Finding of No Significant Impact
Treatment of Light Brown Apple Moth in the Seaside Area in California
Environmental Assessment, July, 2007

The U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), has prepared an environmental assessment (EA) that analyzes potential environmental consequences of treating light brown apple moth (*Epiphyas postvittana*) (LBAM) in the Seaside area of California. LBAM is a destructive pest that attacks a wide variety of plants including over 250 agronomically important crops and many other non-crop plant species. Should it become established, it has the potential to cause many millions of dollars in damage annually. The EA, incorporated by reference in this document, is available on the APHIS website at www.aphis.usda.gov/plant_health/plant_pest_info/lba_moth/index.shtml and from:

U.S. Department of Agriculture
Animal and Plant Health Inspection Service
Plant Protection and Quarantine
Emergency and Domestic Programs
Emergency Management
4700 River Road, Unit 134
Riverdale, MD 20737–1236

The EA analyzed two alternatives: (1) No Action (maintaining the Federal quarantine order without further action by APHIS), and (2) Treatment (continuation of the Federal quarantine order along with treatments of the area with insect pheromone). Female insects produce pheromones to attract males. The males sense the presence of a female by detecting the pheromone. Insect pheromones can be used to disrupt mating by reducing the likelihood for a male to find a female because of the additional sources and levels of pheromone in areas where moths are present. Pheromones are insect specific, only attracting males of the same, or a closely related species. There are two different pheromones that can be used to target LBAM: the LBAM specific pheromone and the omnivorous leaf-roller pheromone. The LBAM specific pheromone attracts only LBAM males and generally will have no effect on other organisms, although a few individuals of closely related moth species may be confused by it incidentally. This is the preferable pheromone, but it is in short supply and is unlikely to be available for use at the beginning of the proposed program. The omnivorous leaf-roller pheromone is currently available and attracts LBAM males, but will also attract other members of the Tortricid family (leaf-rolling Lepidopterans). This is the pheromone likely to be used during the first pheromone application of the program.

The area to be treated would include all, or portions of the area in and around Seaside, Marina, Del Rey Oaks and much of the Monterey Peninsula, including all or part of Monterey, Pacific Grove, Pebble Beach, Carmel, and Del Monte Forest (see attached map of treatment area, Attachment 1) (Seaside area). Due to the size of the area to be treated, it is anticipated that aerial application of the microencapsulated pheromone will be the method used. Adequate buffers will be put in place prior to any aerial spraying to insure that spray material is not deposited in water bodies (lakes and rivers) and the ocean. Pheromone can also be applied by hand in a dispenser suspended from the ground, or in a microencapsulated formula by ground equipment. The dispensers are used at a rate of 250 dispensers per acre and are effective for 90 days before they need to be replaced. The microencapsulated pheromone is effective for 30 days and may require additional applications. The eradication program is expected to extend to subsequent years if LBAM is found in the area after the initial round of treatments.

The EA evaluated the potential impacts from treating the subject area (see attached map of the treatment area, Attachment 1) with pheromone. Due to the rapid breakdown and volatilization of pheromone in both terrestrial and aquatic environments, the insolubility of the pheromone in water, and the low toxicity of the pheromones to aquatic and terrestrial organisms, as well as humans, the likelihood of adverse impacts to human health and the environmental is very small.

A notice of availability of the EA was placed in local newspapers on July 29 which initiated a 31 day public comment period. The EA was also posted on the APHIS webpage. The public comment period expired on August 29, 2007. No comments were received as a result of these actions. However, the California Department of Food and Agriculture (CDFA) held two public meetings to explain the proposed program and received considerable public interest. In addition, the Monterey City Council held a public meeting on the subject on August 29. This meeting was well attended. After 5 hours, it was adjourned and reconvened the next day. CDFA compiled a list of questions emanating from these meetings and has posted their responses to the questions on their website. A copy of the posting is attached (see Attachment 2).

The purpose of preparing an EA is for an agency to determine whether a significant environmental impact is likely to occur as a result of the proposed action, and therefore require the preparation of an Environmental Impact Statement (EIS) concerning the proposed action. The EA need not provide a compendium of information but must provide enough information to make this determination. The EA, incorporated by reference herein, has provided adequate information and analysis to clearly demonstrate that there is only a very remote potential for a low dose application of pheromone to cause a significant impact to the environment based on the available toxicity and environmental fate information.

APHIS is responsible for taking actions to exclude, eradicate, and/or control plant pests under the Plant Protection Act (7 United States Code (U.S.C.) 7701 et seq.). Therefore, it is important that APHIS take the steps necessary to eradicate LBAM from areas in California to prevent its spread to susceptible host plants throughout the United States. The Technical Working Group (TWG), an international team of scientific experts on LBAM and pest eradication methods, was assembled in May 2007 to develop an eradication strategy. Their recommendations have been received and APHIS, in cooperation with CDFA, is developing an eradication program for LBAM. When the plan is finalized, an environmental assessment (EA) will be completed for the plan.

In the interim, treatment of small isolated populations of LBAM (less than 10 moths per trap) is believed to be a desirable strategy to limit the spread of the moth until an eradication program can be implemented. APHIS prepared an EA that evaluated the potential impacts from eradication of small, isolated populations of LBAM. This eradication of those populations is designed to begin before LBAM could increase their populations in that area and spread to other areas, which would make eradication more problematic.

APHIS and CDFA believe that, in accordance with the TWG advice, an important aspect for containing LBAM populations, and eliminating range expansion, is to limit the southern Seaside area population center. The results of LBAM trapping thus far indicate that the LBAM population in the Seaside area is relatively sparse and that it is separated from the main population center further to the north in Soquel, California. Therefore, it should be possible to

employ a mating disruption strategy to limit southward expansion of LBAM and to begin eradication in the Seaside area. Because several generations of LBAM can occur annually, it is important to begin this action before the populations expand and mating disruption would not suffice to control LBAM growth. Therefore, this EA considered the use of mating disruption for the treatment of LBAM in the Seaside area prior to an eradication plan being implemented. When the LBAM eradication plan is finalized, an EA will be completed on the eradication plan

Consultation with the Monterey Bay National Marine Sanctuary

The Monterey Bay National Marine Sanctuary (Sanctuary) is adjacent to the proposed treatment area. This is a federally protected marine area offshore of California's central coast. It stretches from Marin County to Cambria County and encompasses a shoreline length of 276 miles and 5,322 square miles of ocean. It supports a diverse marine ecosystem and is home to numerous mammals, seabirds, fish, invertebrates and plants in a remarkably productive coastal environment. The Sanctuary was established for the purposes of resource protection, research, education, and public use. Any discharge or deposit of foreign materials in the Sanctuary that would be injurious requires a permit from the Sanctuary. Issues raised by Sanctuary staff during consultations included: 1) concern that the affected environment section of the EA did not fully describe the cities of Pebble Beach, Pacific Grove and Carmel; 2) questions concerning the aerial application of the pheromone; and 3) there was a concern that the project as analyzed has been fragmented and does not address cumulative effects and long-term spraying plans.

