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Glassy Winged Sharpshooter Area Wide Management Program

Kern County, California

Environmental Assessment
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practices for the disposal of surplus pesticides and pesticide containers.

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I. Need for the Proposal

A. Introduction

The glassy-winged sharpshooter (GWSS), *Homalodisca coagulata*, is a leaf-hopper that is an important vector of the bacterium *Xylella fastidiosa*, that causes a variety of economically and esthetically important plant diseases. Various strains of *Xylella fastidiosa* cause diseases such as Pierce's disease of grapevine, citrus variegated chlorosis, phoney peach disease, pear leaf scorch, almond leaf scorch, alfalfa dwarf, and oleander leaf scorch. In Pierce's disease, the bacterium attacks the plant's xylem or water-conducting tissues and chokes the flow of water and nutrients within the plant, resulting in stress and eventual death of the plant. The disease eventually kills or renders grapevines unproductive within two to three years. Pierce's disease caused the destruction of winegrape industries in Southern California and was responsible for the loss of 40,000 acres of grapes near Anaheim in the 1880's.

Pierce's disease is prevalent in Florida, Georgia, and the southern states, has been confirmed in Arizona, and is suspected in New Mexico. Currently, Pierce's disease exists in California's Napa, Sonoma, and Mendocino winegrape regions, where it is spread by the less aggressive blue-green sharpshooter. In those areas, the disease has the characteristic of "hot spots" in the vineyards, caused by the migration of the blue-green sharpshooter into the vineyards from bordering riparian or ornamental areas where the pests reproduce. The GWSS presents a greater threat to the vineyards than other vectors of Pierce's disease because: (1) it moves faster and farther; (2) it has a much wider range of hosts; (3) its breeding habits and hosts are different; and (4) it feeds on the larger (basal) stems of plants, making pruning ineffective, and leading to exponential increase.

The severity of Pierce's disease in grapevines is expected to be much more severe with the presence of the GWSS because this species can colonize a greater variety (and therefore number) of host plants in areas surrounding the vineyards and then migrate into the vineyards, causing more extensive damage. The host list for the GWSS is very large, including at least 110 different plants, according to the California Department of Agriculture. The pest feeds on oleander resulting in oleander leaf scorch; oleander is an important reservoir of GWSS throughout the area. Because of the pest's wide host range and ability to vector the bacterium, the GWSS also threatens a wide variety of crops, ornamentals, and naturally-occurring plants in the State of California. It reproduces on eucalyptus and coast live oaks in Southern California, and feeds on common species such as oak, ash, sumac, and even the oleander that is planted by CalTrans along California freeways. It is spreading rapidly throughout California and has been found in at least 9 counties, including: Kern, Los

Angeles, Orange, Riverside, San Bernardino, Santa Barbara, San Diego, Tulare, and Ventura.

B. Purpose and Need

The GWSS and Pierce's disease represent a major threat to the agricultural industries (in particular, the grape and wine industries) of California. California's grape industry alone is estimated at $33 billion. In addition to potential losses to commercial agriculture and nursery crops, CalTrans has estimated that it could lose approximately $52 million in oleander along 2,100 miles of freeway because of oleander leaf scorch. Potential losses to backyard fruit production and home ornamentals is inestimable, but expected to be enormous.

Accordingly, the U.S. Department of Agriculture's Animal and Plant Health Inspection Service (APHIS) is proposing to cooperate with the California Department of Food and Agriculture (CDFA), County Agricultural Departments, and local grower groups in an Area Wide Management Program for the GWSS. The proposed program would target primarily the citrus in Kern County, California, which serves as a major alternate host for GWSS. The reduction of GWSS in citrus would result in the reduction of the incidence of Pierce's Disease and the threat of movement of the pest through intrastate commerce to other areas of California.

APHIS' authority to cooperate in this program is based upon Title IV–Plant Protection Act, *Public Law 106-224, 114 Stat. 438-455*, which authorizes the Secretary of Agriculture to take measures to prevent the dissemination of a plant pest that is new to or not known to be widely prevalent or distributed within or throughout the United States. This environmental assessment has been prepared in compliance with the National Environmental Policy Act of 1969 and its implementing regulations.

II. Alternatives

A. No Action

The no action alternative would be characterized by no APHIS action in support of control activities for GWSS. With the lack of APHIS involvement, the potential for rapid expansion by GWSS into other urban and agricultural areas within California and surrounding states would increase. That expansion would greatly increase the incidence of Pierce's disease within the grape industry, and put the entire citrus, almond and stone fruit industries at risk of diseases vectored by GWSS. The San Joaquin Valley is a very rich farming area and supports a very robust agricultural economy. The moderate climate in this area would allow GWSS to become established within microclimates throughout the region. Once this occurs, the entire production area and the coastal areas would require extensive and control programs to manage this insect pest. Substantial adverse impact to agricultural production and natural ecosystems could be expected to result ultimately if this alternative were adopted.

B. Area Wide Management Plan (Proposed Alternative)

Under the proposed Area Wide Management Plan, APHIS would cooperate with the California Department of Food and Agriculture, County Agricultural Departments, and local grower groups in a comprehensive strategy to reduce (but not eradicate) the threatening population of GWSS in Kern County and nearby surrounding areas. The program would include three primary components: (1) cultural practices (promoting environmental conditions that do not favor the reproduction and sustenance of GWSS), (2) chemical treatments using foliar and systemic insecticides, and (3) biological control.

Chemical insecticide treatments, the principal component of the Area Wide Management Program, would target primarily citrus, the major alternate host (to grapes) of GWSS in Kern County during the dormant season for grapes. Pest population density surveys will be used to determine when thresholds trigger the need for foliar chemical treatments, rather than requiring chemical application to all crops harboring GWSS populations. The disruption of the spatial distribution of the pest population is intended to reduce mating to the extent that the population will be substantially diminished. This in effect will reduce the potential for migration into adjacent crops (especially grapes) or to other distant production areas. This alternative is an immediate response to the current infestation and is intended to provide sufficient initial reduction of GWSS to enable the implementation of more sustainable systems. (Kern Pilot Study 2001)

For the Area Wide Management Program, growers will consult with program managers and be able to choose appropriate foliar or systemic insecticides, based on their individual needs. Approved foliar insecticides include chlorpyrifos, cyfluthrin, methomyl, and pyrethrins. Imidacloprid is an approved systemic insecticide that will be applied through chemigation systems currently used by the growers. Imidacloprid is also efficacious as a soil treatment through its systemic effects. This soil treatment is being developed for registration and its application will be considered for use in the program if registration issues are resolved. In addition, imidacloprid is being registered for use in foliar applications to windbreaks adjacent to grape vineyards. The use of approved insecticides in a carefully managed Area Wide Management Plan would be less than for each of the other two alternatives, with correspondingly less adverse environmental impact to agricultural production systems and natural ecosystems as well.

