Rejection Code: METHODS.


Rejection Code: REVIEW.

57. 2000). SUPPORT DOCUMENT FOR THE SARA SECTION 110 "SECOND 100" LIST
58. 1994). SUPPORT: SUPPLEMENTAL SUBMISSION ON GROUND WATER CONTAMINATION, EPA DOC CTNL NO 8EHQ-0979-0310, AEROJET PROPULSION DIV, RANCHO CORDOVA, CA FACILITY WITH COVER LETTER DATED 032194. EPA/OTS; Doc #0007859590. Rejection Code: SURVEY.

59. 1987). TELEPHONE COMMUNICATION FROM SALESMAN TO OCCIDENTAL CHEM CORP REGARDING AN ITT RAYONIER STUDY CONDUCTED ON DF-112 WITH COVER LETTER DATED 021187. EPA/OTS; Doc #86870000225. Rejection Code: NO TOX DATA.


61. 1982). TOTAL PARTICULATE GASES AND VAPORS (GENERAL) NITROSAMINES FORMALDEHYDE MISCELLANEOUS WITH COVER LETTER. EPA/OTS; Doc #878210919. Rejection Code: SURVEY.


    Rejection Code: METHODS.

68. ABBOTT HA (1986). THE INFLUENCE OF MOLASSES ON THE PHYSICAL PROPERTIES AND SPRAYABILITY OF TWO PESTICIDE FORMULATIONS. *PESTIC SCI; 17* 526-534.
    Rejection Code: METHODS.

    Rejection Code: NO TOX DATA.

    Rejection Code: NO TOX DATA.

    Rejection Code: METHODS.

    Rejection Code: SURVEY.

    Rejection Code: SURVEY.

    Rejection Code: METHODS.

    Rejection Code: NON-ENGLISH.

    Rejection Code: ABSTRACT.

Rejection Code: SURVEY.

Rejection Code: NO TOX DATA.

Rejection Code: HUMAN HEALTH.

Rejection Code: METHODS.

Rejection Code: SURVEY.

Rejection Code: NO SPECIES.

Rejection Code: SURVEY.

Rejection Code: SURVEY.

Rejection Code: ABSTRACT.

Rejection Code: FATE, METABOLISM.

Rejection Code: HUMAN HEALTH.
Rejection Code: NO TOX DATA.

Rejection Code: ABSTRACT.

Rejection Code: METABOLISM.

Rejection Code: METHODS.

Rejection Code: NO CONC.

Rejection Code: NON-ENGLISH.

Rejection Code: SURVEY.

Rejection Code: SURVEY.

Rejection Code: SURVEY.

Rejection Code: NO EFFECT.


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Rejection Code: METHODS.

Rejection Code: IN VITRO.

Rejection Code: METHODS.

Rejection Code: SURVEY.

Rejection Code: REVIEW.

Rejection Code: MODELING.

Rejection Code: IN VITRO.

Rejection Code: METHODS.

Rejection Code: METHODS.

Rejection Code: NO SPECIES.

Rejection Code: NO SPECIES.
    insecticides in the aquatic environment--I. Hydrolysis of sevin, baygon, pyrolan and 
    Rejection Code: FATE.

    framework for impact assessment of urban transport systems. Transportation Research 
    Rejection Code: MODELING.

112. Amri, Hajar Souhaiil-EI, Fargetton, Xavier, Benoit, Etienne, Totis, Muriel, and Batt, Anne-Marie 
    (1988). Inducing effect of albendazole on rat liver drug-metabolizing enzymes and 
    Rejection Code: NO COC.

113. ANADON, A., MARTINEZ-LARRANAGA MR, FERNANDEZ-CRUZ ML, DIAZ MJ, 
    FERNANDEZ MC, and MARTINEZ MA (1996). Toxicokinetics of deltamethrin and its 
    4'-HO-metabolite in the rat. TOXICOLOGY AND APPLIED PHARMACOLOGY, 141 8-
    16. 
    Rejection Code: NO COC.

    Entomol.] 79: 1200-1205. 
    Rejection Code: METHODS.

    with Pesticides and Polychlorinated Biphenyls. J.Econ.Entomol. 79: 1200-1205. 
    Rejection Code: SURVEY.

    inorganic analysis : The nitronaphthols as fluorimetric reagents for stannous tin. 
    Rejection Code: METHODS.

117. Andersson, Tommy, Pesonen, Maija, and Johansson, Conny (1985). Differential induction of 
    cytochrome P-450-dependent monooxygenase, epoxide hydrolase, glutathione transferase 
    and UDP glucuronosyl transferase activities in the liver of the rainbow trout by [beta]-
    naphthoflavone or clophen A50. Biochemical Pharmacology 34: 3309-3314. 
    Rejection Code: METABOLISM.

    augment anti-sheep red blood cell nonreaginic antibody responses in mice but may 
    prolong murine infection with Giardia muris . Environmental Research [ENVIRON. 
    Rejection Code: IN VITRO.

    immobilized glutathione S-transferase and sol-gel entrapped bromcresol green for the 
    Rejection Code: METHODS.

    based on immobilized cholinesterase and sol-gel entrapped bromcresol purple for in-field 
Rejection Code: METHODS.


the isolated skin of Rana esculenta. *Comparative Biochemistry and Physiology Part C: Comparative Pharmacology* 97: 49-51.

Rejection Code: IN VITRO.


Rejection Code: METHODS.


; Habitat: A; Effect Codes: MOR


Rejection Code: MODEL.


Rejection Code: METHODS.


Rejection Code: FATE.


Rejection Code: FATE.


Rejection Code: FATE.

142. ARRETO C-D, DUMAREY, C., NAHORI M-A, and VARGAFTIG BB (1997). The LPS-induced neutrophil recruitment into rat air pouches is mediated by TNAlpha: Likely macrophage origin. *MEDIATORS OF INFLAMMATION; 6 335-343.*

Rejection Code: IN VITRO.


Rejection Code: METHODS.


; Habitat: T


; Habitat: T; Effect Codes: GRO,POP,BEH,BCM


; Habitat: T; Effect Codes: MOR
   Rejection Code: METABOLISM.

   Rejection Code: IN VITRO.

   Rejection Code: MODELING.

   Rejection Code: NO SPECIES/NO TOX DATA.

   ; Habitat: A; Effect Codes: MOR

   Rejection Code: NO SPECIES.

   Rejection Code: NO SPECIES.

   Rejection Code: NO SPECIES.

   Rejection Code: NO SPECIES.

   Rejection Code: NO DURATION/NO TOX DATA.

   Rejection Code: METHODS.

DIFFERENCES IN PESTICIDE SUSCEPTIBILITY OF SPODOPTERA-LITURA FAB COLLECTED FROM THREE LOCALITIES IN TAMIL NADU INDIA. INDIAN J PLANT PROT; 16 67-70.
Rejection Code: SURVEY.

Rejection Code: METHODS/NO SPECIES.

Rejection Code: CHEM METHODS.

Rejection Code: METHODS.

Rejection Code: METHODS.

171. Barcelo, D., Durand, G., Bouvot, V., and Nielen, M. (Use of extraction disks for trace enrichment of various pesticides from river water and simulated seawater samples followed by liquid chromatography-rapid-scanning UV-visible and thermospray-mass spectrometry detection.
Rejection Code: NO SPECIES.

172. Barcelo, D., Durand, G., Bouvot, V., and Nielen, M. (Use of extraction disks for trace enrichment of various pesticides from river water and simulated seawater samples followed by liquid chromatography-rapid-scanning UV-visible and thermospray-mass spectrometry detection.
Rejection Code: NO SPECIES.

Rejection Code: NO SPECIES.

Rejection Code: QSAR.

Rejection Code: IN VITRO.

Rejection Code: METABOLISM.
Rejection Code: MODELING.

Rejection Code: METHODS.

Rejection Code: IN VITRO.

Rejection Code: NO TOX DATA, SURVEY.

Rejection Code: IN VITRO.

Rejection Code: IN VITRO, METABOLISM.

Rejection Code: MIXTURE/NO SPECIES.

Rejection Code: IN VITRO.

Rejection Code: IN VITRO.

Rejection Code: IN VITRO.

Rejection Code: IN VITRO.

LESIONS BY AN EXCITOTOXIC MECHANISM. 45TH ANNUAL MEETING OF THE AMERICAN ACADEMY OF NEUROLOGY, NEW YORK, NEW YORK, USA, APRIL 25-MAY 1, 1993. NEUROLOGY; 43 A407.
Rejection Code: BIOLOGICAL TOXICANT.

Rejection Code: NO TOX DATA.

Rejection Code: NO TOX DATA.

Rejection Code: NO TOX DATA.

Rejection Code: NO TOX DATA.

193. BECKER, P. (1999). About the order in aerobic heterotrophic microbial communities from hydrocarbon-contaminated sites. INTERNATIONAL BIODETERIORATION & BIODEGRADATION; 43 135-146.
Rejection Code: BACTERIA.

Rejection Code: BACTERIA, METABOLISM.

Rejection Code: FATE, BACTERIA.

Rejection Code: REVIEW.


Rejection Code: BACTERIA.


Rejection Code: NON-ENGLISH.


Rejection Code: METHODS.


Rejection Code: HUMAN HEALTH.


Rejection Code: NO TOXICANT, IN VITRO.


Rejection Code: METHODS.


Rejection Code: METHODS, FATE.


Rejection Code: METHODS.


Rejection Code: BACTERIA.


Rejection Code: BACTERIA.

Interaction of carbaryl and N-nitrosocarbaryl with microsomal monooxygenase activities. 
*Toxicology Letters* 45: 251-260.
Rejection Code: IN VITRO.

Rejection Code: IN VITRO.

Rejection Code: SURVEY.

Rejection Code: IN VITRO.

Rejection Code: REVIEW.

Rejection Code: NO DURATION.

Rejection Code: REVIEW.

Rejection Code: MODELING.

Rejection Code: METHODS.

Rejection Code: METHODS.

Rejection Code: NON-ENGLISH.

Rejection Code: METHODS.

Rejection Code: METHODS.

Rejection Code: REVIEW.

Rejection Code: IN VITRO.

Rejection Code: SURVEY.

Rejection Code: SURVEY.

Rejection Code: SURVEY.

Rejection Code: NON-ENGLISH.

Rejection Code: METHODS.

Rejection Code: METHODS, HUMAN HEALTH.

Rejection Code: MODELING.

Rejection Code: BACTERIA.

Rejection Code: IN VITRO.

Rejection Code: IN VITRO.

Rejection Code: EFFLUENT.

Rejection Code: SURVEY.

Rejection Code: SURVEY.

Rejection Code: NO TOX DATA/FOOD/SURVEY.


; Habitat: T

Rejection Code: NON-ENGLISH.

Rejection Code: REVIEW.

Rejection Code: IN VITRO, METABOLISM.
   Rejection Code: IN VITRO, METABOLISM.

   Rejection Code: METABOLISM.

   Rejection Code: IN VITRO, METABOLISM.

   Rejection Code: IN VITRO, METABOLISM.

   Rejection Code: IN VITRO.

   Rejection Code: MIXTURE.

   Rejection Code: METHODS.

   Rejection Code: BACTERIA.

   Rejection Code: METHODS.

   Rejection Code: METABOLISM.

   Rejection Code: IN VITRO.
Rejection Code: NO SPECIES.

Rejection Code: METABOLISM.

Rejection Code: NON-ENGLISH.

Rejection Code: METABOLISM, IN VITRO.

Rejection Code: IN VITRO, METABOLISM.

Rejection Code: BACTERIA.

Rejection Code: METABOLISM.

Rejection Code: FATE.

Rejection Code: FATE.

Rejection Code: FATE.


   Rejection Code: SURVEY.

   Rejection Code: SURVEY.

   Rejection Code: IN VITRO.

   Rejection Code: IN VITRO.

   Rejection Code: REVIEW.

   Rejection Code: REVIEW.

   Rejection Code: METHODS.

   Rejection Code: METHODS.

   Rejection Code: BACTERIA.

   Rejection Code: SURVEY.

   Rejection Code: SURVEY.

   Rejection Code: SURVEY.
Rejection Code: SURVEY.

Rejection Code: ABSTRACT.

Rejection Code: NO CONC.

Rejection Code: EFFLUENT.

Rejection Code: NO CONC/SEDIMENT.

Rejection Code: NO TOXICANT/SEDIMENT CONC.

Rejection Code: FATE.

Rejection Code: ABSTRACT.

Rejection Code: HUMAN HEALTH.

Rejection Code: NON-ENGLISH.

Rejection Code: BIOLOGICAL TOXICANT.

Rejection Code: REVIEW.

Rejection Code: METHODS.

Rejection Code: REVIEW.

Rejection Code: METHODS.

Rejection Code: REVIEW.

Rejection Code: FATE.

Rejection Code: PUBL AS.

Rejection Code: HUMAN HEALTH.

Rejection Code: MODELING.

Rejection Code: IN VITRO, FATE.

Rejection Code: METHODS.
Rejection Code: IN VITRO.

Rejection Code: NO TOX DATA.

Rejection Code: FATE.

Rejection Code: MIXTURE.

Rejection Code: MODELING.

Rejection Code: INCIDENT.

Rejection Code: METHODS.

Rejection Code: CHEM METHODS.

Rejection Code: NO TOX DATA.

; Habitat: A; Effect Codes: POP

; Habitat: A; Effect Codes: NOC,GRO,MOR,BEH,PHY
Rejection Code: SURVEY.


Rejection Code: METHODS.

Rejection Code: ABSTRACT.

Rejection Code: METHODS.

Rejection Code: NO SPECIES.

