

Human Health

The analysis in this chapter is a summary of the screening level Human Health Risk Assessment (HHRA) contained in Appendix D. It addresses the potential impacts from the proposed use of chemical and biological pesticides under the No Program and Program alternatives.

The HHRA was necessarily broadly focused, as the statewide extent of the Program precludes characterization of potential effects to specific individuals or populations. Instead, the screening-level evaluation assessed the potential for adverse health effects using conservative exposure assumptions designed to be protective of all populations, including the most sensitive.

8.1 ENVIRONMENTAL SETTING

The Program Area is defined as all areas of California that could become infested with LBAM, excluding alpine and desert areas and Imperial County. Treatment areas will be restricted to areas below 5,000 feet mean sea level with temperatures below 90°F for most of the year.

The No Program and Program alternatives are summarized in Table 8-1. This table represents a summary of the chemical treatment application scenarios that are described in greater detail in Section D2 of Appendix D and Chapter 2 of the PEIR.

Table 8-1 Condensed Summary of Alternatives Evaluated in PEIR

Alternative	Application Method	Chemical (s)
No Program	As per label directions	Chlorpyrifos, Permethrin, Lambda-cyhalothrin, Spinosad, <i>Bacillus thuringiensis kurstaki</i> (Btk)
Mating Disruption – Twist Ties (MD-1)	Twist Ties	IsoMate (LBAM pheromones)
Mating Disruption – Ground Application (MD-2)	Ground Applications	Hercon Flake, SPLAT (LBAM pheromones)
Mating Disruption – Aerial Application (MD--3)	Aerial Release	Hercon Flake, SPLAT (LBAM pheromones)
Male Moth Attractant (Alternative MMA)	Ground Application	SPLAT (LBAM pheromones) + Permethrin (inert ingredients ethylbenzene; 1,2,4-trimethylbenzene)
<i>Bacillus thuringiensis</i> (Alternative Btk)	Ground Treatments	<i>Bacillus thuringiensis kurstaki</i> (Btk)
Spinosad (Alternative S)	Ground Treatments	Spinosad
Inundative Parasite Wasp Releases (Alternative Bio-P)		None – not considered further for potential human health impacts
Sterile Insect Technique (Alternative SIT)		None – not considered further for potential human health impacts

The following section provides an overview of the population characteristics of the Program Area. That discussion is followed by background information on the regulatory setting with respect to the use of the chemical and biological pesticides proposed for use.

8.1.1 Population Characteristics of the Affected Environment

In 2007, the population of California was estimated at 37.6 million (California Department of Finance 2007a). The population of the primary 13-county-wide Program Area is approximately 8.4 million, which represents 22.3 percent of the statewide total (see Table 8-2).

Population projections for the statewide and primary Program Areas through 2030 are shown in Table 8-3. Statewide growth between 2000 and 2010 is projected at 1.5 percent annually to a population of 39.1 million (California Department of Finance 2007b). Comparable growth in the primary Program Area is projected at 0.8 percent annually to a population of 8.5 million. Growth is expected at 0.9 percent annually between 2020 and 2030. Among counties, San Benito and Solano counties are projected to grow most rapidly (2.1 percent and 1.6 annually, respectively). San Francisco County is expected to grow most slowly at 0.1 percent annually over this period.

Racial and ethnical characteristics of the primary and statewide Program Areas are presented in Table 8-4. In the primary Program Area, White (Caucasian), Hispanic, and Asian are approximately 90.5 percent of the total regional population (California Department of Finance 2004). Considered collectively, other racial groups represent 9.5 percent of the regional total, with Black/African Americans accounting for 6.3 percent. The proportion of Hispanics living and working in the primary Program Area is less than the statewide figure of 34.8 percent (California Department of Finance 2004)

Racial composition varies substantially among counties within the primary Program Area. Monterey County has the lowest White population at 36.1 percent and the highest Hispanic/Latino population at 52.4 percent, representative of areas with a large agricultural industry. Conversely, Marin County has the highest White population at 76.4 percent and the second lowest Hispanic/Latino population at 14.1 percent. Solano County is more racially diversified than other counties in the primary Program Area, with the largest percentage of percent Black/African Americans (13.2 percent) and multiracial persons (3.5 percent), and second highest American Indian/Alaskan Natives (0.6 percent).

Table 8-2 Population and Population Growth in the Primary Program Area (1990–2007)

County/Area	Population			Population Growth (Compound Annual Average)	
	1990	2000	2007	1990–2000	2000–2007
Alameda	1,276,702	1,443,939	1,522,197	1.2%	0.8%
Contra Costa	803,732	948,816	1,051,674	2.4%	1.5%
Marin	230,096	247,289	255,080	1.0%	0.4%
Monterey	355,660	401,762	423,762	1.2%	0.8%
Napa	110,765	124,279	134,844	1.2%	1.2%
San Benito	36,697	53,234	57,296	3.8%	1.1%
San Francisco	723,959	776,733	812,241	0.7%	0.6%
San Mateo	649,623	707,163	730,339	0.9%	0.5%
Santa Barbara	369,608	399,347	423,540	0.8%	0.8%
Santa Clara	1,497,577	1,682,585	1,805,314	1.2%	1.0%
Santa Cruz	229,734	255,602	263,499	1.1%	0.4%
Solano	339,471	394,930	422,974	1.5%	1.0%
Sonoma	388,222	458,614	479,668	1.7%	0.6%
Primary Program Area	7,011,846	7,894,293	8,382,428	1.2%	0.9%
Statewide Program Area	29,758,213	33,873,086	37,559,540	1.3%	1.5%

Table 8-3 Population Projections in the Primary Program Areas (2000–2030)

County/Area	Population Projection			Population Growth (Compound Annual Rate)		
	2010	2020	2030	2000–2010	2010–2020	2020–2030
Alameda	1,550,133	1,663,481	1,791,721	0.7%	0.7%	0.7%
Contra Costa	1,075,931	1,237,544	1,422,840	1.3%	1.4%	1.4%
Marin	253,682	260,305	273,151	0.3%	0.3%	0.5%
Monterey	433,283	476,642	529,145	0.8%	1.0%	1.1%
Napa	142,767	165,786	191,734	1.4%	1.5%	1.5%
San Benito	64,230	83,792	103,340	1.9%	2.7%	2.1%
San Francisco	818,163	844,466	854,675	0.5%	0.3%	0.1%
San Mateo	736,667	761,455	786,069	0.4%	0.3%	0.3%
Santa Barbara	434,497	459,498	484,570	0.8%	0.6%	0.5%
Santa Clara	1,837,361	1,992,805	2,192,501	0.9%	0.8%	1.0%
Santa Cruz	268,016	287,480	304,465	0.5%	0.7%	0.6%
Solano	441,061	503,248	590,166	1.1%	1.3%	1.6%
Sonoma	495,412	546,151	606,346	0.8%	1.0%	1.1%
Primary Program Area	8,551,203	9,282,653	10,130,723	0.8%	0.8%	0.9%
Statewide Program Area	39,135,676	44,135,923	49,240,891	1.5%	1.2%	1.1%

Table 8-4 Race/Ethnicity in the Program Areas (2004)

County/Area	Race (Percent of Total Population)						
	White	Black / African American	American Indian / Alaska Native	Asian	Native Hawaiian / Pacific Islander	Multiracial	Hispanic / Latino
Alameda	39.1%	13.1%	0.4%	22.6%	0.7%	2.7%	21.4%
Contra Costa	55.8%	8.7%	0.4%	11.9%	0.4%	2.1%	20.7%
Marin	76.4%	2.9%	0.3%	4.2%	0.1%	2.0%	14.1%
Monterey	36.1%	2.8%	0.5%	6.0%	0.4%	1.9%	52.4%
Napa	64.4%	1.2%	0.6%	4.1%	0.2%	1.7%	27.9%
San Benito	42.6%	1.0%	0.6%	2.4%	0.1%	1.4%	51.8%
San Francisco	44.7%	7.1%	0.3%	31.2%	0.5%	2.6%	13.5%
San Mateo	46.6%	3.5%	0.2%	22.3%	1.4%	2.4%	23.7%
Santa Barbara	56.4%	2.4%	0.6%	4.1%	0.2%	1.6%	34.9%
Santa Clara	43.0%	2.7%	0.4%	26.6%	0.4%	2.2%	24.8%
Santa Cruz	61.3%	0.9%	0.5%	4.2%	0.1%	1.9%	31.1%
Solano	47.3%	13.2%	0.6%	14.2%	0.8%	3.5%	20.4%
Sonoma	71.0%	1.4%	0.9%	3.9%	0.2%	2.2%	20.5%
Primary Program Area	48.3%	6.3%	0.4%	18.1%	0.5%	2.3%	24.0%
Statewide Program Area	44.6%	6.0%	0.6%	11.6%	0.4%	2.0%	34.8%

Sources: California Department of Finance 2004.
* Represents an average for the primary Program Area counties, weighted by population.

8.1.2 Pesticides and the Environment

8.1.2.1 Environmental Chemistry and Fate

Addressing the full spectrum of the behavior of a chemical released into the environment requires an analysis of the chemical(s) fate and transport. Fate and transport analysis allows for an interpretation of the potential persistence of chemicals in the environment, and the means by which they may be transported from one environmental 'compartment' (e.g., soils) into another (e.g., biological tissues), or otherwise transformed through degradation. A variety of biological, chemical and physical mechanisms affect the persistence of a chemical in the environment, and certain physical and chemical parameters allow for a reasonable prediction of such environmental fate. Typical measures by which the fate and transport of chemicals are evaluated include:

- Half-life in soils, sediments, water, air
- Relative solubility in water versus lipid (fat)
- Adsorption onto soils, sediments, biological tissues (e.g., plant matter)
- Volatilization rate across the air-water interface
- Photolytic half-lives (i.e., degradation/oxidation by sunlight)

Of course, the environmental fate and transport of chemical(s) is also regulated by physical conditions in the environment where the chemical was initially released. Factors of particular relevance that affect fate and transport processes include:

- Temperature
- Wind convection
- Sunlight penetration
- Turbidity (i.e., in water applications)
- pH

The rate and manner in which these natural physical processes affect the breakdown or persistence of a chemical in the environment are chemical specific. Appendix D, Section D3 discusses the environmental fate of the pesticide active ingredients and other chemicals associated with specific pesticide formulations proposed for use for the Program alternatives.

Most of the chemicals evaluated in the HHRA have characteristics that make them break down fairly rapidly in the environment, and they are not expected to remain in environmental media for extended periods of time. Certain chemicals do have the potential to persist in biota or other organic matter such as sediments for periods of weeks to months (i.e., permethrin and spinosad). However, the potential for bioaccumulation of permethrin in humans is limited by its rapid metabolism to water-soluble metabolites that are eliminated in urine, and spinosad is not expected to be released into the environment in sufficient quantities to warrant concern for bioaccumulation. Additionally, the biopesticide Btk has spores that are known to persist in the environment for up to a year.

8.1.3 Hazards and Toxicity in the Environmental Setting

A “hazardous material” is defined in Title 22, CCR, Section 66084, as “a substance or combination of substances which, because of its quantity, concentration or physical, chemical or infectious characteristics, may either: (1) cause, or significantly contribute to, an increase in mortality or an increase in serious irreversible or incapacitating irreversible illness, or (2) pose a substantial present or potential hazard to human health or environment when improperly treated, stored, transported or disposed of or otherwise managed.” Any liquid, solid, gas, sludge, synthetic product, or commodity that exhibits characteristics of toxicity, ignitability, corrosivity, or reactivity has the potential to be considered a “hazardous material.” In contrast, a “hazardous waste” is defined as “any hazardous material that is abandoned, discarded, or recycled” (Title 22, CCR Section 66084).

8.1.3.1 Hazards and Hazardous Materials in Formulations Identified for the No Program and Program Alternatives

The No Program and some Program alternatives could involve the use of hazardous materials as defined in CCR Section 66084. Formulation constituents include the active ingredients and may include inert ingredients. Inert ingredients may not contribute to the pesticides’ insecticidal action by the same mechanism, but rather are added to the formulations to improve solubility, distribution, emulsification, or other actions of the active ingredient during application (generally reducing the amount of active ingredient required). However, several of the ingredients in the LBAM treatment formulations under No Program and Program alternatives could be classified as hazardous materials under CCR Section 66084.

8.1.4 Regulatory Environment

Formulations proposed for each Program alternative for LBAM eradication would be used according to regulatory requirements for the transportation, treatment, and control activities involving the use of each pesticide. Pesticide active ingredients included in this analysis include spinosad, lambda-cyhalothrin, permethrin, chlorpyrifos, Btk, and the LBAM-specific pheromone formulations, SPLAT Hercon, and Isomate. Inert ingredients that were quantitatively evaluated are 1,2,4-trimethylbenzene and ethylbenzene. Federal and state regulations impose requirements on the registration and use of pesticides. The regulatory framework pertaining to the use of pesticides is discussed below.

8.1.4.1 Pesticide Registration and Labeling

The USEPA regulates pesticides under two major statutes: the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and the Federal Food, Drug, and Cosmetic Act (FFDCA). Pesticides are defined under FIFRA as, “any substance intended for preventing, destroying, repelling, or mitigating any pest.” FIFRA requires that pesticides be registered (licensed) by the USEPA before they may be sold or distributed for use in the U.S., and that they perform their intended functions without causing unreasonable adverse effects on people and the environment when used according to USEPA-approved label directions.

Current FIFRA regulations do not require manufacturers to reveal the inert ingredients in pesticide formulations, as FIFRA regulates the active ingredients only. Thus, the identities of some of the inert ingredients in the commercial formulations of the various pesticide products on the market have not been provided to the USEPA. Toxicity studies conducted under FIFRA are required to evaluate the product formulations only, and not the toxicity of the individual inert ingredients that may be used to facilitate absorption and uptake of the pesticide. However, because the formulations are tested, the potential additive or synergistic effect of inert ingredients on toxicity is addressed through the testing protocols adopted. Special uses of pesticides, outside their original label specifications, can be considered on a case-by-case basis through FIFRA Section 24C (U.S. Code of Regulations 2008). However, the use of the LBAM pheromone

formulations considered for use in this PEIR are already authorized in the State of California under FIFRA by the DPR, and uses will conform to the approved label restrictions.

The FFDCA authorizes the USEPA to set tolerances, or maximum legal limits, for pesticide residues in food. Thus, the FFDCA does not expressly regulate pesticide use, but residue limits established by the USEPA may result in a change in the use pattern regulated under FIFRA. The USEPA also requires extensive scientific research and supporting test data as part of its pesticide review and approval process before granting a registration for most pesticides. These studies allow the USEPA to assess risks to human health, domestic animals, wildlife, plants, groundwater, and beneficial insects, and to assess the potential for other environmental effects. When new evidence raises questions about the safety of a registered pesticide, the USEPA may take action to suspend or cancel its registration and revoke the associated residue tolerance. The USEPA may also undertake extensive special review of a pesticide's risks and benefits or work with manufacturers and users to implement changes in a pesticide's use (e.g., reducing application rates or cancellation of a pesticide's use).

8.1.4.2 State of California

California Department of Pesticide Regulation

California's programs for the registration of pesticides and commercial chemicals, licensing and certification, data review and evaluation, and pesticide residue monitoring closely parallel federal programs. However, California data requirements are stricter than federal requirements and are specific to the state (e.g., manufacturers must prove their products are effective and can be used safely under California conditions). The registration of pesticides and commercial chemicals in California is under the California Environmental Protection Agency's purview.

The DPR, a department overseen by the California Environmental Protection Agency, coordinates a number of programs to regulate pesticides, including product evaluation and registration through use enforcement, environmental monitoring, residue testing, and reevaluation, if deemed appropriate. The DPR works with county agricultural commissioners who act as local pesticide enforcement authorities, who evaluate, develop conditions of use, approve, or deny permits for restricted-use pesticides; certify private applicators; conduct compliance inspections; and take formal compliance or enforcement actions. California's pesticide regulatory program has been certified by the Secretary of Resources as meeting CEQA requirements (DPR 2006a).

The State of California also requires commercial growers and pesticide applicators to report commercial pesticide applications to local county agricultural commissioners. The DPR compiles this information in annual pesticide use reports. Agricultural use comprises a vast majority of the total reported annual pesticide use. In addition to pesticide applications for pest management, other nonagricultural uses of pesticides include pest control of right-of-ways, fumigation of nonfood and nonfeed materials, pesticide research, and regulatory pest control in the ongoing control and /or eradication of pest infestations (DPR 2003).

The Environmental Hazards Assessment Program has the lead role in implementing the DPR's environmental protection program. The program collects data and analyzes the results from studies that are conducted to measure pesticide residues in the environment, characterize drift and other off-site pesticide movement, and evaluate the effect of application methods on movement of pesticides in air. If a pesticide is determined to be a toxic air contaminant, appropriate control measures are developed in consultation with the California Air Resources Board to reduce emissions to levels that adequately protect public health. Control measures may include product label amendments, applicator training, restrictions on use patterns or locations, and product cancellations.

Office of Environmental Health Hazard Assessment

The OEHHA’s Pesticide and Environmental Toxicology Branch has four separate sections: Pesticide and Food Toxicology, Pesticide Epidemiology, Water Toxicology, and Fish and Water Quality Evaluation. These sections support and work with the DPR in reviewing risk characterization and hazard evaluations, pesticide illness surveillance, and evaluating chemical contaminants in consumer products and in fish and wildlife. These sections also communicate with the public through education on pesticide-related health issues, developing health advisories, and work with the DPR to develop regulations for protecting workers exposed to agricultural pesticides.

The OEHHA is also responsible for implementing the Safe Drinking Water and Toxic Enforcement Act of 1986, colloquially known as Proposition 65. Proposition 65 was enacted as a ballot initiative in November 1986. The proposition was intended by its authors to protect California citizens from chemicals known to cause cancer, birth defects, or other reproductive harm, and to inform citizens about exposures to such chemicals. Proposition 65 requires the governor to publish, at least annually, a list of chemicals known to the state to cause cancer or reproductive toxicity. The chemical ethylbenzene, an inert ingredient of Permethrin E-Pro, is listed under Proposition 65 as a carcinogen (OEHHA 2008a). Following the May 29, 2009, public meeting of the Carcinogen Identification Committee of OEHHA’s Science Advisory Board, permethrin was listed in the medium priority group (OEHHA 2009a). This committee serves as the “State’s Qualified Experts” for prioritizing a list of recommended chemicals for possible listing under Proposition 65 (The Safe Drinking Water and Toxics Enforcement Act of 1986, codified at Health and Safety Code Section 25249.5) and establishing whether a chemical has been clearly shown to cause cancer through scientifically valid testing according to generally accepted principles.

8.1.4.3 Registration Information on Pesticides Evaluated in the Human Health Risk Assessment

The chemical and biological pesticides evaluated in the HHRA (Appendix D) are summarized in Table 8-5, along with their Chemical Abstracts Service (CAS) registration numbers, the USEPA pesticide code (PC), and the DPR’s chemical code.

Table 8-5 International (CAS), National (USEPA-PC) and State (DPR) Registration Codes for Chemicals/Biopesticides Used in No Program and Program Alternatives

Chemical Name	CAS No.	USEPA-PC No.	DPR Chemical Code
No Program Alternative			
Lambda-cyhalothrin (Warrior)	91465-08-6	100-1112	2297
Chlorpyrifos (Duraguard ME/ Dursban 4E)	2921-88-2	499-367-ZA	253
Permethrin (E-Pro)	52645-53-1	79676-2	2008
Spinosad A; Spinosad D (Entrust)	131929-60-7, 131929-63-0	62719-282	3983
<i>Bacillus thuringiensis kurstaki</i> (Btk) (DiPel DF/DiPel DF PRO)	68038-71-1	73049-39	86
Mating Disruption – Twist Ties (Alternative MD-1)			
(E)-11-Tetradecen-1-yl acetate; (E,E)-9,11-Tetradecadien-1-yl acetate (Isomate)	33189-72-9; 30562-09-5	53575-07008-EU*	
Mating Disruption – Ground Application (Alternative MD-2)			
(E)-11-Tetradecen-1-yl acetate; (E,E)-9,11-Tetradecadien-1-yl acetate (SPLAT)	33189-72-9; 30562-09-5	080386-CA-006**	--
(E)-11-Tetradecen-1-yl acetate; (E,E)-9,11-Tetradecadien-1-yl acetate (Hercon Flake)	33189-72-9; 30562-09-5	8730-73	--

Table 8-5 International (CAS), National (USEPA-PC) and State (DPR) Registration Codes for Chemicals/Biopesticides Used in No Program and Program Alternatives

Chemical Name	CAS No.	USEPA-PC No.	DPR Chemical Code
Mating Disruption – Aerial Application (Alternative MD-3)			
(E)-11-Tetradecen-1-yl acetate; (E,E)-9,11-Tetradecadien-1-yl acetate (SPLAT)	33189-72-9; 30562-09-5	080386-CA-002**	--
(E)-11-Tetradecen-1-yl acetate; (E,E)-9,11-Tetradecadien-1-yl acetate (Hercon Flake)	33189-72-9; 30562-09-5	8730-73	--
Male Moth Attractant (Alternative MMA)			
(E)-11-Tetradecen-1-yl acetate; (E,E)-9,11-Tetradecadien-1-yl acetate (SPLAT)	33189-72-9; 30562-09-5	080386-CA-006**	--
Permethrin (E-Pro)	52645-53-1	79676-2	2008
1,2,4-trimethylbenzene (Permethrin E-Pro)	95-63-6	--	--
Ethylbenzene (Permethrin E-Pro)	100-41-4	--	--
Organically Approved Insecticides (Alternatives Btk and S)			
Spinosad A; Spinosad D (Entrust)	131929-60-7, 131929-63-0	62719-282	3983
<i>Bacillus thuringiensis kurstaki</i> (DiPel DF/ DiPel DF PRO)	68038-71-1	73049-39	86
*CA REG **EPA-established number -- = not available			

8.1.5 Hazards and Hazardous Materials in Pesticide Formulations Identified for the No Program and Program Alternatives

The No Program and Program alternatives include commercial chemical formulations that are considered hazardous materials as defined in CCR Section 66084. Hazardous formulations contained in the No Program or Program alternatives include permethrin, lambda-cyhalothrin, chlorpyrifos, Btk, spinosad, ethylbenzene, and 1,2,4-trimethylbenzene. Both 1,2,4-trimethylbenzene and ethylbenzene are components of the permethrin formulations. Additionally, three LBAM-specific pheromones are evaluated as potentially hazardous materials: Hercon Disrupt Bio-Flake[®] (Hercon), SPLAT LBAM[™] (SPLAT), and Isomate.