C. Biological Control Only

As expected, this alternative would use native or exotic biological control organisms only to reduce populations of GWSS. As with similar recently introduced invasive plant pest species, GWSS appears to have been introduced without its entire complex of natural enemies. A single species of a parasitic wasp has been found attacking GWSS in Kern County; two additional species have been identified in southern California and along the coastal areas. Although California appears to lack an efficacious beneficial insect that displays synchrony with the overwintering population of GWSS, the New World origin of the pest genus *Homalodisca* suggests that such beneficials may exist. Accordingly, a search has been initiated throughout the North and South American continents for possible natural enemies of GWSS. This process of foreign exploration, introduction into quarantine confinement, and evaluation for efficacy prior to field release is time consuming. The results of this undertaking will require approximately one year. The long-term benefits of this strategy may provide a sustainable component for GWSS once the populations have been reduced to lower levels. If suitable biological control agents were discovered and were able to be exploited and this alternative were adopted, its anticipated environmental consequences would be expected to fall somewhere between those for no action and those for the proposed Area Wide Management Plan.

III. Potential Environmental Consequences

The analysis of potential environmental consequences will consider the alternatives of no action, an area wide management plan (proposed alternative), and biological control only. Each of these alternatives have potential adverse environmental consequences. Because the principal environmental concerns in the proposed program relate to use of chemical pesticides, this assessment will focus on the potential environmental consequences of those pesticides on human health and nontarget species.

A. No Action

Under the no action (no APHIS effort) alternative, GWSS control would be left to State agencies, grower groups, or individuals. For this approach to be successful at controlling GWSS, good cooperation and coordination would be needed among those concerned. A lack of coordination with APHIS would limit resources and available technical expertise to deal with this infestation. Further spread of GWSS is likely in California and this spread is anticipated to extend to other locations where damage to crops and ornamental plants could be substantial. Any response to control such expansion of the current infestation by individuals or organizations would probably result in a greater magnitude of environmental impact than would be associated with a coordinated APHIS/State area wide management program. Under those conditions, any available control measures (including more hazardous pesticides) could be used in an uncoordinated manner, resulting in greater environmental impact than is associated with the action alternatives analyzed within this assessment.

1. Environmental Quality

The primary impacts to environmental quality from the no action alternative are anticipated to be the results of uncontrolled and uncoordinated use of pesticides. The expected increases in the use of pesticides with expansion of GWSS range could result in considerable increases in pesticide applications with commensurate adverse impacts to air, water, and soil quality. These adverse impacts to environmental quality would exceed those of the other alternatives.

2. Human Health

The likely options for most growers and homeowners are to control GWSS through pesticide applications. Although some replacement with non-host plants or plants that can tolerate GWSS damage and associated plant diseases is possible, this is not likely to be desired by most growers or homeowners due to constraints on time and costs. The applications of control agents (in the absence of effective biological controls) are largely limited to pesticide applications that would be applied in response to observed damage to plants. The majority of these pesticide applications would be unsupervised and uncoordinated. Accordingly, greater pesticide amounts and higher frequency of application could be anticipated than would occur with a coordinated, cooperative government program. In addition to direct toxic effects to humans from the pesticide applications, cumulative impacts from synergistic effects of multiple exposures are considerably more likely with the lack of coordinated treatments. Human exposure to pesticides and resulting adverse consequences from the no action alternative would be expected to exceed any adverse effects from a coordinated area wide program. The continuing spread of GWSS will reduce the amount of locally available produce from crops that are susceptible to plant diseases spread by this pest. This reduction in availability of local produce may restrict the diet of some members of the public who depend upon this fruit as a substantial portion of their daily nutrition.

3. Nontarget Species

A primary direct impact to nontarget species relates to the damage and loss of plants that serve as hosts of GWSS. As was indicated in the introduction,GWSS feeds on at least 110 plants and carries destructive diseases to many more. No action would be expected to result in continued spread at a rate similar to the last several years with increasingly greater harm to plant life. The recent uncoordinated control actions have not successfully contained GWSS and damage to plants has increased readily.

Anticipated broader pesticide use resulting from lack of APHIS effort to coordinated control actions against GWSS would increase the pesticide load to the environment. This increased level of pesticides would increase the likelihood of adverse effects to nontarget wildlife and domestic animals. The potential increased populations and spread of GWSS would have adverse effects upon susceptible plants and those nontarget species that depend upon those plants for survival. The susceptible plants could include some endangered or threatened species.

B. Area Wide Management Plan (Proposed Alternative)

The area wide management plan includes cultural practices, chemical treatments, and biological control. The proposed cultural practices do not differ substantially from current practices of growers in and around Kern County. The negligible environmental impacts of these cultural practices are not expected to differ from current (no action) effects. The potential environmental consequences of incorporating biological control agents into the program are discussed in detail under that alternative and will not be further described in this section. This section will, therefore, concentrate on the potential environmental consequences of the proposed applications of foliar and systemic chemical control agents on environmental quality, human health, and nontarget species. Much of this discussion is based upon the results of the chemical risk assessment prepared for the GWSS Area Wide Management Program (APHIS, 2002). The findings of that risk assessment will be summarized here and the document is incorporated by reference. This section is divided into parts based upon type of treatment (foliar and systemic) or other treatment-related issues.