Rejection Code: IN VITRO.

Rejection Code: SURVEY.

Rejection Code: METHODS.


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Rearrangement Code: ABSTRACT.

   Rearrangement Code: EFFLUENT.

   Rearrangement Code: EFFLUENT.

   Rearrangement Code: REVIEW.

   Rearrangement Code: NO TOX DATA.

   Rearrangement Code: SURVEY.

   Rearrangement Code: HUMAN HEALTH.

   Rearrangement Code: MIXTURE/NON-ENGLISH.

   Rearrangement Code: IN VITRO, METABOLISM.

   Rearrangement Code: METABOLISM.

   Rearrangement Code: DRUG.
Rejection Code: METHODS.

Rejection Code: IN VITRO.

Rejection Code: HUMAN HEALTH.

Rejection Code: IN VITRO.

Rejection Code: IN VITRO.

Rejection Code: IN VITRO.

Rejection Code: FATE.

Rejection Code: IN VITRO.

Rejection Code: METHODS.

Rejection Code: NO TOX DATA.


Rejection Code: IN VITRO.


Rejection Code: BACTERIA.


Rejection Code: BACTERIA.


Rejection Code: METABOLISM.


Rejection Code: NO TOX DATA.


Rejection Code: EFFLUENT.


Rejection Code: IN VITRO.


Rejection Code: FATE.


Rejection Code: METHODS.


Rejection Code: METHODS.


Rejection Code: IN VITRO.


; Habitat: T; Effect Codes: POP


Rejection Code: SURVEY.

Rejection Code: SURVEY.

Rejection Code: METABOLISM.

Rejection Code: FATE,NO SPECIES.

Rejection Code : IN VITRO, METABOLISM, HUMAN HEALTH.

Rejection Code: SURVEY.

Rejection Code: NO TOX DATA.

Rejection Code: BACTERIA.

Rejection Code: IN VITRO.

391. CHYAU C-C and MAU J-L (1999). Release of volatile compounds from microwave heating of garlic juice with 2,4-decadienals. *FOOD CHEMISTRY; 64* 531-535. 
Rejection Code: HUMAN HEALTH.


Rejection Code: ABSTRACT.

Rejection Code: NO TOX DATA.

Rejection Code: SURVEY.

Rejection Code: ABSTRACT.

Rejection Code: METHODS.

Rejection Code: ABSTRACT.

Rejection Code: METHODS.

Rejection Code: HUMAN HEALTH.

Rejection Code: METHODS.

Rejection Code: METABOLISM, NO TOX DATA.

Rejection Code: IN VITRO.

413. COOMBS MM and BHATT TS (1987). CAMBRIDGE MONOGRAPHS ON CANCER RESEARCH CYCLOPENTA-A-PHENANTHRENES POLYCYCLIC AROMATIC
   Rejection Code: REVIEW.

   Rejection Code: NO TOX DATA.

   Habitat: A; Effect Codes: MOR, ACC, REP

   Habitat: A; Effect Codes: MOR, BCM

   Rejection Code: REVIEW.

   Rejection Code: REVIEW.

   Rejection Code: HUMAN HEALTH.

   Rejection Code: MODELING.

   Rejection Code: MONKEY.

423. Cote-Sierra, Javier, Jongert, Erik, Bredan, Amin, Gautam, Dinesh C., Parkhouse, M., Cornelis,
group of phytoestrogens for the presence of a 2-D geometric descriptor associated with non-genotoxict carcinogens and some estrogens. PROCEEDINGS OF THE SOCIETY FOR EXPERIMENTAL BIOLOGY AND MEDICINE; 217 288-292.

Rejection Code: METHODS.


Rejection Code: BIOLOGICAL TOXICANT.


Rejection Code: METABOLISM.


Rejection Code: REVIEW.


Rejection Code: REVIEW.


Rejection Code: NO TOXICANT.


Rejection Code: NO TOX DATA.


Rejection Code: BACTERIA.


Rejection Code: METHODS.


Rejection Code: NO TOX DATA.

carp during the winter pre-breeding season. *Aquatic Toxicology* 77: 386-392.

**Rejection Code:** METABOLISM, FATE.


**Rejection Code:** NO SPECIES.


**Rejection Code:** NO TOXICANT.


**Rejection Code:** FATE.


**Rejection Code:** SEDIMENT CONC.


**Rejection Code:** FATE.


**Rejection Code:** METABOLISM.


**Rejection Code:** SURVEY.


**Rejection Code:** REVIEW.


**Rejection Code:** METHODS.


**Rejection Code:** ABSTRACT.
   Rejection Code: METHODS, IN VITRO.

   Rejection Code: METHODS, IN VITRO.

   Rejection Code: IN VITRO.

   Rejection Code: FATE.

   Rejection Code: FATE.

   Rejection Code: METHODS.

   Rejection Code: NO TOX DATA/NO SPECIES.

   Rejection Code: METHODS.

   Rejection Code: NO DURATION.

   Rejection Code: SURVEY.

   Rejection Code: IN VITRO.

gland function in rats. Toxicology and Applied Pharmacology 111: 263-278.  
Rejection Code: IN VITRO, METABOLISM.

Rejection Code: ABSTRACT.

468. DE SNOO GR and DE WIT PJ (1998). Buffer zones for reducing pesticide drift to ditches and risks to aquatic organisms. ECOTOXICOLOGY AND ENVIRONMENTAL SAFETY; 41 112-118.  
Rejection Code: SURVEY.

Rejection Code: IN VITRO.

Rejection Code: HUMAN HEALTH.

Rejection Code: HUMAN HEALTH.

Rejection Code: BACTERIA.

Rejection Code: NO TOXICANT.

Rejection Code: BACTERIA.

Rejection Code: BACTERIA.

interactions between xenobiotic chemicals and soil. *SOIL SCIENCE*; 162 858-874.

Rejection Code: FATE.

Rejection Code: HUMAN HEALTH, REVIEW.

Rejection Code: HUMAN HEALTH, SURVEY.

Rejection Code: HUMAN HEALTH.

Rejection Code: METABOLISM.


Rejection Code: METHODS, YEAST.


; Habitat: A; Effect Codes: PHY


Rejection Code: IN VITRO.


Rejection Code: METHODS.


Rejection Code: SURVEY.


Rejection Code: SURVEY, METHODS.


Rejection Code: FATE, METHODS.


Rejection Code: IN VITRO.


Rejection Code: METABOLISM.


; Habitat: T; Effect Codes: MOR


Rejection Code: SURVEY, HUMAN HEALTH.


Rejection Code: METHODS.


Rejection Code: NO SPECIES.


Rejection Code: IN VITRO, METABOLISM.


Rejection Code: FATE.


Rejection Code: FATE.


Rejection Code: SURVEY.
Rejection Code: IN VITRO.

Rejection Code: HUMAN HEALTH.

Rejection Code: IN VITRO.

Rejection Code: SURVEY.

Rejection Code: SURVEY.

Rejection Code: BACTERIA.

Rejection Code: SURVEY.

Rejection Code: SURVEY.

Rejection Code: SURVEY.

Rejection Code: BACTERIA.

Rejection Code: REFS CHECKED/REVIEW.

Rejection Code: METABOLISM.

Rejection Code: METABOLISM.

Rejection Code: METABOLISM.

Rejection Code: IN VITRO, METABOLISM.

Rejection Code: SURVEY.

Rejection Code: SURVEY.

Rejection Code: MODELING.

Rejection Code: METHODS.

Rejection Code: SURVEY.

Rejection Code: NON-ENGLISH.

520. DOWNER AJ, KOEHLER CS, and PAINE TD (91). <04 Article Title>. J ENVIRON HORTIC; 9 <25 Page(s)>; Habitat: <40 Habitat Code>; Effect Codes: <08 Effects Code>.

521. Dragland, S. (1996). Content of Cadmium and Lead in Chamomile (Chamomilla recutita L.) and
Feverfew (Tanacetum parthenium L.) Grown in Different Parts of Norway (Innhold av Kadmium og bly i Kamille (Chamomilla recutita L.) og Matrem (Tanacetum parthenium L.) Dyrket på Ulrike Steder i Norge). *Norsk Landbruksforskning* 10: 181-188.

Rejection Code: MIXTURE.


Rejection Code: REVIEW.


Rejection Code: METHODS.


Rejection Code: METHODS.


Rejection Code: SURVEY.


Rejection Code: ABSTRACT.


Rejection Code: ABSTRACT.


Rejection Code: NO TOX DATA.


Rejection Code: SURVEY.


Rejection Code: FATE.

Rejection Code: SURVEY.

Rejection Code: CHEM METHODS.

Rejection Code: SURVEY.

Rejection Code: NON-ENGLISH.

Rejection Code: NON-ENGLISH.

Rejection Code: METABOLISM, IN VITRO.

Rejection Code: METHODS.

Rejection Code: EFFLUENT.

; Habitat: A; Effect Codes: GRO,REP,MOR

Rejection Code: IN VITRO.

Rejection Code: SURVEY.

Rejection Code: NO TOXICANT.

Rejection Code: METHODS.

; Habitat: T; Effect Codes: MOR

Rejection Code: IN VITRO.

Rejection Code: BACTERIA.

; Habitat: T; Effect Codes: POP

Rejection Code: HUMAN HEALTH.

activities (DMEs) in primary cultures of rabbit hepatocytes. *Toxicology in Vitro* 16: 375-382.

Rejection Code: IN VITRO, METABOLISM.


Rejection Code: ABSTRACT.


Rejection Code: METHODS.


Rejection Code: REFS CHECKED/REVIEW.


Rejection Code: BACTERIA.


Rejection Code: SURVEY.


Rejection Code: EFFLUENT.


Rejection Code: SURVEY.


Rejection Code: SURVEY.


Rejection Code: EFFLUENT.


Rejection Code: METHODS.


; Habitat: T; Effect Codes: BCM, POP


573. ELLENSON WD, MUKEJEE, S., STEVENS RK, WILLIS RD, SHADWICK DS,
Rejection Code: SURVEY.

Rejection Code: REFS CHECKED/REVIEW.

Rejection Code: REFS CHECKED/REVIEW.

Rejection Code: REFS CHECKED/REVIEW.

Rejection Code: REVIEW.

Rejection Code: ABSTRACT.

Rejection Code: ABSTRACT.

Rejection Code: METABOLISM.

Rejection Code: METABOLISM.

Rejection Code: NO COC.

Rejection Code: METHODS.


586. EPA/OTS (1994). Toxicity of Compounds Including P-Nitrodichlorobenzene Used in Building No. 750 with Cover Letter Outlining Current Study of Tetrahydrofuran Toxicity Dated 05/10/94 (Sanitized). EPA/OTS Doc. #869400007055S.


; Habitat: T; Effect Codes: PHY,GRO


Rejection Code: IN VITRO.


Rejection Code: ABSTRACT.


Rejection Code: NO TOX DATA.


Rejection Code: METHODS.


Rejection Code: REVIEW.


Rejection Code: SURVEY.


Rejection Code: SURVEY.


Rejection Code: SURVEY.


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Rejection Code: NO COC.

Rejection Code: METHODS.

Rejection Code: BACTERIA.

Rejection Code: CHEM METHODS.

Rejection Code: METHODS, NO TOX DATA.

Rejection Code: ABSTRACT.

Rejection Code: IN VITRO.

Rejection Code: IN VITRO.

Rejection Code: METHODS.

Rejection Code: ABSTRACT.

Rejection Code: BACTERIA/IN VITRO.


; Habitat: A; Effect Codes: MOR


Rejection Code: NO SOURCE.

Rejection Code: NO SPECIES.

Rejection Code: METHODS.

Rejection Code: NO COC .

Rejection Code: CHEM METHOD.

Rejection Code: NO SPECIES.

Rejection Code: NO SPECIES.

Rejection Code: METHODS.

Rejection Code: METHODS.

Rejection Code: IN VITRO.

Rejection Code: IN VITRO, METABOLISM.


Rejection Code: IN VITRO.


Rejection Code: IN VITRO.


Rejection Code: REVIEW.


Rejection Code: MODELING.


Rejection Code: IN VITRO.


Rejection Code: METHODS.


Rejection Code: METABOLISM, IN VITRO.


Rejection Code: IN VITRO.


Rejection Code: IN VITRO.

Rejection Code: SURVEY.

Rejection Code: SURVEY.

Rejection Code: SURVEY.

Rejection Code: METHODS.

Rejection Code: SURVEY.

Rejection Code: BACTERIA.

Rejection Code: MIXTURE.

Rejection Code: SURVEY.

Rejection Code: NO TOX DATA.

Rejection Code: METABOLISM.

Rejection Code: METABOLISM.

657. Franklin, Michael R. (1991). Drug metabolizing enzyme induction by simple diaryl pyridines; 2-
substituted isomers selectively increase only conjugation enzyme activities, 4-substituted
isomers also induce cytochrome P450. *Toxicology and Applied Pharmacology* 111: 24-
32.
Rejection Code: METABOLISM.

containing Mono-, Di-, Tri- and tetra-arylmethanes. *Biochemical Pharmacology* 46: 683-
689.
Rejection Code: METABOLISM.

evaluation data for organics: 5. C6-C22 nonpolar and semipolar aromatic compounds.
*ENVIRONMENTAL SCIENCE & TECHNOLOGY;* 32 1760-1770.
Rejection Code: MODELING.

660. FRENCH CL, YAUN S-S, BALDWIN LA, LEONARD DA, ZHAO XQ, and CALABRESE EJ
TOXICOLOGY;* 15 167-174.
Rejection Code: METHODS, IN VITRO.