Current FIFRA regulations do not require manufacturers to reveal formulation components. Consequently, the identities of many of the inert ingredients in the commercial formulations of the various pesticide products on the market are not publically available. Toxicity studies conducted under FIFRA are required to evaluate the active ingredient and the product formulation. Ideally, in environments where a variety of pesticides may be used, the potential for chemical interactions of inert and active ingredients should be understood to minimize risks. Since the identity and/or concentrations of the inert ingredients in each formulation are usually proprietary, and the FIFRA does not require disclosure of these concentrations, it was not possible to estimate concentrations or evaluate health risks of most inert ingredients in the formulations considered for use, and only general toxicity hazard information is provided in Appendix D, HHRA. In this assessment, an exception is the permethrin formulation, Permethrin E-Pro. For this product, the material safety data sheet (MSDS) contained information on two inert ingredients (ethylbenzene and 1,2,4-trimethylbenzene) and the percentage composition of each – sufficient information to support the quantitative assessment of potential health effects from exposure.

Whether or not the substances identified in Table 8-5 are associated with adverse health effects in humans depends upon the exposure concentration, the exposure route, the uptake of chemical, and the exposure duration, i.e., the period of time over which exposure may occur (see toxicity discussion below). This PEIR evaluation and the information contained in Appendix D regarding potential human health risks were prepared to evaluate that question i.e., whether any of the Program alternatives present unacceptable risks or hazards to the public, sensitive receptors, or workers.

8.1.5.1 Hazards of Pesticide Ingredients in the No Program and Proposed Program and Alternatives

Detailed evaluations of the toxicity of pesticide active ingredients for No Program and those considered for use in the Proposed Program are provided in Appendix D. The following discussions provide summary information on the toxicity of each of the pesticide ingredients that is excerpted from Appendix D.

Chlorpyrifos

Chlorpyrifos is a broad spectrum organophosphate pesticide that is one of the most widely used organophosphate pesticides in the U.S. Like other organophosphates, chlorpyrifos acts primarily by inhibiting the action of cholinesterases, enzymes that break down acetylcholine and related neurotransmitters of the central and peripheral nervous systems. Recent information (see review by OEHHA 2008a) indicates that chlorpyrifos can have effects on the developing brain that are separate from cholinesterase inhibition.

Experiments with different organisms under varying experimental conditions indicate that chlorpyrifos has the potential to bioaccumulate, with the extent of that accumulation dependent on the species, the dose of chlorpyrifos, and the duration of exposure (Agency for Toxic Substances and Disease Registry [ATSDR] 1997).

As with all chemicals, the effect of chlorpyrifos exposure depends on the factors listed above; i.e., concentration exposure route, uptake, and exposure duration. Chlorpyrifos can be toxic when exposure takes place by ingestion, inhalation, or dermal contact for acute (short-term) or longer exposure periods. Chlorpyrifos appears to be able to cause developmental toxicity and teratogenicity in experimental animals. In humans, long-term low-level chlorpyrifos exposure can cause decreased concentration, memory loss, irritability, and depression. Delayed neurotoxicity is characteristic of longer-term exposure to chlorpyrifos; both sensory loss and peripheral neuropathy have been documented in humans (ATSDR 1997).

No evidence from animals studies exists to indicate that chlorpyrifos is carcinogenic, although the ATSDR (1997) cites only a single chronic-duration study to support this conclusion. In that study, male and female rats and beagle dogs exposed to chlorpyrifos up to 3 mg/kg per day for 1 to 2 years did not have an increased incidence of tumors compared to controls (McCollister et al. 1974). Chlorpyrifos is not listed as a carcinogen by the International Agency for Research on Cancer (IARC), USEPA (2006b), National Toxicology Program (NTP), or under California's Proposition 65.

Lambda-cyhalothrin

Lambda-cyhalothrin is a broad spectrum type II pyrethroid. Pyrethroids are synthetic chemical analogues of pyrethrins, which are naturally occurring insecticidal compounds produced in the flowers of chrysanthemums. Pyrethroids are separated into two broad categories—Type I and Type II—based on distinct chemical and toxicological properties (Bloomquist 1996; ATSDR 2003). The primary toxicity of pyrethroids is manifested in the nervous system of insects as well as mammals, where they act as neurotoxins. Lambda-cyhalothrin's neurotoxicity is a function of its ability to interfere with nerve impulse generation. Because they are lipophilic (i.e., have an affinity for lipids) pyrethroids are readily absorbed by biological membranes and tissues (IPCS 1990; USEPA 2002b).

Lambda-cyhalothrin has significant structural similarity to the compound cyhalothrin (IPCS 1990), and because of this common chemistry, many of the toxicity studies submitted to the USEPA (e.g., 2002b) in support of lambda-cyhalothrin pesticide tolerance evaluations were conducted with cyhalothrin.

Lambda-cyhalothrin and cyhalothrin have been repeatedly and consistently shown to cause decreased body weight gain and reduced food consumption. Signs of neurotoxicity and changes in organ weights are also common effects of exposure to lambda-cyhalothrin and cyhalothrin (USEPA 2002b, 2004a, 2007a).

The USEPA's Hazard Identification Assessment Review Committee (USEPA 2002c) focused on data from two rodent studies in evaluating the potential carcinogenicity of cyhalothrin. One of those studies identified an increased incidence of mammary tumors in mice after receiving cyhalothrin in feed over a 2-year period. Although the USEPA noted some concerns about the adequacy of the study, the agency determined that cyhalothrin should be classified as a Group D chemical (i.e., Not Classifiable as to Human Carcinogenicity). DPR (2007a) cited the increased incidence of mammary tumors in mice, and the USEPA's conclusion that lambda-cyhalothrin was not classifiable as to its carcinogenicity in prioritizing lambda-cyhalothrin for risk assessment initiation. Neither lambda-cyhalothrin nor cyhalothrin are listed as carcinogens by the IARC, USEPA's Integrated Risk Information System (2009a), NTP, or under California's Proposition 65.

Permethrin

Pyrethrum is a naturally occurring substance with insecticidal properties obtained from certain species of chrysanthemum (*C. cinerariaefolium* and *C. cineum*); it is one of many synthetic analogs of pyrethrum that have been commercially developed as insecticides (ATSDR 2003) (see preceding discussion on lambda-cyhalothrin).

Chemical and physical properties of permethrin indicate a potential for permethrin to concentrate and accumulate in biota. However, the potential for bioaccumulation of permethrin in mammals is limited by its rapid metabolism to water-soluble metabolites that are eliminated in urine (ATSDR 2003). Experimental data confirm that while permethrin partitions to both muscle and fat of mammals, it does not accumulate in these tissues with repeated exposure (IPCS 1979, 1999).

In humans, acute effects observed subsequent to ingestion of permethrin include nausea, vomiting, abdominal pain, headache, dizziness, anorexia, and hypersalivation. Reports of severe poisoning are rare and usually follow ingestion of substantial – but poorly described – amounts of permethrin. Symptoms of severe poisoning include impaired consciousness, convulsions, and noncardiogenic pulmonary edema (ATSDR 2003). Permethrin is only slightly toxic via the dermal route (ATSDR 2003). Longer-term exposures to permethrin, documented from studies with experimental animals, have consistently reported tremor or other symptoms of neurotoxicity, decreased body weight, and increased liver weight as the most frequently observed effects of permethrin exposure (IPCS 1999).

Permethrin was classified by the USEPA in 2002 as a Category C carcinogen (likely to be carcinogenic to humans) under its 1999 *Interim Final Guidelines for Carcinogen Risk Assessment* (USEPA 2002d). This classification was based on two reproducible benign tumor types (lung and liver) in the mouse (Tierney and Rinehart 1979), equivocal evidence of carcinogenicity in Long-Evans rats (Braun and Rinehart 1977), and supporting structural activity relationship information (USEPA 2002d). This decision has been supported in subsequent data reviews by the USEPA (2004b, 2005a, 2009b). Most recently, the USEPA has evaluated permethrin as a carcinogen in the human health risk assessments for the Reregistration Eligibility Decision for permethrin (USEPA 2009bc). A cancer slope factor (CSF) of $9.6 \times 10^{-3} \text{ mg/kg-d}^{-1}$ was used in human health risk assessments, as derived and documented by the USEPA (2002d).

Permethrin was recently placed in the medium priority group by the Carcinogen Identification Committee of the OEHHA's Science Advisory Board (OEHHA 2009a). This committee serves as the "State's Qualified Experts" for developing and prioritizing a list of chemicals for possible listing under Proposition 65 (The Safe Drinking Water and Toxics Enforcement Act of 1986, codified at Health and Safety Code Section 25249.5) and establishing whether a chemical has been clearly shown to cause cancer through scientifically valid testing according to generally accepted principles.

Ethylbenzene

Ethylbenzene can be absorbed following exposure by inhalation, ingestion, or dermal contact; it can also cross the placenta (Hazardous Substances Data Base 2009; Oak Ridge National Laboratory 1997).

Ingestion of sublethal amounts of ethylbenzene may cause central nervous system depression, gastric upset, and vomiting (Oak Ridge National Laboratory 1997). Prolonged exposures have caused dose-dependent increases in liver weights, altered liver enzyme levels, and an increase in relative kidney weights in experimental animals (OEHHA 1999).

Long-term inhalation exposure of rats and mice to ethylbenzene resulted in various kidney pathologies, including an increased incidence of renal tumors in males that received the highest dose. Mice exposed to high concentrations of ethylbenzene for 2 years developed lung and liver tumors; male mice also displayed a number of other pathological changes in the liver. Exposure-related effects were also documented in the pituitary gland and thyroid gland (OEHHA 1999). These results came from a carcinogenicity bioassay of ethylbenzene conducted by the NTP.

Based on the review of the NTP data completed by the OEHHA, the NTP reportedly concluded that clear evidence of ethylbenzene's carcinogenicity existed in male rats and some evidence in female rats, based on the renal tumorigenicity findings. Additionally, some evidence of carcinogenicity existed in male and female mice. California has developed CSFs for ethylbenzene based on the NTP data, and has listed ethylbenzene as a carcinogen under Proposition 65 (OEHHA 2008b).

IARC (2000) has classified ethylbenzene as Group 2B, possibly carcinogenic to humans.

1,2,4-Trimethylbenzene

Toxicity data for 1,2,4-trimethylbenzene are extremely limited. The Hazardous Substances Data Base (2009) reports that 1,2,4-trimethylbenzene is a central nervous system depressant and respiratory irritant and is also irritating to the skin and eyes. No exposure data were provided to characterize the concentrations of 1,2,4-trimethylbenzene or duration of exposure associated with induction of these effects. Chronic inhalation exposure can result in bronchitis, although this outcome is likely associated with exposure to high concentrations that occur over long periods of time (Hazardous Substances Data Base 2009).

Bacillus thuringiensis kurstaki

Bacillus thuringiensis and its subspecies (ssp.) are bacteria that have been used as pest control agents for nearly 50 years (McClintlock et al. 1995; World Health Organization [WHO] 1999). The bacterium's selective insecticidal activity derives from crystalline proteins that are formed in the endospore. These crystal (Cry) proteins are toxic to insects in the orders Lepidoptera (moths, butterflies), Coleoptera (beetles), and Diptera (flies). When the Bt spore is ingested by insects, these proteins undergo degradation in the insect gut, forming a biologically active compound known as a delta-endotoxin. This toxin subsequently binds to insect-specific receptors on the insect gut cell walls, ultimately causing the death of the insect. Mammals do not have equivalent receptors, and no data indicate Bt acts similarly in mammals (reviewed in Betz et al. 2000).

Bt and its subspecies are naturally occurring bacteria that have been detected in soil, from leaf and needle surfaces of trees, from vegetables, fruits, herbs, grain, and in water bodies (WHO 1999; Valaderes de Amorim et al. 2001; Frederiksen et al. 2006). Bt spores can persist in soil for 12-24 months, but vegetative cells and the Cry proteins do not (WHO 1999).

Human exposure to Bt occurs during commercial production, during application of Bt products to crops or other vegetation, and by exposure to Bt residues on food and other agricultural products. The WHO notes that

over the many years of commercial production of Btk, no reports have been made of adverse effects occurring to workers in manufacturing facilities (WHO 1999).

During approximately 50 years of commercial use of Bt-based insecticides, only a few isolated instances of human infection with Bt have been documented. These reports indicate Bt appears to be pathogenic only in individuals who may be unable to mount a fully functional immune response.

WHO (1999), McClintock et al. (1995), and Durkin (2004) present comprehensive summaries of the numerous studies submitted to regulatory agencies in support of Bt-containing insecticides. All reviews indicate that acute oral, inhalation, or dermal exposure to Bt, Btk, or to Bt and Btk formulations are neither toxic nor infective.

Subchronic and chronic studies of Btk reviewed by McClintock et al. (1995) demonstrate that even very substantial doses of Btk formulation (e.g., 8.4 g/kg-day) can be tolerated with minimal effect. In a 2-year feeding study, the only reported adverse effect was decreased weight gain in female rodents seen initially at week 10 and persisting to the termination of the study (McClintock et al. 1995).

Human exposure data compiled by Cook (1994) for workers applying a Btk formulation documented Btk exposure-related skin and throat irritation. The biological significance of these effects appears to be modest, as all effects were reversible, none were associated with infection or pathogenicity of Btk, and none were severe enough to result in lost workdays. The data of Cook (1994) were used in Appendix D, Section 3, to derive an acute inhalation reference dose (RfD). That RfD incorporated a net uncertainty factor of 100 to account for uncertainties in the Cook (1994) study (those uncertainties are discussed further in Appendix D, Section 3).

Spinosad

Spinosad is an insecticidal mixture derived from the soil bacterium *Saccharopolyspora spinosa*. Two of the mixtures components, spinosyn A and spinosyn D typically comprise ~ 88 percent of spinosad; the majority of the insecticidal activity of spinosad has been attributed to these two compounds (IPCS 2001).

The chemical and physical properties of spinosad indicate that spinosad has some potential to persist in the environment and in biota (Rutherford et al. 2000; Rothwell and Carson 2005). Bioconcentration factors of spinosad characterized from the muscle, viscera, and whole bodies of fish are 7.5, 28.8, and 21.1, respectively (USEPA 2006c). However, because spinosad is cleared from fish tissues fairly rapidly once exposure ends (half-life of approximately 1 day), the potential for food-chain bioaccumulation is not considered “substantial” (USEPA 2006c).

Technical grade spinosad and spinosyn A and D have low acute mammalian toxicity following oral, dermal, or inhalation exposure (reviewed in IPCS 2001). Tissue vacuolation was a common feature of subchronic spinosad exposure in mice, rats, and dogs. In rodents administered spinosad in the diet, the severity of vacuolation was generally dose-related, with the number of tissues involved increasing with increasing dose (Stebbins et al. 2002; Yano et al. 2002).

The neurotoxicity of spinosad has been evaluated in studies in which spinosad was administered as a single gavage dose, by dietary administration to rats for 13 weeks or 12 months, or by dietary administration to dogs for 12 months (all studies reviewed in IPCS 2001). These studies utilized batteries of tests to assess neurological function, and in certain studies, functional tests were supplemented with histological examination of tissues of the central and peripheral nervous systems. No treatment-related effects of spinosad were observed on neurological function or on neurological tissues. Spinosad does not appear to be a direct developmental toxin (IPCS 2001).

In 2000, the USEPA (2000b) proposed that spinosad be placed in Group E as Not Likely to be Carcinogenic to Humans. Current *Guidelines for Carcinogen Risk Assessment* (USEPA 2005b) recommend this designation “when the available data are considered robust for deciding that no basis exists for human hazard concern.” As of 2008, a final classification of spinosad’s carcinogenicity has not been made (USEPA 2008a). However, the inactivity of spinosad in long-term cancer bioassays (Yano et al. 2002; Stebbins et al. 2002) is consistent with short-term studies of spinosad’s genotoxicity (reviewed by IPCS 2001).

LBAM Pheromones

STRAIGHT CHAIN LEPIDOPTERAN PHEROMONES

The majority of lepidopteran pheromones are naturally occurring unbranched aliphatic compounds of 9 to 18 carbons with up to three double bonds that terminate in an alcohol, an aldehyde, or an acetate functional group (Organization for Economic Cooperation and Development [OECD] 2002; USEPA 1995). The lengthy aliphatic chain gives rise to the designation of this class of compounds as straight chain lepidopteran pheromones, or SCLPs – a category that includes most of the known pheromones produced by insects in the order Lepidoptera (OECD 2002; USEPA 1995). In developing pesticide tolerance exemptions for SCLPs, the USEPA has included both naturally occurring as well as synthetically produced compounds that are identical to a known Lepidopteran pheromone, as well those pheromones that are stereoisomers or mixtures of isomers (USEPA 1995). Because of their selective and nontoxic action, the USEPA exempts SCLPs from pesticide tolerance requirements in or on all raw agricultural commodities when the pheromone is applied to growing crops at a rate that does not exceed 150 grams per year of active ingredient (e.g., USEPA 1995).

Data submitted to the USEPA (1995, 2006d, 2007b) in support of the pesticide tolerance exemptions for SCLPs reportedly provide evidence of and support for “nontoxic” or “practically nontoxic” classifications when SCLPs were tested by inhalation, dermal, and skin and eye irritation. No data indicate that SCLPs are genotoxic (USEPA 2007b). The USEPA’s interpretation of the low toxicity of SCLPs is shared by the OECD (2002). The OECD notes that these substances are inherently different from conventional pesticides in their “nontoxic, target-specific mode of action.” Further, SCLPs are effective at low concentrations (low application rates), and, consistent with their action as attractants, are volatile (OECD 2002).

As a class, toxicity data indicate extremely limited toxicity of SCLPs to mammals. Data cited in the OECD (2002) list the median lethal dose (LD₅₀) as > 5,000 mg/kg for acute oral exposure; an LD₅₀ > 2,000 mg/kg for acute dermal toxicity, a median lethal concentration (LC₅₀) as “generally” > 5 mg/L, and no evidence of mutagenicity as tested in the Ames assay with *Salmonella typhimurium*. The USEPA (1995) cites an absence of significant acute toxicity from the administration of straight chain (unbranched) alcohols, acetates, and aldehydes of 6 to 16 carbon atoms in length (species and doses not specified).

Recently conducted acute toxicity tests of the LBAM pheromone active ingredient (reviewed by OEHHA 2008c) provide evidence that the pheromones are in Toxicity Category IV (the lowest toxicity category) for oral administration (LD₅₀ > 5,000 mg/kg). The dermal irritation testing cited by OEHHA (2008c) indicated that these substances can induce moderate irritation (Toxicity Category III). Of the two dermal sensitization tests that are currently available, one – the Buehler dermal assay – did not indicate that the LBAM pheromones induce dermal sensitization. The second test – the LLNA or Localized Lymph Node Assay, was not conducted on the active ingredients. However, when conducted on other LBAM pheromone-containing formulations, the results of these two different assays of dermal sensitization have provided apparently contradictory results. OEHHA (2008c) discussed the reasons for the different results between the Buehler and LLNA tests, and noted that each measures the response to exposure at a different phase in the development of a sensitization reaction, i.e., “...it is possible that the products are active in the initial phase of the sensitization process, which is what the LLNA measures, but inactive in the later phases, what the guinea pig assay [Buehler assay] measures.” The OEHHA concluded that “In the absence of additional data, the health-

protective approach is to treat the products [LBAM pheromone-containing products] as potential dermal sensitizers, meaning that they have the potential to cause allergic type reactions from skin contact.”

HERCON DISRUPT BIO-FLAKE®-LBAM

Hercon Disrupt Bio-Flake® LBAM is a sprayable starch-based flake pheromone treatment. The active ingredients are the synthetically manufactured LBAM pheromones (E)-11-tetradecenyl acetate and (E,E)-9,11-tetradecadienyl acetate. Hercon is manufactured by Hercon Environmental (2008) for use as a mating disruptor of the LBAM. It has no other known uses. Hercon targets light brown apple moths and has no attractant, physiological, or hormonal effect on fish, reptiles, birds, or mammals. However, the LBAM pheromones may have some ability to affect Tortricid moths (CDFA 2009).

Hercon is manufactured as a biodegradable polymeric controlled release flake; each flake is approximately 1/8 inch x 1/8 inch square, with the pheromone contained between two outer protective layers of starch-based polymer (Hercon Environmental 2009). This layered structure protects the contained pheromone from environmental degradation and rapid evaporation, resulting in controlled release over extended periods.

A series of acute toxicity studies of Hercon were completed in 2008, with results submitted to the USDA. A review of these data by the DPR (2008a) determined that the studies of acute dermal toxicity, primary eye and dermal irritation, and dermal sensitization studies are acceptable to support use of the product. The acute dermal toxicity and primary eye and dermal irritation study results further indicate that Hercon is a Toxicity Category IV for these exposure routes and endpoints. With respect to the dermal sensitization potential of Hercon, the Buehler guinea pig dermal sensitization study indicates that the product is not a dermal sensitizer. An attempt to evaluate Hercon in the LLNA dermal sensitization study was not successful due to the physical and chemical properties of the product (DPR 2008a). However, as noted in the discussion of SCLPs, LBAM pheromone-containing products have given differing results in the LLNA and Buehler tests; thus, the absence of data on Hercon’s sensitization potential in the LLNA leaves uncertainties as to whether Hercon may have sensitizing abilities or not. Hercon could not be evaluated for oral or inhalation toxicity in that multiple attempts to grind the flake to an acceptable size for administration by these routes of exposure were not successful.

ISOMATE®-LBAM PLUS

Isomate®-LBAM Plus (Isomate) is a mixture of the two LBAM pheromones, (E)-11-Tetradecen-1-yl Acetate (63.88 percent and (E,E)-9,11-Tetradecadien-1-yl Acetate (2.64 percent), contained within a twist-tie dispenser. The dispenser is composed of a polyethylene plastic tube parallel to an aluminum wire, and is similar in size to a pipe cleaner (Pacific Biocontrol Fact Sheet, no date). The pheromone active ingredients are contained within the dispenser tube and do not come in contact with crops or other vegetation except as may occur incidentally by placement of the twist tie (Pacific Biocontrol Fact Sheet, no date). Nonactive ingredients comprise 33.48 percent of Isomate; 28.68 percent of these ingredients are not added to the product, but are present as a result of the manufacturing process (Pacific Biocontrol Fact Sheet, no date). Inert ingredients comprise the remaining 4.8 percent of Isomate. The primary purpose for the addition of these inert ingredients is to protect the pheromones from ultraviolet-mediated degradation as well as from exposure to oxidants (Pacific Biocontrol Fact Sheet, no date). The inert ingredients have been approved by the National Organic Program for organic use when used in this type of twist-tie dispenser (Pacific Biocontrol Fact Sheet, no date).