1. Foliar Spray Applications

The chemical pesticides approved for foliar treatments include chlorpyrifos, cyfluthrin, methomyl, and pyrethrins. In addition, imidacloprid is in the process of being registered to treat foliage of windbreaks adjacent to grape vineyards. This compound is most effective through its systemic movement within the plant. Therefore, all potential consequences of imidacloprid applications are described in the next section on systemic applications. The environmental fate, toxicity, potential human health risks, and nontarget species risks are described for each pesticide. These applications to foliage (target site) may result in some residues to soil, water, and other environmental media.

a. Chlorpyrifos

(1) Fate

Chlorpyrifos binds readily to organic matter in soil and sediments (Felsot and Dahm, 1979; Kenaga, 1972). Concentrations in air are highest immediately after application with rapid dissipation and only about 0.26% of the amount applied to wet soil volatilizes to the atmosphere within 24 hours. The principal degradation product (hydrolysis) is 3,5,6-trichloro-2-pyridinol, which is slightly less toxic than chlorpyrifos. The half-life in most soils (the most persistent media) is from 60 to 120 days (Miles *et al.*, 1979). Soil organic matter is environmental media where the most persistent residues of chlorpyrifos are expected from the program applications. Residues from the foliar applications in this program are unlikely to drift or be carried to any water in runoff, except possibly to some irrigation ponds close to the groves. There are very few water bodies close to the treatment areas. Those residues entering water are rapidly sorbed onto sediments and are of decreased bioavailability as a result. The residue levels on California orange and grapefruit foliage (target site of this program) were found to have a half-life that ranged from 2.4 to 3.9 days (Iwata *et al.*, 1983), so the concentrations in the groves would not be expected to persist. Oral intake by humans of chlorpyrifos residues were found to have an elimination half-life of 26.9 hours (Nolan *et al.*, 1984). Residues in fish and mammals decline with environmental concentration, so persistence and bioconcentration in tissues are not issues of concern.

(2) Toxicity

Chlorpyrifos is an organophosphate insecticide that causes toxic effects by inhibition of acetylcholinesterase function at the synapse of certain nerves. At high doses, toxic effects may include headache, nausea, vomiting, blurred vision, weakness, and muscular twitching. Chlorpyrifos is of moderate acute oral and dermal toxicity to human and mammals. The metabolites and degradation products are less acutely toxic than the parent compound.

Chronic studies also indicate a moderate level of toxicity. Two clinical studies of humans have been used by EPA to establish a No-Observed-Effect-Level (NOEL) for inhibition of plasma cholinesterase at 0.03 mg/kg/day (EPA, OPP, 1989a). Chlorpyrifos is not considered to be a dermal sensitizer and was negative in tests for hypersensitivity. Chronic feeding studies of rodents have indicated that chlorpyrifos is not carcinogenic (EPA, OPP, 1989a; EPA, OPP,

1989b). Most studies of mutagenicity suggest that chlorpyrifos is not mutagenic, but some results indicate potential toxicity to DNA and chromosomal aberrations (LAI, 1992). The lowest NOEL for reproductive and developmental toxicity outcomes is 2.5 mg/kg/day from a rat feeding study (EPA, OPP, 1989a).
Oral doses of chlorpyrifos are moderately toxic to mammals, moderately to severely toxic to birds, moderately to less toxic to adult reptiles and amphibians, and severely toxic to terrestrial invertebrates (Table 1). Chlorpyrifos is very highly toxic to fish and aquatic invertebrates (Table 2). Chorpyrifos varies from slightly to very highly toxic to tadpoles of reptiles and amphibians.

Table 1. Acute Oral LD_{50}s[1] for Selected Terrestrial Species Dosed with Chlorpyrifos (mg/kg)

Mouse	62
Rat	97
Bobwhite Quail	32
Bullfrog	400
Honey bee	0.0825

[1]LD_{50} = Lethal dose for 50% of animals treated

Table 2. 96-hour LC_{50}s[1] for Selected Aquatic Species Exposed to Chlorpyrifos (µg/L)

Toad tadpoles	1
Leopard frog tadpoles	3,000
Channel catfish	280
Bluegill	1.7
Daphnia	0.88
Stonefly	0.57

[1]LC_{50} = Lethal concentration for 50% of animals treated

(3) Human Health

Potential exposure of humans to chlorpyrifos is by dermal absorption, inhalation, or ingestion of residues. Exposure of the general public from program applications is expected to be infrequent due to the distance of treatment areas from residential locations and the restriction of all treatments to ground applications. Recent agreements made between EPA and the registrant of chlorpyrifos in fulfillment of the Food Quality Protection Act of 1996 have resulted in elimination of all uses of chlorpyrifos to treat apples and tomatoes as well as restrictions on grapes to dormant applications only (EPA, 2000). Based upon these application restrictions and the proximity to residential areas, it is anticipated that risks of any adverse effects to the public are negligible. Independent of these factors, the quantitative risk assessment (USDA, APHIS, 2002) indicates that risks are slight to negligible for the general public from typical exposure scenarios for chlorpyrifos. Risks to workers from chlorpyrifos are elevated based upon the quantitative risk calculations, but this assumes that the workers do not wear proper protective clothing and do not adhere to proper safety procedures. Adhering to these safety precautions ensures that workers are not adversely affected by chlorpyrifos.

(4) Nontarget species

Chlorpyrifos is severely toxic to terrestrial invertebrates and the quantitative risk assessment (USDA, APHIS, 2002) indicates that all exposed terrestrial invertebrates are at high risk from chlorpyrifos. The risks to populations of exposed birds and mammals within the treatment areas are moderate. The program treatment areas are limited to citrus groves adjacent to grape vineyards. These conditions exist only on limited acreage where movement of terrestrial invertebrates from adjacent areas would be anticipated shortly after degradation of the chlorpyrifos. The impacts on populations of invertebrates are expected to be of short duration. The effects to honey bee could be considerable from these applications. Apiarists with hives in the vicinity of treatments with chlorpyrifos should be notified of the dates and locations of applications to allow them the opportunity to protect their hives from adverse effects of the applications.