PGE-2 PRODUCTION FROM BOVINE ALVEOLAR MACROPHAGES
STIMULATED WITH BOVINE RESPIRATORY VIRUSES AND BACTERIAL
ENDOTOXINS. *75TH ANNUAL MEETING OF THE FEDERATION OF AMERICAN
SOCIETIES FOR EXPERIMENTAL BIOLOGY, ATLANTA, GEORGIA, USA, APRIL 21-
Rejection Code: BACTERIA.

1984.
Rejection Code: MODELING, METABOLISM.

663. Fujita, Shoichi, Peisach, Jack, Ohkawa, Hideko, Yoshida, Yuko, Adachi, Shigeru, Uesugi,
Rejection Code: METABOLISM, IN VITRO.

ENHANCES 1 25 DIHYDROXYVITAMIN D-3-INDUCED INTESTINAL
ABSORPTION OF CALCIUM AND PHOSPHORUS IN RATS. *MINER
Rejection Code: METABOLISM.

Rejection Code: METABOLISM.

666. GALASSI, S., VALSECCHI, S., and TARTARI GA (1997). The distribution of PCB's and
chlorinated pesticides in two connected Himalayan lakes. *WATER AIR AND SOIL
POLLUTION;* 99 717-725.
Rejection Code: SURVEY.

Rejection Code: SURVEY.

Rejection Code: BACTERIA.

Rejection Code: IN VITRO.

Rejection Code: IN VITRO.

Rejection Code: NON-ENGLISH.

Rejection Code: NO SPECIES.

Rejection Code: FATE.

Rejection Code: METHODS.

Rejection Code: METHODS.
Rejection Code: REFS CHECKED/REVIEW.

Rejection Code: METHODS.

; Habitat: T; Effect Codes: MOR

Rejection Code: IN VITRO.

Rejection Code: METHODS.

Rejection Code: REVIEW.

Rejection Code: REVIEW.

Rejection Code: METHODS.

Rejection Code: IN VITRO, METABOLISM.

Rejection Code: SURVEY.

Rejection Code: METABOLISM, NO TOX DATA.


group as an auxochrome in dyes: The synthesis of para-substituted
Rejection Code: METHODS.

activity, and incubation time on production of aflatoxins and cyclopiazonic acid by an
isolate of Aspergillus flavus in surface agar culture. APPLIED AND ENVIRONMENTAL
MICROBIOLOGY; 63 1048-1053.
Rejection Code: IN VITRO.

and humic acids in seepage water of waste deposits by pyrolysis-gas
chromatography/mass spectrometry. WATER RESEARCH; 31 1609-1618.
Rejection Code: METHODS.

Lanice conchilega (Polychaeta) and its geographical variation between the English
Channel and the German Bight. CHEMOSPHERE; 37 1283-1298.
Rejection Code: SURVEY.

strain D61.M by selected benzimidazole compounds. MUTATION RESEARCH; 343
185-199.
Rejection Code: BACTERIA.

FUNGI COLONIZING CEREAL GRAIN IN STORAGE STRUCTURE AND
PROPERTIES. CHELKOWSKI, J. (ED.). DEVELOPMENTS IN FOOD SCIENCE, VOL.
26. CEREAL GRAIN: MYCOTOXINS, FUNGI AND QUALITY IN DRYING AND
STORAGE. XXII+607P. ELSEVIER SCIENCE PUBLISHERS B.V.: AMSTERDAM,
NETHERLANDS; (DIST. IN THE USA AND CANADA BY ELSEVIER SCIENCE
PUBLISHING CO., INC.: NEW YORK, NEW YORK, USA). ILLUS. MAPS. ISBN 0-444-
88554-4; 0 (0). 1991. 355-403.
Rejection Code: BIOLOGICAL TOXICANT.

Rejection Code: MODELING.

Haemophilus somnus in bovine blood monocytes and alveolar macrophages.
MICROBIAL PATHOGENESIS; 25 227-235.
Rejection Code: IN VITRO.

(1997). Development of an automated controlled-pore glass flow through immunosensor
Rejection Code: NO SPECIES.

(1997). Development of an automated controlled-pore glass flow-through immunosensor
for carbaryl: The Second Workshop on Biosensors and Bioanalytical Techniques in
Rejection Code: METHODS.
Rejection Code: FATE.

Rejection Code: IN VITRO, METABOLISM.

Rejection Code: NO TOX DATA.

Rejection Code: BACTERIA.

Rejection Code: MODELING.

Rejection Code: METABOLISM, NO COC.

; Habitat: T; Effect Codes: MOR,REP


Rejection Code: REFS CHECKED/REVIEW.

Rejection Code: IN VITRO, METABOLISM.

Rejection Code: METHODS.
Rejection Code: IN VITRO.

Rejection Code: EFFLUENT.

Rejection Code: MODELING.

Rejection Code: SURVEY.

Rejection Code: NO SPECIES.

Rejection Code: SURVEY.

Rejection Code: SURVEY.

Rejection Code: METHODS.

Rejection Code: IN VITRO.

Rejection Code: NO TOX DATA.


**Rejection Code:** IN VITRO.
Rejection Code: IN VITRO.

Rejection Code: SURVEY.

Rejection Code: IN VITRO.

Rejection Code: IN VITRO.

Rejection Code: NO DURATION.

Rejection Code: METHODS.

Rejection Code: NO CONC.

Rejection Code: NON-ENGLISH.

Rejection Code: FATE.

Rejection Code: IN VITRO.

Rejection Code: NO TOX DATA.
Rejection Code: SURVEY.

Rejection Code: NON-ENGLISH/QSAR.

Rejection Code: FATE.

Rejection Code: IN VITRO.

Rejection Code: METABOLISM.

Rejection Code: SURVEY.

Rejection Code: NO TOX DATA.


; Habitat: T; Effect Codes: MOR

Rejection Code: IN VITRO.

Rejection Code: REVIEW, MODELING.


; Habitat: A; Effect Codes: MOR
1: Metabolism of 1-naphthyl-N-methyl carbamate (Sevin) in the rat. Biochemical
Pharmacology 15: 2045-2055.
Rejection Code: IN VITRO.

764. Hassan, Saad S. M., Mahmoud, Wagiha H., Elmosallamy, Mohamed A. F., and Othman, Abdel
Hammeed M. (1999). Determination of metformin in pharmaceutical preparations using
potentiometry, spectrofluorimetry and UV-visible spectrophotometry. Analytica Chimica
Rejection Code: METHODS.

within boreal, temperate and Mediterranean ecosystems. JOURNAL OF ECONOMIC
ENTOMOLOGY; 91 665-670.
Rejection Code: FATE.

Ames, Iowa 1053-1101.
Rejection Code: REVIEW.

Deposition on Lymantria monacha Larvae Feeding on Spruce Trees. Oecologia 118:
210-217.
Rejection Code: NO TOXICANT.

768. Hatzell, H. H. ( Pesticides In Surface Water From Three Agricultural Basins In South-Central
Georgia, 1993-95.
Rejection Code: SURVEY.

769. HATZINGER PB and STEVENS JL (1989). RAT KIDNEY PROXIMAL TUBULE CELLS IN
DEFINED MEDIUM THE ROLES OF CHOLERA TOXIN EXTRACELLULAR
CALCIUM AND SERUM IN CELL GROWTH AND EXPRESSION OF GAMMA
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Rejection Code: IN VITRO.

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LIPOPHORIN AND ARYLPHORIN TWO HEMOLYMPH PROTEINS OF
HELIOTHIS-ZEA. ARCH INSECT BIOCHEM PHYSIOL; 3 87-96.
Rejection Code: METABOLISM.

ACHROMOBACTER CARBOFURAN HYDROLASE INTERACT TO PRODUCE
THREE ACTIVE FORMS OF THE DIMERIC ENZYME. 93rd General Meeting of the
American Society for Microbiology, Atlanta, Georgia, Usa, May 16-20, 1993. Abstr Gen
Rejection Code: ABSTRACT.

772. HAUSCHILD JE and TOMASEK PH (1993). TWO POLYPEPTIDE ASSOCIATED WITH
ACHROMOBACTER CARBOFURAN HYDROLASE INTERACT TO PRODUCE
THREE ACTIVE FORMS OF THE DIMERIC ENZYME. 93RD GENERAL MEETING
OF THE AMERICAN SOCIETY FOR MICROBIOLOGY, ATLANTA, GEORGIA, USA,
MAY 16-20, 1993. ABSTR GEN MEET AM SOC MICROBIOL; 93 366.
Rejection Code: BACTERIA.


; Habitat: T; Effect Codes: MOR


Biochemical and Biophysical Research Communications 23: 660-665.
Rejection Code: METHODS.

Rejection Code: MIXTURE.

Rejection Code: HUMAN HEALTH.

Rejection Code: FATE.

Rejection Code: MODELING.

Rejection Code: METHODS.

Rejection Code: ABSTRACT.


; Habitat: T; Effect Codes: MOR

Rejection Code: METHODS.

Rejection Code: NO TOX DATA/METHODS.
Rejection Code: REVIEW.

Rejection Code: NON-ENGLISH.

Rejection Code: IN VITRO, METABOLISM.

Rejection Code: SEDIMENT/SURVEY.

Rejection Code: BACTERIA.

Rejection Code: HUMAN HEALTH.

Rejection Code: METHODS.

Rejection Code: IN VITRO.

Rejection Code: NO TOX DATA.

Rejection Code: IN VITRO, METABOLISM.

Rejection Code: IN VITRO, METABOLISM.

tropical storm Alberto; pesticides in urban and agricultural watersheds; and nitrate and pesticides in ground water, Georgia, Alabama, and Florida.

Rejection Code: HUMAN HEALTH.


Rejection Code: REVIEW.


Rejection Code: BACTERIA.


Rejection Code: BACTERIA.


; Habitat: A; Effect Codes: MOR,GRO


; Habitat: T; Effect Codes: MOR,REP,POP


Rejection Code: IN VITRO.


Rejection Code: SURVEY.


Rejection Code: REVIEW.


Rejection Code: HUMAN HEALTH.


Rejection Code: SURVEY.


819. Hoffmann, Michael P., Gardner, Jeffrey, and Curtis, Paul D (20031023). <04 Article Title>. <25 Page(s)>; Habitat: <40 Habitat Code>; Effect Codes: <08 Effects Code>.


821. Hoffmann, Michael P., Gardner, Jeffrey, and Curtis, Paul D (20031023). Fiber-supported pesticidal compositions. 41 pp. Rejection Code: NO TOX DATA.

822. Hoffmann, Michael P., Gardner, Jeffrey, and Curtis, Paul D (20031023). Fiber-supported pesticidal compositions. 41 pp. Rejection Code: NO TOX DATA.


Rejection Code: MIXTURE/SURVEY.

Rejection Code: SURVEY.

831. Hou, Li-Xiang and Vollmer, Sara (1994). The activity of S-thiomethyl modified creatine kinase is due to the regeneration of free thiol at the active site. *Biochimica et Biophysica Acta (BBA) - Protein Structure and Molecular Enzymology* 1205: 83-88.
Rejection Code: IN VITRO, METABOLISM.

Rejection Code: METHODS.

833. HOUK VS, SCHLAKOWSKY, S., and CLAXTON LD (1989). DEVELOPMENT AND VALIDATION OF THE SPIRAL SALMONELLA ASSAY AN AUTOMATED APPROACH TO BACTERIAL MUTAGENICITY TESTING. *MUTAT RES*; 223 49-64.
Rejection Code: BACTERIA.

Rejection Code: METHODS.

Rejection Code: METHODS.

Rejection Code: VIRUS.

Rejection Code: METHODS.

Rejection Code: METHODS.
Rejection Code: NO SPECIES.

Rejection Code: FATE.

Rejection Code: METHODS.

Rejection Code: SURVEY, HUMAN HEALTH.

Rejection Code: METHODS.

Rejection Code: SURVEY.

Rejection Code: MIXTURE.

Rejection Code: NO TOX DATA.

Rejection Code: IN VITRO, METHODS.

Rejection Code: NO CONC.
Rejection Code: NO CONC.

Rejection Code: SURVEY.

Rejection Code: METABOLISM.

; Habitat: T; Effect Codes: CEL

Rejection Code: FATE.

Rejection Code: REFS CHECKED/REVIEW.

Rejection Code: IN VITRO.

Rejection Code: IN VITRO.

Rejection Code: METHODS.

Rejection Code: METHODS.

Rejection Code: SURVEY.
Rejection Code: METHODS.

Rejection Code: METHODS.

Rejection Code: BIOLOGICAL TOXICANT.

Rejection Code: METHODS.

Rejection Code: NO TOX DATA.

Rejection Code: NO TOX DATA, METABOLISM.

Rejection Code: IN VITRO.

Rejection Code: IN VITRO.

Rejection Code: SURVEY.

Rejection Code: METABOLISM.

Rejection Code: HUMAN HEALTH.
Rejection Code: SURVEY.


; Habitat: A; Effect Codes: BCM,MOR

Rejection Code: METABOLISM.


; Habitat: T; Effect Codes: MOR


; Habitat: T; Effect Codes: MOR


; Habitat: A; Effect Codes: BEH,POP

Rejection Code: FATE.

Rejection Code: METHODS.

Rejection Code: CHEM METHOD.

Rejection Code: SURVEY.


Rejection Code: METHODS.


Rejection Code: BACTERIA.


Rejection Code: METHODS.


Rejection Code: METHODS.


Rejection Code: BIOLOGICAL TOXICANT.


Rejection Code: REFS CHECKED/REVIEW.


Rejection Code: METHODS.


Rejection Code: PUBL AS.


Rejection Code: PUBL AS.