The MSDS for Isomate®-LBAM Plus (Pacific Biocontrol 2007) provides information on the acute toxicity of the pheromone active ingredient within the twist-tie dispenser tubes. Isomate®-LBAM Plus is in USEPA Toxicity Category III (Pacific Biocontrol 2007), having an oral LD₅₀ > 5,000 mg/kg; a dermal LD₅₀ > 2,000 mg/kg, and an LC₅₀ > 5.26 mg/L. In animal tests of Isomate’s eye irritation potential, all eye irritation cleared within 72 hours. Isomate® did however, induce slight to moderate skin irritation. Although Isomate® reportedly did not induce dermal sensitization, information provided in the MSDS does not indicate whether that conclusion was based on the Buehler test or LLNA (or both). Because it is not known whether Isomate

was tested (and found to be negative for dermal sensitization) in both sensitization assays, considered with the limited data that are available to interpret the sensitization potential of LBAM pheromones, the cautions regarding dermal sensitization that were noted for SCLPs (and Hercon) are applicable to Isomate as well.

SPLAT LBAM™

SPLAT LBAM™ (Specialized Pheromone & Lure Application Technology) is a proprietary matrix formulation of LBAM pheromones and biologically inert materials that is designed to provide a sustained and controlled release of the LBAM pheromones. SPLAT LBAM™ is manufactured by ISCA Technologies for use as a mating disruptor of the LBAM (ISCA Technologies 2008). It has no other known uses i.e., like Hercon, it has no attractant, physiological or hormonal effect on fish, reptiles, birds, or mammals. However, the LBAM pheromones may have some ability to affect Tortricid moths (CDFA 2009).

As was done for Hercon, a series of acute toxicity studies of SPLAT were completed in 2008 by independent toxicology laboratories, with results submitted to the USDA. A review of these data by the DPR (2008b) determined that the studies of acute oral, dermal, and inhalation toxicity, as well as those that evaluated primary eye and dermal irritation are acceptable to support use of the product. For the acute oral, dermal, and inhalation routes of exposure, SPLAT is considered to be in Toxicity Category IV hazard (the lowest toxicity rating). Results of the LLNA dermal sensitization study were also deemed acceptable; data from that study indicate that SPLAT is a potential skin sensitizer. However, results from the Buehler guinea pig dermal sensitization study yielded no evidence to indicate that SPLAT is a dermal sensitizer. Both the LLNL and Buehler tests represent accepted methodologies for testing skin sensitization potential, and the different outcome of the two study types for certain LBAM pheromone-containing formulations leave the question of SPLAT's skin sensitizing potential unresolved. OEHHA (2008c) recommended that the health-protective interpretation of the skin-sensitization potential of the LBAM pheromones is to consider the products to be potential dermal sensitizers.

8.1.5.2 Toxicity Concepts

Mammalian toxicology is the study of a chemical or biological materials' ability to elicit an adverse effect in an organism. The toxicity of a material is related to the specific amount that is taken up by an organism (i.e., the dose received via inhalation, dermal contact, etc.), the duration of time over which a dose is received, the potency of the material for eliciting a toxic effect (i.e., the 'response'), and the sensitivity of the receptor receiving the dose of the material. Most commonly, the relationship between the dose of material and the nature and severity of response are determined in controlled laboratory tests using experimental animals. However, for certain pesticides with long-standing histories of use, e.g., chlorpyrifos and Btk, some of the available knowledge on their effects (or lack of effects as is the case for Btk) comes from human experience.

Toxic effects are evaluated by examining the relationship between dose (exposure) and response, where the probability of a toxic response (e.g., increased heart rate, respiratory complications, death, etc.) typically increases with the dose received. For noncarcinogens, toxicological data generally indicate a threshold dose above which effects may occur. For regulatory risk assessment, all carcinogen exposures are assumed to be associated with some risk of developing cancer regardless of the dose.

The toxicity criteria used in the risk assessment to evaluate noncarcinogens were primarily based on No Observed Effect Levels or No Observed Adverse Effect Levels (NOELs/NOAELs). If a NOEL/NOAEL was not available, then a Lowest Observed Adverse Effect Level (LOAEL) was identified. These NOEL/NOAELs or LOAELs typically provide the basis for the development of reference toxicity criteria, which in turn are used to interpret the significance of calculated human doses. For the two carcinogens evaluated – permethrin and ethylbenzene – the toxicity evaluation resulted in the selection of toxicity criteria to characterize both noncancer effects and the risk of cancer. Cancer risk is estimated by multiplying the estimated dose by a criterion known as a cancer slope factor. That CSF represents the theoretical upper bound probability of

excess cancer cases occurring in an exposed population, when exposure is averaged over a lifetime. Details of the methodology used to evaluate the significance of human health impacts from Program alternatives are provided in Appendix D, Section 5 and are summarized in Section 8.2.2, Evaluation Methods and Assumptions.

8.1.5.3 Exposure

Exposure to chemicals and pesticides is required for toxic effects to occur. Exposure does not in itself imply that toxicity will result (as toxicity is a function of exposure, dose, potency, and sensitivity, as previously discussed); but it is a necessary first step for the potential for an adverse health effect to exist. In conducting HHRA, the evaluation process typically begins by developing a conceptual framework i.e., a conceptual site model (CSM), to support an understanding of how human exposures may occur. The CSM utilizes information on the chemical and physical properties of a material, its mode of introduction to the environment (e.g., backpack-based spraying), mode of environmental transport (e.g., dispersal by wind), the identification of an exposure 'point' where humans could come in contact with the material, and activity characteristics of human populations (e.g., gardening, visiting a park) to identify relevant exposure routes. If this evaluation indicates that a potentially significant level of exposure could occur by a given route (e.g., inhalation), then exposure to the material(s) by each relevant exposure route is incorporated into the CSM.

As part of the HHRA (Appendix D), three separate CSMs were developed to represent the potential exposure pathways from the No Program and Program alternatives. The CSMs identify the human receptors that have the highest potential for exposure to pesticide formulations during and following the treatment project. Figures 8-1, 8-2, and 8-3 illustrate the CSMs for potential exposure to human populations as evaluated in Appendix D.

8.2 ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

This section evaluates the potential impacts from the No Program and Program alternatives, focusing on the human health impacts specific to the use of chemical and biological pesticides for each alternative.

8.2.1 Evaluation Concerns and Criteria

Impacts are considered adverse and significant if potential health effects associated with a Program alternative exceed a noncancer hazard index (HI) of 1 and/or an incremental lifetime excess risk of cancer of 1 in a million (1×10^{-6}).¹

CEQA Guidelines (Appendix G of the Guidelines), outline evaluation 'criteria' for considering human health concerns related to air quality or to the use and/or production of hazardous materials. Using those applicable CEQA criteria, each alternative was evaluated to determine whether it would cause a significant impact by:

1. Exposing sensitive receptors to substantial pollutant concentrations
2. Creating a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials.

Additionally, the public has expressed concerns (see Chapter D1) that the HHRA:

3. Address Program impacts on people and pets through all ingestion and absorption pathways, and proposed mitigation. Address impacts on chemically sensitive people, pregnant women and developing

¹ This cancer risk criterion of 1×10^{-6} is under discussion with the OEHHA and is subject to revision.

fetuses, homeless persons, and sensitive populations such as at schools, daycare facilities, hospitals, and nursing homes.

4. Evaluate both short-term and long-term health risks. Address long-term, additive health impacts, subchronic impacts, and acute impacts. Address impacts of chemicals on pre-existing health conditions, such as Parkinson's or Alzheimer's disease.
5. Evaluate cancer risks from Program-related chemicals.
6. Analyze impacts of each chemical ingredient, individually and in combination.
7. Discuss the impacts of synthetic moth pheromones on human hormonal levels and human behavior.
8. Discuss impacts of Program on swimming pools and groundwater systems.

With respect to concern 7, no scientific data are available to support an assessment of the potential effects of synthetic moth pheromones on human hormonal levels and human behavior. Because of this fact, no further analysis of this concern is provided.

Regarding concern 8, "Discuss impacts of Program on swimming pools and groundwater systems," the HHRA (Appendix D) determined that ground-based applications of pesticides, such as would occur under all alternatives except Alternative MD-3, would preclude the deposition of significant quantities of pesticides into any bodies of water including swimming pools. Alternative MD-3 would not deposit pesticides into swimming pools due to Program treatment plans that explicitly avoid pheromone release to pools and surface waters. Because of these two considerations, potential exposures to Program pesticides via contact with swimming pools were not evaluated in the HHRA (Appendix D). With respect to potential impacts to groundwater, information provided in Chapter 11 (e.g., Section 11.2.1.1) and Appendix D (see subsections of Section 3 that address chemical and physical properties for each chemical) indicates that the chemical and physical properties of pesticides evaluated in the HHRA – such as rapid environmental degradation or strong binding to soil – are expected to minimize any potential for contamination of groundwater. Because of these considerations, no further analysis of this concern is provided.

All other criteria are specifically addressed in the HHRA (Appendix D) as follows:

- Potential health effects to sensitive receptors were evaluated by identifying two hypothetical sensitive receptor populations (Child Resident and Child Recreational Park User), and by estimating exposures for these receptors by applying separate exposure factors from those used for adults. These exposure factors address the fact that relative to adults, children have a greater skin surface area that may come in contact with contaminated soil or vegetation, and greater soil and food ingestion rates. These higher intakes, attributable to anatomical differences as well as activity and behavior patterns that are distinct from adults, make children potentially more vulnerable (sensitive) to any health effects of pesticides (Criterion 1, above).
- Potential effects to the public from the use of pesticides were addressed by evaluating impacts to the hypothetical human receptor populations; Adult Resident, Adult Gardener, Adult Recreational Park User, Nursery/Project Workers and Agricultural Workers (Criterion 2, above).
- For the receptor populations previously noted, as well as two hypothetical worker populations (Nursery/Project Workers and Agricultural Workers), the HHRA (Appendix D) evaluated, as appropriate to the specific receptor population, potential exposure by inhalation, incidental ingestion of contaminated soil, dermal contact with contaminated soil, dermal contact with contaminated vegetation, and ingestion of contaminated produce (Criterion 3, above).

**LIGHT BROWN APPLE MOTH ERADICATION PROGRAM
DRAFT PEIR**

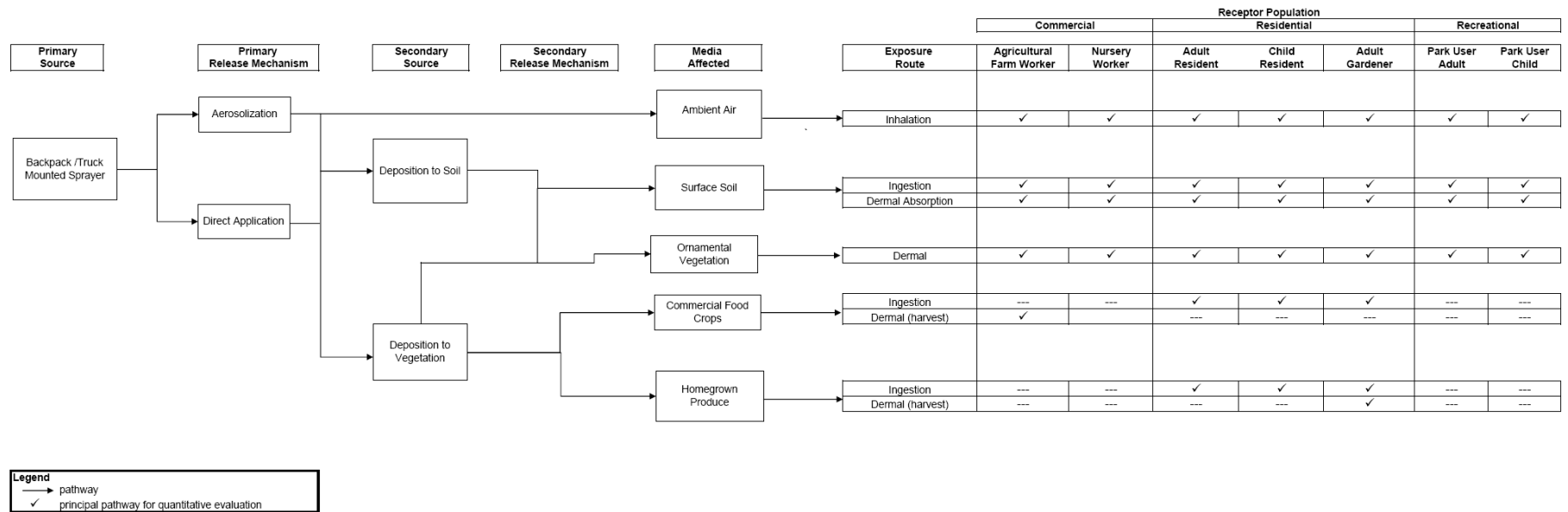


Figure 8-1 Conceptual Site Model for Potential Exposure Pathways for Chemicals Released by Alternatives MMA, Btk, and S, and the No Program Alternative

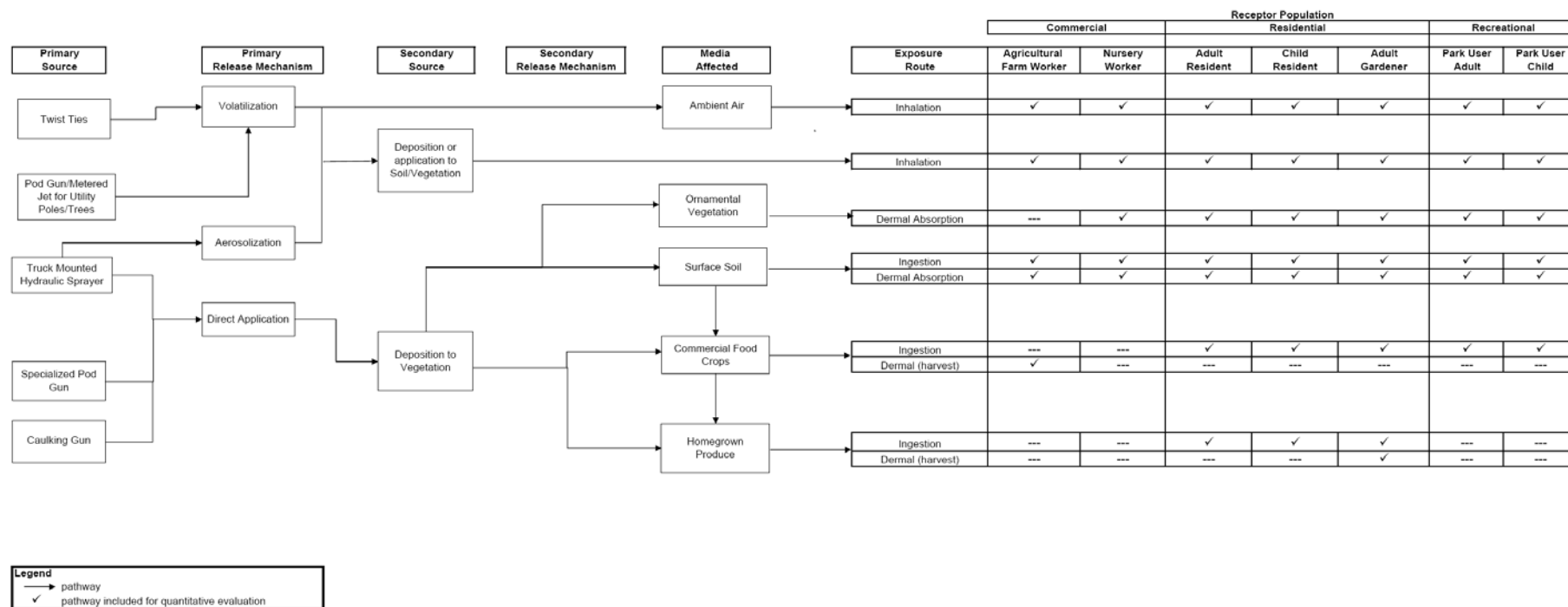


Figure 8-2 Conceptual Site Model for Potential Exposure Pathways for Pheromones Released by Alternative MD-2

**LIGHT BROWN APPLE MOTH ERADICATION PROGRAM
DRAFT PEIR**

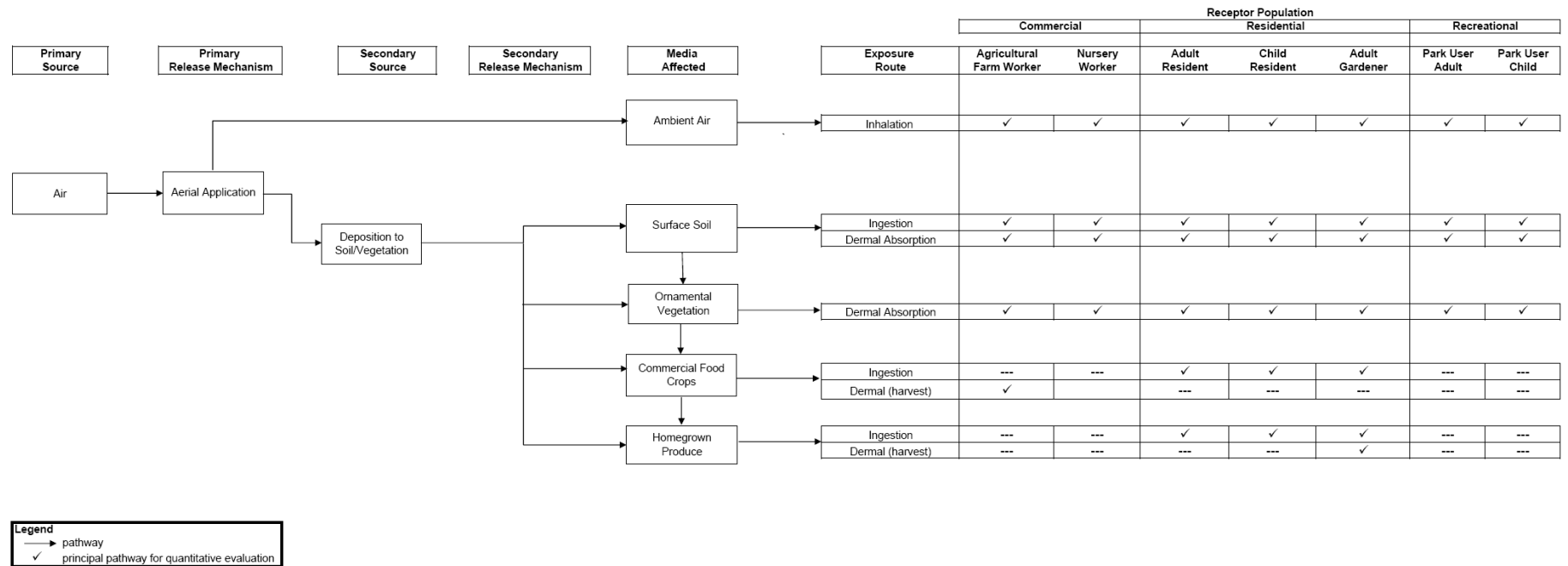


Figure 8-3 Potential Exposure Pathways for Pheromones Released by Aerial Application under Alternative MD-3

- Evaluated acute, subchronic, and chronic inhalation exposure, and chronic ingestion or dermal-based exposure pathways, as appropriate to the specific receptor population and pesticide. Additive effects of exposure to multiple ingredients were addressed for Alternative MMA, the only Program alternative for which sufficiently detailed information on formulation ingredients were available (Criterion 4, above). The state of scientific information is not sufficient to evaluate the potential combined effects of Program pesticides to individuals with Parkinson’s disease, Alzheimer’s disease or other illnesses.
- Evaluated the potential cancer risk from permethrin and ethylbenzene, the two formulation ingredients classified as a carcinogen (Criterion 5, above).
- Evaluated the potential health impacts of each pesticide for each alternative. As noted above, additive effects of exposure were addressed, where information was sufficient to do so (Criterion 6, above).

The remaining analysis focuses on an evaluation of these human health impact concerns and criteria (Impact HH) for significance under CEQA.

8.2.2 Evaluation Methods and Assumptions

8.2.2.1 Human Receptor Populations Evaluated in the HHRA

To quantify the potential health effects of Program chemicals and biological insecticides, five hypothetical receptor populations were identified: Nursery/Program Workers, Agricultural Workers, Adult Gardeners, Residents (adult and child), and Recreational Park Users (adult and child). The rationale for selecting each of these populations for evaluation, and the exposure pathways evaluated for each receptor population are discussed below. Estimated exposure point concentrations are provided in Table 8-6.