In response to these concerns, APHIS and CDFA have provided the Sanctuary staff with additional information regarding the procedures and protocols of the aerial application of pheromone in the area, including transect maps. In addition we have provided additional risk assessment documentation (see Attachment 3) that demonstrates that, even if some pheromone material were to enter water, there is little likelihood that it could result in any negative impacts on marine life. Testing indicates that toxicity thresholds are many times higher than the environmental concentrations that would be expected even if the pheromone were directly applied to the water. In addition, the pheromone is not soluble in water and quickly volatilizes or breaks down due to ultraviolet light and therefore would not affect aquatic organisms.

However, in order to insure the integrity of the Sanctuary, aerial spraying will not be conducted adjacent to the Pacific Ocean or over waterways leading into the Sanctuary until consultations with the Sanctuary have been concluded to the satisfaction of Sanctuary staff.

Other Consultations and Compliance with Relevant Executive Orders

CDFA has consulted with the Central Coast Water Quality Control Board to ensure that water quality standards are not jeopardized by the proposed program. The Central Coast Water Board has provided an email to CDFA indicating that as long as the material is applied in accordance with the restrictions of the Section 18 pesticide label and direct applications to water are avoided, they have no objections to the proposal and will not require a permit.

APHIS and the CDFA have consulted with the U.S. Fish and Wildlife Service (FWS), as required by the Endangered Species Act, for the proposed spraying. FWS has concurred with CDFA that the proposed action is not likely to adversely affect listed species in the Seaside area, including the

Smith's blue butterfly, tidewater goby, brown pelican, California least tern, southern sea otter, western snowy plover and California red-legged frog. This finding was based on a lack of toxicity of the pheromone, specificity of the pheromone to LBAM, that no spraying will be conducted over water and the pheromone's rapid degradation.

The USDA National Organic Program has recently approved the use of the Checkmate® pheromone (the product to be used in the LBAM program) in organic agriculture. This has prompted the California Certified Organic Farmers, one of the oldest and largest organic certification agencies in North America, to announce its support of aerial spraying of a pheromone to control LBAM in a statement on August 31, 2007.

Due to the nature of the proposed actions described herein, there should be no disproportionate adverse effects to minorities, low-income populations, or children in accordance with Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations," and Executive Order 13045, "Protection of Children from Environmental Health Risks and Safety Risks."

APHIS' finding of no significant impact from treatment in this area is based upon the expected limited environmental consequences, as analyzed in the EA, and as further described in the Attachments hereto. An EIS must be prepared if implementation of the proposed action may significantly affect the quality of the human environment. I have determined that there would be no significant impact to the human environment from the implementation of the treatment alternative and, therefore, no EIS needs to be prepared.

Robert M Baca ACTING FOR

Osama El-Lissy
Emergency and Domestic Programs
Plant Protection and Quarantine
Animal and Plant Health Inspection Agency

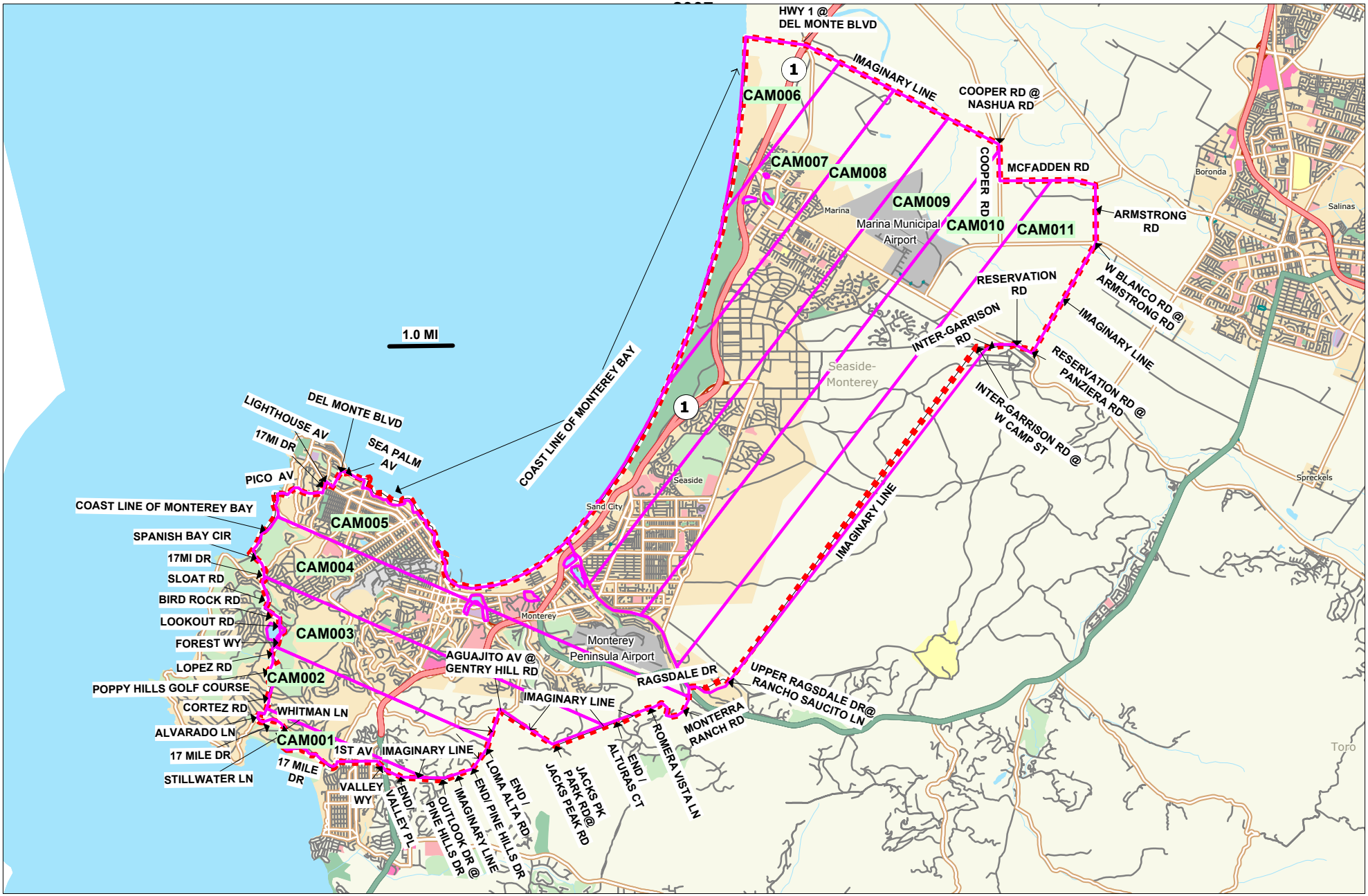
SEPTEMBER 07, 2007

Date

Attachment 1: Treatment area map
Attachment 2: Light Brown Apple Moth Questions and Answers
Attachment 3: Screening Level Ecological Risk Assessment for Acetate Based Straight Chain Lepidopteran Pheromones