Rejection Code: METHODS.


Rejection Code: IN VITRO.


; Habitat: T; Effect Codes: MOR

905. JONES TD and EASTERLY CE (1996). A RASH analysis of national toxicology program data: Predictions for 30 compounds to be tested in rodent carcinogenesis experiments. ENVIRONMENTAL HEALTH PERSPECTIVES; 104 1017-1030.

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Rejection Code: MODELING.


Rejection Code: NON-ENGLISH.


Rejection Code: METABOLISM.


Rejection Code: NO TOX DATA.


Rejection Code: NON-ENGLISH.


Rejection Code: IN VITRO, METABOLISM.


Rejection Code: IN VITRO.


Rejection Code: BACTERIA.
914. KALIA AK and SINGH SP (1998). Horse dung as a partial substitute for cattle dung for operating family-size biogas plants in a hilly region. *BIORESOURCE TECHNOLOGY; 64* 63-66. Rejection Code: NO TOX DATA.


; Habitat: A; Effect Codes: ACC,GRO


; Habitat: A; Effect Codes: BCM,MOR,BEH,PHY


; Habitat: A; Effect Codes: MOR,ACC


; Habitat: A; Effect Codes: ACC,BCM,PHY


; Habitat: A; Effect Codes: ACC,MOR


Rejection Code: MODELING.

Rejection Code: EFFLUENT.

Rejection Code: FATE.

Rejection Code: BIOLOGICAL TOXICANT.

Rejection Code: FATE.

Rejection Code: NO EFFECT.

Rejection Code: METHODS.

Rejection Code: SURVEY.

Rejection Code: MIXTURE, NO COC.

Rejection Code: METHODS.

Rejection Code: METHODS.

Rejection Code: NO TOX DATA/FOOD/METHODS.


Rejection Code: METHODS.


Rejection Code: FATE.


Rejection Code: FATE.


Rejection Code: BACTERIA.


Rejection Code: IN VITRO.


Rejection Code: MIXTURE, NO COC.


Rejection Code: METHODS.


Rejection Code: METHODS.


Rejection Code: METHODS.


Rejection Code: SURVEY.

948. KEMP JC and BARRETT GW (1989). SPATIAL PATTERNING IMPACT OF UNCULTIVATED CORRIDORS ON ARTHROPOD POPULATIONS WITHIN SOYBEAN AGROECOSYSTEMS. ECOLOGY; 70 114-128.


Rejection Code: IN VITRO.

  Rejection Code: BACTERIA.

  Rejection Code: HUMAN HEALTH.

  Rejection Code: IN VITRO.

973. 1994).
  Rejection Code: NO SPECIES.

  Rejection Code: SURVEY.

  Habitat: A; Effect Codes: MOR,PHY

  Rejection Code: METABOLISM.

  Rejection Code: IN VITRO.

  Rejection Code: METHODS/NO SPECIES.

  Rejection Code: SURVEY.

  Rejection Code: METHODS.


**Rejection Code:** FATE.


**Rejection Code:** MIXTURE.


**Rejection Code:** SURVEY.


**Rejection Code:** METHODS.


**Rejection Code:** NO TOX DATA.


**Rejection Code:** NO CONC.


**Rejection Code:** CHEM METHODS.


**Rejection Code:** IN VITRO.


**Rejection Code:** REFS CHECKED/REVIEW.


**Rejection Code:** REFS CHECKED/REVIEW.


**Rejection Code:** REFS CHECKED/REVIEW.

Rejection Code: HUMAN HEALTH.

Rejection Code: FATE, METABOLISM.

Rejection Code: METHODS.

Rejection Code: HUMAN HEALTH.

Rejection Code: METHODS.

Rejection Code: METHODS.

Rejection Code: METHODS.

Rejection Code: METHODS.

Rejection Code: IN VITRO.

Rejection Code: METHODS.


Rejection Code: METHODS.


Rejection Code: SURVEY.


Rejection Code: METHODS.


Rejection Code: MIXTURE.


Rejection Code: ABSTRACT.


Rejection Code: MODELING.


: Habitat: T; Effect Codes: MOR


Rejection Code: METABOLISM.


Rejection Code: SURVEY.


Rejection Code: FATE, IN VITRO.


Rejection Code: IN VITRO.


Rejection Code: IN VITRO, METABOLISM.


Rejection Code: IN VITRO, METABOLISM.


Rejection Code: IN VITRO.


Rejection Code: IN VITRO.


Rejection Code: NO COC.


Rejection Code: IN VITRO.


Rejection Code: CHEM METHODS.


Rejection Code: METHODS/NO TOX DATA/FOOD.

Rejection Code: METHODS.

Rejection Code: METHODS.

Rejection Code: METABOLISM.

Rejection Code: ABSTRACT.

Rejection Code: NO DURATION.

Habitat: T; Effect Codes: MOR,GRO

Rejection Code: REVIEW.

Rejection Code: REVIEW.

Rejection Code: SURVEY.

Rejection Code: NO TOXICANT.
Rejection Code: SURVEY.

Rejection Code: METHODS, BACTERIA.

Rejection Code: METHODS.

Rejection Code: METABOLISM, NO TOX DATA.

Rejection Code: BIOLOGICAL TOXICANT.

Rejection Code: METHODS.

Rejection Code: IN VITRO.

Rejection Code: CHEM METHODS.

Rejection Code: METHODS.

Rejection Code: NO TOX DATA, NO EFFECT.

Rejection Code: METHODS.

Rejection Code: FATE/BACTERIA.


Rejection Code: NO TOX DATA.


Rejection Code: METHODS.


Rejection Code: BIOLOGICAL TOXICANT.


Rejection Code: METHODS.


; Habitat: A; Effect Codes: MOR


Rejection Code: METHODS.


Rejection Code: METHODS.


Rejection Code: REFS CHECKED/REVIEW.


Rejection Code: NO TOX DATA.


Rejection Code: SURVEY.


Rejection Code: IN VITRO.
ROZMAN, K. AND O. HANNINEN (ED.). GASTROINTESTINAL TOXICOLOGY. 
XXIV+606P. ELSEVIER SCIENCE PUBLISHERS B.V.: AMSTERDAM, 
NETHERLANDS (DIST. IN THE USA AND CANADA BY ELSEVIER SCIENCE 
PUBLISHING CO. INC.: NEW YORK, NEW YORK, USA). ILLUSTR. ISBN 0-444-90424- 
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Rejection Code: REVIEW.

1058. LAMMERS, J. H. CM and KULIG BM (1997). Multivariate time of peak effects assessment for 
use in selecting time of testing in acute neurotoxicity studies. NEUROTOXICOLOGY 
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81.
Rejection Code: IN VITRO.

CARBOFURAN IN TOBACCO SAMPLES BY HRGC HPLC AND CZE. Hrc Journal 
Rejection Code: CHEM METHODS.

1062. Land, L. F. and Brown, M. F. ( Water-Quality Assessment of the Trinity River Basin, Texas- 
Pesticides in Streams Draining an Urban and an Agricultural Area, 1993-95.
Rejection Code: HUMAN HEALTH.

1063. LANGE CR and LANGE SR (1997). BIOMONITORING. WATER ENVIRONMENT 
RESEARCH; 69 900-915.
Rejection Code: SURVEY.

1064. Larkin, M. J. (1988). The specificity of 1-naphthol oxygenases from three bacterial isolates, 
Pseudomonas spp. (NCIB 12042 and 12043) and Rhodococcus sp. (NCIB 12038) 
Rejection Code: BACTERIA, FATE.

Rejection Code: METHODS, FATE.

decontamination of groundwater hazardous chemicals.
Rejection Code: SURVEY.

1067. LARSON RA and MARLEY KA (1994). OXIDATIVE MECHANISMS OF PHOTOTOXICITY. 
NRIAGU, J. O. AND M. S. SIMMONS (ED.). ADVANCES IN ENVIRONMENTAL 
SCIENCE AND TECHNOLOGY, VOL. 28. ENVIRONMENTAL OXIDANTS. 
XVIII+630P. JOHN WILEY AND SONS, INC.: NEW YORK, NEW YORK, USA; 

Rejection Code: SURVEY.


Rejection Code: NO TOXICANT.


Rejection Code: FATE.


Rejection Code: NO SPECIES.


Rejection Code: METABOLISM.


Rejection Code: HUMAN HEALTH.


Rejection Code: METABOLISM.


Rejection Code: METABOLISM.


Rejection Code: METABOLISM.


Rejection Code: IN VITRO.

Rejection Code: METABOLISM.
Rejection Code: IN VITRO.

Rejection Code: HUMAN HEALTH.


; Habitat: T; Effect Codes: MOR

Rejection Code: METHODS.

Rejection Code: METHODS.

Rejection Code: METHODS.

Rejection Code: METHODS/NO TOX DATA.

Rejection Code: SURVEY.

Rejection Code: METHODS.

Rejection Code: INCIDENT.

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Rejection Code: MODELING.


Rejection Code: NO TOX DATA.


Rejection Code: YEAST.


Rejection Code: SURVEY.


Rejection Code: METABOLISM.


; Habitat: A; Effect Codes: PHY

1095. Li, Gwo-Chen, Wong, Sue-San, and Tsai, Mei-Chen (2002). *Yaowu Shipin Fenxi* 10: <25 Page(s)>; Habitat: <40 Habitat Code>; Effect Codes: <08 Effects Code>.


Rejection Code: HUMAN HEALTH.


Rejection Code: FL/METHODS/NO TOX DATA/FOOD.


Rejection Code: BACTERIA.

Rejection Code: IN VITRO.

Rejection Code: IN VITRO, METABOLISM.

Rejection Code: HUMAN HEALTH.

; Habitat: AT; Effect Codes: MOR

Rejection Code: HUMAN HEALTH.

Rejection Code: BACTERIA.

Rejection Code: BACTERIA.

Rejection Code: IN VITRO.

Rejection Code: BACTERIA.

Rejection Code: IN VITRO.
Rejection Code: IN VITRO.

Rejection Code: HUMAN HEALTH.

Rejection Code: NO TOX DATA, FATE.

Rejection Code: NO TOX DATA.

Rejection Code: FATE.

Rejection Code: METHODS.

Rejection Code: BIOLOGICAL TOXICANT.

Rejection Code: METHODS.

Rejection Code: METABOLISM.

Rejection Code: NO TOX DATA.

Rejection Code: HUMAN HEALTH.


; Habitat: A; Effect Codes: MOR,BEH


Rejection Code: FATE/EFFLUENT.


Rejection Code: EFFLUENT.


Rejection Code: SURVEY.


Rejection Code: BACTERIA.


Rejection Code: REVIEW.


Rejection Code: IN VITRO.


Rejection Code: SURVEY.


Rejection Code: METHODS.


Rejection Code: BACTERIA.

Rejection Code: METHODS.


Rejection Code: SEDIMENT.


; Habitat: T; Effect Codes: MOR


Rejection Code: METHODS.


Rejection Code: MIXTURE/NO DURATION/SURVEY.


Rejection Code: IN VITRO.


Rejection Code: METABOLISM.


Rejection Code: IN VITRO.


Rejection Code: METABOLISM, NO TOX DATA.


Rejection Code: NO TOX DATA.


Rejection Code: HUMAN HEALTH.
   Rejection Code: NO CONC/SURVEY.

   Rejection Code: METABOLISM.

   ; Habitat: A; Effect Codes: MOR

   Rejection Code: FATE.

   Rejection Code: SURVEY.

   Rejection Code: METHODS.

   Rejection Code: NON-ENGLISH.

   Rejection Code: NON-ENGLISH.

   ; Habitat: T; Effect Codes: MOR, BEH

   Rejection Code: METHODS.

    Rejection Code: METHODS.


    Rejection Code: METABOLISM, IN VITRO.


    Rejection Code: METABOLISM.


    Rejection Code: METHODS.


    ; Habitat: A; Effect Codes: MOR,BEH


    Rejection Code: IN VITRO.


    Rejection Code: FATE.


    ; Habitat: T; Effect Codes: BCM


    Rejection Code: METABOLISM.


    Rejection Code: BACTERIA.

hydrogenase in agar cultures and root nodules formed by Rhizobium leguminosarum. 
Rejection Code: BACTERIA.

Banana Cultivation Region of Baru, Panama (Schwermetalle in Boeden, Pflanzen, 
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Rejection Code: NO DURATION/SURVEY.

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Rejection Code: IN VITRO.

1165. MAHMOOD, T. and YOUSUF, M. (1986). Effect of some insecticides on the hemocytes of 
Gryllus bimaculatus. PAKJ ZooL; 17 77-84. 
Rejection Code: IN VITRO.

Rejection Code: NON-ENGLISH.

1167. Maine Forest Serv., Dep. of Conservation (1980). Effects of Carbaryl (Sevin) on Brook Trout in 
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Rejection Code: REFS CHECKED/REVIEW.

9. 
Rejection Code: METHODS.

aqueous solution--IV 2-nitroso-1-naphthol-7-sulphonic acid as a new ligand. Journal of 
Inorganic and Nuclear Chemistry 32: 2800-2802. 
Rejection Code: NO SPECIES.

Rejection Code: METHODS.
Rejection Code: METHODS.

Rejection Code: REVIEW.

Rejection Code: SURVEY.

Rejection Code: FATE.

Rejection Code: BACTERIA.

Rejection Code: BIOLOGICAL TOXICANT.

Rejection Code: METABOLISM.

Rejection Code: NON-ENGLISH.

Rejection Code: NO SPECIES.

; Habitat: T; Effect Codes: MOR,ACC

; Habitat: T; Effect Codes: MOR

Rejection Code: METHODS.