Chlorpyrifos is very highly toxic to most aquatic invertebrates and fish. The quantitative risk assessment indicates that direct application to ponds or creeks places these species at high risk. The program area has very few bodies of water. If no pesticide applications are made within 25 feet of those irrigation ponds found within the program area (mitigation measure), the likelihood of adverse effects is considerably less. The estimated drift of chlorpyrifos from the quantitative risk assessment indicates that the vast majority of the residues fall within 25 feet of the target and limiting treatments to ground applications further controls the placement of pesticide. Applications should also be avoided if runoff is likely from anticipated heavy precipitation.

b. Cyfluthrin

(1) Fate

Cyfluthrin is considered immobile in soil. It has a half-life of 56 to 63 days in soils (EPA,OPP, 1987). Cyfluthrin photodegrades rapidly with a half-life of less than 2 days. It has low water solubility and a strong tendency to bioaccumulate in fish (EPA, OPP, 1987). Cyfluthrin has been found to accumulate in the sediments of aquatic ecosystems (Heimbach *et al.*, 1992). Runoff or drift of cyfluthrin to water bodies should be avoided. Residues can be taken up by plants and accumulate in crops. Residues can accumulate in animals, but the concentration decreases rapidly (half-life of 9 days) when there is no longer a source of exposure (EPA, 1991). Most residues of cyfluthrin are expected to land on leaves of citrus where persistence is not expected to exceed a few weeks. The primary degradation products of cyfluthrin are 4-fluoro-3- phenoxybenzaldehyde and 4-fluoro-3-phenoxybenzoic acid ((EPA, 1991).

(2) Toxicity

The mode of toxic action of cyfluthrin occurs through effects on the sodium channel to stimulate nerves to produce repetitive discharges. Muscle contractions are sustained until a block of the contractions occurs. Nerve paralysis occurs at high levels of exposure (Walker and Keith, 1992). Cyfluthrin is of moderate acute oral toxicity and of slight acute dermal toxicity to mammals (EPA, OPP, 1987). The primary degradation products are less toxic than the parent compound (EPA, 1991).

Chronic studies indicate a moderate level of toxicity. A two year feeding study of rats determined the systemic NOEL of cyfluthrin to be 2.5 mg/kg/day (EPA, OPP, 1987). Cyfluthrin is not a skin sensitizer. Chronic feeding and oncogenic studies at doses up to 22.5 mg/kg/day indicate that cyfluthrin is not an oncogen. Cyfluthrin tests for gene mutations, structural chromosome aberrations, and unscheduled DNA synthesis have negative outcomes (EPA, OPP, 1987). Effects of cyfluthrin on reproductive and developmental systems occur at doses in excess of systemic effects. The maternal NOEL determined for cyfluthrin is 3 mg/kg/day and the fetotoxic and teratogenic NOELs were both 30 mg/kg/day (EPA, OPP, 1987).

Oral doses of cyfluthrin are moderately toxic to mammals, practically non-toxic to birds, and moderately to severely toxic to terrestrial invertebrates (Table 3). Cyfluthrin is very highly toxic to fish and aquatic invertebrates (Table 4). Synthetic pyrethroids such as cyfluthrin should be kept out of water.

Table 3. Acute Oral LD_{50}s[1] for Selected Terrestrial Species Dosed with Cyfluthrin (mg/kg)

Rat	291
Bobwhite Quail	2000
Honey bee	0.12

[1]LD_{50} = Lethal dose for 50% of animals treated

Table 4. 96-hour LC_{50}s[1] for Selected Aquatic Species Exposed to Cyfluthrin (µg/L)

Channel catfish	1.5
Daphnia	0.00014
Grass shrimp	0.00024

[1]LC_{50} = Lethal concentration for 50% of animals treated

(3) Human Health

Potential exposure of humans to cyfluthrin is by dermal absorption, inhalation, or ingestion of residues. Exposure of the general public from program applications is expected to be infrequent due to the distance of treatment areas from residential locations and the restriction of all treatments to ground applications. Even the extreme and accidental exposure scenario analyzed in the quantitative risk assessment (USDA, APHIS, 2002) indicate negligible risks to the public. The risk assessment indicates slight to moderate risks to workers in the extreme exposure scenario if proper protective clothing is not worn and proper safety procedures are not adhered to. Adhering to these safety precautions ensures that workers are not adversely affected by cyfluthrin.

(4) Human Health

Oral doses of cyfluthrin are moderately toxic to mammals and practically non-toxic to birds. Unlike chlorpyrifos that poses moderate to high risks to these species, cyfluthrin poses negligible risks. The quantitative risk assessment (USDA, APHIS, 2002) does, however, indicate that cyfluthrin poses moderate to high risks for terrestrial invertebrates present and active within the treatment area. The limited program area and short duration of residual toxic action ensure that movement of invertebrates from untreated adjacent areas will be expected to repopulate the area shortly after degradation of cyfluthrin. The effects to honey bee could be considerable from these applications. Apiarists with hives in the vicinity of treatments with cyfluthrin should be notified of the dates and locations of applications to allow them the opportunity to protect their hives from adverse effects of the applications.

Cyfluthrin is very highly toxic to fish and aquatic invertebrates. The quantiative risk assessment indicates that direct application to ponds places all aquatic species at high risk and direct applications to streams place most species at high risk. The program area has very few bodies of water. If no pesticide applications are made within 25 feet of those irrigation ponds found within the program area (mitigation measure), the likelihood of adverse effects is considerably less. The estimated drift of cyfluthrin from the quantitative risk assessment indicates that the vast majority of the residues fall within 25 feet of the target and limiting treatments to ground applications further controls the placement of pesticide. Synthetic pyrethroids such as cyfluthrin should be kept out of water. Applications should also be avoided if runoff is likely from anticipated heavy precipitation.

c. Methomyl

(1) Fate

Methomyl applied to plants may be taken up or translocated to other parts of the plant. The half- life of methomyl on plants is 3 to 7 days (Hartley and Kidd, 1983; Menzie, 1980). Methomyl is readily degraded when exposed to sunlight (EPA, 1998). The low volatility of methomyl ensures that levels in air will decrease shortly after application. Unlike chlorpyrifos and cyfluthrin that bind readily to soil, methomyl has only slght to moderate binding to soil particles. Leaching to groundwater is, however, not an important issue in natural soils due to rapid degradation by microbial action. The half-life of methomyl in soil ranges from 3 to 6 weeks. Methomyl is highly water soluble and has a half-life in natural waters of about 6 days (NRC, 1977). Although readily absorbed from the skin, lungs, and gastrointestinal tract, methomyl is also readily excreted and poses little bioaccumulation.

(2) Toxicity

Methomyl is a carbamate insecticide that causes toxic effects by inhibition of acetylcholinesterase function at the synapse of certain nerves. Unlike the strong inhibition of chlorpyrifos, the binding of methomyl is more reversible and of shorter duration. At high doses, toxic effects may include headache, nausea, vomiting, blurred vision, weakness, and muscular twitching. Methomyl is of severe acute oral toxicity and slight acute dermal toxicity to human and mammals. Methomyl is not a primary skin or eye irritant. The metabolites and degradation products are less acutely toxic than the parent compound.