Attachment 1
Map of Aerial Spray Zones

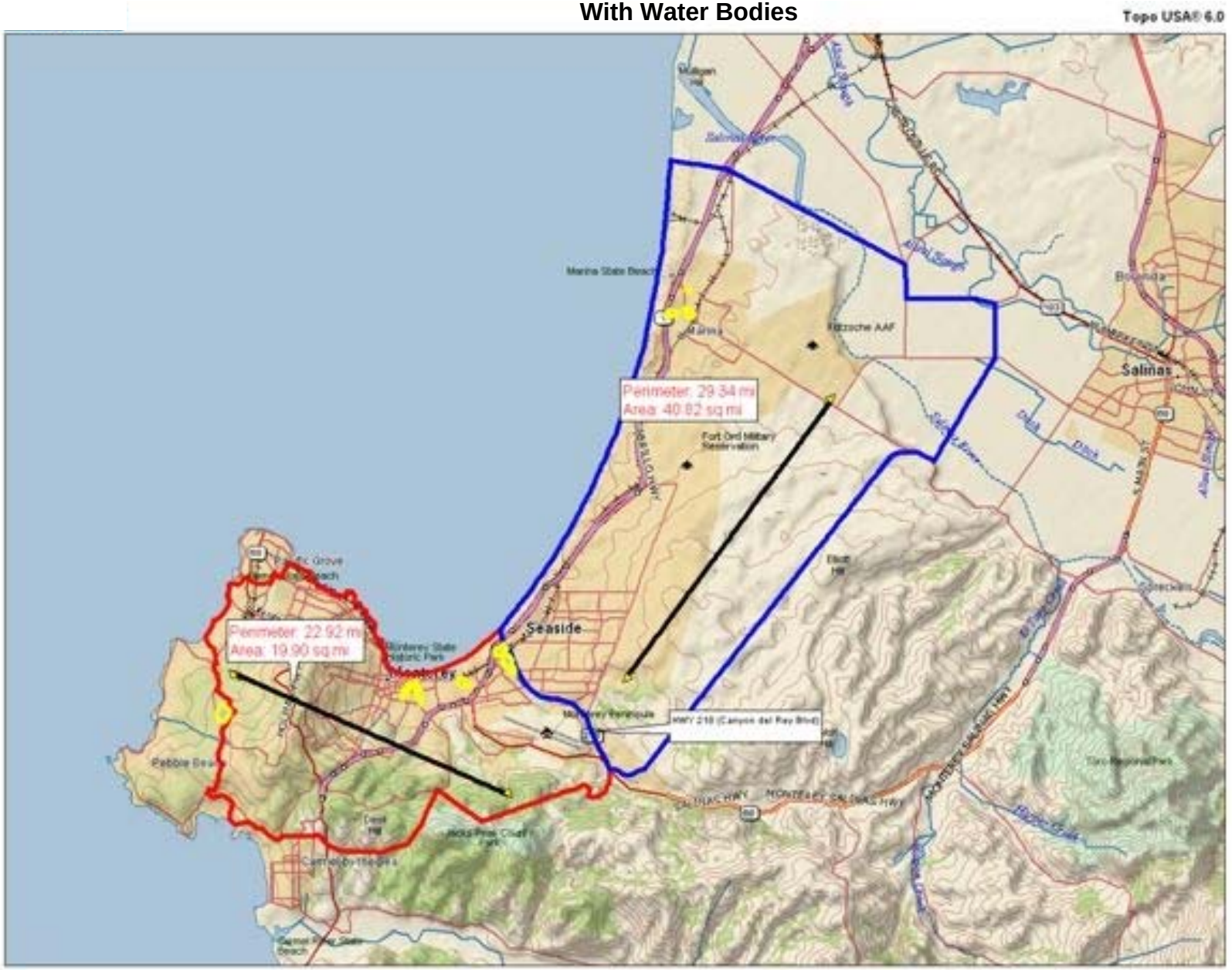
LIGHT BROWN APPLE MOTH
SEASIDE, MONTEREY COUNTY
AERIAL SPRAY ZONES



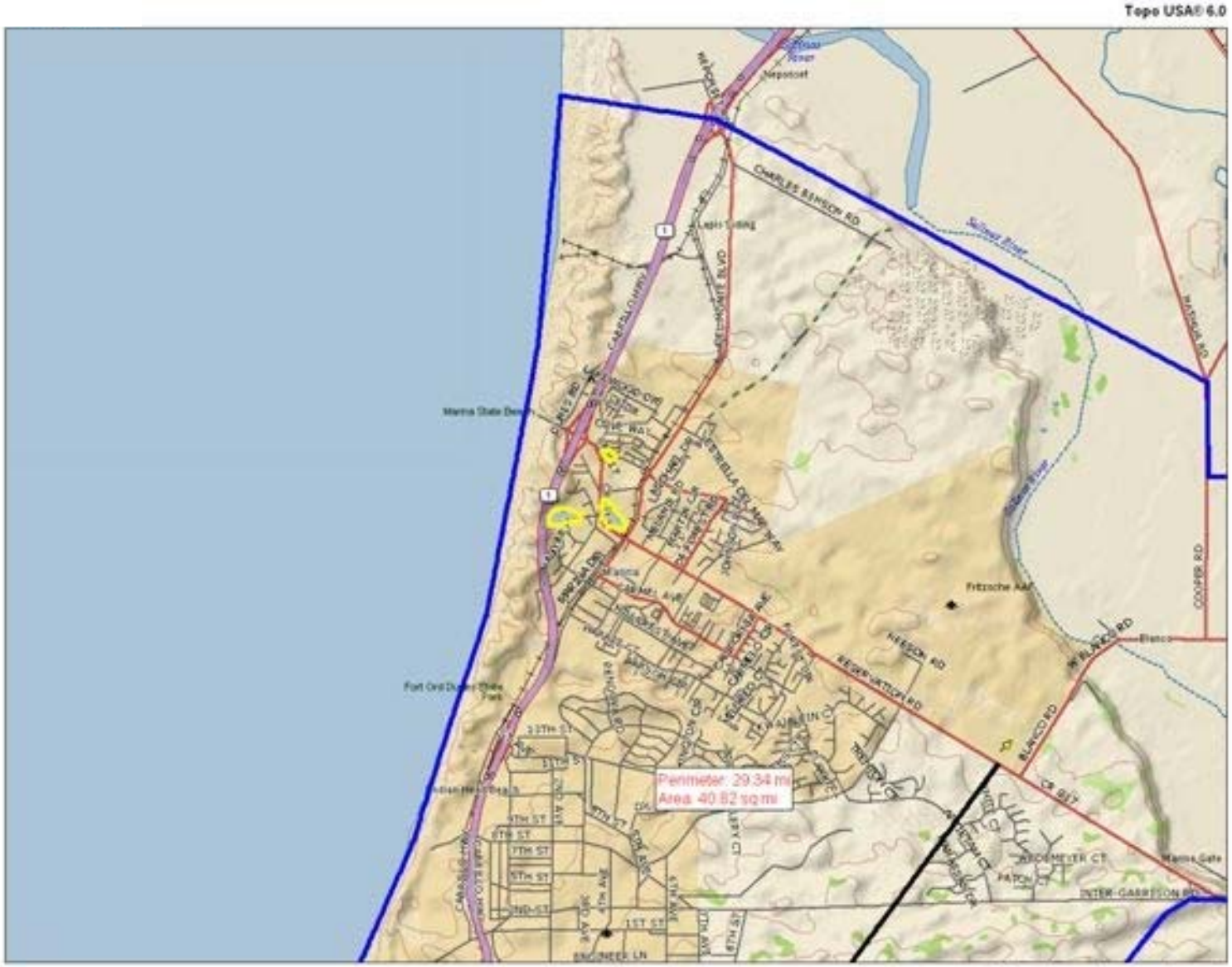
cdfa

ERADICATION BOUNDARY

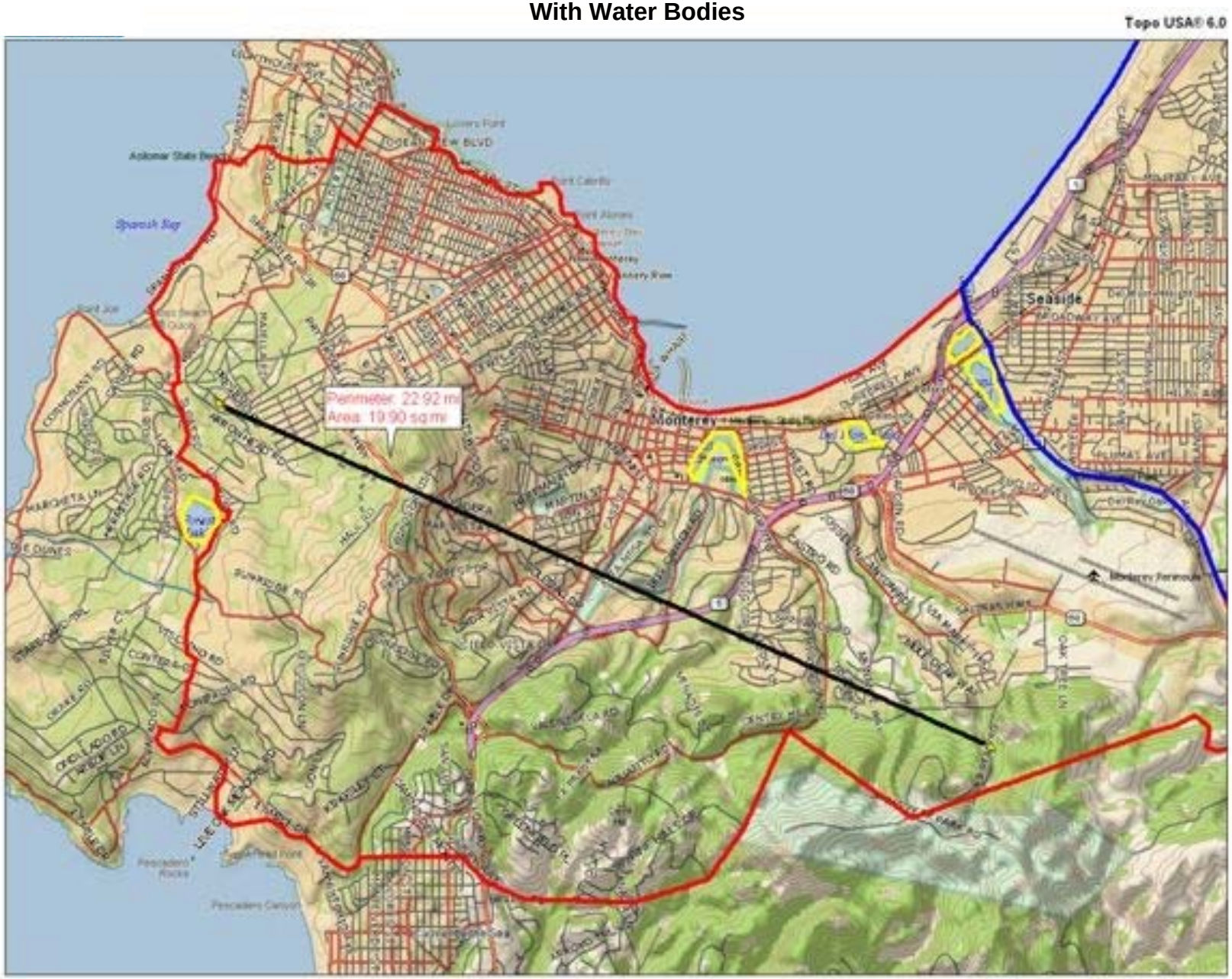
Light Brown Apple Moth
Arial Spray Zone
With Water Bodies



Light Brown Apple Moth
Northern End of Arial Spray Zone
With Water Bodies



Light Brown Apple Moth
Southern end of Arial Spray Zone
With Water Bodies



Attachment 2
Light Brown Apple Moth
Questions and Answers

Light Brown Apple Moth (LBAM) Questions and Answers
Including information about pheromones, aerial treatment plans and other elements of the eradication effort.

Is the aerial application of this pheromone safe?
The pheromone materials Checkmate OLR-F and Checkmate LBAM-F have been reviewed and approved for aerial application by the federal Environmental Protection Agency (EPA) and the state Department of Pesticide Regulation (DPR). These pheromones and many others like them are present in our environment every day as many insects use them to attract mating partners or signal other behaviors. Humans and other mammals do not use these insect pheromones and cannot detect them. Studies of this pheromone in particular and about the interaction of pheromones and mammals in general have shown no evidence for concern about exposure to pheromones, even at much higher levels than proposed for the aerial treatment of the Monterey Peninsula.