Rejection Code: NO TOX DATA, METHODS.

Rejection Code: BACTERIA.

Rejection Code: METHODS.

Habitat: <40 Habitat Code>; Effect Codes: <08 Effects Code>.

Rejection Code: NO COC.

Habitat: <40 Habitat Code>; Effect Codes: <08 Effects Code>.

Rejection Code: BIOLOGICAL TOXICANT.

Rejection Code: METHODS.

Rejection Code: NO SPECIES.


Rejection Code: METHODS.

Rejection Code: METHODS.

Rejection Code: ABSTRACT.

Rejection Code: MIXTURE.

Rejection Code: NO SPECIES.

Rejection Code: METHODS.

Rejection Code: NO SPECIES.

Rejection Code: EFFLUENT.

Rejection Code: CHEM METHODS.

Rejection Code: METHODS.

1215. MATTHEWS GA (1997). TECHNIQUES TO EVALUATE INSECTICIDE EFFICACY. *DENT, D. R. AND M. P. WALTON (ED.). METHODS IN ECOLOGICAL AND AGRICULTURAL ENTOMOLOGY. XIV+387P. CAB INTERNATIONAL:*
Rejection Code: REVIEW, FATE.

; Habitat: A; Effect Codes: MOR

Rejection Code: REFS CHECKED/REVIEW.

Rejection Code: METABOLISM.

Rejection Code: NO TOX DATA.

Habitat: <40 Habitat Code>;; Effect Codes: <08 Effects Code>.

Rejection Code: HUMAN HEALTH.

Rejection Code: IN VITRO.

Rejection Code: BACTERIA.

Rejection Code: IN VITRO.
   Rejection Code: SURVEY.

   Rejection Code: CHEM METHODS.

   Rejection Code: IN VITRO.

   Rejection Code: REVIEW.

   Rejection Code: METHODS.

1231. MCLAREN GF (1989). Control of oystershell scale Quadraspidiotus ostreaeformis (Curtis) on apples in Central Otago (New Zealand). *N Z J CROP HORTIC SCI; 17 221-228.*
   Rejection Code: BACTERIA.

   Rejection Code: SURVEY.

   Rejection Code: IN VITRO.

   Rejection Code: SURVEY.

   Rejection Code: METHODS.


**Rejection Code:** FATE.


**Rejection Code:** IN VITRO, METABOLISM.


**Rejection Code:** IN VITRO.


**Rejection Code:** IN VITRO.


**Rejection Code:** FATE.


**Rejection Code:** NO SPECIES.


**Rejection Code:** METHODS.


**Rejection Code:** SURVEY.


**Rejection Code:** NO TOX DATA.


**Rejection Code:** MODELING.

; Habitat: T


Rejection Code: METHODS.


Rejection Code: METHODS/NO TOX DATA/FOOD.


Rejection Code: BACTERIA.


Rejection Code: METHODS/NO TOX DATA/FOOD.


Rejection Code: METHODS.


Rejection Code: FATE/ABSTRACT.


; Habitat: T; Effect Codes: POP


Rejection Code: FATE.


Rejection Code: FATE.


; Habitat: A; Effect Codes: MOR


; Habitat: T; Effect Codes: POP,REP


carbamate pesticides. *SOIL BIOLOGY & BIOCHEMISTRY;* 28 1767-1776.
Rejection Code: FATE.

Rejection Code: REFS CHECKED/REVIEW.

Rejection Code: IN VITRO.

Rejection Code: REVIEW.

Rejection Code: BIOLOGICAL TOXICANT.

Rejection Code: NO DURATION/SURVEY.


; Habitat: T; Effect Codes: MOR

Rejection Code: METABOLISM, IN VITRO.

Rejection Code: METABOLISM, IN VITRO.

Rejection Code: IN VITRO.

Rejection Code: IN VITRO.


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Rejection Code: NO CONC.


Rejection Code: SURVEY.


Rejection Code: NO SPECIES, MIXTURE.


Rejection Code: IN VITRO.


Rejection Code: METABOLISM.


Rejection Code: BACTERIA.


Rejection Code: IN VITRO.


Rejection Code: FATE.


Rejection Code: NO SPECIES/NO TOX DATA.


CAMBODIA. INTERNATIONAL RICE RESEARCH NOTES; 21 51.
Rejection Code: SURVEY.

Rejection Code: REFS CHECKED/REVIEW.

Rejection Code: IN VITRO.

Rejection Code: IN VITRO.

Rejection Code: METHODS.

Rejection Code: MIXTURE.

Rejection Code: IN VITRO, METABOLISM.

Rejection Code: FATE.

Rejection Code: FATE.

Rejection Code: BACTERIA.

Rejection Code: BACTERIA.

Rejection Code: NO SPECIES.

Rejection Code: METHODS.


; Habitat: A; Effect Codes: MOR


; Habitat: A; Effect Codes: MOR


; Habitat: A; Effect Codes: MOR


; Habitat: A; Effect Codes: MOR


; Habitat: A; Effect Codes: PHY,GRO

ENVIRONMENTAL QUALITY; 27 1318-1324.
Rejection Code: FATE.

Rejection Code: NON-ENGLISH.

Rejection Code: NO DURATION.

Rejection Code: NO DURATION.

Rejection Code: METHODS.

Rejection Code: NO SPECIES.

Rejection Code: ABSTRACT.

Rejection Code: REFS CHECKED/REVIEW.

Rejection Code: REVIEW.

Rejection Code: REVIEW.

Rejection Code: METHODS.

Rejection Code: METHODS.
Rejection Code: FATE.

Rejection Code: NO TOX DATA.

Rejection Code: METHODS.

Rejection Code: IN VITRO/NO DURATION.

Rejection Code: IN VITRO.

Rejection Code: METABOLISM.

Rejection Code: FATE.

Rejection Code: ATTACHED TO.

Rejection Code: BACTERIA.

Rejection Code: MODELING, IN VITRO, METABOLISM.

   Rejection Code: IN VITRO.

   Rejection Code: IN VITRO.

   Rejection Code: METABOLISM.

   Rejection Code: IN VITRO.

   Rejection Code: METHODS.

   Rejection Code: METHODS.

   Rejection Code: NO TOXICANT.

   Rejection Code: METHODS.

Rejection Code: METHODS.

Rejection Code: METHODS.

Rejection Code: QSAR.

Rejection Code: SURVEY.


; Habitat: T; Effect Codes: PHY,POP

Rejection Code: IN VITRO.

Rejection Code: QSAR.

Rejection Code: IN VITRO.

Rejection Code: NO DURATION.

Rejection Code: NO DURATION.

Rejection Code: NO TOX DATA/METHODS.

Rejection Code: IN VITRO.


Rejection Code: METABOLISM, IN VITRO.

Rejection Code: METHODS.

Rejection Code: BACTERIA.

Rejection Code: IN VITRO.
Rejection Code: IN VITRO.

Rejection Code: IN VITRO.

Rejection Code: METHODS/NO TOX DATA/FOOD.

Rejection Code: METHODS.

Rejection Code: BACTERIA/IN VITRO.

Rejection Code: SURVEY.

Rejection Code: METHODS.

Rejection Code: METHODS.

Rejection Code: METABOLISM.

Rejection Code: IN VITRO.

Rejection Code: HUMAN HEALTH.
Rejection Code: IN VITRO.

Rejection Code: IN VITRO.

Rejection Code: NO TOX DATA.

; Habitat: A; Effect Codes: GRO

Rejection Code: FATE.

Rejection Code: BACTERIA.

Rejection Code: MIXTURE.

Rejection Code: HUMAN HEALTH.

Rejection Code: IN VITRO.

Rejection Code: REVIEW,MODELING.

Rejection Code: NO SPECIES.

Concentrations of 90 polychlorinated biphenyl (PCB) congeners were determined in water, surface sediment, zooplankton, and fish collected from eight remote lakes in northwestern Ontario. The lakes vary in surface area from 0.2 to 4848 km² and receive PCBs only from atmospheric deposition. Systematic differences with lake size in concentrations of SIGMAPCBs or in congener distributions were not detected in any of the sample sets, except sediments. Concentrations of SIGMAPCBs in surface sediments increased in the largest lakes when expressed on an organic carbon basis because carbon content decreased with lake size. In general, there were few strong correlations among PCB concentrations in water, sediment, or biota and physical, chemical, or biotic conditions at the time of sampling. There was no strong biomagnification of PCBs up the food chain from plankton to piscivorous fish. The results of this study are surprising because many factors that are thought to affect PCB.

Rejection Code: SURVEY.


Rejection Code: MIXTURE.


Rejection Code: REVIEW.


Rejection Code: FATE/ABSTRACT.


Rejection Code: FATE.


Rejection Code: IN VITRO.


Rejection Code: METABOLISM.


Rejection Code: METABOLISM.

Rejection Code: METABOLISM.

Rejection Code: IN VITRO.

Rejection Code: BACTERIA.

Rejection Code: METHODS.

Rejection Code: METHODS.

Rejection Code: ABSTRACT.

Rejection Code: FATE.

Rejection Code: METHODS.

Rejection Code: METHODS.

Rejection Code: MIXTURE.

Rejection Code: MIXTURE.

Rejection Code: MIXTURE.


   Rejection Code: METHODS, NO TOX DATA.

   Rejection Code: REFS CHECKED/REVIEW.

   Rejection Code: BIOLOGICAL TOXICANT.

   Rejection Code: ABSTRACT/NO TOX DATA.

   Rejection Code: ABSTRACT.

   Rejection Code: ABSTRACT.

   Rejection Code: METHOD/NO TOX DATA/FOOD.

   Rejection Code: EFFLUENT.

1471. POKHARKAR DS and CHAUDHARY SD (97). <04 Article Title>. *INDIAN JOURNAL OF PLANT PROTECTION;* 25 <25 Page(s)>; Habitat: <40 Habitat Code>; Effect Codes: <08 Effects Code>.

   Rejection Code: NO TOX DATA.

   Rejection Code: SURVEY.

Rejection Code: METABOLISM.

Rejection Code: MODELING.

Rejection Code: HUMAN HEALTH.

Rejection Code: METHODS.

Rejection Code: NO TOX DATA.

Rejection Code: IN VITRO.

Rejection Code: METHODS.

Rejection Code: REVIEW/FATE.

Rejection Code: NO TOXICANT.

Rejection Code: FATE.

Rejection Code: FATE.

Rejection Code: FATE.


; Habitat: T; Effect Codes: GRO

Rejection Code: SURVEY.

Rejection Code: NON-ENGLISH.

Rejection Code: NO TOXICANT.

Rejection Code: NO TOX DATA.

Rejection Code: HUMAN HEALTH.

Rejection Code: HUMAN HEALTH.

Rejection Code: BACTERIA.

Rejection Code: MODELING.

Rejection Code: BACTERIA.

Rejection Code: IN VITRO.
Rejection Code: BACTERIA.

Rejection Code: SURVEY.

Rejection Code: METHODS.

Rejection Code: HUMAN HEALTH.

Rejection Code: FATE.

; Habitat: T; Effect Codes: MOR,POP

Rejection Code: NO TOX DATA.

Rejection Code: REVIEW.

Rejection Code: METABOLISM.

Rejection Code: BACTERIA/FATE.

Rejection Code: FATE.

Rejection Code: SURVEY.

Rejection Code: METHODS.

Rejection Code: NO TOXICANT.

Rejection Code: BACTERIA.

Rejection Code: FATE.

Rejection Code: REVIEW.

Rejection Code: EFFLUENT.

Rejection Code: FATE.


Habitat: T; Effect Codes: MOR


   Rejection Code: METHODS.

   Rejection Code: METHODS.

   Rejection Code: METHODS.

   Rejection Code: FATE.


   ; Habitat: T; Effect Codes: MOR

   Rejection Code: REVIEW.

   Rejection Code: SURVEY.

   Rejection Code: ABSTRACT.

   Rejection Code: NO TOX DATA.

   Rejection Code: NO TOX DATA.

   Rejection Code: SURVEY.

CLEARANCE OF 1 NAPHTHOL AND DISPOSITION OF ITS GLUCURONIDE AND SULFATE CONJUGATES IN THE ISOLATED PERFUSED RAT KIDNEY. *J PHARMACOL EXP THER*; 244 263-267.

Rejection Code: METABOLISM.


Rejection Code: EFFLUENT.


Rejection Code: FATE/NO TOX DATA.


Rejection Code: METHODS.

1543. REID WJ (1986). EXTRACTION AND CLEAN-UP OF CONTAMINANTS AND TOXICANTS FROM FOOD FOR MASS SPECTROMETRIC ANALYSIS A LITERATURE REVIEW. *FOOD ADDIT CONTAM*; 3 1-42.

Rejection Code: METHODS.


Rejection Code: HUMAN HEALTH.


Rejection Code: METHODS.


Rejection Code: METHODS.


Rejection Code: SURVEY.


Rejection Code: SURVEY.


Rejection Code: IN VITRO.


; Habitat: T; Effect Codes: MOR


; Habitat: A; Effect Codes: MOR


Rejection Code: EFFLUENT.

Rejection Code: MIXTURE.

Rejection Code: METABOLISM.

Rejection Code: HUMAN HEALTH.


Rejection Code: IN VITRO.

Rejection Code: IN VITRO.

Rejection Code: IN VITRO.

Rejection Code: MIXTURE, NO COC.

Rejection Code: IN VITRO.

Rejection Code: IN VITRO.

Rejection Code: SURVEY, NO TOX DATA.

Rejection Code: IN VITRO.