Chronic feeding studies indicate a moderate level of toxicity. The systemic NOEL of methomyl was determined to be 2.5 mg/kg/day based upon effects to kidney at higher doses in a two-year feeding study of dogs (EPA, 1998). Methomyl has not been shown to be a skin sensitizer or tp elicit unique immunotoxic responses. EPA has classified methomyl as not likely to be carcinogenic in humans via relevant routes of exposures based upon chronic feeding and oncogenic studies in mice (EPA, 1998). Methomyl has been shown to be negative in tests for mutagenic and genotoxic potential (EPA, OPP, 1989e). Tests of methomyl for teratogenicity and embryotoxicity were negative at the highest dose tested (400 ppm). The maternal NOEL for rats exposed to methomyl was determined to be 2 mg/kg/day (EPA, 1998).

Oral doses of methomyl are severely toxic to mammals and birds. Methomyl is moderately to severely toxic to terrestrial invertebrates (Table 5). Methomyl is moderately to highly toxic to fish and highly to very highly toxic to aquatic invertebrates (Table 6).

Table 5. Acute Oral LD_{50}s[1] for Selected Terrestrial Species Dosed with Methomyl (mg/kg)

Mouse	10
Rat	17
Bobwhite Quail	24.2
Mallard duck	42
Honey bee	0.9675

[1]LD_{50} = Lethal dose for 50% of animals treated

Table 6. 96-hour LC_{50}s[1] for Selected Aquatic Species Exposed to Methomyl (µg/L)

Channel catfish	300
Bluegill	370
Daphnia	7.6
Stonefly	60

[1]LC_{50} = Lethal concentration for 50% of animals treated

(3) Human Health

Potential exposure of humans to methomyl is by dermal absorption, inhalation, or ingestion of residues. Exposure of the general public from program applications is expected to be infrequent due to the distance of treatment areas from residential locations and the restriction of all treatments to ground applications. The extreme and accidental exposure scenarios analyzed in the quantitative risk assessment (USDA, APHIS, 2002) indicate negligible risks from methomyl exposure to the public. The risk assessment indicates moderate risks to workers in the extreme exposure scenario if proper protective clothing is not worn and proper safety procedures are not adhered to. Adhering to these safety precautions ensures that workers are not adversely affected by methomyl.

(4) Nontarget Species

Methomyl is severely toxic to mammals and birds. The quantitative risk assessment (USDA, APHIS, 2002) indicates that exposed mammals and birds are at moderate to high risk from methomyl. Terrestrial invertebrates are also at moderate to high risk. The program treatment areas are limited to citrus groves adjacent to grape vineyards. These conditions exist only on limited acreage where movement of organism to and from adjacent areas would be anticipated. The impacts on populations of invertebrates are expected to be of short duration and repopulation from adjacent areas would be expected shortly after degradation of the methomyl. The effects on honey bees, however, could be considerable from these applications. Apiarists with hives in the vicinity of treatments with methomyl should be notified of the dates and locations of applications to allow them the opportunity to protect their hives from adverse effects of the applications.

Methomyl is moderately to highly toxic to fish and highly to very highly toxic to aquatic invertebrates. The quantitative risk assessment indicates low risks to fish in creeks, but moderate risk to fish in ponds from exposure to methomyl in typical exposure scenarios. Aquatic invertebrates are at moderate risk in creeks and at high risk in ponds. The program area has very few bodies of water. If no pesticide applications are made within 25 feet of those irrigation ponds found within the program area (mitigation measure), the likelihood of adverse effects is considerably less. The estimated drift of methomyl from the quantitative risk assessment indicates that the vast majority of the residues fall within 25 feet of the target and limiting treatments to ground applications further controls the placement of pesticide. Applications should also be avoided if runoff is likely from anticipated heavy precipitation.

d. Pyrethrins

(1) Fate

Pyrethrins are unstable and degrade readily in all environmental media. Their persistence in soil is for only a few hours and leaching to groundwater is not an issue of concern. The low water solubility and low tendency to bioaccumulate make residual exposures unlikely. Although natural pyrethrins are highly fat soluble, they are readily degraded. Excretion of parent compounds and metabolites occurs through the urine and feces. Neither pyrethrin I nor pyrethrin II undergo any metabolism and are excreted unchanged. Other natural pyrethrins undergo rapid detoxification in the liver and gastrointestinal tract (Elliot *et al.*, 1972).

(2) Toxicity

The mode of toxic action of pyrethrins occurs through effects on the sodium channel to stimulate nerves to produce repetitive discharges. Muscle contractions are sustained until a block of the contractions occurs. Nerve paralysis occurs at high levels of exposure (Walker and Keith, 1992). Pyrethrins are of slight acute oral toxicity to humans and mammals. The metabolic and degradation products of pyrethrins are less acutely toxic than the parent compound.

The systemic NOEL based upon chronic feeding studies of rodents is 5 mg/kg/day. The Acceptable Daily Intake of pyrethrins established by the U.S. Food and Drug Administration for humans is 0.04 mg/kg body weight/day (Vettorazi, 1979). Pyrethrins are known to have allergenic properties that induce skin irritation, itching, pricking sensations, and local burning sensations that may last for about 2 days (Aldridge, 1990). None of the chronic feeding studies of pyrethrins are known to have resulted in any oncogenic properties, even at high doses. Pyrethrins are not considered to be mutagenic based upon negative results from Ames assays and genotoxic studies. Pyrethrins are not considered to be teratogenic. The reproductive and developmental NOEL of pyrethrins to rats is 50 mg/kg/day based upon adverse maternal effects at higher doses.

Oral doses of pyrethrins are slightly toxic to mammals and very slightly toxic to birds. Pyrethrins are moderately to severely toxic to terrestrial invertebrates (Table 7). Pyrethrins are very highly toxic to fish and aquatic invertebrates (Table 8).