The EPA does not permit long-term human studies for any type of pesticide. Instead, the possibility of chronic effects is typically addressed by animal studies. Testing of the active ingredient on animals did not demonstrate any signs of poisoning. Proposed aerial treatments would apply a small fraction of the amount used for testing, indicating a large margin of safety for even the most sensitive groups.

The EPA has established that this is a very low toxicity material applied in a very dilute concentration. No illnesses related to the use of these materials have ever been reported, even by people handling concentrated forms of Checkmate or similar pheromone products used to control other insects. The State of California and US EPA have long maintained systems for tracking illness reports related to treatments. In addition, the USDA has certified this product and other pheromones for use on organic crops.

Related resources:
The EPA provides an online summary of its quarantine exemptions for LBAM pheromones. At the bottom of this web page, several additional references and resources are provided:
http://www.epa.gov/pesticides/local/region9/lbam_quarantine.htm

The online Federal Register includes an informative page summarizing EPA's determinations about lepidopteran (moth) pheromones:
http://www.epa.gov/fedrgstr/EPA-PEST/1995/August/Day-30/pr-388.html

Are the planes, treatment equipment and flight plans safe?
The contractor Dynamic Aviation, their planes and the individual pilots are required to be reviewed and licensed/approved by the Federal Aviation Administration (FAA). CDFA has contracted with this company for many years for aerial release of sterile Mediterranean fruit flies in the Los Angeles basin, and their safety record is unblemished. Detailed flight plans are submitted to local aviation authorities for review in advance. To ensure that no contamination of the pheromone product occurs, the mixing, loading and treatment equipment is required to be new and dedicated to this project. We will conduct

sampling of the pheromone mixtures and follow a strict chain-of-custody procedure in the delivery of these materials for testing. Strict protocols are also in place for the purchase, transport, storage, mixture and loading of the material to be used in the treatment.

If the proposed application is safe, why does your literature and the product label mention precautions?

The EPA requires precautionary statements on every product it approves. The precautions on the label are relatively minimal when compared to the precautions typically seen on labels for conventional pesticides. Based on review and approval of this product by the EPA and the California Department of Pesticide Regulation (DPR), there is no human or animal health risk from exposure to the material during treatment. However, as we do with any aerial treatment, we advise those who wish to avoid unnecessary exposure to take simple precautions such as staying indoors or under cover, closing windows, removing laundry from outdoor lines, etc.

A complicating factor in this discussion is that a label for "Checkmate OLR-F" that has been circulated by members of the public is not the correct label for the product that will be used. The label that has been disseminated in error is appropriate only for treatments in agricultural areas where higher concentrations of the active ingredient are prescribed. The warnings and precautions on this label are intended for trained workers who routinely and repeatedly handle concentrated, undiluted pesticide ingredients while they are being mixed and prepared for treatment. This information does not apply to those who may be exposed to a diluted form of the material to be used during an aerial treatment.

Why is this eradication project an emergency?

Data from our statewide insect trapping efforts shows that this infestation is a recent arrival to California. The populations of LBAM are still relatively small and are considered by an international panel of expert scientists to be eradicable if significant action is taken promptly. These moth populations can grow exponentially, going through approximately five generations per year with each female moth laying hundreds of eggs. Failure to act quickly could result in uncontrolled spread and substantial environmental and economic impacts.

Who decides whether or not aerial applications are necessary? How is that decision made?

At the direction of federal and state law, agricultural officials with the USDA and CDFA are responsible for eradicating invasive pests. Agency policy requires that we choose the most environmentally sensitive approach that will be effective against the infestation. For a project such as the eradication of the light brown apple moth, the agency secretaries are the primary decision-makers who rely on the scientific knowledge of staff as well as on consultations with their counterparts in health and environmental agencies and other experts. For the LBAM eradication project, CDFA and USDA appointed a technical working group of expert scientists to establish whether eradication is possible and, if so, to recommend the most environmentally friendly means of eradication. The proposed aerial treatment is a central element in that plan.

How long will the treatment project take?
Each aerial treatment would take approximately three nights to apply the treatment over the entire eradication area. Wind or other inclement weather could delay or extend the treatment schedule. A second, identical treatment is proposed approximately one month after the first treatment. Depending upon subsequent trapping data, additional treatments may be necessary.

How do you protect against drift?
The airplanes use pre-programmed GPS guidance systems to ensure even application of the treatment. The programming includes automatically turning the treatment off over bodies of water. The protocols call for treatment to occur only if wind and other weather conditions are within established limits.

How will these applications affect the environment, including the ocean?
Pheromones are among the most environmentally friendly treatments ever used to eradicate a pest infestation in California. While conventional pesticides kill insects directly, the pheromones applied in this effort will simply confuse the male moths so that they cannot locate a mating partner, and the infestation eventually collapses as breeding subsides. Pheromones also have the distinct advantage of affecting only a very limited number of closely related insects while leaving beneficial insects and endangered species unaffected.

Concerns have been expressed about exposure of fish and other aquatic species to the treatment. However, the treatments will not be applied over bodies of water, including the ocean. The pheromone breaks down in water and all of the ingredients are biodegradable, so runoff is not a concern.

How would/does the light brown apple moth affect the environment?
Because the LBAM feeds on hundreds of different kinds of plants, it presents a threat to trees and plants in the natural environment as well as in crops and landscaping. Cypress and redwood trees, Monterey pine, oaks, lupines and many other native species are included on the extensive "host list" for this pest.

If the infestation is not eradicated, another important environmental effect would likely be an increase in the use of conventional insecticides by many residents, businesses and public entities acting to protect the plants in their gardens, landscaping, parks and other areas.

Will the pheromone harm the monarch butterfly? Are other moths affected by the pheromone?
Although moths and butterflies are similar insects, the pheromones used by separate species are different. Monarch butterflies are not attracted to the light brown apple moth pheromone and will not be confused or otherwise affected by it. The pheromone treatment is water-based and contains no oils or other materials that would pose a threat to the Monarch population.

In the pheromone-based traps that we use to detect LBAM, we have trapped only limited numbers of five closely related moth species, further indicating the highly specific nature of this pheromone. Two of the five other moth species are also invasive, unwanted pests, although they do not pose the same level of threat as the LBAM. Because these other moths are permanently established in the surrounding region beyond the limits of the LBAM treatment area, any reduction in these populations would be expected to rebound after LBAM eradication treatments subside.