1574. RONAI ZA, GRADIA, S., EL-BAYOUMY, K., AMIN, S., and HECHT SS (1994). Contrasting incidence of ras mutations in rat mammary and mouse skin tumors induced by anti-benzo-(c)-phenanthrene-3,4-diol-1,2-epoxide. CARCINOGENESIS (OXFORD); 15 2113-2116.
Rejection Code: NO COC.

Rejection Code: IN VITRO.

Rejection Code: NON-ENGLISH.

Rejection Code: BACTERIA.

Rejection Code: MODELING.

Rejection Code: FATE.


1585. Rueegg, Willy T (20040812). *<04 Article Title>*; <25 Page(s)>; Habitat: <40 Habitat Code>; Effect Codes: <08 Effects Code>.


Rejection Code: METHODS/QSAR.

Rejection Code: MODELING.

Rejection Code: FATE.

Rejection Code: EFFLUENT.

Rejection Code: SURVEY.

Rejection Code: MODELING.

Rejection Code: IN VITRO.

Rejection Code: IN VITRO.

Rejection Code: METHODS.

Rejection Code: MIXTURE.


Beetle Aleochara bilineata (Col.: Staphylinidae) in the Laboratory. *Entomophaga* 40: 95-104.

; Habitat: T; Effect Codes: MOR,REP,GRO


Rejection Code: REVIEW.


Rejection Code: NO SPECIES.


; Habitat: A; Effect Codes: PHY


Rejection Code: NO TOX DATA.


Rejection Code: ABSTRACT.


Rejection Code: NO SPECIES.


Rejection Code: METHODS.


Rejection Code: NO TOXICANT/NO SPECIES.


Rejection Code: METHODS.

Rejection Code: FATE.


Rejection Code: METHODS/NO TOXICANT.


Rejection Code: METHODS.


Rejection Code: SURVEY.


Rejection Code: BACTERIA.


Rejection Code: HUMAN HEALTH.


Rejection Code: MODELING.


Rejection Code: METHODS.


Rejection Code: METHODS.

Rejection Code: SURVEY.

Rejection Code: NO COC, HUMAN HEALTH.

Rejection Code: IN VITRO.

Rejection Code: IN VITRO.

Rejection Code: IN VITRO.

Rejection Code: SURVEY.

Rejection Code: METHODS.

Rejection Code: METABOLISM.

Rejection Code: HUMAN HEALTH.

Rejection Code: SEDIMENT CONC, FATE.

Rejection Code: IN VITRO.
Rejection Code: IN VITRO.

Rejection Code: IN VITRO.

Rejection Code: IN VITRO.

Rejection Code: BACTERIA.

; Habitat: T; Effect Codes: MOR

; Habitat: T; Effect Codes: MOR

Rejection Code: SURVEY.

Rejection Code: NO TOX DATA.

Rejection Code: IN VITRO, MIXTURE.

Rejection Code: IN VITRO.

Rejection Code: HUMAN HEALTH.

Rejection Code: IN VITRO.

Rejection Code: METHODS.

Rejection Code: NON-ENGLISH.

; Habitat: A; Effect Codes: POP,PHY,ACC,REP,MOR,BCM

Rejection Code: NO TOX DATA.

Rejection Code: METHODS.

Rejection Code: MODELING.

Rejection Code: SURVEY.

Rejection Code: IN VITRO.
Rejection Code: NO TOX DATA.

Rejection Code: METABOLISM, IN VITRO.

Rejection Code: IN VITRO.

Rejection Code: REVIEW.

Rejection Code: NO TOX DATA.

Rejection Code: REVIEW.

Rejection Code: NO SPECIES (DEAD).

Rejection Code: IN VITRO.

Rejection Code: IN VITRO.

Rejection Code: METHODS.

Rejection Code: METHODS.


Page 549 of 602
Rejection Code: NO TOX DATA.

Rejection Code: BACTERIA, METABOLISM.

Rejection Code: IN VITRO.

Rejection Code: IN VITRO.

Rejection Code: NO TOXICANT.

Rejection Code: REFS CHECKED/REVIEW.

Rejection Code: REFS CHECKED/REVIEW.

Rejection Code: METHODS.

Rejection Code: HUMAN HEALTH.

Rejection Code: FATE.

Rejection Code: FATE.
Rejection Code: FATE.

Rejection Code: FATE/NO TOX DATA.

; Habitat: T; Effect Codes: MOR

; Habitat: T; Effect Codes: MOR

Rejection Code: IN VITRO.

Rejection Code: IN VITRO.

Rejection Code: IN VITRO.

Rejection Code: IN VITRO.

Rejection Code: HUMAN HEALTH.

Rejection Code: METHODS.

Rejection Code: NO TOX DATA.


Rejection Code: REFS CHECKED/REVIEW.

Rejection Code: METHODS.

Rejection Code: METHODS.

Rejection Code: HUMAN HEALTH, NO COC.

Rejection Code: SURVEY, HUMAN HEALTH.

Rejection Code: METHODS.

Rejection Code: METHODS, NO SPECIES.

Rejection Code: MIXTURE.

Rejection Code: MIXTURE.

Rejection Code: MODELING.

Rejection Code: QSAR.

Rejection Code: REVIEW.


Rejection Code: ABSTRACT.

Rejection Code: IN VITRO.

Rejection Code: IN VITRO.

Rejection Code: METHODS, NO TOX DATA.

Rejection Code: METHODS.

Rejection Code: METHODS.

Rejection Code: METHODS.

Rejection Code: NO SPECIES.

Rejection Code: SURVEY.

Rejection Code: NO TOXICANT.

Rejection Code: REVIEW.

Rejection Code: VIRUS.

Rejection Code: IN VITRO.

Rejection Code: METHODS, METABOLISM.

Rejection Code: IN VITRO.

Rejection Code: IN VITRO.

Rejection Code: IN VITRO.

Rejection Code: METABOLISM.

Rejection Code : SURVEY.


; Habitat: T; Effect Codes: MOR


Rejection Code: METHODS.


Rejection Code: FATE.


Rejection Code: FATE.


Rejection Code: REVIEW.


Rejection Code: HUMAN HEALTH.


Rejection Code: METHODS.


Rejection Code: METHODS.


Rejection Code: SURVEY.


; Habitat: A; Effect Codes: PHY


Rejection Code: SURVEY.

Rejection Code: BIOLOGICAL TOXICANT.

Rejection Code: HUMAN HEALTH.

Rejection Code: FATE.

Rejection Code: METHODS.

Habitat: <40 Habitat Code>;; Effect Codes: <08 Effects Code>.

Rejection Code: CHEM METHODS.

Rejection Code: METHODS.

Rejection Code: NO SPECIES.

Rejection Code: METHODS.

Rejection Code: METABOLISM/NO CONC/SURVEY.

Rejection Code: MIXTURE.


; Habitat: T; Effect Codes: MOR


Rejection Code: METABOLISM, IN VITRO.

1795. STIMMANN MW and FERGUSON MP (1990). PROGRESS REPORT VICE PRESIDENT'S TASK FORCE ON PEST CONTROL ALTERNATIVES POTENTIAL PESTICIDE USE CANCELLATIONS IN CALIFORNIA USA. CALIF AGRIC; 44 12-16.

Rejection Code: SURVEY.


Rejection Code: NO COC.


Rejection Code: ABSTRACT.


Rejection Code: SURVEY.


; Habitat: A; Effect Codes: MOR


Rejection Code: SURVEY.


Rejection Code: METABOLISM.
Rejection Code: METABOLISM.

Rejection Code: METHODS.

Rejection Code: METHODS.

Rejection Code: METHODS.

Rejection Code: METHODS.

Rejection Code: IN VITRO.

Rejection Code: METHODS.

Rejection Code: FATE.

Rejection Code: NO SPECIES.

Rejection Code: FATE.
1813. Suski, V. (Protection Of Fruit Orchards In Poland. 
Rejection Code: NO TOX DATA.

Rejection Code: EFFLUENT.

Rejection Code: BACTERIA.

Rejection Code: NON-ENGLISH.

Rejection Code: METHODS.

Rejection Code: SURVEY.

Rejection Code: ABSTRACT.

Rejection Code: FATE.

Rejection Code: CHEM METHODS.
Rejection Code: CHEM METHOD.

Rejection Code: REVIEW.

Rejection Code: REVIEW.

Rejection Code: REVIEW.

Rejection Code: IN VITRO.

Rejection Code: METHODS.

Rejection Code: METHODS.

Rejection Code: METHODS.

Rejection Code: METHODS.

Rejection Code: METHODS.

Rejection Code: ABSTRACT.

1833. Tamas, Ladislav, Durcekova, Katarina, Haluskova, L'ubica, Huttova, Jana, Mistrik, Igor, and Olle, Marta ( Rhizosphere localized cationic peroxidase from barley roots is strongly activated

**Rejection Code:** NO TOX DATA.


**Rejection Code:** ABSTRACT.


**Rejection Code:** BIOLOGICAL TOXICANT.


**Rejection Code:** IN VITRO.


**Rejection Code:** METHODS.


**Rejection Code:** NON-ENGLISH.


**Rejection Code:** METHODS.


**Rejection Code:** NO TOX DATA.


**Rejection Code:** SURVEY.


**Rejection Code:** IN VITRO.


**Rejection Code:** IN VITRO.
Rejection Code: METHODS.

Rejection Code: METHODS.

Rejection Code: METHODS.

Rejection Code: METABOLISM.

Rejection Code: REVIEW.

Rejection Code: SURVEY.

Rejection Code: FATE/METHODS.

Rejection Code: METHODS.

Rejection Code: FATE.

Rejection Code: BACTERIA.

Rejection Code: REVIEW.

Rejection Code: REVIEW.

Rejection Code: ABSTRACT.

Rejection Code: IN VITRO.


; Habitat: T; Effect Codes: MOR

Rejection Code: IN VITRO, METABOLISM.

Rejection Code: CHEM METHODS.

Rejection Code: CHEM METHODS.

Rejection Code: NON-ENGLISH.

1864. TITUS JE and HOOVER DT (1993). Reproduction in two submersed macrophytes declines
progressively at low pH. *FRESHWATER BIOL*; 30 63-72.

**Rejection Code: NO TOXICANT.**

1865. Tizio, R., Trippi, V. S., Trione, S. O., and Almelapons, G. (1961). Studies on Rooting in Grapevine Cuttings. IV. Action of 2,4-D, 2,4,5-T, NAA and IAA, Alone or in Combination and with or Without Addition of Sucrose, on Rooting Capacity (Estudios Sobre Enraizamiento en vid IV. Efecto de los Acidos 2,4-Diclorofenoxicetico, 2,4,5-Triclorofenoxicetico, Naftalenacetico e indol-3-acetico y Combinaciones de los Mismos y con Sacarosa), Sobre la Capacidad de Enraizamiento). *Phyton (B.Aires)* 17: 15-19.

**Rejection Code: NON-ENGLISH.**

1866. Tizio, R., Trippi, V. S., Trione, S. O., and Almelapons, G. (1961). Studies on Rooting in Grapevine Cuttings. IV. Action of 2,4-D, 2,4,5-T, NAA and IAA, Alone or in Combination and with or Without Addition of Sucrose, on Rooting Capacity (Estudios Sobre Enraizamiento en vid IV. Efecto de los Acidos 2,4-Diclorofenoxicetico, 2,4,5-Triclorofenoxicetico, Naftalenacetico e indol-3-acetico y Combinaciones de los Mismos y con Sacarosa), Sobre la Capacidad de Enraizamiento). *Phyton (B.Aires)* 17: 15-19.

**Rejection Code: NON-ENGLISH.**


**Rejection Code: METABOLISM, IN VITRO.**


**Rejection Code: METHODS.**


; **Habitat:** A; **Effect Codes:** MOR


**Rejection Code: BACTERIA.**


**Rejection Code: FATE.**


**Rejection Code: SURVEY.**


**Rejection Code: METHODS.**


Rejection Code: BACTERIA.


Rejection Code: REVIEW.


Rejection Code: METHODS.


Rejection Code: NON-ENGLISH.


Rejection Code: NON-ENGLISH.


Rejection Code: METABOLISM.


Rejection Code: METHODS, METABOLISM.


Rejection Code: EFFLUENT.


Rejection Code: SURVEY.


Rejection Code: SURVEY.


Rejection Code: NO CONC.

**Rejection Code:** PUBL AS.


**Rejection Code:** MIXTURE.


**Rejection Code:** METHODS.


**Rejection Code:** IN VITRO.


**Rejection Code:** NO TOX DATA.


; Habitat: A; Effect Codes: MOR


**Rejection Code:** IN VITRO.


**Rejection Code:** HUMAN HEALTH.


**Rejection Code:** REVIEW.


**Rejection Code:** REVIEW.


**Rejection Code:** FATE, METABOLISM.
Rejection Code: FATE.

Rejection Code: METHODS.

Rejection Code: NON-ENGLISH.

Rejection Code: IN VITRO, NO TOX DATA.

Rejection Code: NON-ENGLISH.

Rejection Code: METHODS.

Rejection Code: FATE, IN VITRO.

Rejection Code: IN VITRO, METABOLISM.

Rejection Code: IN VITRO, METABOLISM.

Rejection Code: METABOLISM.

Rejection Code: NO TOXICANT.

1908. UNO, Y., TAKASAWA, H., MIYAGAWA, M., INOUE, Y., MURATA, T., and YOSHIKA, W.


Rejection Code: IN VITRO.

Rejection Code: METABOLISM, IN VITRO.


Rejection Code: METHODS.

Rejection Code: METABOLISM.

Rejection Code: FATE.

Rejection Code: METHODS.

Rejection Code: IN VITRO, METHODS.