Table 8-6 Exposure Point Concentrations used in Appendix D, Human Health Risk Assessment

	Air (mg/m ³)			Deposition Rate (mg/m ²)	Soil (mg/kg)	Vegetation (mg/kg)
	Acute	Subchronic	Chronic			
No Program Alternative						
<i>Bacillus thuringiensis kurstaki</i>	8.17E-03	1.36E-04	1.36E-04	1.36E+02	6.79E-01	1.36E+01
Spinosad	3.24E-04	9.64E-07	9.64E-07	2.05E+00	1.02E-02	2.05E-01
Lambda-Cyhalothrin	3.08E-04	9.16E-07	9.16E-07	2.58E+00	1.29E-02	2.58E-01
Chlorpyrifos	6.68E-03	3.37E-04	3.37E-04	8.78E+00	4.39E-02	8.78E-01
Permethrin	1.51E-03	4.49E-06	4.49E-06	1.84E+01	9.18E-02	1.84E+00
Mating Disruption, Twist Ties (Alternative MD-1)						
Isomate	3.22E-04	1.65E-05	1.65E-05	---	---	---
Mating Disruption, Ground Application (Alternative MD-2)						
Hercon	3.54E-01	2.81E-03	2.81E-03	1.38E+01	6.91E-02	1.38E+00
SPLAT	1.50E+00	5.85E-03	5.85E-03	2.08E+01	1.04E-01	2.08E+00
Mating Disruption, Aerial Application (Alternative MD-3)						
Hercon	7.14E-03	6.23E-05	6.23E-05	5.84E+00	2.92E-02	5.84E-01
SPLAT	2.63E-02	9.95E-05	9.95E-05	4.94E+00	2.47E-02	4.94E-01
Male Moth Attractant (Alternative MMA)						
SPLAT	1.04E-03	4.14E-06	4.14E-06	5.19E-02	2.60E-04	5.19E-03
Permethrin	1.25E-03	4.85E-06	4.85E-06	7.21E-01	3.61E-03	7.21E-02
Ethylbenzene	1.02E-05	4.00E-08	4.00E-08	2.54E-04	1.27E-06	2.54E-05
1,2,4-Trimethylbenzene	1.35E-03	5.33E-06	5.33E-06	3.38E-02	1.69E-04	3.38E-03

Table 8-6 Exposure Point Concentrations used in Appendix D, Human Health Risk Assessment

	Air (mg/m ³)			Deposition Rate (mg/m ²)	Soil (mg/kg)	Vegetation (mg/kg)
	Acute	Subchronic	Chronic			
Organically Approved Insecticides (Alternatives Btk and S)						
<i>Bacillus thuringiensis kurstaki</i>	8.17E-03	1.36E-04	1.36E-04	1.36E+02	6.79E-01	1.36E+01
Spinosad	3.24E-04	5.40E-06	5.40E-06	1.15E+01	5.73E-02	1.15E+00
--- = Not applicable; mg/kg/day = milligram(s) per kilogram per day; mg/m ³ = milligram(s) per cubic meter						

Nursery/Program Worker

Nursery/Program Workers are individuals who may be exposed to chemical or biological pesticides to control LBAM while working in nurseries or other locations where LBAM infestations are a concern. Although Nursery/Program Workers will wear protective clothing to minimize or prevent any significant exposures from occurring during application, potential exposure of this receptor population was assessed to address exposures that may occur after application has ended. Immediately following spray application, these workers may inhale a chemical that is present in ambient air (acute inhalation). Nursery/Program Workers may also incur exposures to residual material present in air from repeated applications (subchronic inhalation). Chronic inhalation exposure may occur due to potential persistence and/or resuspension of a chemical from soil or vegetation. Nursery/Program Workers may also be exposed by the incidental ingestion of soil where chemicals have deposited, by dermal contact with soil, and y dermal contact with ornamental vegetation. These latter pathways are evaluated under the assumption that these exposures occur for extended periods of time

Agricultural Workers

Agricultural Workers represent a population that may be exposed to chemical or biological pesticides to eradicate LBAM while working in agriculture (e.g., post-application harvest of crops). The exposure pathways evaluated for Agricultural Workers are the same as those considered for Nursery/Program Workers, except that dermal uptake of chemicals by contact with contaminated commercial crops is evaluated instead of dermal uptake from contact with ornamental vegetation.

Residents

Because the LBAM infestation area may encompass residential neighborhoods, potential exposures to chemical and biological insecticides were also calculated for residential receptor populations. Separate exposure estimates were developed for adult residents and for children that may reside in the Program Area. Children were evaluated as a separate population using child-specific exposure factors, which addresses the fact that relative to adults, children have a greater skin surface area that may come in contact with soil or vegetation, and greater soil and food ingestion rates (see Appendix D for a table of exposure factors used). These higher intakes, attributable to anatomical differences as well as activity and behavior patterns that are distinct from adults (OEHHA 2003), make children potentially more vulnerable (sensitive) to any health effects of insecticides. The child resident represents one of two sensitive populations evaluated. Exposures of adult and child residents to insecticides may potentially occur by acute, subchronic, or chronic inhalation; by incidental ingestion of soil; by ingestion of home-grown produce; or by dermal contact with home-grown produce or ornamental vegetation.

Adult Gardeners

The characteristics of this receptor population were developed to evaluate a hypothetical adult who may receive higher exposures than an adult Resident by virtue of their activities in a home garden. While the relevant exposure pathways for this receptor population are the same as for an adult Resident, exposure of this population was assessed by incorporating higher breathing rates than were used for residential receptors (Table 4-1 in Appendix D) to address the possibility that gardening is associated with a higher activity level than is typical for an average Resident. The estimation of dermal dose for this receptor population also utilized a higher transfer coefficient than for the Adult Resident, reflecting the likelihood that gardeners will engage in a greater frequency of activities that bring them into contact with contaminated foliage.

Recreational Park Users

Potential exposure of individuals who may recreate in areas treated for LBAM infestation was evaluated for a hypothetical Recreational Park User. As with the residential receptor population, separate exposure parameters were developed for adults and for children. As discussed in Appendix D, anatomical and behavioral characteristics of children can lead to relatively greater exposures than adults, which may leave children more vulnerable to any health effects of insecticide exposure. Thus, the child Recreational Park User represents the second sensitive receptor population evaluated. Exposure of recreational populations to chemical or biological insecticides may occur by acute, subchronic, or chronic inhalation, by ingestion of soil, or by dermal contact with contaminated ornamental vegetation.

8.2.2.2 Evaluation Methods

The following discussion describes the methods used to assess the potential adverse health effects associated with each alternative. This information is summarized from a comprehensive screening-level HHRA provided as Appendix D.

For all chemical or biological pesticides, chemical-specific data for each component of a pesticide formulation (if known) were evaluated to characterize the environmental fate and toxicity. The risk assessment incorporated that information by developing exposure scenarios used to support the quantification of potential health effects from No Program and Program alternatives. Those exposure scenarios identified exposure pathways (such as inhalation or dermal contact with contaminated soil) that were relevant to each of several theoretical human receptor populations. For each exposure pathway and receptor population, exposure factors were selected. These exposure factors, when used in combination with estimated (modeled) exposure point concentrations, yield the intake or exposure of each chemical. Those exposures are used in conjunction with toxicity criteria to determine the likelihood of adverse effects (see following).

To assess the potential for health effects occurring from exposure to chemicals with noncarcinogenic effects, a hazard index (HI) approach is used. This approach involves the calculation of an HI, which represents the ratio of the estimated level of total exposure to the relevant noncancer toxicity criterion, e.g., the RfD. When the ratio is calculated for a specific exposure pathway (or for a single substance), the ratio is called a hazard quotient (HQ). The HQs are summed over all exposure pathways and all chemicals to develop a total HI. The RfD is developed by identifying a NOAEL (or LOAEL if an appropriate NOAEL is not available), and applying one or more uncertainty factors (see Appendix D). If the value of the HI is less than 1, it is considered unlikely that exposure will cause adverse health effects; conversely, if the HI is greater than 1 then health effects may result from exposure. Unlike cancer risk estimates that are expressed as probabilities (e.g., 1 in a million), HIs do not represent the probability of health effects developing, but are presented to provide context to the relationship between the known toxicity of a substance and the estimated magnitude of exposure. In general, the lower the HI, the lower the likelihood of an adverse effect, and the greater the HI, the greater the likelihood of an adverse effect. However, since the RfDs used to develop the HIs incorporate

large margins of safety from the use of uncertainty factors, it is possible that no adverse effects may occur even if the threshold value of 1 is exceeded. The equations used to calculate HQs and HIs are shown below:

Equation 8-1	Hazard Quotient (HQ) = $\frac{\text{Exposure (dose)}}{\text{RfD}}$
---------------------	--

Where:

- HQ = Hazard Quotient (unitless)
 Exposure = dose, milligrams (mg) per kilogram (kg)-day
 RfD = Reference Dose, milligrams (mg) per kilogram (kg)-day

Equation 8-2	Hazard Index (HI) = ΣHQ
---------------------	--

Where:

- HI = Hazard Index (unitless)
 HQ = Hazard Quotient (unitless)

Cancer risks are estimated by calculating the upper-bound incremental probability that an individual will develop cancer over a lifetime as a direct result of exposure to a potential carcinogen. The CSF is the toxicity value used to estimate cancer risk, and is defined by OEHHA (2003) as “the theoretical upper bound probability of extra cancer cases occurring in an exposed population assuming a lifetime exposure to the chemical when the chemical dose is expressed in exposure units of milligrams/kilogram-day (mg/kg-d).” The equation used to calculate potential excess cancer risk (Equation 8-3) is:

Equation 8-3	Excess Cancer Risk = Exposure (dose) × CSF
---------------------	---

Where:

- Exposure = dose, milligrams (mg) per kilogram (kg)-day
 CSF = Cancer Slope Factor, [milligrams (mg)/kilogram (kg)-day(d)]⁻¹

TOXICITY VALUES

Depending on the availability of data for each pesticide, toxicity criteria (e.g., RfDs, CSFs) were identified for one or more routes of exposure. These toxicity criteria were obtained from documents and on-line sources from the USEPA’s Office of Pesticide Programs, OEHHA, USEPA Integrated Risk Information System, and ATSDR. If a criterion was not available from these sources, information in other regulatory documents or the primary literature was relied on. When toxicity criteria were developed for this assessment (e.g., from data in the regulatory or primary literature), uncertainty factors were incorporated to address data gaps, effects on sensitive receptors, and variability in study and/or human populations. The values in Table 8-7 reflect this use of multiple information sources.

8.2.3 No Program Alternative

The No Program Alternative consists of maintaining the current state and federal Quarantine Orders without further action by the state or USDA. Private landowners would manage LBAM infestations on their land using currently approved chemicals and treatments without state or federal oversight.

The human health impact assessment for the No Program Alternative considered the potential health effects from the expanded use of the pesticides chlorpyrifos, permethrin, lambda-cyhalothrin, spinosad, and Btk. These pesticides are currently registered for use for LBAM and other pests by the DPR. Analysis of risks from the No Program Alternative has assumed that use of these chemicals would be implemented at local scales through ground application, and that no aerial application of these chemicals would be permitted.

Because no basis exists to assume that more than one of these pesticides would be used at a given time, additive effects were not evaluated. Cancer risks above 1×10^{-6} were estimated for Nursery Workers, Adult Residents, Child Residents, Gardeners, and both Adult and Child Park Users from potential exposure to permethrin (Tables 8-8 through 8-14). These estimated cancer risks are all attributable to dermal doses from contact with vegetation; no other exposure pathway contributes significantly to permethrin risk. For lambda-cyhalothrin, Nursery Workers (Table 8-8) were the only population with an HI above 1 (dermal dose from contact with vegetation). Chlorpyrifos exposures calculated under this alternative yielded HIs in excess of 1 for a number of receptor populations. For Nursery and Agricultural Workers (Tables 8-8 and 8-9), dermal dose from contact with vegetation was the dominant source of the elevated HIs. HIs above 1 were estimated for Adult Residents (Table 8-10) exposed to chlorpyrifos via contact with contaminated ornamental vegetation or ingestion of commercial produce. Child Residents (Table 8-11) also had HIs above 1 for these two pathways, as well as for subchronic inhalation and chronic inhalation. Residential Gardeners (Table 8-12) also have an HI above 1 for chlorpyrifos-attributable exposure, with the single largest contributor to this HI ingestion of commercial produce. Adult and Child Park Users (Tables 8-13 and 8-14) both have chronic HIs above 1 attributable to ingestion of chlorpyrifos on commercial produce; the Child Park User also has an acute inhalation HI of 4 from short-term inhalation.

Calculated exposures to spinosad and Btk yielded HIs below 1 for all receptor populations, indicating that use of either of these materials to control the LBAM is not expected to be associated with adverse effects.

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Table 8-7 Toxicity Values

Pesticide or Chemical	Carcinogenic Toxicity Values				Noncarcinogenic Toxicity Values							
	Inhalation CSF (mg/kg-day) ⁻¹		Oral CSF (mg/kg-day) ⁻¹		Chronic Inhalation RfD (mg/kg-day)		Subchronic Inhalation RfD (mg/kg-day)		Acute Inhalation RfD (mg/kg-day)		Oral RfD (mg/kg-day)	
Hercon	---	---	---	---	---		5.70E-02	OEHHA 2009b	2.29E+00	OEHHA 2009b	---	---
SPLAT	---	---	---	---	---		5.70E-02	OEHHA 2009b	9.49E-01	Crutchfield 2008a	---	---
Isomate							5.70E-02	OEHHA 2009b	2.29E+00	OEHHA 2009b	---	---
<i>Bacillus thuringiensis kurstaki</i>	---	---	---	---	---		---		2.00E-03	Cook 1994	---	---
Spinosad	---	---	---	---	2.70E-02	USEPA 2007c	---		4.90E-02	USEPA 2007c	2.40E-02	IPCS 2001
Permethrin	---	---	9.60E-03	USEPA 2005a	1.10E-01	USEPA 2005a	1.10E-01	USEPA 2005a	1.10E-01	USEPA 2005a	2.50E-01	USEPA 2005a
Lambda-cyhalothrin	---	---	---	---	8.00E-04	USEPA 2007d	8.00E-04	USEPA 2007d	8.00E-04	USEPA 2007d	5.00E-03	USEPA 2009a
Chlorpyrifos	---	---	---	---	3.00E-04	USEPA 2006b	1.00E-03	USEPA 2006b	1.00E-03	USEPA 2006b	3.00E-03	USEPA 2009a
Ethylbenzene	8.70E-03	OEHHA 2009c	1.10E-02	OEHHA 2009c	5.71E-01	OEHHA 2009c	8.70E-01	ATSDR 2008	1.24E+01	ATSDR 2008	1.00E-01	USEPA 2009a
1,2,4-Trimethylbenzene	---	---	---	---	2.00E-03	PPRTV 2009	2.00E-02	PPRTV 2009	---		---	

Sources:

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 USEPA. 2009a. Integrated Risk Information System. <http://cfpub.epa.gov/ncea/iris/index.cfm>

-- = no cancer slope factor or noncancer reference dose available
 CSF = cancer slope factor
 mg/kg-day = milligram(s) per kilogram per day
 RfD = reference dose

Table 8-8 Nursery/Program Worker Cancer Risks and Hazard Quotients – No Program Alternative

Exposure Medium:	Chemical-Specific Cancer Risks					Total Cancer Risk	
	Air	Soil			Ornamental Vegetation		
Pathway:	Inhalation	Incidental Ingestion	Dermal Contact	Dermal Contact	All Pathways		
<i>Bacillus thuringiensis kurstaki</i>	----	----	NA	NA	----		
Spinosad	----	----	----	---	----		
Permethrin	----	8.5E-11	3.7E-10	4.8E-05	5.E-05		
Lambda-Cyhalothrin	----	----	----	----	----		
Chlorpyrifos	----	----	----	----	----		
Chemical-Specific Noncarcinogenic Hazard Quotients							
Exposure Medium:	Air			Soil		Ornamental Vegetation	Total Chronic HI
Pathway:	Inhalation	Subchronic Inhalation	Acute Inhalation	Incidental Ingestion	Dermal Contact	Dermal Contact	All Pathways
<i>Bacillus thuringiensis kurstaki</i>	----	----	7.6E-02	----	NA	NA	----
Spinosad	3.6E-06	----	1.2E-04	4.1E-07	1.2E-07	1.6E-02	2.E-02
Permethrin	4.1E-06	4.3E-06	2.5E-04	3.5E-07	1.5E-06	2.0E-01	2.E-01
Lambda-Cyhalothrin	1.1E-04	1.2E-04	7.2E-03	2.5E-06	7.2E-06	9.4E-01	9.E-01
Chlorpyrifos	1.1E-01	3.6E-02	1.2E-01	1.4E-05	1.2E-05	1.6E+00	2.E+00
---- = Appropriate toxicity value is not available. NA = Not applicable							

Table 8-9 Agricultural Worker – No Program Alternative

Exposure Medium:	Chemical-Specific Cancer Risks					Total Cancer Risk	
	Air	Soil			Commercial Produce		
Pathway:	Inhalation	Incidental Ingestion	Dermal Contact	Dermal Contact	All Pathways		
<i>Bacillus thuringiensis kurstaki</i>	----	----	NA	NA	----		
Spinosad	----	----	----	---	----		
Permethrin	----	8.5E-11	3.7E-10	NE	5.E-10		
Lambda-Cyhalothrin	----	----	----	----	----		
Chlorpyrifos	----	----	----	----	----		
Chemical-Specific Noncarcinogenic Hazard Quotients							
Exposure Medium:	Air			Soil		Commercial Produce	Total Chronic HI
Pathway:	Inhalation	Subchronic Inhalation	Acute Inhalation	Incidental Ingestion	Dermal Contact	Dermal Contact	All Pathways
<i>Bacillus thuringiensis kurstaki</i>	----	----	7.6E-02	----	NA	NA	----
Spinosad	3.6E-06	----	1.2E-04	4.1E-07	1.2E-07	1.6E-02	2.E-02
Permethrin	4.1E-06	4.3E-06	2.5E-04	3.5E-07	1.5E-06	NE	6.E-01
Lambda-Cyhalothrin	1.1E-04	1.2E-04	7.2E-03	2.5E-06	7.2E-06	9.4E-01	9.E-01
Chlorpyrifos	1.1E-01	3.6E-02	1.2E-01	1.4E-05	1.2E-05	1.6E+00	2.E+00
---- = Appropriate toxicity value is not available. NA = Not applicable NE = Not evaluated because permethrin is registered by the USEPA primarily for use as a termiticide and on nonfood crops (Etiqra. 2007. Product Label for Permethrin E-Pro. Revised July 9 2007).							

Table 8-10 Adult Resident Cancer Risks and Hazard Quotients – No Program Alternative

Chemical-Specific Cancer Risks									
Exposure Medium:	Air	Soil		Ornamental Vegetation	Commercial Produce	Homegrown Produce	Total Cancer Risk		
Pathways:	Inhalation	Incidental Ingestion	Dermal Contact	Dermal Contact	Ingestion	Ingestion	All Pathways		
Btk	---	---	NA	NA	---	---	---		
Spinosad	---	---	---	---	---	---	---		
Permethrin	---	1.4E-10	1.9E-10	5.9E-05	NE	NE	6.E-05		
Lambda-Cyhalothrin	---	---	---	---	---	---	---		
Chlorpyrifos	---	---	---	---	---	---	---		
Chemical-Specific Noncarcinogenic Hazard Quotients									
Exposure Medium:	Air			Soil		Ornamental Vegetation	Commercial Produce	Homegrown Produce	Total Chronic HI
Pathways:	Inhalation	Subchronic Inhalation	Acute Inhalation	Incidental Ingestion	Dermal Contact	Dermal Contact	Ingestion	Ingestion	All Pathways
Btk	---	---	5.1E-02	---	NA	NA	---	---	---
Spinosad	1.0E-05	---	8.3E-05	7.0E-07	6.1E-08	1.9E-02	4.5E-02	7.9E-03	7.E-02
Permethrin	1.2E-05	1.2E-05	1.7E-04	6.0E-07	7.9E-07	2.5E-01	NE	NE	2.E-01
Lambda-Cyhalothrin	3.3E-04	3.5E-04	4.8E-03	4.2E-06	3.7E-06	1.1E+00	2.7E-01	4.8E-02	1.E+00
Chlorpyrifos	3.2E-01	1.0E-01	8.4E-02	2.4E-05	6.3E-06	2.0E+00	1.5E+00	2.7E-01	4.E+00

--- = Appropriate toxicity value is not available. NE = Not evaluated because permethrin is registered by the USEPA primarily for use as a termiticide and on nonfood crops (Etigra. 2007. Product Label for Permethrin E-Pro. Revised July 9 2007).
NA = Not applicable

Table 8-11 Child Resident Cancer Risks and Hazard Quotients – No Program Alternative

Chemical-Specific Cancer Risks									
Exposure Medium:	Air	Soil		Ornamental Vegetation	Commercial Produce	Homegrown Produce	Total Cancer Risk		
Pathways:	Inhalation	Incidental Ingestion	Dermal Contact	Dermal Contact	Ingestion	Ingestion	All Pathways		
Btk	---	---	NA	NA	---	---	---		
Spinosad	---	---	---	---	---	---	---		
Permethrin	---	7.4E-10	3.9E-10	7.3E-05	NE	NE	7.E-05		
Lambda-Cyhalothrin	---	---	---	---	---	---	---		
Chlorpyrifos	---	---	---	---	---	---	---		
Chemical-Specific Noncarcinogenic Hazard Quotients									
Exposure Medium:	Air			Soil		Ornamental Vegetation	Commercial Produce	Homegrown Produce	Total Chronic HI
Pathways:	Inhalation	Subchronic Inhalation	Acute Inhalation	Incidental Ingestion	Dermal Contact	Dermal Contact	Ingestion	Ingestion	All Pathways
Btk	---	---	7.7E-02	---	NA	NA	---	---	---
Spinosad	1.5E-05	---	1.2E-04	3.6E-06	1.3E-07	2.4E-02	4.9E-02	8.7E-03	8.E-02
Permethrin	1.8E-05	1.8E-05	2.6E-04	3.1E-06	1.6E-06	3.1E-01	NE	NE	3.E-01
Lambda-Cyhalothrin	4.9E-04	5.2E-04	7.2E-03	2.2E-05	7.6E-06	1.4E+00	3.0E-01	5.3E-02	2.E+00
Chlorpyrifos	4.8E+00	1.5E+00	1.3E+00	1.2E-04	1.3E-05	2.4E+00	1.7E+00	3.0E-01	9.E+00

--- = Appropriate toxicity value is not available. NE = Not evaluated because permethrin is registered by the USEPA primarily for use as a termiticide and on nonfood crops (Etigra. 2007. Product Label for Permethrin E-Pro. Revised July 9 2007).
NA = Not applicable

Table 8-12 Residential Adult Gardener Cancer Risks and Hazard Quotient – No Program Alternative

Chemical-Specific Cancer Risks										
Exposure Medium:	Air		Soil		Ornamental Vegetation	Commercial Produce	Homegrown Produce		Total Cancer Risk	
Pathways:	Inhalation	Incidental Ingestion	Dermal Contact	Dermal Contact	Ingestion	Ingestion	Dermal Contact	All Pathways		
Btk	---	---	NA	NA	---	---	NA	---		
Spinosad	---	---	---	---	---	---	---	---		
Permethrin	---	4.1E-11	9.5E-11	1.7E-05	NE	NE	NE	2.E-05		
Lambda-Cyhalothrin	---	---	---	---	---	---	---	---		
Chlorpyrifos	---	---	---	---	---	---	---	---		
Chemical-Specific Noncarcinogenic Hazard Quotients										
Exposure Medium:	Air			Soil		Ornamental Vegetation	Commercial Produce	Homegrown Produce		Total Chronic HI
Pathways:	Inhalation	Subchronic Inhalation	Acute Inhalation	Incidental Ingestion	Dermal Contact	Dermal Contact	Ingestion	Ingestion	Dermal Contact	All Pathways
Btk	---	---	1.0E-01	---	NA	NA	---	---	NA	---
Spinosad	5.0E-07	---	1.7E-04	2.0E-07	3.1E-08	5.4E-03	4.5E-02	7.9E-03	2.5E-03	6.E-02
Permethrin	5.7E-07	2.1E-06	3.5E-04	1.7E-07	4.0E-07	7.0E-02	NE	NE	NE	7.E-02
Lambda-Cyhalothrin	1.6E-05	5.8E-05	9.8E-03	1.2E-06	1.9E-06	3.3E-01	2.7E-01	4.8E-02	1.5E-01	8.E-01
Chlorpyrifos	1.6E-02	1.7E-02	1.7E-01	6.8E-06	3.2E-06	5.6E-01	1.5E+00	2.7E-01	2.6E-01	3.E+00