How would/does the light brown apple moth affect the economy?
The current LBAM infestation has already caused the nations of Canada and Mexico to impose onerous restrictions on exports of crops and plants from the infested areas of California. China also has begun the kind of information gathering that frequently leads to such trade restrictions. As businesses are forced to delay, reduce or abandon exports to these nations, employment, investment and tax levels are all adversely impacted. Internally, restrictions are also imposed by CDFA and USDA on businesses such as plant nurseries in the infested areas so that their counterparts outside of the area can be protected from the infestation. These businesses must comply with strict regulations that limit or delay the companies' ability to export their plants outside the area. If the infestation is not eradicated, these regulations and trade restrictions would continue indefinitely and other countries would likely adopt similar measures.

What are the inert ingredients in the treatment? Are they safe?
The inert ingredients in the formulation are water and biodegradable elements used to delay the release of the active ingredient so that the treatment will be effective for an extended period of about one month. The basic biodegradable "building block" is urea, a normal constituent of the human body that is derived from the breakdown of proteins that we eat.

How will I be notified about the treatment?
As required by state law, CDFA notifies all known residents of a treatment area by first-class mail in advance of an emergency treatment.

How will you notify homeless people and others without a permanent address?
In addition to sending the required first-class mailings to residents, we will work with local news media and elected officials and staff at the city and county levels to get the message out about the treatment schedule and other elements of the project. We also share information about the treatments in advance with local homeless shelters, farm worker organizations and other groups that have been brought to our attention by local officials or have requested information.

Why are Pebble Beach and Carmel not included in the proposed treatment area?
Portions of both Pebble Beach and Carmel are included in the proposed treatment area, while other portions of these communities are not. The treatment area is based on two factors: the biology of the pest (i.e., the distance it is capable of moving during its life cycle) and the location of the trap sites where moths were detected. Traps are distributed

at a consistent ratio throughout the entire region so that the infested area can be determined with a high degree of accuracy. CDFA staff generate a GPS-driven map based on these factors, then draw a final boundary using the closest available roads or other physically identifiable lines.

How have you communicated with environmental regulators? What have you communicated?

We have provided details of our proposed treatment to a number of local, regional, state and federal groups including the United States Fish and Wildlife Service, the California Coastal Commission, the National Marine and Fisheries Service, the Monterey Bay National Marine Sanctuary and the Central Coast Regional Water Quality Control Board. Communications have included meetings, e-mail, telephone and mail. We also work with local news media and elected officials and staff at the city and county levels to get the message out about the treatment schedule and other elements of the project. The information includes details about the program components, treatment schedule, the affected area, the pheromone, and the availability of a toll-free number for further information.

When will you develop an Environmental Impact Report (EIR)?

This pest has the biological ability to multiply and disperse quickly, so eradication efforts can only be successful if the efforts begin immediately. CDFA has declared an emergency to allow the eradication to begin under a temporary exemption from environmental analysis, with the understanding that a full environmental assessment of the project, including these emergency treatments, will be required. That assessment will likely take more than a year to complete, and will begin in the next few months.

Why not just let the apple moth be?

If we do not eradicate this infestation, the moth would eventually multiply and spread to other areas of California, the United States and beyond. Farmers, residents, municipalities and other entities would repeatedly use pheromones and other, more toxic pesticides to suppress the infestation and protect their crops, landscaping and habitat. Populations of threatened and endangered species could be severely impacted should this moth adapt to feeding on them or competing with them for food or habitat. The impact on agricultural production of crops that are hosts of the LBAM could reach $160 to $640 million annually in the currently infested counties in California (source: USDA). Additionally, California would likely be placed under perpetual quarantine by neighboring states and trading partners around the world, restricting our ability to export crops and plants. Canada and Mexico have already imposed such restrictions, resulting in delays, added expenses and reduced export business for local growers.

Should I be worried about my pets?

EPA's review of this pheromone product indicates it is highly specific for the apple moth and does not affect mammals. Pheromones are used by insects to trigger behaviors such as mating, but mammals do not use these same signaling systems. The pheromone is undetectable to humans, pets and other mammals.

Should I take any precautions inside my home?
The treatment will be applied as a mist in a mixture that is mostly water, which carries the pheromone down to the surface (trees, rooftops, plants, ground, etc.). This method of treatment makes it unlikely that the material would directly enter homes or other buildings. However, if it were to do so, health officials have established that this is a very low toxicity material applied in a very dilute concentration. The State of California and US EPA have long maintained systems for tracking illness reports related to treatments and no illnesses have been reported, even in people handling concentrated forms of Checkmate or similar pheromone products used to control other insects. Based on this lack of reported illnesses, no precautions are necessary inside the home. Residents who wish to take precautions may close doors and windows to further minimize exposure.

Will the paint on my car be damaged? Should outdoor play equipment be hosed down after applications?
Testing performed by the United States Department of Agriculture and decades of experience with aerial pheromone treatments in the U.S. and other nations has resulted in no reports of damage to automotive paint, outdoor furniture or other common outdoor surfaces. Based on this information no action is suggested to protect these items.

What about outdoor public gatherings on the night of applications?
CDFA is in contact with local officials, school districts, etc. and has been made aware of evening and night events in the treatment area. The treatments on these nights are scheduled so that the specific sites in question are to be treated in the morning hours toward the end of the shift, after the activities have ended.

Should people stay away from public parks and schools the morning after applications?
It is not necessary to stay away from treated areas after the treatment. Health officials have established that this is a very low toxicity material applied in a very dilute concentration. The State of California and US EPA have long maintained systems for tracking illness reports related to treatments, and no illnesses have been reported, even in people handling concentrated forms of Checkmate or similar pheromone products used to control other insects.

Why can't twist ties be used instead?
Application of twist ties infused with the pheromone is effective in very small areas, such as the 200-meter radius around an individual moth find or a similar area around a handful of tightly contained finds. In such a case, 40-50 staff require about four days to apply an average of about 30-40 twist ties to the trees and plants on each property. Extending such an effort over the proposed 60-square-mile treatment area along the Monterey Peninsula would require 62,000 staff and more than 9 million twist ties. The idea was considered and rejected primarily because of the insufficient supply of twist ties available for use—it would take a minimum of several months for the manufacturers to produce the necessary supply of twist ties, by which time the moths would have multiplied through several additional generations and the infestation would no longer be considered eradicable. The

extraordinary staffing and budgetary elements of an operation of this magnitude were also considerations in rejecting this alternative.

Why is Monterey being treated before Santa Cruz?
Experts within the USDA, CDFA and a Technical Working Group of moth and eradication experts from around the world have recommended a progressive series of steps toward eradication of this infestation. The general principle of the eradication effort is to work from the outer edges of the infestation inward toward the core. The specific treatment recommendations began in the summer of 2007 with the deployment of pheromone twist-ties around a number of "outlier" sites where single moths or small numbers of moths were detected in traps that were in relatively isolated locations. Working inward from these fringes of the infestation, the next recommended step is aerial pheromone release over the Monterey peninsula. The series of treatments would be followed by continued trapping to determine the rate of success of the treatments and to indicate what additional steps may be necessary.