Table 7. Acute Oral LD_{50}s[1] for Selected Terrestrial Species Dosed with Pyrethrins (mg/kg)

Mouse	370
Rat	200
Japanese Quail	7070
Mallard duck	10000
Honey bee	8.25

[1] LD_{50} = Lethal dose for 50% of animals treated

Table 8. 96-hour LC_{50}s[1] for Selected Aquatic Species Exposed to Pyrethrins (µg/L)

Channel catfish	8.96
Bluegill	39
Daphnia	5.0
Stonefly	1.0

[1] LC_{50} = Lethal concentration for 50% of animals treated

(3) Human Health

Potential exposure of humans to pyrethrins is by dermal absorption, inhalation, or ingestion of residues. Exposure of the general public from program applications is expected to be infrequent due to the distance of treatment areas from residential locations and the restriction of all treatments to ground applications. The extreme and accidental exposure scenarios analyzed in the quantitative risk assessment (USDA, APHIS, 2002) indicate negligible risks from pyrethrin exposure to the public. The risk assessment indicates slight risks to workers in the extreme exposure scenario if proper protective clothing is not worn and proper safety procedures are not adhered to. Adhering to these safety precautions ensures that workers are not adversely affected by pyrethrins.

(4) Nontarget Species

Oral doses of pyrethrins are slightly toxic to mammals and very slightly toxic to birds. Pyrethrins are moderately to severely toxic to terrestrial invertebrates. The quantitative risk assessment (USDA, APHIS, 2002) indicates that most exposed terrestrial wildlife are at low risk from the pyrethrin applications. However, direct exposure to honey bees should be prevented. Apiarists with hives in the vicinity of treatments with methomyl should be notified of the dates and locations of applications to allow them the opportunity to protect their hives from adverse effects of the applications.

Pyrethrins are very highly toxic to fish and aquatic invertebrates. The quantitative risk assessment indicates low risks to fish and aquatic invertebrates in flowing waters such as creeks, but moderate to high risks in ponds from exposure to pyrethrins. The program area has very few bodies of water. If no pesticide applications are made within 25 feet of those irrigation ponds found within the program area (mitigation measure), the likelihood of adverse effects is considerably less. The estimated drift of pyrethrins from the quantitative risk assessment indicates that the vast majority of the residues fall within 25 feet of the target and limiting treatments to ground applications further controls the placement of pesticide. Applications should also be avoided if runoff is likely from anticipated heavy precipitation.

2. Systemic Applications

The chemical pesticide approved for systemic treatment is imidacloprid. It is registered for application through chemigation, but analysis was also completed for potential soil treatments which are being developed for registration in the near future. Foliar applications of imidacloprid are in the process of registration for use in windbreaks adjacent to grape vineyards. The information about imidacloprid will cover the environmental fate, toxicity, potential human health risks, and nontarget species risks.

a. Imidacloprid

(1) Fate

The program applications involve chemigation, foliar treatment, and soil treatments that result in plant uptake of imidacloprid systemically. This movement in the growing parts of woody plants and trees may remain active for as long as 18 months. Although imidacloprid is readily taken up by the roots of plants, it is of low mobility in soil and leaching to groundwater is not a concern for the program applications. The half-life of imidacloprid in soil varies from 48 to 190 days depending upon the organic matter, ground cover, and plant uptake (Scholz and Spiteller, 1992). Imidacloprid is moderately soluble in water. The half-life of imidacloprid in water exceeds 31 days from pH 5 to pH 9. Imidacloprid has a moderate tendency to adsorb to sediments and would not remain suspended in water for long periods of time. Imidacloprid has low vapor pressure and little volatilization to the atmosphere is expected. Imidacloprid is readily absorbed from the gastrointestinal tract and eliminated via urine and feces (96% of the parent compound) within 48 hours (Kidd and James, 1991). The primary metabolite of concern is 6-chloronicotinic acid, a compound that can act on the nervous system. This compound is readily conjugated with glycine and eliminated or reduced to guanidine.

(2) Toxicity

Imidacloprid is a systemic, chloronicotinyl insecticide. The mode of toxic action of imidacloprid is unique and involves direct binding to the nicotinergic acetylcholine receptors (Storey, 1995). This binding causes a nerve impulse to be sent, but acetylcholinesterase enzyme is incapable of removing imidacloprid from the site. The receptor site becomes overstimulated and is eventually blocked. The nicotinergic site of action is more prevalent in insects than in higher organisms, so the toxicity is selectively more toxic to insects. Imidacloprid is of moderately acute oral toxicity and low acute dermal toxicity to humans and mammals. The metabolite, 6-chloronicotinic acid, is the primary active agent causing binding to the nicotinergic acetylcholine receptors, but this compound is readily conjugated with glycine or reduced with guanidine to less toxic metabolites.

Chronic toxicity of imidacloprid to mammals is low. The systemic NOEL of imidacloprid based upon a 2 year feeding study of male mice was determined to be 5.7 mg/kg/day based upon increased thyroid lesions at the next higher dose (EPA, 1995a). The neurotoxic NOEL to female rats was determined to be 20 mg/kg/day based upon adverse motor and locomotor activity at higher dose levels. Imidacloprid is not considered to be a skin sensitizer (Kidd and James, 1991). Based upon negative test results from a 2-year feeding study of rats at doses as high as 1,800 ppm, EPA has classified imidacloprid as having evidence of noncarcinogenicity to humans (EPA, 1995b). Imidacloprid may be weakly mutagenic based upon 2 positive test results in the 23 laboratory tests conducted. Positive results for causing changes in chromosomes in human lymphocytes and for causing genotoxic effects in Chinese hamster ovary cells were noted (EPA, 1995a). The NOEL for a three generation reproduction study of rats fed imidacloprid was determined to be 8 mg/kg/day.

Oral doses of imidacloprid are moderately toxic to mammals and birds. Imidacloprid is severely toxic to terrestrial invertebrates (Table 9). Imidacloprid is practically nontoxic to fish and slightly toxic to aquatic invertebrates (Table 10). Contamination of water with imidacloprid is not expected for the proposed program uses.