--- = Appropriate toxicity value is not available. NE = Not evaluated because permethrin is registered by the USEPA primarily for use as a termiticide and on nonfood crops (Etigra. 2007. Product Label for Permethrin E-Pro. Revised July 9 2007).
NA = Not applicable

Table 8-13 Adult Park User Cancer Risks and Hazard Quotients – No Program Alternative

Chemical-Specific Cancer Risks								
Exposure Medium:	Air			Soil		Commercial Produce	Ornamental Vegetation	Total Cancer Risk
Pathways:	Inhalation			Incidental Ingestion	Dermal Contact	Ingestion	Dermal Contact	All Pathways
Btk	---	---	---	---	NA	---	NA	---
Spinosad	---	---	---	---	---	---	---	---
Permethrin	---	---	---	2.1E-11	5.4E-11	NE	1.7E-05	2.E-05
Lambda-Cyhalothrin	---	---	---	---	---	---	---	---
Chlorpyrifos	---	---	---	---	---	---	---	---
Chemical-Specific Noncarcinogenic Hazard Quotients								
Exposure Medium:	Air			Soil		Commercial Produce	Ornamental Vegetation	Total Chronic HI
Pathways:	Inhalation	Subchronic Inhalation	Acute Inhalation	Incidental Ingestion	Dermal Contact	Ingestion	Dermal Contact	All Pathways
Btk	---	---	1.0E-01	---	NA	---	NA	---
Spinosad	5.0E-07	---	1.7E-04	9.9E-08	1.7E-08	4.5E-02	5.4E-03	5.E-02
Permethrin	5.7E-07	5.9E-07	3.5E-04	8.6E-08	2.3E-07	NE	7.0E-02	7.E-02
Lambda-Cyhalothrin	1.6E-05	1.7E-05	9.8E-03	6.0E-07	1.1E-06	2.7E-01	3.3E-01	6.E-01
Chlorpyrifos	1.6E-02	4.9E-03	1.7E-01	3.4E-06	1.8E-06	1.5E+00	5.6E-01	2.E+00

--- = Appropriate toxicity value is not available. NE = Not evaluated because permethrin is registered by the USEPA primarily for use as a termiticide and on nonfood crops (Etigra. 2007. Product Label for Permethrin E-Pro. Revised July 9 2007).
NA = Not applicable

significant under CEQA, as indicated by cancer risks that exceed 1×10^{-6} and/or noncancer HIs that exceed 1. **Impacts would be potentially significant.**

Short-Term, Subchronic, Long-Term, and/or Additive Human Health Impacts

Potential short-term (acute) health effects to Child Recreational Park Users are potentially significant under CEQA, as indicated by a noncancer HI that exceeds 1. **Impacts would be potentially significant.**

Potential subchronic health effects to Child Residents are potentially significant under CEQA, as indicated by a noncancer HI that exceeds 1. **Impacts would be potentially significant.**

Potential long-term (chronic) health effects to Nursery/Project Workers, Agricultural Workers, Adult and Child Residents, Adult Gardeners, and Adult and Child Recreational Park Users are potentially significant under CEQA, as indicated by cancer risks that exceed 1×10^{-6} and/or noncancer HIs that exceed 1. **Impacts would be potentially significant.**

Additive impacts of concurrent exposure to more than one pesticide were not evaluated in this alternative because no basis exists for assuming that more than one of the alternatives' pesticides would be used at a given time.

Increase in Cancer Risk Due to Application of Pesticides

In regulatory risk assessments, cancer risks are quantified only for those substances that have been classified as carcinogens, and for which CSFs have been developed (see Equation 8-3 and Appendix D). Permethrin is the only substance considered in this alternative that is classified as a carcinogen. Cancer risks for Nursery Workers, Adult and Child Residents, Adult Gardeners, and Adult and Child Recreational Park Users are potentially significant under CEQA, as indicated by risks that exceed 1×10^{-6} . **Impacts would be potentially significant.**

Adverse Health Effects from Pesticides Analyzed Individually and in Combination

Potential adverse health effects to Nursery/Project Workers, Agricultural Workers, Adult and Child Residents, Adult Gardeners, and Adult and Child Recreational Park Users from exposure to individual pesticides are potentially significant under CEQA, as indicated by cancer risks that exceed 1×10^{-6} and/or noncancer HIs that exceed 1. **Impacts would be potentially significant.**

Additive impacts of concurrent exposure to more than one pesticide were not evaluated in this alternative because no basis exists for assuming that more than one of the alternatives' pesticides would be used at a given time.

8.2.4 Mating Disruption (Alternative MD)

The HHRA (Appendix D) evaluated potential health effects from Alternative MD-1 (Isomate twist ties), Alternative MD-2 (ground-based application of SPLAT and Hercon), and MD-3 (aerial application of SPLAT or Hercon). For all of the application methods, inhalation is expected to be the dominant exposure pathway given the volatile nature of the LBAM pheromones. Accordingly, both acute and subchronic inhalation are evaluated for all alternatives. Accidental ingestion of a twist tie by a child is also evaluated for Alternative MD-1. The possibility of dermal sensitization from exposure to the LBAM pheromones could not be evaluated quantitatively given a lack of definitive information on the sensitization potential of these substances. However, as noted in Appendix D and previously in this chapter, the pheromones may have the potential to cause sensitization reactions from contact.

8.2.4.1 Alternative MD-1

Tables 8-15 through 8-21 provide the noncancer HQs from acute and subchronic inhalation exposures to the LBAM pheromones present in twist ties. All of these HIs are substantially below 1, and indicate that adverse health effects from inhalation of the pheromones released from Isomate are not likely to occur. The HQ from the accidental ingestion of a twist tie is 0.05. In the unlikely event that a child were exposed to the LBAM pheromones by inhalation (Tables 8-18 and 8-21) as well as by accidental ingestion, the HI is 0.05 for both the Child Resident and Child Park User. Because this HI is considerably less than 1, no health effects of exposure are considered likely.

Table 8-15 Nursery/Program Worker Hazard Quotients – Mating Disruption Alternative, Twist Ties

Exposure Medium:	Chemical-Specific Noncarcinogenic Hazard Quotients					
	Air			Soil		Ornamental Vegetation
Pathways:	Inhalation	Subchronic Inhalation	Acute Inhalation	Incidental Ingestion	Dermal Contact	Dermal Contact
Isomate	---	3.1E-05	2.6E-06	---	---	---

--- = Appropriate toxicity value is not available.

Table 8-16 Agricultural Worker Hazard Quotients – Mating Disruption Alternative, Twist Ties

Exposure Medium:	Chemical-Specific Noncarcinogenic Hazard Quotients					
	Air			Soil		Food
Pathways:	Inhalation	Subchronic Inhalation	Acute Inhalation	Incidental Ingestion	Dermal Contact	Dermal Contact
Isomate	---	3.1E-05	2.6E-06	---	---	---

--- = Appropriate toxicity value is not available.

Table 8-17 Adult Resident Hazard Quotients – Mating Disruption Alternative, Twist Ties

Exposure Medium:	Chemical-Specific Noncarcinogenic Hazard Quotients							
	Air			Soil		Ornamental Vegetation	Commercial Produce	Homegrown Produce
Pathways:	Inhalation	Subchronic Inhalation	Acute Inhalation	Incidental Ingestion	Dermal Contact	Dermal Contact	Ingestion	Ingestion
Isomate	---	8.7E-05	1.8E-06	---	---	---	---	---

--- = Appropriate toxicity value is not available.

Table 8-18 Child Resident Hazard Quotients – Mating Disruption Alternative, Twist Ties

Exposure Medium:	Chemical-Specific Noncarcinogenic Hazard Quotients							
	Air			Soil		Ornamental Vegetation	Commercial Produce	Homegrown Produce
Pathways:	Inhalation	Subchronic Inhalation	Acute Inhalation	Incidental Ingestion	Dermal Contact	Dermal Contact	Ingestion	Ingestion
Isomate	---	1.3E-04	1.4E-07	---	---	---	---	---

--- = Appropriate toxicity value is not available.

Table 8-19 Residential Adult Gardener Hazard Quotients – Mating Disruption Alternative, Twist Ties

Exposure Medium:	Chemical-Specific Noncarcinogenic Hazard Quotients								
	Air			Soil		Ornamental Vegetation	Commercial Produce	Homegrown Produce	
Pathways:	Inhalation	Subchronic Inhalation	Acute Inhalation	Incidental Ingestion	Dermal Contact	Dermal Contact	Ingestion	Ingestion	Dermal Contact
Isomate	---	1.5E-05	3.6E-06	---	---	---	---	---	---

--- = Appropriate toxicity value is not available.

Table 8-20 Adult Park User Hazard Quotients – Mating Disruption Alternative, Twist Ties

Exposure Medium:	Chemical-Specific Noncarcinogenic Hazard Quotients						
	Air			Soil		Ornamental Vegetation	Commercial Produce
Pathways:	Inhalation	Subchronic Inhalation	Acute Inhalation	Incidental Ingestion	Dermal Contact	Dermal Contact	Ingestion
Isomate	---	4.2E-06	3.6E-06	---	---	---	---

--- = Appropriate toxicity value is not available.

Table 8-21 Child Park User Hazard Quotients – Mating Disruption Alternative, Twist Ties

Exposure Medium:	Chemical-Specific Noncarcinogenic Hazard Quotients						
	Air			Soil		Ornamental Vegetation	Commercial Produce
Pathways:	Inhalation	Subchronic Inhalation	Acute Inhalation	Incidental Ingestion	Dermal Contact	Dermal Contact	Ingestion
Isomate	---	1.1E-05	9.4E-06	---	---	---	---

--- = Appropriate toxicity value is not available.

8.2.4.2 Alternative MD-2

Tables 8-22 through 8-28 give the HQ s attributable to inhalation exposure to the pheromones present in SPLAT and Hercon subsequent to ground-based application. For all receptor populations, including the sensitive populations of the Child Resident and Child Park User, HQ s are well below 1.

Table 8-22 Nursery/Program Worker Hazard Quotients – Mating Disruption Alternative, Ground Application

Exposure Medium:	Chemical-Specific Noncarcinogenic Hazard Quotients					
	Air			Soil		Ornamental Vegetation
Pathways:	Inhalation	Subchronic Inhalation	Acute Inhalation	Incidental Ingestion	Dermal Contact	Dermal Contact
Hercon	---	5.2E-03	2.9E-03	---	---	---
SPLAT	---	1.1E-02	2.9E-02	---	---	---

--- = Appropriate toxicity value is not available.

Table 8-23 Agricultural Worker Hazard Quotients – Mating Disruption Alternative, Ground Application

Exposure Medium:	Chemical-Specific Noncarcinogenic Hazard Quotients					
	Air			Soil		Commercial Produce
Pathways:	Inhalation	Subchronic Inhalation	Acute Inhalation	Incidental Ingestion	Dermal Contact	Dermal Contact
Hercon	---	5.2E-03	2.9E-03	---	---	---
SPLAT	---	1.1E-02	2.9E-02	---	---	---

--- = Appropriate toxicity value is not available.

Table 8-24 Adult Resident Hazard Quotients – Mating Disruption Alternative, Ground Application

Exposure Medium:	Chemical-Specific Noncarcinogenic Hazard Quotients							
	Air			Soil		Ornamental Vegetation	Commercial Produce	Homegrown Produce
Pathways:	Inhalation	Subchronic Inhalation	Acute Inhalation	Incidental Ingestion	Dermal Contact	Dermal Contact	Ingestion	Ingestion
Hercon	---	1.5E-02	1.9E-03	---	---	---	---	---
SPLAT	---	3.1E-02	2.0E-02	---	---	---	---	---

--- = Appropriate toxicity value is not available.

Table 8-25 Child Resident Hazard Quotients – Mating Disruption Alternative, Ground Application

Exposure Medium:	Chemical-Specific Noncarcinogenic Hazard Quotients									
	Air			Soil		Ornamental Vegetation		Commercial Produce	Homegrown Produce	
Pathways:	Inhalation	Subchronic Inhalation	Acute Inhalation	Incidental Ingestion	Dermal Contact	Incidental Ingestion	Dermal Contact	Ingestion	Ingestion	
Hercon	---	2.2E-02	2.9E-03	---	---	---	---	---	---	
SPLAT	---	4.6E-02	3.0E-02	---	---	---	---	---	---	

--- = Appropriate toxicity value is not available.

Table 8-26 Residential Adult Gardener Hazard Quotients – Mating Disruption Alternative, Ground Application

Exposure Medium:	Chemical-Specific Noncarcinogenic Hazard Quotients									
	Air			Soil		Ornamental Vegetation	Commercial Produce	Homegrown Produce		
Pathways:	Inhalation	Subchronic Inhalation	Acute Inhalation	Incidental Ingestion	Dermal Contact	Dermal Contact	Ingestion	Ingestion	Dermal Contact	
Hercon	---	2.5E-03	3.9E-03	---	---	---	---	---	---	
SPLAT	---	5.2E-03	4.0E-02	---	---	---	---	---	---	

--- = Appropriate toxicity value is not available.

Table 8-27 Adult Park User Hazard Quotients – Mating Disruption Alternative, Ground Application

Exposure Medium:	Chemical-Specific Noncarcinogenic Hazard Quotients						
	Air			Soil		Ornamental Vegetation	Commercial Produce
Pathways:	Inhalation	Subchronic Inhalation	Acute Inhalation	Incidental Ingestion	Dermal Contact	Dermal Contact	Ingestion
Hercon	---	7.1E-04	3.9E-03	---	---	---	---
SPLAT	---	1.5E-03	4.0E-02	---	---	---	---

--- = Appropriate toxicity value is not available.

Table 8-28 Child Park User Hazard Quotients – Mating Disruption Alternative, Ground Application

Exposure Medium:	Chemical-Specific Noncarcinogenic Hazard Quotients						
	Air			Soil		Ornamental Vegetation	Commercial Produce
Pathways:	Inhalation	Subchronic Inhalation	Acute Inhalation	Incidental Ingestion	Dermal Contact	Dermal Contact	Ingestion
Hercon	---	1.9E-03	1.0E-02	---	---	---	---
SPLAT	---	3.9E-03	1.1E-01	---	---	---	---

Note:
--- = Appropriate toxicity value is not available.

8.2.4.3 Alternative MD-3

Tables 8-29 through 8-35 provide the HQs attributable to inhalation exposure associated with aerial application of Hercon or SPLAT. All of the HQs for all receptor populations exposed to pheromones in either SPLAT or Hercon are below 1. Accordingly, no impacts from aerial application of SPLAT or Hercon would occur.

Table 8-29 Nursery/Program Worker Hazard Quotients – Mating Disruption Alternative, Aerial Application

Exposure Medium:	Chemical-Specific Noncarcinogenic Hazard Quotients					
	Air			Soil		Ornamental Vegetation
Pathways:	Inhalation	Subchronic Inhalation	Acute Inhalation	Incidental Ingestion	Dermal Contact	Dermal Contact
Hercon	---	1.2E-04	5.8E-05	---	---	---
SPLAT	---	1.9E-04	5.1E-04	---	---	---

--- = Appropriate toxicity value is not available

Table 8-30 Agricultural Worker Hazard Quotients – Mating Disruption Alternative, Aerial Application

Exposure Medium:	Chemical-Specific Noncarcinogenic Hazard Quotients					
	Air			Soil		Commercial Produce
Pathways:	Inhalation	Subchronic Inhalation	Acute Inhalation	Incidental Ingestion	Dermal Contact	Dermal Contact
Hercon	---	1.2E-04	5.8E-05	---	---	---
SPLAT	---	1.9E-04	5.1E-04	---	---	---

--- = Appropriate toxicity value is not available.

Table 8-31 Adult Resident Hazard Quotients – Mating Disruption Alternative, Aerial Application

Exposure Medium:	Chemical-Specific Noncarcinogenic Hazard Quotients							
	Air			Soil		Ornamental Vegetation	Commercial Produce	Homegrown Produce
Pathways:	Inhalation	Subchronic Inhalation	Acute Inhalation	Incidental Ingestion	Dermal Contact	Dermal Contact	Ingestion	Ingestion
Hercon	---	3.3E-04	3.9E-05	---	---	---	---	---
SPLAT	---	5.3E-04	3.5E-04	---	---	---	---	---

--- = Appropriate toxicity value is not available.

Table 8-32 Child Resident Hazard Quotients – Mating Disruption Alternative, Aerial Application

Exposure Medium:	Chemical-Specific Noncarcinogenic Hazard Quotients							
	Air			Soil		Ornamental Vegetation	Commercial Produce	Homegrown Produce
Pathways:	Inhalation	Subchronic Inhalation	Acute Inhalation	Incidental Ingestion	Dermal Contact	Dermal Contact	Ingestion	Ingestion
Hercon	---	4.9E-04	5.8E-05	---	---	---	---	---
SPLAT	---	7.9E-04	5.2E-04	---	---	---	---	---

--- = Appropriate toxicity value is not available.

Table 8-33 Residential Adult Gardener Hazard Quotients – Mating Disruption Alternative, Aerial Application

Exposure Medium:	Chemical-Specific Noncarcinogenic Hazard Quotients								
	Air			Soil		Ornamental Vegetation	Commercial Produce	Homegrown Produce	
Pathways:	Inhalation	Subchronic Inhalation	Acute Inhalation	Incidental Ingestion	Dermal Contact	Dermal Contact	Ingestion	Ingestion	Dermal Contact
Hercon	---	5.6E-05	7.9E-05	---	---	---	---	---	---
SPLAT	---	8.9E-05	7.0E-04	---	---	---	---	---	---

--- = Appropriate toxicity value is not available.

Table 8-34 Adult Park User Hazard Quotients – Mating Disruption Alternative, Aerial Application

Exposure Medium:	Chemical-Specific Noncarcinogenic Hazard Quotients						
	Air			Soil		Ornamental Vegetation	Commercial Produce
Pathways:	Inhalation	Subchronic Inhalation	Acute Inhalation	Incidental Ingestion	Dermal Contact	Dermal Contact	Ingestion
Hercon	---	1.6E-05	7.9E-05	---	---	---	---
SPLAT	---	2.5E-05	7.0E-04	---	---	---	---

--- = Appropriate toxicity value is not available.

Table 8-35 Child Park User Hazard Quotients – Mating Disruption Alternative, Aerial Application

Exposure Medium:	Chemical-Specific Noncarcinogenic Hazard Quotients						
	Air			Soil		Ornamental Vegetation	Commercial Produce
Pathways:	Inhalation	Subchronic Inhalation	Acute Inhalation	Incidental Ingestion	Dermal Contact	Dermal Contact	Ingestion
Hercon	---	4.2E-05	2.1E-04	---	---	---	---
SPLAT	---	6.6E-05	1.8E-03	---	---	---	---

--- = Appropriate toxicity value is not available.

Sensitive Receptors Exposed to Substantial Pollutant Concentrations

Inhalation HIs are less than 1 for the Sensitive Receptor populations of a Child Resident and a Child Park User that were evaluated for Alternative MD-1 (Tables 8-18, 8-21); MD-2 (Tables 8-25 and 8-28); and MD-3 (Tables 8-32 and 8-3). The HI for the accidental ingestion of a twist tie by a Sensitive Receptor (see Section 8.2.4.1, Alternative MD-1) is also less than 1 (HI of 0.05). On the basis of these results, in which all HIs for sensitive receptors are less than 1, no adverse health effects on sensitive receptors are expected.

Impact HH-1: Sensitive receptors would not be exposed to substantial pollutant concentrations under Alternatives MD-1, MD-2, and MD-3. No impact would occur. Therefore, mitigation is not required.

Create a Significant Hazard to the Public or the Environment through Transport, Use, or Disposal of Hazardous Material

None of the pheromone formulations evaluated in Alternatives MD-1, MD-2, and MD-3 are expected to have adverse health effects on the public (Appendix D). That conclusion is based on an assessment of potential effects to Nursery/Project Workers and Agricultural Workers (Tables 8-15, 8-16 [MD-1]; Tables 8-22, 8-23 [MD-2] Tables 8-29, 8-30 [MD-3], Adult Residents (Table 8-17 [MD-1], Table 8-24 [MD-2], Table 8-31 [MD-3]), Adult Gardeners (Table 8-19 [MD-1], Table 8-26 [MD-2], Table 8-33 [MD-3]), and Adult Recreational Park Users (Table 8-20 [MD-1], Table 8-27 [MD-2], Table 8-34 [MD-3]) that yielded HIs for each receptor population that were less than 1. No impacts would occur.

Impact HH-2: Alternatives MD-1, MD-2, and MD-3 would not create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials. No impacts would occur. Therefore, mitigation is not required.

Impacts on People, Including Sensitive Receptors, through Ingestion and other Exposure Pathways

Appendix D quantitatively evaluated potential short-term effects of exposure to the pheromones present in Isomate, SPLAT, and Hercon. The resulting HIs are provided in Tables 8-15 through 8-35. Accidental ingestion of a twist tie (see Section 8.2.4.1 and Appendix D) resulted in an acute ingestion HI of 0.05. These results indicate that all acute HIs are less than 1; no adverse health effects of short-term exposure are expected.

Tables 8-15 through 8-35 also provide the results of HIs calculated for subchronic exposure to the pheromones released from Isomate, SPLAT, and Hercon. These results indicate that all subchronic HIs are less than 1; no adverse health effects of subchronic exposure are expected.

Intakes were calculated for longer-term exposures such as might occur from incidental ingestion of soil, dermal contact with soil, and ingestion of homegrown and commercial produce. Although no chronic toxicity data are available to develop HQs or HIs from these intakes, the highest intakes are approximately 1,000 times lower than available toxicity criteria (OEHHA 2009a). On the basis of this analysis, Isomate, SPLAT, and Hercon are not expected to have adverse long-term human health effects.

Additive effects of exposure to Isomate, SPLAT, and Hercon were not evaluated, as no basis exists for assuming that they would be used together. No adverse health effects are expected.

Impact HH-3: Alternatives MD-1, MD-2, and MD-3 would not have impacts on people, including sensitive receptors, through ingestion and other exposure pathways. No impacts would occur. Therefore, mitigation is not required.