Who is paying for this?
The USDA has provided the bulk of the funding for treatment as well as for the other activities in this program, including plant and crop inspections, traps, outreach and other elements. CDFA and local agricultural officials have also contributed to the project.

What if the pheromone treatment doesn't work?
The pheromone treatments are a central part of a multi-year project that will require multiple tools to be successful. We have already contained the infestation by imposing quarantine restrictions and inspections on plant and crop shipments, and we have suppressed the infestation by deploying pheromone twist-ties in several locations around the fringes of the infested areas. The proposed aerial treatments are the next step in the eradication process. Based on the history of pheromone treatments for this pest in Australia and New Zealand and for similar pests here in the U.S., we have confidence in the success of the proposed treatments. However, if the overall eradication project is not successful, we would have to reconsider whether eradication of the pest is possible under the circumstances. If not, the goal would then become suppression and containment of the infestation over the long term in order to minimize the environmental and economic impact of the infestation.

Are pheromone treatments effective in New Zealand, Australia and Hawaii?
Pheromones are a reliable method of treatment to control LBAM in New Zealand and Australia. In Hawaii treatments have not been attempted because of a number of factors, including the fact that the infestation is relatively small and restricted to higher elevations. Pheromone treatments in general have an excellent track record against moths and other insect pests.

SEPTEMBER 2007

Prepared by the California Department of Food and Agriculture. For the most current version of this document, please visit the department's LBAM web site at www.cdfa.ca.gov/phpps/PDEP/lbam/lbam_main.html

Attachment 3
Ecological Risk Assessment

Screening Level Ecological Risk Assessment for Acetate Based Straight Chain Lepidopteran Pheromones

Introduction

The purpose of this risk assessment is to quantify the risks of straight chain lepidopteran pheromones to non-target terrestrial and aquatic organisms. Several groups of lepidopteran pheromones have been identified, but the focus of this assessment is to determine potential ecological risks of acetate-based lepidopteran pheromones. This is the class of pheromones that are the active ingredients in both Checkmate labels that are proposed for use in the light brown apple moth (LBAM) eradication program. Current registration data requirements for straight chain lepidopteran pheromones in the United States, Canada and Europe are less than conventional insecticides (OECD 2002, EPA 2007). The reduced data requirements are based on similarities in toxicity, exposure and environmental fate that suggest that these types of pheromones pose minimal risk to human health and the environment. Due to these similarities in fate and effects regulatory agencies have adopted a structure activity relationship approach for straight chain lepidopteran pheromones (Weatherston and Minks 1995). This assessment summarizes the range of toxicity data for acetate-based straight chain lepidopteran pheromones. It also provides conservative estimates of exposure in terrestrial and aquatic environments so that conservative estimates of risk can be determined and discussed.

Toxicity

Terrestrial

Based on the available acute mammalian toxicity data for approximately 10 different lepidopteran pheromones the median lethal oral dose (LD_{50}) for rats would be considered practically non-toxic with values ranging from greater then 5 g/kg to greater than 34.6 g/kg. Acute dermal toxicity is also considered low with LD_{50} values ranging from greater than 2 g/kg to 20.25 g/kg based on study results from nine acetate based straight chain lepidopteran pheromones. Inhalation hazards are also low based on results compiled from three studies that show that the median lethal concentration (LC_{50}) values range from 3.3 to 33.2 mg/L (Touhey 1990, Inscoe and Ridgway 1992, Weatherston and Stewart 2002).

Available subchronic and developmental mammalian toxicity studies have shown no mutagenic or developmental effects for all tested pheromones (Touhey 1990). Daughtrey *et al.* (1990) dosed rats daily five days per week for 13 weeks with tridecyl acetate at doses ranging from 0.1 to 1.0 g/kg/day. The calculated no observable effect level was found to be 0.1 g/kg/day based on a slight increase in liver weight which is consistent with long term dosing.

Toxicity to birds is also considered to be very low based on available avian toxicity data. Acute oral LD_{50} values for bobwhite quail are greater than 2 g/kg while mallard values range from greater than 2 g/kg to greater than 10 g/kg (Weatherston 2002).

Aquatic

Based on the available acute toxicity data for freshwater fish straight chain lepidopteran pheromones would be considered practically non-toxic. Based on results from four bluegill studies and three rainbow trout studies the range of toxicity values is greater than 100 mg/L to 540 mg/L for the bluegill sunfish and greater than 100 mg/L to 270 mg/L for the rainbow trout (Weatherston and Minks 2002). Aquatic invertebrates appear to be more sensitive than fish with EC_{50} values ranging from 1.30 to 6.80 mg/L for the freshwater cladoceran, *Daphnia magna*. All aquatic toxicity values that have been reported are above the solubility limits for these types of pheromones in water and would not occur in the environment due to their chemical properties.

Exposure

Due to the unique method of application being implemented in this program currently available drift models such as AgDrift and AgDisp have limited use. Proposed application heights are well above the 150 foot application height limit that has been validated using these types of models. To determine exposure of non-target organisms to pheromone applications, residues in terrestrial and aquatic systems were calculated based on the assumption of direct applications to both environments.

Terrestrial

Residues in terrestrial environments were determined using the EPA Office of Pesticide Program (OPP) Terrestrial Residue Exposure Model (T-REX) (EPA 2005). T-REX allows the user to input variables such as use, application rate/type, percent active ingredient, foliar dissipation half life, application interval and number of applications to calculate exposure concentrations on a variety of food items. All estimated environmental concentrations (EEC) in this risk assessment are based on the upper bound residue estimates on different terrestrial food items. Output from the model has been validated based on the review of field residue data (Fletcher *et al.* 1994) Dose based residues were calculated for different sized mammals and birds so that they could be compared to the most sensitive toxicity value for each group (Table 1 and 2). Residues are assumed to result from a direct application to the listed food items.

Table 1. Expected pheromone residues for different mammalian classes and body weights

Dose-Based EECs (mg/kg-bw*)	Mammalian Classes and Body weight					
	Herbivores/ insectivores			Granivores		
	15 g	35 g	1000 g	15 g	35 g	1000 g
Short Grass	10.07	6.96	1.61			
Tall Grass	4.61	3.19	0.74			
Broadleaf plants/sm Insects	5.66	3.91	0.91			
Fruits/pods/seeds/lg insects	0.63	0.43	0.10	0.14	0.10	0.02

*bw = body weight

Table 2. Expected pheromone residues for different avian classes and body weights.