; Habitat: T

Rejection Code: NO TOX DATA.


activity relationships of epoxides: Induction of sister-chromatid exchanges in V79 cells
by enantiomeric epoxides. MUTAT RES; 278 289-297.
Rejection Code: IN VITRO.

1939. VORHEES DJ, CULLEN AC, and ALTSHUL LM (1999). Polychlorinated biphenyls in house
dust and yard soil near a superfund site. ENVIRONMENTAL SCIENCE &
technology; 33 2151-2156.
Rejection Code: SURVEY.

Rejection Code: NON-ENGLISH.

ALUMINUM-RELATED BONE DISEASE AND VITAMIN D METABOLITES IN
GROWING UREMIC RATS. XXTH EUROPEAN SYMPOSIUM ON CALCIFIED
TISSUES, SIRMIONE, ITALY, OCTOBER 4-8, 1987. CALCIF TISSUE INT 41: 63.
Rejection Code: ABSTRACT.

Rejection Code: METHODS.

WHO TECHNICAL REPORT SERIES; 01-VIII, 1-69.
Rejection Code: HUMAN HEALTH.

teratogenicity study with gamma-cyclodextrin in rats. REGULATORY TOXICOLOGY
AND PHARMACOLOGY; 27 166-171.
Rejection Code: NO COC.

1945. WADE HF, YORK AC, MOREY AE, PADMORE JM, and RUDO KM (1998). The impact of
pesticide use on groundwater in North Carolina. JOURNAL OF ENVIRONMENTAL
QUALITY; 27 1018-1026.
Rejection Code: SURVEY.

Rejection Code: IN VITRO, NO TOX DATA.

new technique for visualizing virus particles electrophoretically transferred from infected
Rejection Code: METHODS, VIRUS.

Cardiotonic Amines with Ionpair-HPLC (Neue Herzwirksame Drogen II, Nachweis und
Isolierung Herzwirksamer Amine Durch Lonenpaar-HPLC. Planta Med. 44: 36-40
(GER) (ENG ABS).
Rejection Code: NON-ENGLISH.

Atmospheric Deposition Of Pesticides In A Small Southern Saskatchewan Watershed.
14: 1171-1175.
Rejection Code: SURVEY.

Rejection Code: SURVEY.

Rejection Code: NO SURVEY.

Rejection Code: NO SURVEY.

Rejection Code: SURVEY.

Rejection Code: SURVEY.

Rejection Code: SURVEY.

Rejection Code: EFFlUENT/FATE.

Rejection Code: EFFlUENT/FATE.

Rejection Code: MODELING.

Rejection Code: IN VITRO.

Rejection Code: SURVEY.

Rejection Code: METHODS.

Rejection Code: REVIEW.

Rejection Code: METHODS.

Rejection Code: NO CONC/SURVEY.

Rejection Code: BACTERIA, ABSTRACT.

Rejection Code: BACTERIA.

Rejection Code: SURVEY.

Rejection Code: HUMAN HEALTH.

Rejection Code: BACTERIA.

Rejection Code: NO TOX DATA.
Rejection Code: NO TOX DATA.

Rejection Code: NO TOX DATA.

Rejection Code: NO TOX DATA.

Rejection Code: METABOLISM.

Rejection Code: MODELING.

Rejection Code: IN VITRO.

Rejection Code: BIOLOGICAL TOXICANT.

Rejection Code: METHODS/NO TOX DATA.

Rejection Code: METHODS.

Rejection Code: METHODS.

Rejection Code: IN VITRO.


   Rejection Code: NO CONC.

   Rejection Code: FATE.

   Rejection Code: NO SPECIES/REVIEW.

   Rejection Code: NO SPECIES.

   Rejection Code: NO SPECIES.

   Rejection Code: FATE.

   Rejection Code: FATE.

   Rejection Code: BACTERIA.

   Rejection Code: BACTERIA.

   Rejection Code: BACTERIA.

   Rejection Code: BACTERIA.

   Rejection Code: REFS CHECKED/REVIEW.

the Fate of These Chemicals can be Quantified in a Simplified, Straightforward Manner. 
**Rejection Code:** REFS CHECKED/REVIEW.

**Rejection Code:** REFS CHECKED/REVIEW.

**Rejection Code:** BOOK ORDERED - BURDITT VOL 17.

**Rejection Code:** METHODS.

**Rejection Code:** METABOLISM, METHODS.

**Rejection Code:** METHODS, NO TOX DATA.

**Rejection Code:** REVIEW.

**Rejection Code:** METHODS.

**Rejection Code:** IN VITRO.

**Rejection Code:** IN VITRO.

**Rejection Code:** METHODS.

Rejection Code: SURVEY/EFFlUENT.

Rejection Code: SURVEY.


; Habitat: T; Effect Codes: BCM

Rejection Code: REVIEW.

Rejection Code: BACTERIA.

Rejection Code: HUMAN HEALTH.

Rejection Code: BACTERIA.

Rejection Code: CHEM METHODS.

Rejection Code: EFFlUENT.

Rejection Code: REVIEW.
Rejection Code: FATE.


Rejection Code: NO.

Rejection Code: NO TOX DATA.

Rejection Code: NO TOX DATA.

Rejection Code: FATE.

Rejection Code: HUMAN HEALTH.

Rejection Code: IN VITRO.

Rejection Code: METHODS.

Rejection Code: METHODS.

Rejection Code: METHODS.

Rejection Code: BACTERIA, METABOLISM.
Rejection Code: FATE.

Rejection Code: IN VITRO.

Rejection Code: NON-ENGLISH.

Rejection Code: IN VITRO.

Rejection Code: IN VITRO.

Rejection Code: FATE.

Rejection Code: FATE.

Rejection Code: IN VITRO.

Rejection Code: METHODS.

Rejection Code: SURVEY.

Rejection Code: IN VITRO.
Rejection Code: MIXTURE/OIL.

Rejection Code: METHODS.

Rejection Code: METHODS.

Rejection Code: SURVEY.

Rejection Code: NO TOXICANT.

Rejection Code: REVIEW.

Rejection Code: MODELING/REVIEW.

Rejection Code: MODELING/REVIEW.

Rejection Code: SURVEY.

Rejection Code: SURVEY.

Rejection Code: FATE.

Rejection Code: METHODS.

Rejection Code: BIOLOGICAL TOXICANT.

Rejection Code: IN VITRO, METHODS.

Rejection Code: NON-ENGLISH.

Rejection Code: SURVEY.

Rejection Code: METHODS.

Rejection Code: IN VITRO, METABOLISM.

Rejection Code: METHODS.

Rejection Code: HUMAN HEALTH.

Rejection Code: MIXTURE.

Rejection Code: MIXTURE.

Rejection Code: MIXTURE.


; **Habitat:** T; **Effect Codes:** MOR


Rejection Code: NO DURATION/SURVEY.


Rejection Code: METHODS.


Rejection Code: SURVEY.


Rejection Code: SURVEY.


Rejection Code: METABOLISM.


Rejection Code: FATE.


Rejection Code: BACTERIA.


Rejection Code: SURVEY.


Rejection Code: NO TOX DATA.


Rejection Code: IN VITRO, METHODS.

2102. Zhang, Yaodong, Muench, Susanne B, Schulze, Holger, Perz, Roland, Yang, Bolun, Schmid, Rolf D, and Bachmann, Till T (2005). Disposable biosensor test for organophosphate and
Rejection Code: HUMAN HEALTH.

Rejection Code: CHEM METHOD.

Rejection Code: FATE.

Rejection Code: FATE.

Rejection Code: METABOLISM.

2107. ZHU BT, ROY, D., and LIEHR JG (1993). The carcinogenic activity of ethinyl estrogens is determined by both their hormonal characteristics and their conversion to catechol metabolites. *ENDOCRINOLOGY; 132* 577-583.
Rejection Code: IN VITRO.

Rejection Code: FATE.

Rejection Code: METHODS, METABOLISM.

Rejection Code: IN VITRO, METABOLISM.

Rejection Code: IN VITRO, METABOLISM.

Rejection Code: SURVEY.
Rejection Code: BACTERIA.

Rejection Code: FATE.

Rejection Code: METHODS/NO TOX DATA/FOOD.

Rejection Code: METHODS.
Appendix I. Individual Effect Analysis.

Likelihood of individual acute effects to freshwater invertebrates based on maximum application rate with 26 application per year.

<table>
<thead>
<tr>
<th>Predictors of chance of individual effect using probit dose-response curve slope and median lethal estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enter LC₅₀ or LD₅₀</td>
</tr>
<tr>
<td>Enter desired threshold</td>
</tr>
<tr>
<td>Enter slope of dose-response</td>
</tr>
<tr>
<td>z score result</td>
</tr>
<tr>
<td>Probability associated with z</td>
</tr>
<tr>
<td>Chance of individual effect, ~1 in . . . .</td>
</tr>
</tbody>
</table>

This is based on the formula logLC₅₀ = logLC₅₀ + (z/b)
where: z is the standard normal deviate and b equals slope
Works for dose-response models based on a probit assumption (i.e. log normal distribution of individual sensitivity)
Note: Probability associated with z value may be reported as "0." This is due to the inability of Excel to handle extremes in z scores beyond ~8.2
For such cases the chance of individual effect is defaulted to 1 in 10⁸⁸, which is the limit of Excel reporting.

Ed Odenkirchen, May 28, 2003 EFED/OPP/USEPA

Figure II. Estimation of likelihood on individual mortality based on risk quotients for freshwater fish (RQ=2.52) following 26 applications per year to lawns. Estimated dose-response slope is 6.4.

Likelihood of an individual acute effects to freshwater invertebrates based on maximum application rate and a single application per year.

<table>
<thead>
<tr>
<th>Predictors of chance of individual effect using probit dose-response curve slope and median lethal estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enter LC₅₀ or LD₅₀</td>
</tr>
<tr>
<td>Enter desired threshold</td>
</tr>
<tr>
<td>Enter slope of dose-response</td>
</tr>
<tr>
<td>z score result</td>
</tr>
<tr>
<td>Probability associated with z</td>
</tr>
<tr>
<td>Chance of individual effect, ~1 in . . . .</td>
</tr>
</tbody>
</table>

This is based on the formula logLC₅₀ = logLC₅₀ + (z/b)
where: z is the standard normal deviate and b equals slope
Works for dose-response models based on a probit assumption (i.e. log normal distribution of individual sensitivity)
Note: Probability associated with z value may be reported as "0." This is due to the inability of Excel to handle extremes in z scores beyond ~8.2
For such cases the chance of individual effect is defaulted to 1 in 10⁸⁸, which is the limit of Excel reporting.

Ed Odenkirchen, May 28, 2003 EFED/OPP/USEPA

Figure II. Estimation of likelihood of individual mortality based on risk quotients for freshwater fish (RQ=0.88) following three applications of carbaryl per year to lawns. Estimated dose-response slope is 6.4.
IEC V1 - Individual Effect Chance Model Version 1
Predictor of chance of individual effect using probit dose-response curve slope and median lethal estimate

<table>
<thead>
<tr>
<th>Predictor of chance of individual effect using probit dose-response curve slope and median lethal estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Enter LC₅₀ or LD₅₀</strong></td>
</tr>
<tr>
<td><strong>Enter desired threshold</strong></td>
</tr>
<tr>
<td><strong>Enter slope of dose-response</strong></td>
</tr>
<tr>
<td><strong>z score result</strong></td>
</tr>
<tr>
<td><strong>Probability associated with z</strong></td>
</tr>
<tr>
<td><strong>Chance of individual effect</strong></td>
</tr>
</tbody>
</table>

This is based on the formula log(LC₅₀) = log(LC₅₀) + z(b)
where: z is the standard normal deviate and b equals slope
Works for dose-response models based on a probit assumption (i.e. log normal distribution of individual sensitivity)
Note: Probability associated with z value may be reported as "0". This is due to the inability of Excel to handle extremes in z scores beyond -8.2
In such cases the chance of individual effect is defaulted to 1 in 10⁰⁰, which is the limit of Excel reporting.

Ed Odenkirchen, May 28, 2003 EFED/OPP/USEPA

Figure I3. Estimation of likelihood of individual mortality based on risk quotients for freshwater fish (RQ=0.44) following a single application of carbaryl per year to lawns.
Estimated dose-response slope is 6.4.

IEC V1 - Individual Effect Chance Model Version 1
Predictor of chance of individual effect using probit dose-response curve slope and median lethal estimate

<table>
<thead>
<tr>
<th>Predictor of chance of individual effect using probit dose-response curve slope and median lethal estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Enter LC₅₀ or LD₅₀</strong></td>
</tr>
<tr>
<td><strong>Enter desired threshold</strong></td>
</tr>
<tr>
<td><strong>Enter slope of dose-response</strong></td>
</tr>
<tr>
<td><strong>z score result</strong></td>
</tr>
<tr>
<td><strong>Probability associated with z</strong></td>
</tr>
<tr>
<td><strong>Chance of individual effect</strong></td>
</tr>
</tbody>
</table>

This is based on the formula log(LC₅₀) = log(LC₅₀) + z(b)
where: z is the standard normal deviate and b equals slope
Works for dose-response models based on a probit assumption (i.e. log normal distribution of individual sensitivity)
Note: Probability associated with z value may be reported as "0". This is due to the inability of Excel to handle extremes in z scores beyond -8.2
In such cases the chance of individual effect is defaulted to 1 in 10⁰⁰, which is the limit of Excel reporting.