Short-Term, Subchronic, Long-Term, and/or Additive Human Health Impacts

The HHRA quantitatively evaluated potential short-term (acute) and subchronic effects of exposure to the pheromones present in Isomate, SPLAT, and Hercon. HIs calculated for acute and subchronic inhalation of the pheromones present in Isomate, SPLAT, and Hercon are all well below an HI of 1 (Tables 8-15 through 8-35). Accidental ingestion of a twist tie (an additional short-term exposure) had an HI of 0.05, also below an HI of 1 (see Section 8.2.4.1). These HIs below 1 indicate that adverse health effects are not expected to occur from short-term or subchronic exposures.

Intakes were also calculated for longer-term exposures such as might occur from incidental ingestion of soil, dermal contact with soil, and ingestion of homegrown and commercial produce. Although no chronic toxicity data are available to develop HQs or HIs from these chronic intakes, the highest chronic intakes are approximately 1,000 times lower than available toxicity criteria (OEHHA 2009a). On the basis of this comparison, Isomate, SPLAT, and Hercon are not expected to have adverse long-term human health effects.

Additive effects of exposure to Isomate, SPLAT, and Hercon were not evaluated, as no basis exists for assuming that they would be used together. No adverse health effects are expected.

Impact HH-4: Alternatives MD-1, MD-2, and MD-3 would not have short-term, subchronic, and/or long-term human health impacts. No impacts would occur. Therefore, mitigation is not required.

Increase in Cancer Risk Due to Application of Pesticides

As noted in Appendix D, neither of the pheromone active ingredients, nor the Isomate, SPLAT, or Hercon formulations or formulation components are classified as carcinogens, so no basis exists for the evaluation of cancer risks. Therefore, no impacts are expected.

Impact HH-5: Application of pesticides under Alternative MD-1, MD-2, and MD-3 would not cause an increase in cancer risk. No impacts would occur. Therefore, mitigation is not required.

Adverse Health Effects from Pesticides Analyzed Individually and in Combination

Isomate, SPLAT, and Hercon all contain the same active ingredients, the synthetic Lepidopteran pheromones (E)-11-Tetradecen-1-yl acetate and (E,E)-9,11-Tetradecadien-1-yl acetate and, thus, have the same action against the LBAM (i.e., they act as mating disruptors). Because of this similarity, no reason exists to use any of these products in combination and, consequently, the potential health effects of exposure to Isomate, SPLAT, and Hercon were evaluated individually, not in combination. The evaluation of potential health effects from the use of Isomate, SPLAT, or Hercon indicates that none is expected to be associated with adverse health effects. Therefore, no impact would occur.

Impact HH-6: Pesticides evaluated in Alternatives MD-1, MD-2, and MD-3 do not have adverse health effects when analyzed individually. No impacts would occur. Therefore, mitigation is not required.

8.2.5 Male Moth Attractant (Alternative MMA)

In Alternative MMA, the pheromone formulation SPLAT² would be applied with Permethrin E-Pro to attract and kill LBAM. The permethrin product is a formulation that contains ethylbenzene and 1,2,4-trimethylbenzene as well as permethrin as the active ingredient. Both permethrin and ethylbenzene are classified as carcinogens (USEPA 2002d; OEHHA 2008a), and cancer risk attributable to potential permethrin and ethylbenzene exposure was calculated for the individual chemicals as well as the additive risk from combined exposures. Additive noncancer HIs from permethrin, ethylbenzene, 1,2,4-trimethylbenzene, and the pheromone components of SPLAT (the one pheromone formulation that will be applied with permethrin) were also calculated. Under Alternative MMA, Nursery Workers, Adult Residents, and Child Residents have potential cancer risks somewhat in excess of 1×10^{-6} (see Tables 8-36, 8-38, 8-39). These risks are attributable to permethrin alone, and are solely from potential exposure to ornamental vegetation. Ethylbenzene does not contribute significantly to the cancer risks estimated under Alternative MMA. All noncancer HIs are below 1 for individual chemicals (all pathways) (see Tables 8-36 through 8-42). If the chronic HIs are summed for each receptor population for hazard attributable to permethrin, ethylbenzene, and 1,2,4-trimethylbenzene, the HIs for all chemicals considered together are also well below an HI of 1 for all receptor populations.

² The density of SPLAT/Permethrin E-Pro applications per square mile may be revised. If these revisions are made, the exposure point concentrations and estimated health effects predicted for this alternative will also be subject to revision.

Table 8-36 Nursery/Program Worker Cancer Risks and Hazard Quotients – Male Moth Attractant

Exposure Medium:	Chemical-Specific Cancer Risks					Total Cancer Risk	
	Air	Soil		Ornamental Vegetation			
Pathway:	Inhalation	Incidental Ingestion	Dermal Contact	Dermal Contact	All Pathways		
SPLAT	----	----	----	----	----	----	
Permethrin		3.3E-12	1.4E-11	1.9E-06	2E-06		
Ethylbenzene	3.5E-12	NA	NA	NA	3E-12		
1,2,4-Trimethylbenzene	----	NA	NA	NA	----		
Chemical-Specific Noncarcinogenic Hazard Quotients							
Exposure Medium:	Air			Soil		Ornamental Vegetation	Total Chronic HI
Pathway:	Inhalation	Subchronic Inhalation	Acute Inhalation	Incidental Ingestion	Dermal Contact	Dermal Contact	All Pathways
SPLAT	----	7.7E-06	2.0E-05	----	----	----	----
Permethrin	4.4E-06	4.7E-06	2.1E-04	1.4E-08	6.0E-08	7.9E-03	8E-03
Ethylbenzene	7.0E-09	4.9E-09	1.5E-08	1.2E-11	NA	NA	7E-09
1,2,4-Trimethylbenzene	2.7E-04	2.8E-05	----	----	NA	NA	3E-04
---- = Appropriate toxicity value is not available. NA = Not applicable							

Table 8-37 Agricultural Worker Cancer Risks and Hazard Quotients – Male Moth Attractant

Exposure Medium:	Chemical-Specific Cancer Risks					Total Cancer Risk	
	Air	Soil		Commercial Produce			
Pathway:	Inhalation	Incidental Ingestion	Dermal Contact	Dermal Contact	All Pathways		
SPLAT	----	----	----	----	----	----	
Permethrin	----	3E-12	1E-11	NE	2E-11		
Ethylbenzene	3E-12	1E-15	NA	NA	3E-12		
1,2,4-Trimethylbenzene	----	----	NA	NA	----		
Chemical-Specific Noncarcinogenic Hazard Quotients							
Exposure Medium:	Air			Soil		Commercial Produce	Total Chronic HI
Pathway:	Inhalation	Subchronic Inhalation	Acute Inhalation	Incidental Ingestion	Dermal Contact	Dermal Contact	All Pathways
SPLAT	----	8E-06	2E-05	----	----	----	----
Permethrin	4E-06	5E-06	2E-04	1E-08	6E-08	NE	4E-06
Ethylbenzene	7E-09	5E-09	2E-08	1E-11	NA	NA	7E-09
1,2,4-Trimethylbenzene	3E-04	3E-05	----	----	NA	NA	3E-04
---- = Appropriate toxicity value is not available. NE = Not evaluated because permethrin is registered by the USEPA primarily for use as a termiticide and on nonfood crops (Etigra. 2007. Product Label for Permethrin E-Pro. Revised July 9 2007). NA = Not applicable							

Table 8-38 Adult Resident Cancer Risks and Hazard Quotients – Male Moth Attractant

Chemical-Specific Cancer Risks									
Exposure Medium:	Air		Soil		Ornamental Vegetation	Commercial Produce	Homegrown Produce	Total Cancer Risk	
Pathways:	Inhalation	Incidental Ingestion	Dermal Contact	Dermal Contact	Ingestion	Ingestion	All Pathways		
SPLAT	---	---	---	---	---	---	---		
Permethrin	---	5.6E-12	7.4E-12	2.3E-06	NE	NE	2.E-06		
Ethylbenzene	1.0E-11	2.3E-15	NA	NA	1.5E-10	2.6E-11	2.E-10		
1,2,4-Trimethylbenzene	---	---	NA	NA	---	---	---		
Chemical-Specific Noncarcinogenic Hazard Quotients									
Exposure Medium:	Air			Soil		Ornamental Vegetation	Commercial Produce	Homegrown Produce	Total Chronic HI
Pathways:	Inhalation	Subchronic Inhalation	Acute Inhalation	Incidental Ingestion	Dermal Contact	Dermal Contact	Ingestion	Ingestion	All Pathways
SPLAT	---	2.2E-05	1.4E-05	---	---	---	---	---	---
Permethrin	1.3E-05	1.3E-05	1.4E-04	2.4E-08	3.1E-08	9.6E-03	NE	NE	1.E-02
Ethylbenzene	2.0E-08	1.4E-08	1.0E-08	2.1E-11	NA	NA	1.3E-06	2.4E-07	2.E-06
1,2,4-Trimethylbenzene	7.7E-04	8.0E-05	---	---	NA	NA	---	---	8.E-04
--- = Appropriate toxicity value is not available. NE = Not evaluated because permethrin is registered by the USEPA primarily for use as a termiticide and on nonfood crops (Etigra. 2007. Product Label for Permethrin E-Pro. Revised July 9 2007). NA = Not applicable									

Table 8-39 Child Resident Cancer Risks and Hazard Quotients – Male Moth Attractant

Chemical-Specific Cancer Risks									
Exposure Medium:	Air		Soil		Ornamental Vegetation	Commercial Produce	Homegrown Produce	Total Cancer Risk	
Pathways:	Inhalation	Incidental Ingestion	Dermal Contact	Dermal Contact	Ingestion	Ingestion	All Pathways		
SPLAT	---	---	---	---	---	---	---		
Permethrin	---	2.9E-11	1.5E-11	2.9E-06	NE	NE	3E-06		
Ethylbenzene	1.5E-11	1.2E-14	NA	NA	1.6E-10	2.8E-11	2E-10		
1,2,4-Trimethylbenzene	---	---	NA	NA	---	---	---		
Chemical-Specific Noncarcinogenic Hazard Quotients									
Exposure Medium:	Air			Soil		Ornamental Vegetation	Commercial Produce	Homegrown Produce	Total Chronic HI
Pathways:	Inhalation	Subchronic Inhalation	Acute Inhalation	Incidental Ingestion	Dermal Contact	Dermal Contact	Ingestion	Ingestion	All Pathways
SPLAT	---	3.3E-05	2.1E-05	---	---	---	---	---	---
Permethrin	1.9E-05	2.0E-05	2.1E-04	1.2E-07	6.4E-08	1.2E-02	NE	NE	1E-02
Ethylbenzene	3.0E-08	2.1E-08	1.5E-08	1.1E-10	NA	NA	1.5E-06	2.6E-07	2E-06
1,2,4-Trimethylbenzene	1.2E-03	1.2E-04	---	---	NA	NA	---	---	1E-03
--- = Appropriate toxicity value is not available. NE = Not evaluated because permethrin is registered by the USEPA primarily for use as a termiticide and on nonfood crops (Etigra. 2007. Product Label for Permethrin E-Pro. Revised July 9 2007). NA = Not applicable									

Table 8-40 Residential Adult Gardener Cancer Risks and Hazard Quotients – Male Moth Attractant

Chemical-Specific Cancer Risks										
Exposure Medium:	Air	Soil		Ornamental Vegetation	Commercial Produce	Homegrown Produce		Total Cancer Risk		
Pathways:	Inhalation	Incidental Ingestion	Dermal Contact	Dermal Contact	Ingestion	Ingestion	Dermal Contact	All Pathways		
SPLAT	---	---	---	---	---	---	---	---		
Permethrin	---	1.6E-12	3.7E-12	6.6E-07	NE	NE	NE	7E-07		
Ethylbenzene	4.8E-13	6.5E-16	NA	NA	1.5E-10	2.6E-11	NA	2E-10		
1,2,4-Trimethylbenzene	---	---	NA	NA	---	---	NA	---		
Chemical-Specific Noncarcinogenic Hazard Quotients										
Exposure Medium:	Air		Soil		Ornamental Vegetation	Commercial Produce	Homegrown Produce		Total Chronic HI	
Pathways:	Inhalation	Subchronic Inhalation	Acute Inhalation	Incidental Ingestion	Dermal Contact	Dermal Contact	Ingestion	Ingestion	Dermal Contact	All Pathways
SPLAT	---	3.7E-06	2.8E-05	---	---	---	---	---	---	---
Permethrin	6.1E-07	2.2E-06	2.9E-04	6.7E-09	1.6E-08	2.7E-03	NE	NE	NE	3E-03
Ethylbenzene	9.7E-10	2.3E-09	2.1E-08	5.9E-12	NA	NA	1.3E-06	2.4E-07	NA	2E-06
1,2,4-Trimethylbenzene	3.7E-05	1.4E-05	---	---	NA	NA	---	---	NA	4E-05
--- = Appropriate toxicity value is not available. NE = Not evaluated because permethrin is registered by the USEPA primarily for use as a termiticide and on nonfood crops (Etigra. 2007. Product Label for Permethrin E-Pro. Revised July 9 2007). NA = No applicable										

Table 8-41 Adult Park User Cancer Risks and Hazard Quotients – Male Moth Attractant

Chemical-Specific Cancer Risks								
Exposure Medium:	Air	Soil		Commercial Produce	Ornamental Vegetation	Total Cancer Risk		
Pathways:	Inhalation	Incidental Ingestion	Dermal Contact	Ingestion	Dermal Contact	All Pathways		
SPLAT	---	---	---	---	---	---		
Permethrin	---	8.1E-13	2.1E-12	NE	6.6E-07	7E-07		
Ethylbenzene	4.8E-13	3.3E-16	NA	1.5E-10	NA	5E-13		
1,2,4-Trimethylbenzene	---	---	NA	---	NA	---		
Chemical-Specific Noncarcinogenic Hazard Quotients								
Exposure Medium:	Air		Soil		Commercial Produce	Ornamental Vegetation	Total Chronic HI	
Pathways:	Inhalation	Subchronic Inhalation	Acute Inhalation	Incidental Ingestion	Dermal Contact	Ingestion	Dermal Contact	All Pathways
SPLAT	---	1.1E-06	2.8E-05	---	---	---	---	---
Permethrin	6.1E-07	6.4E-07	2.9E-04	3.4E-09	8.8E-09	NE	2.7E-03	3E-03
Ethylbenzene	9.7E-10	6.7E-10	2.1E-08	3.0E-12	NA	1.3E-06	NA	1E-09
1,2,4-Trimethylbenzene	3.7E-05	3.9E-06	---	---	NA	---	NA	4E-05
--- = Appropriate toxicity value is not available. NE = Not evaluated because permethrin is registered by the USEPA primarily for use as a termiticide and on nonfood crops (Etigra. 2007. Product Label for Permethrin E-Pro. Revised July 9 2007). NA = Not applicable								

Table 8-42 Child Park User Cancer Risks and Hazard Quotients – Male Moth Attractant

Chemical-Specific Cancer Risks								
Exposure Medium:	Air		Soil		Commercial Produce	Ornamental Vegetation	Total Cancer Risk	
Pathways:	Inhalation	Incidental Ingestion	Dermal Contact	Ingestion	Dermal Contact	All Pathways		
SPLAT	---	---	---	---	---	---		
Permethrin	---	4.2E-12	4.4E-12	NE	8.2E-07	8E-07		
Ethylbenzene	1.3E-12	1.7E-15	NA	1.6E-10	NA	1E-12		
1,2,4-Trimethylbenzene	---	---	NA	---	NA	---		
Chemical-Specific Noncarcinogenic Hazard Quotients								
Exposure Medium:	Air			Soil		Commercial Produce	Ornamental Vegetation	Total Chronic HI
Pathways:	Inhalation	Subchronic Inhalation	Acute Inhalation	Incidental Ingestion	Dermal Contact	Ingestion	Dermal Contact	All Pathways
SPLAT	---	2.8E-06	7.3E-05	---	---	---	---	---
Permethrin	1.6E-06	1.7E-06	7.6E-04	1.7E-08	1.8E-08	NE	3.4E-03	3E-03
Ethylbenzene	2.6E-09	1.8E-09	5.5E-08	1.5E-11	NA	1.5E-06	NA	3E-09
1,2,4-Trimethylbenzene	9.7E-05	1.0E-05	---	---	NA	---	NA	1E-04
--- = Appropriate toxicity value is not available. NE = Not evaluated because permethrin is registered by the USEPA primarily for use as a termiticide and on nonfood crops (Etigra. 2007. Product Label for Permethrin E-Pro. Revised July 9 2007). NA = Not applicable								

Sensitive Receptors Exposed to Substantial Pollutant Concentrations

Potential cancer risks to the two Sensitive Receptor Populations, the Child Resident and the Child Recreational Park User, were evaluated for the effects of exposure to permethrin and ethylbenzene. The cancer risks calculated for the child resident exceeds 1×10^{-6} (Table 8-39), and indicates that this receptor population may experience adverse effects from exposure.

Noncancer HIs calculated for the sensitive receptors for permethrin, ethylbenzene, and 1,2,4-trimethylbenzene evaluated individually or additively indicate that these receptors are not expected to experience adverse noncancer health impacts.

Impact HH-7: Sensitive receptors could be exposed to substantial pollutant concentrations under Alternative MMA. Impacts would be potentially significant but mitigable.

Mitigation HH-7a: Apply the MMA material containing Permethrin E-Pro to poles, trees, or similar structures at heights that are above the breathing zone of an average person. Placement of the formulation at this height should preclude most opportunities for direct contact, while enhancing volatilization of the material. The planned height is 8 feet aboveground and this height has been tested for sufficiency by the DPR (Kim 2009).

Mitigation HH-7b: The CDFA will avoid parks and schools when treating for LBAM.

Significance after Mitigation: Less than significant

Create a Significant Hazard to the Public or the Environment through Transport, Use, or Disposal of Hazardous Materials

Potential effects to the public from Alternative MMA were addressed by evaluating health impacts to Nursery/Project Workers (Table 8-36), Agricultural Workers (Table 8-37), Adult Residents (Table 8-36) Adult Gardeners (Table 8-40), and Adult Recreational Park Users (Table 8-42) (also see Appendix D). Estimated cancer risks to Nursery/Project Workers (Table 8-36) and Adult Residents (Table 8-36) exceed 1×10^{-6} and, thus, are potentially significant under CEQA.

Noncancer HIs do not exceed 1 for any receptor population evaluated for this alternative and, thus, noncancer effects are not potentially significant under CEQA.

Impact HH-8: **Alternative MMA could create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials. Impacts are potentially significant but mitigable.**

Mitigation HH-8a: Ensure that Alternative MMA pesticides are applied in strict accordance with label requirements.

Mitigation HH-8b: Ensure that appropriate worker training is conducted prior to use of pesticides.

Mitigation HH-8c: Ensure that appropriate personal protective equipment is used. See also Mitigation Measure HH-7a.

Significance after Mitigation: Less than significant

Impacts on People, Including Sensitive Receptors, through Ingestion and Other Exposure Pathways

The HHRA (Appendix D) evaluated impacts to sensitive receptors by ingestion, as well as by inhalation and dermal exposure (Tables 8-39 and 8-42). Cancer risks calculated for the Sensitive Receptor population of the Child Resident (Table 8-39) exceeds 1×10^{-6} and, thus, are potentially significant under CEQA.

Cancer risks and noncancer HIs were also evaluated for other receptor populations by considering ingestion, inhalation, and dermal exposures (Tables 8-36, 8-37, 8-38, 8-40, 8-41). Estimated cancer risks to Nursery/Project Workers (Table 8-36) also exceed 1×10^{-6} and are potentially significant under CEQA. Noncancer HIs do not exceed 1 for any receptor population.

Impact HH-9: **Alternative MMA could have impacts on people, including sensitive receptors, through ingestion and other exposure pathways. Impacts are potentially significant but mitigable.**

Mitigation HH-9: See Mitigation Measures HH-7a, HH-7b, HH-8a, HH-8b, and HH-8c.

Significance after Mitigation: Less than significant

Short-Term, Subchronic, Long-Term, and/or Additive Human Health Impacts

Acute health effects estimated for Nursery/Project Workers, Agricultural Workers, Adult and Child Residents, and Adult and Child Recreational Park Users (Appendix D) and summarized in Tables 8-36, 8-37, 8-38, 8-39, 8-40, 8-41, and 8-42 show that all acute inhalation exposures yield HIs less than 1. Because all HIs are less than 1, no health impacts are anticipated from potential short-term (acute) exposures evaluated under Alternative MMA.

Subchronic health effects estimated for Nursery/Project Workers, Agricultural Workers, Adult and Child Residents, and Adult and Child Recreational Park Users (Tables 8-36, 8-37, 8-38, 8-39, 8-40, 8-41, and 8-42) indicate that these receptors all have subchronic noncancer HIs that are less than 1. Because all these HIs are less than 1, no adverse health effects are expected from potential subchronic exposures evaluated under this alternative.

Potential long-term (chronic) health effects were evaluated by calculating both cancer risk and chronic noncancer HIs for all receptor populations, i.e., Nursery/Project Workers, Agricultural Workers, Adult and Child Residents, and Adult and Child Recreational Park Users. Cancer risks for Nursery/Project Workers (Table 8-36) and Adult and Child Residents (Tables 8-38 and 8-39, respectively) exceed 1×10^{-6} and are potentially significant under CEQA.

Chronic noncancer HIs do not exceed 1 for any individual chemical when evaluated for all receptor populations (Tables 8-36, 8-37, 8-38, 8-39, 8-40, 8-41, and 8-42), indicating that no adverse health effects are expected for this endpoint.

Additive noncancer HIs from Permethrin E-Pro ingredients do not exceed 1, indicating that no adverse health effects are expected for this endpoint.

Impact HH-10.1: Alternative MMA would not have short-term exposure impacts on human health. Therefore, no mitigation is required.

Impact HH-10.2: Subchronic health effects estimated for Nursery/Project Workers, Agricultural Workers, Adult and Child Residents, and Child Recreational Park Users indicate that these receptors all have noncancer HIs that are less than 1. Alternative MMA would not have subchronic impacts on human health. Therefore, no mitigation is required.

Impact HH-10.3: Cancer risks for Nursery/Project Workers and Adult and Child Residents exceed 1×10^{-6} . Alternative MMA could have long-term, human health impacts. Impacts are potentially significant but mitigable.

Mitigation HH-10.3: See Mitigation Measures HH-7a, HH-7b, HH-8a, HH-8b, and HH-8c.

Significance after Mitigation: Less than significant

Impact HH-10.4: Alternative MMA would not have additive on human health impacts. Therefore, no mitigation is required.