Dose-based EECs (mg/kg-bw)	Avian Classes and Body Weights		
	small	mid	large
	20 g	100 g	1000 g
Short Grass	12.03	6.86	3.07
Tall Grass	5.51	3.14	1.41
Broadleaf plants/sm Insects	6.77	3.86	1.73
Fruits/pods/seeds/lg insects	0.75	0.43	0.19

Aquatic

As a more conservative estimate of exposure, residues in aquatic environments were determined based on the assumption of a direct application. This would not occur in an actual application since it is inconsistent with the label for both products, and would be a violation of FIFRA. In addition the pheromone is insoluble in water and would not be able to go into solution resulting in exposure to aquatic fauna. The assumptions in the direct application were that a maximum rate of pheromone (20 g active ingredient/acre) would be applied directly to a body of water one hectare in size and 0.5 meters deep. The water body was assumed to be a closed system with no inlet or outlet and no degradation of the pheromone. In addition the pheromone was considered to be 100% soluble in water. Based on these very conservative assumptions the maximum residue in the defined aquatic system was determined to be 0.01 mg/L.

Risk

The risk to terrestrial and aquatic organisms was quantified by dividing the exposure residue by the most sensitive toxicity value in each environment to determine a risk quotient.

Risk Quotient (RQ) = Estimated Environmental Concentration / Toxicity Endpoint

EPA OPP uses a similar approach in calculating risk and then compares the risk quotient to levels of concern that have been established to determine a presumption of risk to terrestrial and aquatic non-target organisms. Levels of concern that have been established for direct acute effects to terrestrial organisms range from 0.1 for endangered species to 0.5 as a trigger for acute high risk. For aquatic species the levels of concern range from 0.05 for listed species to 0.5 for aquatic high risk. Risk quotient values that exceed these values result in a presumption of risk and further analysis is needed. Chronic levels of concern are set at one for both terrestrial and aquatic organisms.

Terrestrial

Based on the calculated residues for different mammal classes and the lowest acute toxicity value for mammals (LD_{50} >5 g/kg) all risk quotients were less than 0.009 suggesting minimal risk to non-target mammals. Using the lowest subchronic toxicity endpoint (NOEL = 0.1 g/kg) chronic risk to different mammal classes was 0.05, and below, for all mammal classes and sizes suggesting minimal chronic risk.

Using the residues calculated for different bird classes and sizes, and the lowest reported avian toxicity value (LD_{50} >2 g/kg) all acute risk quotient values were less than 0.01 since the toxicity value was based on a value where no effect was observed at the highest concentration tested.

All calculated risk quotient values for terrestrial non-target organisms were well below any levels of concern that have been established for terrestrial non-target organisms by EPA.

Aquatic

The risk to fish was calculated by taking the residue value of 0.01 mg/L and dividing it by the lowest reported LC_{50} which is reported as greater than 100 mg/L. In this case the resulting risk quotient value is <0.0001 since the toxicity value is reported as greater than the highest test concentration. Taking the lowest reported *D. magna* value (EC_{50} = 1.30 mg/L) and comparing it to the 0.01 mg/L maximum residue results in a risk quotient value of 0.008. These values show that the residues in water are 130 to greater than 10,000 times below any available aquatic effects data based on overly conservative estimates of exposure. In addition the calculated risk quotients are an order of

magnitude or more below the most sensitive levels on concern defined by EPA. Risks are actually much lower since the residue calculations assumed a direct application and that the pheromone is soluble in water, both of which are not representative of the use pattern or chemical characteristics of the pheromone.

Summary

As with any risk assessment there is uncertainty due to the limited amount of available toxicity data. In aquatic systems this uncertainty is addressed to a great extent based on the physical properties of the pheromone in aquatic systems which restricts exposure to water column and benthic organisms. In addition any pheromone that may reach water volatilizes rapidly and degrades when exposed to oxidation and UV light. Degradation of the pheromone in terrestrial environments is also rapid with half lives ranging from a few hours to slightly greater than one day.

Uncertainty exists in the calculated residues in terrestrial environments where they do not account for all food types that can be consumed by various mammals and birds. The values represent levels for mammals and birds that have high consumption rates relative to their body size and would therefore potentially consume proportionally larger amounts of pheromone. The higher proportional consumption rates and the assumption that all consumed food items are contaminated with upper bound estimates of residues provides a conservative estimate of risk.

Uncertainty regarding the toxicity of the active ingredient, which is what the standard toxicity studies are based on, versus the toxicity of the formulation is also reduced since greater than 95% of the inert material is deionized water. The remaining 4-5% of the inerts are materials that occur at very low concentrations and are not considered to be of toxicological significance due to low exposure and/or toxicity.

Risks are actually much lower than the calculated values above since the residue calculations assumed a direct application and that the pheromone is soluble in water, both of which are not representative of the use pattern or chemical characteristics of the pheromone. Based on the available toxicity and environmental fate data, and extremely conservative exposure assumptions, the risk to terrestrial and aquatic non-target organisms is expected to be negligible from applications of acetate-based straight chain lepidopteran pheromones.

Literature Cited

EPA 2005. User's Guide T-REX Version 1.2.3. (*T*errestrial *R*esidue *EX*posure model). 25 pp.

EPA 2007. Biopesticide Registration Document. Straight Chain Lepidopteran Pheromones (SCLP). Office of Pesticide Programs. Biopesticides and Pollution Prevention Division. 57 pp.

Fletcher, J.S., J.E. Nellesson and T.G. Pfleeger. 1994. Literature review and evaluation of the EPA food chain (Kenaga) nomogram, an instrument for estimating pesticide residues on plants. Environ. Tox. and Chem. 13(9):1383-1391.

Inscoe, M.N. and R.L. Ridgway. 1992. Non-target effects of lepidopteran sex attractant pheromones. BCPC Monograph No. 51, Pheromones and Behavior-Modifying Chemicals. 49-59.

OECD. 2002. OECD Series on Pesticides: Number 12: Guidance for Registration Requirements for Pheromones and Other Semiochemicals Used for Arthropod Pest Control. 25 pp.

Tohey, J.G. 1990. "A review of the current basis for the United States Environmental Protection Agency's policies for the regulation of pheromones and other semiochemicals, together with a review of the available relevant data which may impact the assessment of risk for these classes of chemicals. Part No. 1, Straight Chain Alcohols, Acetate Esters and Aldehydes". (Unpublished report, 474 pp.)

Weatherston, I. and A.K. Minks. 1995. Regulation of semiochemicals – global aspects. Integrated Pest Management Reviews. 1:1-13.

Weatherston, I. and R. Stewart. 2002. Regulatory issues in the commercial development of pheromones and other semiochemicals. Use of pheromones and other semiochemicals in integrated production. IOBS wprs Bulletin Vol. 25: 1-10.