Ed Odenkirchen, May 28, 2003 EFED/OPP/USEPA

Figure 15. Estimation of likelihood of individual mortality based on risk quotients for freshwater invertebrates (RQ=314) following multiple (26) applications to lawns.
Estimated dose-response slope is 4.3.
Figure I6. Estimation of likelihood of individual mortality based on risk quotients for freshwater invertebrates (RQ=14) following a single applications to lawns. Estimated dose-response slope is 4.3.

J.1 Background

The Barton Springs are supplied predominantly with water discharging from fractures and conduits formed in the Barton Springs Segment of the Edwards Aquifer (BSSEA) as a result of dissolution of the fractured limestone aquifer over time. Slade et al. (1986) estimated that approximately 85% of the water that recharges this aquifer infiltrates through the beds of six creeks that cross the recharge zone (Slade et al. 1986, Barrett and Charbeneau 1996), with the remaining approximately 15% of the recharge derived from precipitation and recharge in interbed areas in the recharge zone. In the BSSEA, natural ground water discharge occurs primarily at Barton Springs (Lindgren et al., 2004). Recharge features in creek bottoms overlying the recharge zone allow only a limited flow of water during a storm event; therefore, water that is in excess of the flow capacities of recharge features leaves the recharge zone as creek flow. The contributing zone encompasses the watersheds of the upstream portions of the six major creeks that cross the recharge zone and therefore provides the source for most of the water that enters the BSSEA as recharge. These streams gain water, as they flow across the land surface in the contributing zone, from the lower-permeability Glen Rose limestone of the adjacent Trinity aquifer (Lindgren et al., 2004). Kuniansky (1989) estimated baseflow discharge from the Trinity aquifer to streams and creeks in this area ranging from 25% to 90% of total flow. In the portion of the Trinity aquifer nearest the contributing zone this was loosely estimated at 30%. The remainder of water in creeks in the contributing zone is derived from precipitation and runoff.

J.2 Model Outline

The refined conceptual model attempts to capture the most important aspects of this unique hydrology. In this regard, the nature of the contributing zone and the recharge zone are distinguished and treated separately. Runoff from the recharge zone is assumed to enter the karst environment directly, whereas runoff from the contributing zone is assumed to mix with stream water prior to entering the karst environment of the recharge zone. The long-term average flow volume in the streams in the contributing zone was assumed to be due 30% to aquifer discharge and 70% to runoff, as is consistent with Kuniansky (1989). Thus surface runoff in the contributing zone mixes with the aquifer discharge flow prior to flowing into the recharge zone.

Masses and volumes of runoff are determined for this assessment from modeling scenarios developed specifically for the various land uses (e.g., orchards, nurseries, vineyards, residential) found in the Barton Springs Salamander action area. Similar to the Agency’s standard ecological risk assessment methodology described above, 30 years of meteorological data were linked to these specific scenarios to estimate 1-in-10-year edge-of-field exposure to potential carbaryl uses.
J.3 Determination of Runoff Concentrations and Volume

As described previously, the contributing zone and the recharge zone are treated differently. Calculations for the contributing zone are described first and these are followed by calculations for the recharge zone.

J.3.1 Contributing Zone

This refined assessment uses the long term average stream flow information to calculate an approximate average daily stream flow in the contributing zone. Because the ratio of runoff flow to base stream flow was given by Kuniansky (1989) to be 70:30, knowing the long-term runoff flow enables an estimate of the long-term average streamflow. The long-term (30 year simulated) runoff volume was calculated for each scenario using PRZM and the respective areas within the contributing zone. The cumulative runoff volume for the contributing zone was calculated according to

\[ V_{CZ} = \sum_{i=1}^{n} \left( \sum_{t=1}^{m} (V_{CZ,i,t}) \right) \]  

(J.1)

where \( V_{CZ} \) = 30-year simulated cumulative runoff [volume]  
\( V_{CZ,i,t} \) = runoff from area i on day t [volume]  
\( n \) = number of days in simulation  
\( m \) = number of different areas (e.g., crop areas) in simulation

The estimated daily aquifer-driven base flow in the streams within the contributing zone is calculated from the 70:30 ratio as given by Kuniansky (1989):

\[ V_{base} = \frac{V_{CZ}}{n} \left( \frac{0.30}{0.70} \right) \]  

(J.2)

where \( V_{base} \) = the long-term average daily aquifer-driven stream volume [volume]

Daily stream volume was calculated by adding the base stream flow to the daily runoff flows as follows:

\[ V_{stream,t} = \sum_{i=1}^{m} (V_{CZ,i,t}) + V_{base} \]  

(J.3)

where \( V_{stream,t} \) = the total stream volume on day t [volume]

Daily stream concentrations were calculated directly from the PRZM output, the area of the scenario, and the stream base flow as follows:
\[
C_{\text{stream},t} = \sum_{i=1}^{n} \left( M_{\text{CZ},i,t} \right) + M_{\text{base}} \frac{V_{\text{stream},t}}{V_{\text{stream},t}}
\] (J.4)

where \( C_{\text{stream},t} \) = the daily stream concentration [mass/volume]
\( M_{\text{CZ},i,t} \) = mass of runoff for scenario \( i \) on day \( t \) in contributing zone [mass]
\( M_{\text{base}} \) = daily average mass in stream base flow [mass]

The above calculated stream volume \( (V_{\text{stream},t}) \) in equation J.3 along with its associated concentration \( (C_{\text{stream},t}) \) in equation J.4 are assumed to be delivered to the recharge zone where they mix with recharge zone runoff as described next.

### J.3.2 Recharge Zone

Runoff originating in the recharge zone was determined in a similar manner as for the contributing zone using PRZM output as follows:

\[
V_{\text{RZ},t} = \sum_{i=1}^{n} \left( V_{\text{RZ},i,t} \right)
\] (J.5)

where \( V_{\text{RZ},t} \) = total daily runoff in recharge zone [volume]
\( V_{\text{RZ},i,t} \) = runoff from area \( i \) on day \( t \) [volume]
\( m \) = number of different areas (e.g., crop areas) in simulation

The concentration of runoff in the recharge zone was determined from the PRZM mass output (output as mass/area), the area represented by the scenario, and the volume of runoff in the recharge zone as follows:

\[
C_{\text{RZ},t} = \sum_{i=1}^{n} \left( M_{i,t} \right) \frac{V_{\text{RZ},t}}{V_{\text{RZ},t}}
\] (J.6)

where \( C_{\text{RZ},t} \) = daily recharge zone runoff concentration [mass/volume]
\( M_{\text{RZ},i,t} \) = mass of runoff for scenario \( i \) on day \( t \) in recharge zone [mass]

### J.4 Barton Springs Daily Concentrations

It is assumed that the stream flow from the contributing area and the runoff from the recharge area mix and flow through the Karst and into Barton Springs. The spring concentration is determined from:

\[
C_{\text{Barton},t} = \frac{C_{\text{RZ},t}V_{\text{RZ},t} + C_{\text{stream},t}V_{\text{stream},t}}{V_{\text{RZ},t} + V_{\text{stream},t}}
\] (J.7)

where \( C_{\text{Barton},t} \) = the daily concentration in Barton Spring [mass/volume]
The daily Springs EECs in the Barton Springs were processed in order to provide durations of exposure. Peak, 14-day, 21-day, 30-day, 60-day, and 90-day average concentrations were calculated across 30 years of daily EEC values. In order to match the standard PRZM/EXAMS output, the maximum values for each of the 30 years of daily and rolling averages were ranked and the 90th percentiles from the rankings were selected as the final 1-in-10-year EECs for use in risk estimation.
J.5 Special Case: Use area hydrologically similar to non-use area

In the case where a pesticide use area has the same hydrological characteristics as the non-use area, a simplification can be made that gives approximately identical results as the more complicated model described above. For example, in the Barton Springs area of interest, the non-crop use area is modeled with a residential PRZM scenario (predominantly characterized by a curve number of 85). If a sole use area is also modeled with the same residential scenario, then runoff would occur from both the use area and the non-use areas in an identical manner.

Consider now, the Barton Springs calculation (equation J.7 above). This equation can be rewritten as:

\[
C_{Barton,t} = \frac{M_{RZ,\text{non-use},t} + M_{RZ,\text{use},t} + M_{CZ,\text{non-use},t} + M_{CZ,\text{use},t} + M_{\text{base},t}}{V_{RZ,\text{non-use},t} + V_{RZ,\text{use},t} + V_{CZ,\text{non-use},t} + V_{CZ,\text{use},t} + V_{\text{base},t}} \quad (J.8)
\]

For the 30-year simulation of the watershed area, less than 9 of the 569 runoff events produced runoff from the area that had a volume of less than 10 times the calculated stream base flow. This means that the volume of the base stream flow is negligible in nearly every event in comparison to runoff volume. In the unlikely case that a high pesticide concentration would occur from one of these rare events (1.6% of runoff events) then such an event would be screened out by the EPA practice of selecting the 90\textsuperscript{th} percentile reoccurrence event. Therefore for practical purposes, the base volume can be eliminated from the above equation. Additionally, since all the runoff volumes are generated from the same scenario with only area differing among them and if base stream concentrations can be assumed to be negligible, then equation A.8 can be rewritten as

\[
C_{Barton,t} = \frac{(M_{A,t} A_{CZ,\text{use}} + A_{RZ,\text{use}})}{D_t (A_{CZ,\text{non-use}} + A_{CZ,\text{use}} + A_{RZ,\text{non-use}} + A_{RZ,\text{use}})} \quad (J.9)
\]

where \( M_{A,t} \) = daily PRZM output for pesticide mass [mass/area]
\( D_t \) = daily PRZM output for runoff depth [length]
\( A_{CZ,i} \) = extent of \( i \) area in contributing zone [area]
\( A_{RZ,i} \) = extent of \( i \) area in recharge zone [area]

Therefore, the Barton Springs concentration can be determined by the PRZM edge-of-field concentration times the ratio of use area to total area:

\[
C_{Barton,t} = C_{\text{edge}} \frac{A_{\text{use}}}{A_{\text{total}}} \quad (J.10)
\]

where \( C_{\text{edge}} \) = PRZM edge of field concentration [mass/volume]
\( A_{\text{use}} \) = total use area [area]
\( A_{\text{total}} \) = total Barton Springs watershed area [area]
The above simplified model equation (J.10) can be used where the use and non-use areas can be described by the same PRZM scenario and where background concentrations are not present.
Appendix K. Product Formulations Containing Multiple Active Ingredients

The Agency does not routinely include, in its risk assessments, an evaluation of mixtures of active ingredients, either those mixtures of multiple active ingredients in product formulations or those in the applicator’s tank. In the case of the product formulations of active ingredients (that is, a registered product containing more than one active ingredient), each active ingredient is subject to an individual risk assessment for regulatory decision regarding the active ingredient on a particular use site. If effects data are available for a formulated product containing more than one active ingredient, they may be used qualitatively or quantitatively.

There are no product LD50 values, with associated 95% Confidence Intervals (CIs) available for carbaryl.

As discussed in USEPA (2000) a quantitative component-based evaluation of mixture toxicity requires data of appropriate quality for each component of a mixture. In this mixture evaluation an LD50 with associated 95% CI is needed for the formulated product. The same quality of data is also required for each component of the mixture. Given that the formulated products for carbaryl do not have LD50 data available it is not possible to undertake a quantitative or qualitative analysis for potential interactive effects. However, because the active ingredients are not expected to have similar mechanisms of action, metabolites, or toxicokinetic behavior, it is reasonable to conclude that an assumption of dose-addition would be inappropriate. Consequently, an assessment based on the toxicity of carbaryl is the only reasonable approach that employs the available data to address the potential acute risks of the formulated products.


### Pesticide Products Formulated with Carbaryl and Other Pesticide Active Ingredients

#### CARBARYL PRODUCTS

<table>
<thead>
<tr>
<th>PRODUCT/TRADE NAME</th>
<th>EPA Reg.No.</th>
<th>% Carbaryl</th>
<th>LD 50 (mg/kg)</th>
<th>CI (mg/kg)</th>
<th>A.I Adjusted CI (mg/kg)</th>
<th>A.I Adjusted LD50 (mg/kg)</th>
<th>PM</th>
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<tbody>
<tr>
<td>Bonide Vegetable Floral Dust or Spray</td>
<td>00000400029</td>
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<td>ND</td>
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<td>ND</td>
<td>ND</td>
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<tr>
<td>Bonide Fruit Tree Spray</td>
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<td>0.5</td>
<td>&gt;5000</td>
<td>ND</td>
<td>ND</td>
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<tr>
<td>Bonide A Complete Fruit Tree Spray</td>
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<td>&gt;500</td>
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<tr>
<td>Bonide Slug, Snail &amp; Sowbug Bait</td>
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<tr>
<td>PRODUCT/TRADE NAME</td>
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<td>% Carbaryl</td>
<td>PRODUCT</td>
<td>ADJUSTED FOR ACTIVE INGREDIENT</td>
<td>PM</td>
<td></td>
<td></td>
</tr>
<tr>
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<tr>
<td>Ferti-Lome Home Garden Bug Bait</td>
<td>00740100265</td>
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<td>307 mg/kg; CI 286.1-329.5 mg/kg</td>
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</tr>
<tr>
<td>Corry’s Slug, Snail &amp; Insect Killer</td>
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<tr>
<td>The Andersons GC Bicarb Insecticide + Fertilizer</td>
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<td>&gt;5000</td>
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<td>The Andersons Bicarb Insect Killer Granules</td>
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<tr>
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<td>&gt;5000</td>
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<td>ECHO Home Garden Fungicide and Insecticide</td>
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\* From registrant submitted data to support registration. Compiled by Office of Pesticide Programs Health Effects Division.
\* Carbaryl LD50 = 307 mg/kg; CI = 286.1-329.5 mg/kg