Increase in Cancer Risk Due to Application of Pesticides

Cancer risks attributable to potential exposures to permethrin and ethylbenzene were estimated for Nursery/Project Workers (Table 8-36), Agricultural Workers (Table 8-37), Adult and Child Residents (Tables 8-38 and 8-39), Adult Gardeners (Table 8-40), and Adult and Child Recreational Park Users (Tables 8-41 and 8-42) (also see evaluation in Appendix D). The calculated cancer risks for Nursery/Project Workers, Adult Residents, and Child Residents exceed 1×10^{-6} and are potentially significant under CEQA.

Impact HH-11: Application of pesticides under Alternative MMA could cause an increase in cancer risk. Impacts are potentially significant but mitigable.

Mitigation HH-11: See Mitigation Measures HH-7a, HH-7b, HH-8a, HH-8b, and HH-8c.

Significance after Mitigation: Less than significant

Adverse Health Effects from Pesticides Analyzed Individually and in Combination

Because the components of Permethrin E-Pro (permethrin, ethylbenzene, and 1,2,4 trimethylbenzene) would be applied together as a formulation, health effects were evaluated for these individual chemicals as well as for the formulation chemicals considered together, depending on the availability of appropriate toxicity data (Appendix D).

No adverse health effects are anticipated for any of the receptor populations from potential short-term (acute) exposures evaluated under Alternative MMA for exposures to the pheromone components of SPLAT, or to permethrin or ethylbenzene evaluated individually or together based on HIs that are less than 1 (Tables 8-36, 8-37, 8-38, 8-37, 8-38, 8-39, 8-40, 8-41, and 8-42). Acute toxicity data are not available for 1,2,4-trimethylbenzene, so neither an acute HQ nor an acute HI could be calculated. However, a 48-hour LC₅₀ for 1,2,4-trimethylbenzene has been reported to be >2,000 parts per million (i.e., >9,830 mg/m³) (TOXNET 2009). That concentration is more than a billion times larger than the highest calculated acute inhalation intake (Table D4-35, intake of 2.3x10⁻⁶ mg/m³ for a Child Resident), and indicates that adverse acute health effects from 1,2,4-trimethylbenzene exposure are not expected.

Subchronic health effects evaluated for Nursery/Project Workers (Table 8-36), Agricultural Workers (Table 8-37), Adult and Child Residents (Tables 8-38 and 8-39), Gardeners (Table 8-40) and Adult and Child Recreational Park Users (Tables 8-41 and 8-42) yielded subchronic noncancer HIs that are all below 1; thus, no adverse health effects are expected from subchronic exposures.

Potential long-term (chronic) health effects attributable to permethrin, ethylbenzene, and 1,2,4-trimethylbenzene were evaluated by calculating both cancer risk and chronic noncancer HIs for all receptor populations (Tables 8-36, 8-37, 8-38, 8-37, 8-38, 8-39, 8-40, 8-41, and 8-42). Cancer risks from potential permethrin exposures for Nursery/Project Workers (Table 8-36) and Adult and Child Residents (Tables 8-38 and 8-39) exceed 1x10⁻⁶; impacts are potentially significant under CEQA.

Chronic noncancer HIs do not exceed 1 for any individual chemical for any of the receptor populations (Tables 8-36, 8-37, 8-38, 8-37, 8-38, 8-39, 8-40, 8-41, and 8-42). Additive chronic noncancer HIs from permethrin, ethylbenzene, and 1,2,4-trimethylbenzene do not exceed 1. No adverse health effects are expected.

Impact HH-12.1: Pesticides evaluated in Alternative MMA would not have short-term adverse health effects when analyzed individually and in combination. No impacts would occur. Therefore, mitigation is not required

Impact HH-12.2: Pesticides evaluated in Alternative MMA would not have subchronic adverse health effects when analyzed individually and in combination. No impacts would occur. Therefore, mitigation is not required

Impact HH-12.3: Pesticides evaluated in Alternative MMA could have adverse chronic health effects from cancer when analyzed individually and in combination. Impacts are potentially significant but mitigable.

Mitigation HH-12.3: See Mitigation Measures HH-7a, HH-7b, HH-8a, HH-8b, and HH-8c.

Significance after Mitigation: Less than significant

8.2.6 Organically Approved Insecticides (Alternatives Btk and S)

These alternatives consider the use of spinosad and the biopesticide Btk for LBAM eradication. Potential health effects of Btk exposures were quantitatively evaluated for acute inhalation only, consistent with the availability of suitable toxicity criteria. That evaluation indicates that all receptor populations are expected to have HIs less than 1 (Tables 8-43 through 8-49). Despite an absence of comprehensive toxicity data for other exposure routes, years of Btk usage data have shown that this biopesticide is only minimally toxic. A comparison of predicted Btk intakes for noninhalation pathways to acute toxicity criteria indicates that it is unlikely that use of Btk will be associated with adverse effects (Appendix D). Similarly, available data were not sufficient to support quantitation of subchronic inhalation exposures to spinosad, although all other relevant exposure pathways and exposure durations were addressed (Appendix D).

The HIs associated with the use of spinosad or Btk by both worker populations, Adult and Child Residents, Adult Gardeners, and Adult and Child Recreational Park Users are all less than 1, indicating no adverse effects of exposure are expected from the use of spinosad or Btk.

Table 8-43 Nursery/Program Worker Hazard Quotients – Organic Treatment Alternative

Chemical-Specific Noncarcinogenic Hazard Quotients							
Exposure Medium:	Air			Soil		Ornamental Vegetation	
Pathway:	Inhalation	Subchronic Inhalation	Acute Inhalation	Incidental Ingestion	Dermal Contact	Dermal Contact	Total Chronic HI
<i>Bacillus thuringiensis kurstaki</i>	----	----	7.6E-02	----	NA	NA	----
Spinosad	2.0E-05	----	1.2E-04	2.3E-06	6.6E-07	8.7E-02	9.E-02

---- = Appropriate toxicity value is not available.
NA = Not applicable

Table 8-44 Agricultural Worker Hazard Quotients – Organic Treatment Alternative

Chemical-Specific Noncarcinogenic Hazard Quotients							
Exposure Medium:	Air			Soil		Ornamental Vegetation	
Pathway:	Inhalation	Subchronic Inhalation	Acute Inhalation	Incidental Ingestion	Dermal Contact	Dermal Contact	Total Chronic HI
<i>Bacillus thuringiensis kurstaki</i>	----	----	7.6E-02	----	NA	NA	----
Spinosad	2.0E-05	----	1.2E-04	2.3E-06	6.6E-07	8.7E-02	9.E-02

---- = Appropriate toxicity value is not available.
NA = Not applicable

Table 8-45 Adult Resident Hazard Quotients – Organic Treatment Alternative

Chemical-Specific Noncarcinogenic Hazard Quotients									
Exposure Medium:	Air			Soil		Ornamental Vegetation	Commercial Produce	Homegrown Produce	Total Chronic HI
Pathway:	Inhalation	Subchronic Inhalation	Acute Inhalation	Incidental Ingestion	Dermal Contact	Dermal Contact	Ingestion	Ingestion	All Pathways
<i>Bacillus thuringiensis kurstaki</i>	----	----	5.1E-02	----	NA	NA	----	----	----
Spinosad	5.8E-05	----	8.3E-05	3.9E-06	3.4E-07	1.1E-01	2.5E-01	4.4E-02	4.E-01

---- = Appropriate toxicity value is not available.
NA = Not applicable

Table 8-46 Child Resident Hazard Quotients – Organic Treatment Alternative

Chemical-Specific Noncarcinogenic Hazard Quotients									
Exposure Medium:	Air			Soil		Ornamental Vegetation	Commercial Produce	Homegrown Produce	Total Chronic HI
Pathway:	Inhalation	Subchronic Inhalation	Acute Inhalation	Incidental Ingestion	Dermal Contact	Dermal Contact	Ingestion	Ingestion	All Pathways
<i>Bacillus thuringiensis kurstaki</i>	----	----	7.7E-02	----	NA	NA	----	----	----
Spinosad	8.6E-05	----	1.2E-04	2.0E-05	7.1E-07	1.3E-01	2.8E-01	4.9E-02	5.E-01

---- = Appropriate toxicity value is not available.
NA = Not applicable

Table 8-47 Residential Adult Gardener Hazard Quotients – Organic Treatment Alternative

Chemical-Specific Noncarcinogenic Hazard Quotients										
Exposure Medium:	Air			Soil		Ornamental Vegetation	Commercial Produce	Homegrown Produce		Total Chronic HI
Pathway:	Inhalation	Subchronic Inhalation	Acute Inhalation	Incidental Ingestion	Dermal Contact	Dermal Contact	Ingestion	Ingestion	Dermal Contact	All Pathways
<i>Bacillus thuringiensis kurstaki</i>	----	----	1.0E-01	----	NA	NA	----	----	NA	----
Spinosad	2.8E-06	----	1.7E-04	1.1E-06	1.7E-07	3.0E-02	2.5E-01	4.4E-02	1.4E-02	3.E-01

---- = Appropriate toxicity value is not available.
NA = Not applicable

Table 8-48 Adult Park User Hazard Quotients – Organic Treatment Alternative

Chemical-Specific Noncarcinogenic Hazard Quotients								
Exposure Medium:	Air			Soil		Commercial Produce	Ornamental Vegetation	Total Chronic HI
Pathway:	Inhalation	Subchronic Inhalation	Acute Inhalation	Incidental Ingestion	Dermal Contact	Ingestion	Dermal Contact	All Pathways
<i>Bacillus thuringiensis kurstaki</i>	----	----	1.0E-01	----	NA	----	NA	----
Spinosad	2.8E-06	----	1.7E-04	5.6E-07	9.8E-08	2.5E-01	3.0E-02	3.E-01

---- = Appropriate toxicity value is not available.
NA = Not applicable

Table 8-49 Child Park User Hazard Quotients – Organic Treatment Alternative

Chemical-Specific Noncarcinogenic Hazard Quotients								
Exposure Medium:	Air			Soil		Commercial Produce	Ornamental Vegetation	Total Chronic HI
Pathway:	Inhalation	Subchronic Inhalation	Acute Inhalation	Incidental Ingestion	Dermal Contact	Ingestion	Dermal Contact	All Pathways
<i>Bacillus thuringiensis kurstaki</i>	----	----	2.7E-01	----	NA	----	NA	----
Spinosad	7.3E-06	----	4.4E-04	2.9E-06	2.0E-07	2.8E-01	3.8E-02	3.E-01

---- = Appropriate toxicity value is not available.
NA = Not applicable

Sensitive Receptors Exposed to Substantial Pollutant Concentrations

The HHRA (Appendix D) evaluated potential health effects for the Sensitive Receptor populations of the Child Resident (Table 8-46) and Child Recreational Park User (Table 8-49) exposed to spinosad and Btk. These evaluations were subject to the availability of toxicity data, which were not sufficient to quantify effects from all exposure pathways. However, for those pathways where HQs and HIs could be developed, the HQs and HIs are less than 1. For those pathways where toxicity data were not available e.g., chronic inhalation or ingestion-based exposure to Btk, intakes were calculated and compared to available toxicity data. Those comparisons indicate that intakes are well below levels likely to be associated with adverse effects. On the basis of HIs less than 1, and comparisons to toxicity data when HIs could not be calculated, no adverse health effects are expected.

Impact HH-13: Sensitive receptors would not be exposed to substantial pollutant concentrations under Alternatives Btk and S. No impacts would occur. Therefore, mitigation is not required.

Create a Significant Hazard to the Public or the Environment through Transport, Use, or Disposal of Hazardous Materials

Potential effects of exposure to spinosad and Btk were addressed by evaluating impacts to the receptor populations Nursery/Project Workers (Table 8-43), Agricultural Workers (Table 8-44), Adult Residents (Table 8-45), Adult Gardeners (Table 8-47), and Adult Recreational Park Users (Table 8-48) (also see Appendix D). On the basis of HIs that are all below 1, neither spinosad nor Btk are expected to cause adverse health effects to members of the public. As noted for Impact HH-13, calculations of HIs were subject to the availability of toxicity data, which were not sufficient to quantify effects from all exposure pathways.

However, for those pathways where HQs and HIs could be developed, the HQs and HIs are less than 1. For those pathways where toxicity data were not available, e.g., chronic inhalation or ingestion-based exposure to Btk, intakes were calculated and compared to available toxicity data. Those comparisons indicate that intakes are well below levels likely to be associated with adverse effects. On the basis of HIs less than 1, and comparisons to toxicity data when HIs could not be calculated, no adverse health impacts are expected.

Impact HH-14: Alternatives Btk and S would not create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials. No impacts would occur. Therefore, mitigation is not required.

Impacts on People, Including Sensitive Receptors, through Ingestion and Other Exposure Pathways

The HHRA (Appendix D) evaluated impacts to sensitive receptors (Tables 8-46 and 8-49) from ingestion and dermal contact with spinosad, as well as by inhalation of both spinosad and Btk. As previously noted for Impacts HH-13 and HH-14, toxicity data were not available to support the quantization of exposures from all pathways such as ingestion-based exposures to Btk. Additionally, dermal exposures to Btk were not evaluated given that no evidence indicates that Btk can be absorbed across intact skin. However, on the basis of available pathway-specific HIs that are less than 1, and from comparisons of intakes to toxicity data as noted under Impacts HH-13 and HH-14 and discussed in Appendix D, no adverse health effects are expected.

Impact HH-15: Alternatives Btk and S would not have impacts on people, including sensitive receptors, through ingestion and other exposure pathways. Therefore, mitigation is not required.

Short-Term, Subchronic, Long-Term, and/or Additive Human Health Impacts

Based on the analysis provided in Appendix D and the HIs summarized in Tables 8-43 through 8-49, all HIs are less than 1. Consequently, no adverse health effects from exposure to Btk or spinosad are anticipated from potential short-term (acute) exposures evaluated under Alternatives Btk and S.

Potential impacts from subchronic inhalation exposure to Btk or spinosad were not evaluated due to a lack of appropriate toxicity data. See discussions under Impacts HH-13 and HH-14 regarding comparisons of intakes to available toxicity data. As previously noted, those comparisons indicate that no adverse health effects of subchronic exposures are expected.

Potential long-term (chronic) health effects were evaluated for all receptor populations for spinosad exposure. Based on HIs less than 1, no adverse health effects are expected. Potential impacts from chronic exposure to Btk were not quantitatively evaluated due to a lack of suitable toxicity data (as previously noted under Impacts HH-13 and HH-14 and discussed in Appendix D). However, the extensive safe usage record for Btk – covering approximately 50 years – combined with an evaluation of available chronic toxicity data indicates that no adverse health effects are expected from chronic exposures to Btk.

Additive noncancer HIs from Btk and spinosad exposure were not estimated, as no reason exists to expect that the two materials would be used in combination.

Impact HH-16: Alternatives Btk and S would not have short-term, subchronic, long-term, or additive human health impacts. Therefore, no mitigation is required.

Increase in Cancer Risk Due to Application of Pesticides

Neither spinosad nor Btk are classified as carcinogens, so no basis exists for the evaluation of cancer risks associated with exposure to either of these materials (see supporting literature review in Appendix D). Therefore, no impacts are expected.

Impact HH-17: Application of pesticides under Alternatives Btk and S would not cause an increase in cancer risk. No impacts would occur. Therefore, mitigation is not required.

Adverse Health Effects from Pesticides Analyzed Individually and in Combination

The biopesticides evaluated in Alternatives Btk and S are expected to be used individually and not in combination with each other or any other pesticide (Appendix D). As a consequence, no basis exists to evaluate health effects of these substances used in combination. The evaluation of potential health effects from the use of Btk or spinosad used individually (Tables 8-43 through 8-49; also see discussion under Impacts HH-13 and HH-14) indicates that neither substance is expected to be associated with adverse health effects. No adverse health effects are expected.

Impact HH-18: Pesticides evaluated in Alternatives Btk and S would not have adverse health effects when analyzed individually and in combination. No impacts would occur. Therefore, mitigation is not required.

8.2.7 Inundative Parasite Wasp Releases (Alternative Bio-P)

Impacts associated with Alternative Bio-P are addressed in Chapter 9 (Aquatic Resources) and Chapter 10 (Terrestrial Resources). No chemical treatments would occur.

8.2.8 Sterile Insect Technique (Alternative SIT)

Impacts associated with Alternative SIT are addressed in Chapter 9, Aquatic Resources, and Chapter 10, Terrestrial Resources. No chemical treatments would occur.

8.2.9 Cumulative Impacts

CEQA Guidelines define “cumulative impacts” as “two or more individual effects which, when considered together, are considerable or compound or increase other environmental impacts” (CEQA Guidelines, Section 15355).

Cumulative impacts, as they pertain to human health, include past, present, and reasonably foreseeable actions that potentially impact individuals who reside in the state of California. Cumulative impacts can result from individually minor, but collectively significant, projects taking place over a period of time. The determination that is made in this discussion is whether the Proposed Program’s incremental contribution to a cumulative impact results in a potentially “considerable” (i.e., significant) cumulative impact, and, if so, whether the Program’s incremental contribution can be mitigated to a less-than-significant level.

Under CEQA Guidelines, Section 15064(h)(4), a project does not have cumulative impacts unless it contributes some amount to the cumulative conditions. In other words, the mere existence of significant cumulative impacts caused by other projects alone – without a contribution from the project at issue – does not equate to a finding that the *project’s* incremental effects are cumulatively considerable. In this case, when the LBAM Program, or an alternative considered for the Program, makes no incremental contribution at all to a significant cumulative impact caused by other plans, programs, and projects (i.e., the “no impact”

determination for a Program alternative), then it cannot be called cumulatively considerable. Even if existing cumulative impacts are significant, it does not follow that any level of incremental contribution to that impact by the proposed project results in the project having cumulatively considerable impacts. A summary of the level of significance of the Program's predicted effects from chemical treatments on human receptor populations is presented in Table 8-50. The following sections contain a discussion of whether these impacts could become cumulatively considerable. To make this determination, consideration is given to the combined contribution of Program impacts considered together with impacts that exist outside of the Program. If those impacts, taken all together, result in a significant impact, then the Program's incremental contribution to the combined significant cumulative impact is "cumulatively considerable."

Two methods exist for analyzing the cumulative impacts of past, present, and reasonably foreseeable future projects: the "list method" and the "summary of projections method" (CEQA Guidelines Section 15130). Both of these methods are most appropriate to the evaluation of land development or projects involving changes in land use and related activities.

- The list method requires a discussion of related past, present, and future projects; and in the case of human health, it would require discovering and disclosing impacts to public health from all of these projects. This approach is not practical given the LBAM Program's nearly statewide extent, which makes the development of a list of projects most difficult and would then require a human health impact assessment for a very long list and variety of projects potentially creating a physical change in the environment.
- The summary of projections method relies on projections contained in approved land use documents such as general plans, specific plans, and local coastal plans to serve as the foundation for the cumulative analysis. The issue is whether the project under evaluation is consistent with the forecasts of economic and population growth contained in the planning documents and, therefore, already addressed in the certified EIRs on these plans and projects. Can the agency rely on the cumulative analyses addressed in a prior EIR to say that no further analysis is needed?

The LBAM Program would not result in additional housing or commercial/industrial development in an area. However, it does result in the use of pesticides, and for some materials, an increase in pesticide use over existing conditions. Local plans do not forecast future pesticide use and neither does the CDFA or DPR. However, the cumulative analysis for human health concerns can address the question of increases in pesticide use as a result of the Program alternatives as a variation of the summary of projections method to address statewide cumulative impacts of pesticide use and whether the incremental contributions of the Program's chemical treatment methods contribute to cumulative health-related impacts. The estimates of pesticide use provided in the analysis below are not based on population or housing units or employees in the state but rather on past trends in pesticide use from available data on pesticide sales as reported to the DPR. The analysis seeks to provide the statewide context needed for a reasonable discussion of cumulative impacts. Just as local and regional plans project growth based on past trends, the analysis below relies on past trends to address changes in pesticide use and potential cumulative human health impacts.

The following discussion of cumulative impacts addresses human health concerns where no impacts, less-than-significant impacts after mitigation, or potentially significant impacts occur. Human health concerns addressed in this analysis focus solely on effects of pesticide use, in that potential health effects of the Program's use of pesticides provided the framework for the HHRA (Appendix D) and, therefore, also serve as the basis for understanding any potential cumulative health-related impacts. Only the potentially significant and less-than-significant impacts of the Program alternatives have the potential to add an incremental effect to a cumulatively significant impact.

8.2.9.1 No Impacts

Two of the four categories of Program alternatives, Alternative MD (MD-1, MD-2, and MD-3) and the Organically Approved Insecticides (Alternatives Btk and S), would not adversely affect the health of any of the human receptor populations evaluated in the HHRA (Tables 8-15 through 8-35 [Alternative MD] and Tables 8-43 through 8-49 [Organically Approved Insecticides]). This determination was based on either (1) HQs or HIs that were below the health-effects threshold of 1, or (2) if HQs or HIs could not be calculated because of a lack of appropriate toxicity criteria (e.g., RfDs), toxicity data were considered in conjunction with exposure estimates (intakes) to support the conclusion that exposures will be below levels likely to be of concern to human health. Because no human health impacts were identified in association with the chemical and biological pesticides evaluated under Alternatives MD, Btk, and S, the Program makes no incremental contribution to any pre-existing cumulative impacts. The Program's additional use of 3,300 pounds per year of Btk and 128 pounds per year of spinosad is not cumulatively considerable.

8.2.9.2 Impacts Less Than Significant After Mitigation

This analysis considers whether potential exists for any incremental contribution of projected Program chemical use that, when combined with other reasonably foreseeable uses of specific pesticide(s), would result in cumulative impacts that could be considered "cumulatively considerable" to human health.

Program alternative impacts were identified as "less than significant after mitigation" if the impact was first identified as "potentially significant but mitigable" on the basis of a noncancer HQ or HI that exceeded the threshold of 1, or a cancer risk that exceeded 1×10^{-6} , and the finding of significance was coupled to one or more implementable mitigation measures. The resulting impact was deemed less than significant after mitigation.

Male Moth Attractant (Alternative MMA)

Although it is primarily a pheromone treatment (SPLAT), Alternative MMA incorporates a low dosage of the pesticide permethrin, and the inert ingredients ethylbenzene and 1,2,4-trimethylbenzene. Moths would be attracted to the pheromone (used as a bait), and be killed subsequent to contact exposure with permethrin.

Prior to applying mitigation measures, the analyses of human health effects under this alternative yielded estimates of cancer risk above 1×10^{-6} for all receptor populations except the Agricultural Workers. These risk estimates are significant but mitigable, based on a significance threshold of 1×10^{-6} . Estimates of noncancer health effects did not exceed HQs of 1 for any exposure pathway (all receptors), and did not exceed chronic HIs of 1 when considering all exposure pathways (all receptors). Alternative MMA was found to have less-than-significant impacts after mitigation (see Section 8.2.1.1).