Table 9. Acute Oral LD_{50}s[1] for Selected Terrestrial Species Dosed with Imidacloprid (mg/kg)

Mouse	131
Rat	450
Bobwhite Quail	152
Honey bee	0.037

[1]LD_{50} = Lethal dose for 50% of animals treated

Table 10. 96-hour LC_{50}s[1] for Selected Aquatic Species Exposed to Pyrethrins (µg/L)

Rainbow trout	211.0
Carp	280.0
Daphnia	85.0

[1]LC_{50} = Lethal concentration for 50% of animals treated

(3) Human Health

Potential exposure of humans to imidacloprid is by dermal absorption, inhalation, or ingestion of residues. Exposure of the general public from program applications is expected to be negligible due to the distance of treatment areas from residential locations and the restriction of all treatments to chemigation and soil treatments. All exposure scenarios analyzed in the quantitative risk assessment (USDA, APHIS, 2002) indicate negligible risks from imidacloprid exposure to the public. The risk assessment indicates negligible risks to workers except in the scenario for accidental exposure. Risk in this accident exposure scenario can also be minimized if proper protective clothing is not worn and proper safety procedures are not adhered to. Adhering to these safety precautions ensures that workers are not adversely affected by imidacloprid.

(4) Nontarget Species

Oral doses of imidacloprid are moderately toxic to mammals and birds. Imidacloprid is severely toxic to terrestrial invertebrates. The quantitative risk assessment indicates that typical exposures of domestic animals, birds, and mammals to imidacloprid from program applications pose low risks. Typical exposures to exposed terrestrial invertebrates pose high risks. Most terrestrial invertebrates are unlikely to be exposed. There is high risk to soil organisms, wood-boring insects, and sap-feeding insects. There is negligible risk to honey bees and most terrestrial invertebrates not directly associated with treated woody plants or trees. The program treatment areas are limited to citrus groves adjacent to grape vineyards. These conditions exist only on limited acreage where movement of organisms to and from adjacent areas would be anticipated. The impacts on populations of exposed invertebrates are expected to be of relatively short duration and repopulation from adjacent areas would be expected shortly after degradation of the imidacloprid.

Imidacloprid is practically nontoxic to fish and slightly toxic to aquatic invertebrates. Contamination of water with imidacloprid is highly unlikely for the proposed program uses. No adverse effects to aquatic species are anticipated from systemic treatments with imidacloprid.

3. Other Issues

Other issues of concern to program treatments include effects to endangered and threatened species, cumuative impacts, site-specific issues, and methods employed to reduce risk. Each of these issues is discussed in this section.

a. Endangered and Threatened Species

The Endangered Species Act of 1973 (ESA) and its implementing regulations require Federal agencies to consult with the U.S. Department of the Interior's Fish and Wildlife Service (FWS) to ensure that their actions are not likely to adversely affect the continued existence of endangered or threatened species and their habitats. APHIS and California Department of Food and Agriculture have consulted with FWS , under provisions of section 7 of the ESA. California Natural Diversity Database indicates that no endangered or threatened species reside within the current program treatment area. However, endangered and threatened species occur in other parts of Kern and surrounding counties. In particular, APHIS is aware of the threatened Kern primrose sphinx moth that occurs in another part of the Kern County. If the program is expanded into other areas of those counties, and if there is a potential for affecting Federally listed or proposed endangered and threatened species, APHIS will consult with FWS over protective measures that may be required. No adverse impacts to endangered or threatened species, or their habitats, are foreseen.

b. Cumulative Impacts

Cumulative and synergistic effects are those adverse effects that result from exposures to more than one chemical or exposure to a given chemical more than once with a frequency that results in greater adverse effects than a single exposure. The potential for multiple exposures depends on site-specific conditions and persistence of the chemical or chemicals. Cumulative effects are those adverse effects from exposures that can be added together to indicate overall potential risk. Synergistic effects are those adverse effects from exposure to more than one compound that result in greater overall potential risk than the sum of the risks from individual exposures.

Synergism of the toxicity of carbamates (such as methomyl) and organophosphates (such as chlorpyrifos) is possible with exposure to other organophosphate and carbamate pesticides (Knaak and O'Brien, 1960; Segal and Fedoroff, 1989). Some organophosphates have been shown to be synergized by synthetic pyrethroids (Keil and Parrella, 1990). Toxicity of lindane and synthetic pyrethroids (such as cyfluthrin and pyrethrins) may be synergized by some other organochlorine and synthetic pyrethroid pesticides (Keplinger and Deichmann, 1967; Calabrese, 1991).

Neither cumulative nor synergistic effects are anticipated for the glassy winged sharpshooter program because participating growers are likely to minimize their pesticide applications to a frequency where adverse effects are not additive and the proximity the treatments of citrus groves during the dormant season of most crops is expected to be isolated in time and space from other sites of recent pesticide applications.

c. Site-specific Issues

The proposed program area is in citrus groves and the edges of adjacent grape vineyards in Kern County and adjacent counties in California. The treatment areas are limited and will only occur if trapping indicates a high enough population of GWSS to warrant control efforts. There are no noteworthy bodies of water near the pesticide application sites and there are no residential areas nearby. None of the treatment areas are close to major scenic or recreational areas. Los Padres National Forest is to the south, Sequoia National Forest is to the northeast, and Tule Elk State Park is to the north of current program sites. Program actions will be conducted to prevent adverse effects to these locations if actions should expand to locations close to these areas.

Consistent with Executive Order 12898, "Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations," APHIS considered the potential for disproportionately high and adverse human health effects on minority and low-income populations. The population of this area is diverse and lacks any characteristics that differ from the general population. There are, however, some areas that have minority communities within the county. There is at least one reservation for native Americans within Kern County. The program treatments are applied to minimize drift and occur at locations where the general public would not be expected. The safety precautions ensure that none of the workers will be adversely affected. Based upon the nature of the program, there is no evidence that any one population is likely to have disproportionate effects from program activities.

APHIS also recognizes that a proportion of the population may have unusual sensitivity to certain chemicals or environmental pollutants and that program treatments pose higher risks for these individuals. Consistent with Executive Order 13045, "Protection of Children From Environmental Health Risks and Safety Risks," APHIS considered the potential for disproportionately high and adverse health or safety effects to children. The potential risks from program actions were determined to pose no excess risk to children. The limited treatment area of the program in a rural setting makes exposure to program chemicals by children or highly sensitive individuals very unlikely.

The program alternatives were compared with respect to their potential for adverse effects to environmental quality, human health, and nontarget species. Selection of the no action alternative or the biological control alternative would not eliminate the need for growers to treat their citrus groves and grape vineyards to prevent excessive damage from GWSS. A coordinated area wide management program provides guidance to minimize the need to treat and thereby, lowers potential environmental impacts to the local area. The area wide management program can incorporate effective biological control agents to further reduce the need for pesticide application as this technology becomes available.

d. Methods To Reduce Risk

The proposed area wide management program includes a number of methods to mitigate adverse effects from pesticide applications. Adherence to these approaches ensures that adverse effects to the environment are minimized and effective program treatments are optimized.