The use of permethrin associated with Alternative MMA is limited, and after implementing mitigation measures, permethrin is expected to be only minimally available for direct contact by human receptors. At issue here, however, is whether the additional use of permethrin under Alternative MMA would incrementally contribute to a cumulatively significant impact within the state, resulting in an increase in risk over the "less than significant after mitigation" Program use alone. To examine this possibility, the use of permethrin within the state was determined. That usage, based on pesticide sales from 2002 to 2007, was fairly constant between 2002 and 2005, ranging from roughly 428,000 to 484,000 pounds purchased per year. Consumption based on sales increased precipitously to approximately 605,000 pounds, but dropped similarly precipitously to roughly 355,000 pounds in 2007, the last year of records reviewed (Table 8-51). The average use of permethrin over the time period reviewed, 470,967 pounds, lies within the range seen between 2002 and 2005. The reduced demand in 2007 may simply reflect oversupply from purchases made in 2006.

Table 8-50 Comparison of Impacts of Alternative Chemical Treatments on Human Health

Affected Resource and Area of Potential Impact	No Program Alternative					Alternatives MD-1, MD-2, and MD-3			Alternative MMA		Alternatives Btk and S	
	Lambda-Cyhalothrin	Chlorpyrifos	Permethrin	Spinosad	Btk	SPLAT / Pheromone	Hercon / Pheromone	Isomate	SPLAT / Pheromone	Permethrin E-Pro	Spinosad	Btk
Significance Criteria												
Sensitive receptors may be exposed to substantial pollutant concentrations.	PS	PS	PS	N	N	N	N	N	N	SM	N	N
Alternative may create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials.	PS	PS	PS, N	N	N	N	N	N	N	SM	N	N
Alternative may have impacts on people, including sensitive receptors, through ingestion and other exposure pathways.	PS	PS	PS	N	N	N	N	N	N	SM	N	N
Alternative may have short-term, subchronic, and additive long-term health impacts.	PS	PS	PS, N	N	N	N	N	N	N	SM	N	N
Application of pesticides under the alternative may cause an increase in cancer risk.	N	N	PS	N	N	N	N	N	N	SM	N	N
Pesticides evaluated in the alternative may have adverse health effects when analyzed individually and in combination.	PS	PS	PS	N	N	N	N	N	N	SM	N	N
Key: LS = Less-than-significant impact N = No impact na = Not applicable PS = Potentially significant impact (Applies to No Program only. Program alternatives have either feasible mitigations or unavoidable impacts.) SM = Potentially significant but mitigable impact SU = Potentially significant and unavoidable impact												

The use of permethrin with Alternative MMA represents a selective use of permethrin that is not anticipated to be replicated by other programs. Therefore, the potential for cumulative impacts from its use with Alternative MMA is more related to the use of permethrin by users in the private sector. Alternative MMA offers only limited potential for an incremental increase in permethrin use that could be cumulatively considerable as a result of elevating permethrin use above the environmental baseline contained in Table 8-51. Based on projected applications under Alternative MMA, where 12 crews would be working 240 days per year, using application rates as identified in Table 2.5 of Appendix C, the CDFA estimates the incremental annual usage of permethrin to be 2,970 pounds. This increase in use is well within the variation of sales under the environmental baseline (as a projection of use) identified in Table 8-51. No increase in the use of permethrin by other programs is reasonably foreseeable, and the impacts are not cumulatively significant.

Table 8-51 Pesticide Sales of No Program and Organically Approved Pesticides in California, 2002–2007

Year	Btk ^{1,2}		Chlorpyrifos		Lambda-Cyhalothrin		Permethrin		Spinosad	
	Pounds Sold ³	Number of Registrants	Pounds Sold ¹	Number of Registrants	Pounds Sold ¹	Number of Registrants	Pounds Sold ¹	Number of Registrants	Pounds Sold ¹	Number of Registrants
2002	19,722	1	1,697,022	53	24,061	7	427,960	165	88,586	5
2003	3,075,300	20	1,951,080	36	27,892	7	478,825	171	82,520	5
2004	2,729,593	15	2,324,085	30	25,689	7	474,761	163	84,336	4
2005	225,871	12	2,374,322	26	37,757	11	484,146	160	97,929	6
2006	257,554	10	2,516,048	27	54,754	13	605,304	167	101,999	6
2007	275,485	11	1,806,445	28	85,771	17	354,808	171	94,207	8

Source: DPR 2002–2007
1. Btk - includes all Bt kurstaki strains and types.
2. Registrants for Btk may contain duplicate companies.
3. Data obtained from DPR website (<http://www.cdpr.ca.gov/docs/mill/nopdsold.htm>).

8.2.9.3 Potentially Significant Impacts

This section addresses the potential for cumulatively considerable impacts under the No Program Alternative. Impacts from the No Program Alternative were generally identified as “potentially significant” if HQs or HIs exceeded 1 or if cancer risks exceeded 1×10^{-6} . Findings of potentially significant impacts were reached for all receptor populations evaluated. All receptor populations (with the exception of Agricultural Workers) had potentially significant impacts attributable to both cancer risk (permethrin) and noncancer effects (chlorpyrifos and lambda-cyhalothrin). These impacts are unavoidable.

No Program Alternative

Both commercial and residential utilization of No Program chemicals was identified as a potential strategy for LBAM control, should none of the Program alternatives be implemented. Under the impacts analysis described in Section 8.2., the use of individual chemicals in this alternative was determined to represent potentially significant impacts (Table 8-50). Under the No Program Alternative, LBAM eradication would be extremely unlikely. Accordingly, pesticide use has the potential to increase as crop damage increases with the expected growth in LBAM populations over time, in the absence of other use restrictions that might be placed on currently approved chemicals. Only three of the several conventional pesticides approved for use in nurseries and host crops were evaluated in this PEIR to be representative of other pesticides approved for use against LBAM. The use of other pesticides that would also be effective for LBAM control (e.g., carbaryl, dimethoate, methoxyfenozide, phosmet, etc.) could increase as well. Under the No Program Alternative, the two organically approved pesticides (Btk and spinosad), which are also considered under the Program’s Organically Approved Insecticides (Alternatives Btk and S), would likely increase.

The selection of which approved pesticide might be used is up to the consumer, and predicting chemical-specific usage at a statewide scale is not possible. Furthermore, a cumulative effects analysis of the No Program Alternative is not required under law because the CEQA lead agency (CDFG) will not have control over nonagency-administered control programs. However, some prediction of effects of the No Program Alternative is provided for consideration.

Using permethrin as a surrogate for all insecticides that could be used, Dowell (2008a) estimated that homeowner use in 9 of the currently infested northern California counties could increase between 281 and 2,353 pounds. When considering the full 16-county area where trapping or eradication efforts have been initiated, an increase between 20,364 and 74,305 pounds of permethrin was considered possible. These estimates were based on (1) an estimate of single-family dwellings in the overall treatment area from Census Bureau statistics, (2) an estimate of the number of these houses that might apply insecticide (3 to 7 percent), and (3) an assumption that those houses that treat would only do so once a year. These input variables were applied to yield the estimates of increased use (i.e., increase use [pounds] = no. residences x 1 gallon spray/residence/year x 0.0106 or 0.024 pound permethrin per spray event). Similarly, Dowell (2008b) estimates an annual increase in use from 600 to 4,800 pounds of Bt (1.4 to 10.5 percent), and 1,900 to 3,800 pounds of spinosad, in the *absence* of the implementation of Program alternatives.

In addition to the projected increase in use, as discussed above, all of the nonorganic, conventional No Program pesticides evaluated in this PEIR have been identified in environmental monitoring programs in the state of California. Organophosphate use, such as chlorpyrifos has been decreasing. However, seven water bodies of California have been placed on the Section 303d list due to chlorpyrifos as part of the final 1998 Section 303(d) (Clean Water Act) list of impaired water bodies in California. As a result of the Section 303(d) listings and other legal actions, four Total Maximum Daily Loads for chlorpyrifos have been initiated in California.

Overall, the trend is towards reduced pesticide use in California. One way to characterize pesticide utilization trends in California is through DPR annual sales reports. DPR tracks the pesticides sold throughout the state on an annual basis. In 2006, 190 million pounds of pesticide and herbicide were used, including organically approved pesticides. This usage represented a reduction of nearly 6 million pounds over what was used in 2005. Most of this reduction was attributed to a 24 percent decrease in the use of sulphur, an organically approved fungicide. In 2006, statewide insecticide use decreased by 10 percent in pounds of active ingredient and by 3 percent measured as acres treated, compared to 2005. This decrease was accompanied by a 5 percent increase of acres harvested. The decrease in acres treated with insecticides was mainly associated with the decreased uses of chlorpyrifos (-19 percent), methomyl (-42 percent), and carbofuran (-35 percent) (DPR 2005, 2006b, 2007a). In 2007, 1,806,444 pounds of chlorpyrifos, 85,771 pounds of lambda-cyhalothrin, and 354,808 pounds of permethrin were sold (DPR 2007a). By comparison, in 2006, 2,516,048 pounds of chlorpyrifos, 54,754 pounds of lambda-cyhalothrin, and 605,304 pounds of permethrin were sold (DPR 2006b). While amounts sold do not translate directly to the amounts used, these data suggest reductions in use of chlorpyrifos may be occurring statewide. While organophosphate sales appear to be declining most recently (Table 8-51), the use of pyrethroid-based insecticides appears to be holding relatively steady when considering a longer period of record. For some members of this class of compounds (lambda-cyhalothrin), use is increasing.

Environmental monitoring provides additional information about the potential for cumulative impacts from pesticide use. While environmental monitoring data cannot be translated into direct estimates of human exposure, they provide further information on pesticide usage patterns and insights into the relative persistence of certain chemicals. Where detections of specific pesticides are common, the potential for cumulatively considerable impacts from incremental uses may be considered more likely if the chemical in question is toxic and if potential exists for exposure. In a relatively recent study, Bacey et al. (2004) sampled for permethrin and related pyrethroids (e.g., lambda-cyhalothrin) and organophosphates in water and sediment samples from the Sacramento and San Joaquin watersheds collected after storm events. Permethrin and/or

esfenvalerate were detected in 7 of 40 whole water samples, with concentrations measured up to 0.094 ppb. Review of these data showed that permethrin was only detected in one sample, and the majority of pyrethroid detections were for esfenvalerate. Lambda-cyhalothrin was apparently not analyzed in water samples, but was analyzed in sediment and was not detected. In contrast, trace amounts of chlorpyrifos were identified most consistently among the three No Program pesticides evaluated. The continued use of these pesticides is foreseeable throughout the state and could increase in the absence of the implementation of Program alternatives, and monitoring data suggest their persistence and/or mobility in the environment. As conclusions on cumulative impacts typically are not evaluated under CEQA for a No Program Alternative, none is offered here. Consequently, no conclusion regarding the cumulative impacts of the No Project Alternative has been reached, but the qualitative information given above is nonetheless provided for consideration.

8.2.10 Environmental Impacts Summary

This section summarizes the relative impacts of the No Program and Program alternatives based on the proposed pesticides and mode(s) of pesticide application specific to each alternative. The following bullets summarize potential Program impacts relevant to the CEQA criteria initially identified in Section 8.2.1.

- The No Program Alternative poses a potentially significant risk of cancer to sensitive receptors, evaluated as a hypothetical Child Resident and Child Recreational Park User. Alternative MMA has potentially significant but mitigable impacts to sensitive receptors based on a cancer risk in excess of 1×10^{-6} .
- The No Program Alternative is associated with potentially significant impacts to the public from the routine transport, use, or disposal of hazardous materials. Alternative MMA has potentially significant but mitigable impacts to the public from the routine transport, use, or disposal of hazardous materials.
- The No Program Alternative has potentially significant impacts on people, including sensitive receptors, through ingestion and other exposure pathways. Alternative MMA has potentially significant but mitigable impacts on people, including sensitive receptors, through ingestion and other exposure pathways.
- The No Program Alternative has potentially significant long-term impacts on human health. Alternative MMA has potentially significant but mitigable impacts on long-term impacts on human health.
- Alternative MMA has potentially significant but mitigable impacts on increased cancer risk.
- Pesticides evaluated in the No Program Alternative have potentially significant adverse health effects when analyzed individually and/or in combination. Alternative MMA pesticides have potentially significant but mitigable impacts on health when analyzed individually and/or in combination.

Table 8-52 provides a summary comparison of impacts of the No Program Alternative and Alternatives MD-1, MD-2, MD-3, MMA, Btk, and S, and it includes all of the impact statements.

**LIGHT BROWN APPLE MOTH ERADICATION PROGRAM
DRAFT PEIR**

Table 8-52 Summary Comparison of Impacts of Alternatives

Impact Statement	No Program	MD-1	MD-2	MD-3	MMA	Btk and S	Bio-P	SIT
Sensitive Receptors Exposed to Substantial Pollutant Concentrations	PS	N	N	N	SM	N	na	Na
Impact HH-1: Sensitive receptors would not be exposed to substantial pollutant concentrations under Alternatives MD-1, MD-2, and MD-3.	na	N	N	N	na	na	na	na
Impact HH-7: Sensitive receptors could be exposed to substantial pollutant concentrations under Alternative MMA.	na	na	na	na	SM	na	na	na
Impact HH-13: Sensitive receptors would not be exposed to substantial pollutant concentrations under Alternatives Btk and S.	na	na	na	na	na	N	na	na
Create a Significant Hazard to the Public or the Environment through Transport, Use, or Disposal of Hazardous Material	PS	N	N	N	SM	N	na	na
Impact HH-2: Alternatives MD-1, MD-2, and MD-3 would not create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials.	na	N	N	N	na	na	na	na
Impact HH-8: Alternative MMA could create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials.	na	na	na	na	SM	na	na	na
Impact HH-14: Alternatives Btk and S would not create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials.	na	na	na	na	na	N	na	na
Impacts on People, Including Sensitive Receptors, through Ingestion and Other Exposure Pathways	PS	N	N	N	SM	N	na	na
Impact HH-3: Alternatives MD-1, MD-2, and MD-3 would not have impacts on people, including sensitive receptors, through ingestion and other exposure pathways.	na	N	N	N	na	na	na	na
Impact HH-9: Alternative MMA could have impacts on people, including sensitive receptors, through ingestion and other exposure pathways.	na	na	na	na	SM	na	na	na
Impact HH-15: Alternatives Btk and S would not have impacts on people, including sensitive receptors, through ingestion and other exposure pathways.	na	na	na	na	na	N	na	na
Short-Term, Subchronic, Long-Term, and/or Additive Human Health Impacts	PS	N	N	N	SM	N	na	na
Impact HH-4: Alternatives MD-1, MD-2, and MD-3 would not have short-term, subchronic, and/or long-term human health impacts.	na	N	N	N	na	na	na	na
Impact HH-10.1: Alternative MMA would not have short-term exposure impacts on human health.	na	na	na	na	N	na	na	na
Impact HH-10.2: Subchronic health effects estimated for Nursery/Project Workers, Agricultural Workers, Adult and Child Residents, and Child Recreational Park Users indicate that these receptors all have noncancer HIs that are less than 1. Alternative MMA would not have subchronic impacts on human health.	na	na	na	na	N	na	na	na

Table 8-52 Summary Comparison of Impacts of Alternatives

Impact Statement	No Program	MD-1	MD-2	MD-3	MMA	Btk and S	Bio-P	SIT
Impact HH-10.3: Cancer risks for Nursery/Project Workers and Adult and Child Residents exceed 1×10^{-6} . Alternative MMA could have long-term, human health impacts.	na	na	na	na	SM	na	na	na
Impact HH-10.4: Alternative MMA would not have additive on human health impacts.	na	na	na	na	N	na	na	na
Impact HH-16: Alternatives Btk and S would not have short-term, subchronic, long-term, or additive human health impacts.	na	na	na	na	na	na	na	na
Increase in Cancer Risk Due to Application of Pesticides	PS	N	N	N	SM	N	na	na
Impact HH-5: Application of pesticides under Alternative MD-1, MD-2, and MD-3 would not cause an increase in cancer risk.	na	N	N	N	na	na	na	na
Impact HH-11: Application of pesticides under Alternative MMA could cause an increase in cancer risk.	na	na	na	na	SM	na	na	na
Impact HH-17: Application of pesticides under Alternatives Btk and S would not cause an increase in cancer risk.	na	na	na	na	na	N	na	na
Adverse Health Effects from Pesticides Analyzed Individually and in Combination	PS	N	N	N	SM	N	na	na
Impact HH-6: Pesticides evaluated in Alternatives MD-1, MD-2, and MD-3 do not have adverse health effects when analyzed individually. No impacts would occur. Therefore, mitigation is not required.	na	N	N	N	na	na	na	na
Impact HH-12.1: Pesticides evaluated in Alternative MMA would not have short-term adverse health effects when analyzed individually and in combination.	na	na	na	na	N	na	na	na
Impact HH-12.2: Pesticides evaluated in Alternative MMA would not have subchronic adverse health effects when analyzed individually and in combination.	na	na	na	na	N	na	na	na
Impact HH-12.3: Pesticides evaluated in Alternative MMA could have adverse chronic health effects from cancer when analyzed individually and in combination.	na	na	na	na	SM	na	na	na
Impact HH-18: Pesticides evaluated in Alternatives Btk and S would not have adverse health effects when analyzed individually and in combination.	na	na	na	na	na	N	na	na
<p>Key:</p> <p>LS = Less-than-significant impact</p> <p>N = No impact</p> <p>na = Not applicable</p> <p>PS = Potentially significant impact (Applies to No Program only. Program alternatives have either feasible mitigations or unavoidable impacts.)</p> <p>SM = Potentially significant but mitigable impact</p> <p>SU = Potentially significant and unavoidable impact</p>								

8.2.11 Mitigation and Monitoring

Mitigation measures are not applicable to Alternatives MD-1, MD-2, MD-3, Btk, or S as no impacts are associated with their implementation.

Mitigation measures for Impacts HH-7 and HH-8 are included in this section. In summary, all mitigation measures would reduce potential health impacts to sensitive receptors and the public that may result from application of pesticides under Alternative MMA, as delineated by Impacts HH-7, HH-8, and HH-10.3. These mitigation measures are applicable to all treatment areas.

Impact HH-7: Sensitive receptors could be exposed to substantial pollutant concentrations under Alternative MMA. Impacts would be potentially significant but mitigable.

Mitigation Measure HH-7a: Apply the MMA material containing Permethrin E-Pro to poles, trees, or similar structures at heights that are above the breathing zone of an average person. Placement of the formulation at this height should preclude most opportunities for direct contact, while enhancing volatilization of the material. The planned height is 8 feet aboveground and this height has been tested for sufficiency by the DPR (Kim 2009).

Location: All treatment areas prepared for Alternative MMA.

Monitoring/Reporting Action: CDFA will report to the DPR and OEHHA if any complaints are received from workers or the public. Additional air sampling should be conducted to resolve complaints.

Effectiveness Criteria: As noted in Section 6.2.5.5, permethrin has a faint, mild petroleum odor. If the application height is not effective under any site-specific conditions, then the odor would be perceptible.

Responsible Agency: CDFA

Timing: Following treatment

Mitigation Measure HH-7b: CDFA will avoid parks and schools when treating for LBAM.

Location: All treatment areas

Monitoring/Reporting Action: CDFA will monitor treatment crews for compliance with no treatment zones which include schools and parks.

Effectiveness Criteria: CDFA will GPS-monitor treatment crews for compliance with policy to avoid no treatment zones which include schools and parks.

Responsible Agency: CDFA

Timing: Before and during treatment

Impact HH-8: Alternative MMA could create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials. Impacts are potentially significant but mitigable.

Mitigation Measure HH-8a: Ensure that Alternative MMA pesticides are applied in strict accordance with label requirements.

This mitigation measure will ensure that excess quantities of pesticide are not used and, thus, will minimize the magnitude of potential exposure of sensitive receptors, workers, and the public.

Location: All treatment areas

Monitoring/Reporting Action: Develop and implement required annual pesticide training for workers.

Effectiveness Criteria: Maintain pesticide certification for all CDFA treatment programs as required by law.

Responsible Agency: CDFA

Timing: During treatment

Mitigation Measure HH-8b: Ensure that appropriate worker training is conducted prior to use of pesticides.

This mitigation measure will ensure that workers understand the hazardous nature of the pesticides being applied and, thus, do not carelessly spill or otherwise release unnecessary amounts into the environment. These precautions should ensure that potential adverse health effects to workers, sensitive receptors, and the public are minimized.

Location: All treatment areas

Monitoring/Reporting Action: Develop and implement required annual pesticide training for workers.

Effectiveness Criteria: Maintain pesticide certification for all CDFA treatment programs as required by law.

Responsible Agency: CDFA

Timing: Before and during treatment

Mitigation Measure HH-8c: Ensure that appropriate personal protective equipment is used. See also Mitigation Measure HH-7a.

This mitigation measure will minimize and potentially prevent exposure of workers via inhalation and/or dermal contact with contaminated soil or vegetation.

Location: All treatment areas

Monitoring/Reporting Action: Develop and implement worker and supervisor training to increase awareness of the label requirements, regulations, and permits for personal protective equipment.

Effectiveness Criteria: CDFA will monitor treatment crews for compliance with personal protective equipment requirements.

Responsible Agency: CDFA

Timing: Before and during treatment

Impact HH-9: Alternative MMA could have impacts on people, including sensitive receptors, through ingestion and other exposure pathways. Impacts are potentially significant but mitigable.

Mitigation HH-9: See Mitigation Measures HH-7a, 7b, HH-8a, HH-8b, and HH-8c.

Impact HH-10.3: Cancer risks for Nursery/Project Workers and Adult and Child Residents exceed 1×10^{-6} . Alternative MMA could have long-term, human health impacts. Impacts are potentially significant but mitigable.

Mitigation HH-10.3: See Mitigation Measures HH-7a, HH-7b, HH-8a, HH-8b, and HH-8c.

Impact HH-11: Application of pesticides under Alternative MMA could cause an increase in cancer risk. Impacts are potentially significant but mitigable.

Mitigation HH-11: See Mitigation Measures HH-7a, HH-7b, HH-8a, HH-8b, and HH-8c.

Impact HH-12.3: Pesticides evaluated in Alternative MMA could have adverse chronic health effects from cancer when analyzed individually and in combination. Impacts are potentially significant but mitigable.

Mitigation HH-12.3: See Mitigation Measures HH-7a, HH-7b, HH-8a, HH-8b, and HH-8c.