1. All growers will be required to follow applicable Federal, State, and local environmental laws and regulations related to pesticide application.

2. All chemicals will be applied in strict accordance with the EPA- and State-approved label instructions.

3. All pesticides will be applied by hand-operated or motorized ground equipment, not aerial. This will decrease the potential for drift of pesticide residues.

4. Pesticide applications will be limited to citrus groves and plantings adjacent to grape vineyards. There will be no application to other sites. This restricts movement through drift and runoff to only those areas adjacent to the commodity to be protected.

5. Applicators and persons within the treatment area are required to wear protective clothing or remain inside a closed vehicle with recirculating air during pesticide applications.

6. Workers will be advised of the respective reentry periods following pesticide treatments and will not reenter without protective clothing prior to the completion of this period of time.

7. Applicators should cease treatments if unprotected members of the public are observed in the treatment area. Treatments may continue when such persons are no longer present.

8. Pesticide applications will not be made within 25 feet of any body of water. This 25 foot buffer prevents potential adverse effects to water quality, human health, and aquatic wildlife from drift and runoff of chemical residues.

9. To minimize drift and runoff (and increase efficacy), pesticide applications will not be made when any of the following conditions exist in the treatment area: wind velocity exceeding 10 mph (or less if required by State law), rainfall or imminent rainfall within 48 hours, air turbulence that could seriously affect the normal spray pattern, and temperature inversions that could lead to offsite movement of spray.

10. Before beginning foliar treatment, growers will notify any apiarists in the immediate vicinity of the planned date and approximate time of application to provide the apiarists an opportunity to protect their bees from potential adverse effects of pesticide exposure.

11. Before initiating operations, APHIS will obtain concurrence from the U.S. Department of the Interior's Fish and Wildlife Service on protective measures that are required for endangered and threatened species, or their critical habitat.

12. Environmental monitoring of the program for drift, runoff, and human health effects will be conducted in accordance with the current environmental monitoring plans.

C. Biological Control Only

The prospects for use of this alternative were described in the section on alternatives. The present effort to locate and assess viability of potential biological control agents is anticipated to require a year or more. The potential impacts relate to effects of release of the biological control agents and the methods of introducing them into the program area. No specific biological control agents are presently under consideration. Impacts associated with mass rearing of the biological control agent would need to be addressed when a specific agent is selected for implementation in the program.

1. Environmental Quality

Releases of biological control agents are of negligible direct impact to air quality, water quality, soil quality. The means of transport of biological control agents (aerial release or release from motor vehicles) does release hydrocarbons from combustion, but the small quantities of hydrocarbons are not anticipated to pose any impacts to local air quality.

2. Human Health

Releases of biological control agents is generally considered to pose no direct effects to humans. There are documented allergic reactions of humans to high exposures to insect body parts and fungi (which may serve as biological control agents), but this effect is fairly unlikely from a field release. Laboratory and rearing facilities require some protection from excessive exposure to insect body parts or fungal vegetative bodies. The potential exposures to hydrocarbons in air from the combustion processes during releases of biological control agents are negligible and would not differ from other routine daily exposures to hydrocarbons.

3. Nontarget Species

The host range of the biological control agents releases is an important consideration to indirect impacts on other insects and plants. Biological control agents are usually not limited to one host. Predators, parasites, and diseases of GWSS may also attack other nontarget species of insects. The adverse impact from these effects on species other than GWSS may result in decreases in pollinating insects or other beneficial species. These associated adverse effects to beneficial insects could harm survival of some plant species. Any decisions about the release of given biological control agents should address this issue.

4. Endangered and Threatened Species

The lack of selective targeting of biological control agents for only GWSS results in potential adverse effects to other nontarget species as described in the previous paragraph. Any contemplated releases of a non-native biological control agent will require Section 7 consultation with the U.S. Fish and Wildlife Service to ensure that no endangered and threatened species or their habitats will be adversely impacted by the release. Considering that the initial search for viable biological control agents is still in progress, any consultation will depend upon what the researchers are find and indications are that this search will require at least another year.

IV. Agencies, Organizations, and Individuals Consulted

California Department of Food and Agriculture
Department of Plant Industry
Sacramento, California

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Animal and Plant Health Inspection Service
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U.S. Department of Agriculture
Animal and Plant Health Inspection Service
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Environmental Services
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Finding of No Significant Impact
for
Glassy Winged Sharpshooter Area Wide Management Program
Kern County, California
Environmental Assessment
October 2001

The U.S. Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS) has prepared an environmental assessment (EA) that analyzes alternatives for area wide management of the glassy winged sharpshooter, a serious agricultural pest that has been found in Kern County, California. The EA, incorporated by reference in this document, is available from:

USDA, APHIS, PPQ Western Regional Office 1629 Blue Spruce, Suite 204 Ft. Collins, CO 80524	or	USDA, APHIS, PPQ Program Support 4700 River Road, Unit 134 Riverdale, MD 20737-1236

The EA for this program analyzed alternatives of (1) no action, (2) area wide management plan (the proposed alternative), and (3) biological control only. Each of those alternatives was determined to have potential environmental consequences. APHIS selected the area wide management plan as its approach for the proposed program because of its capability to achieve insect pest population reduction in a way that also reduces the magnitude of those potential environmental consequences.

APHIS has determined that this program will have no adverse impacts to endangered and threatened species based upon its review of proposed program operations, and upon review of consultations by the California Department of Food and Agriculture with the U.S. Department of the Interior, Fish and Wildlife Service (FWS).

I find that implementation of the proposed program will not significantly impact the quality of the human environment. I have considered and based my finding of no significant impact on the quantitative and qualitative risk assessments of the proposed pesticides and on my review of the program's operational characteristics. In addition, I find that the environmental process undertaken for this program is entirely consistent with the principles of "environmental justice," as expressed in Executive Order 12898 and the protection of children as expressed in Executive Order 13045. Lastly, because I have not found evidence of significant environmental impact associated with this proposed program, I further find that an environmental impact statement does not need to be prepared and that the program may proceed.

/s/
Lloyd E. Wendel
Program Manager

2/25/02
Date