CHAPTER 13

Greenhouse Gases and Climate Change

13.1 ENVIRONMENTAL SETTING

This chapter of the report summarizes the potential effects of the LBAM Eradication Program on climate change and global warming. It provides a discussion of what types of activities contribute to climate change and puts into context global, national, and state emissions of greenhouse gases (GHGs). This analysis is based on Appendix G, Evaluation of Greenhouse Gas Emissions.

13.1.1 Global Climate Change

Global warming and *global climate change* are terms that describe changes in the earth's climate. *Global climate change* is a broader term used to describe any worldwide, long-term change in the earth's climate. This change could be, for example, an increase or decrease in temperatures, the start or end of an ice age, or a shift in precipitation patterns. The term *global warming* is more specific and refers to a general increase in temperatures across the earth. Though global warming is characterized by rising temperatures, it can cause other climatic changes, such as a shift in the frequency and intensity of rainfall or hurricanes. Global warming does not necessarily imply that all locations will be warmer. Some specific, unique locations may be cooler even though the earth, on average, is warmer. All of these changes fit under the umbrella of global climate change.

While global warming can be caused by natural processes, general scientific consensus concurs that most current global warming is the result of human activity on the planet (IPCC 2007a). This human-made, or anthropogenic, warming is primarily caused by increased GHG emissions that keep the earth's surface warm, known as "the greenhouse effect." The greenhouse effect and the role GHGs play in it are described below.

13.1.2 The Greenhouse Effect

Greenhouses allow sunlight to enter and then capture some of the heat generated by the sunlight's impact on the earth's surface. The earth's atmosphere acts like a greenhouse by allowing sunlight in, and trapping some of the heat that reaches the earth's surface. When solar radiation from the sun reaches the earth, much of it penetrates the atmosphere to ultimately reach the earth's surface; this solar radiation is absorbed by the earth's surface and then re-emitted as heat in the form of infrared radiation.[1] Whereas the GHGs in the atmosphere let solar radiation through, the infrared radiation is trapped by GHGs, resulting in the warming of the earth's surface.[2]

The earth's greenhouse effect has existed far longer than humans have and has played a key role in the development of life. Concentrations of major GHGs, such as carbon dioxide (CO_2), methane (CH_4), nitrous

1 All light, be it visible, ultraviolet, or infrared, carries energy.

2 Infrared radiation is characterized by longer wavelengths than solar radiation. GHGs reflect radiation with longer wavelengths. As a result, instead of escaping back into space, GHGs reflect much infrared radiation (i.e., heat) back to earth.

oxide (N_2O), and water vapor (H_2O) have been naturally present for millennia at relatively stable levels in the atmosphere, adequate to keep temperatures on earth hospitable. Without these GHGs, the earth's temperature would be too cold for life to exist.

As human industrial activity has increased, atmospheric concentrations of certain GHGs have grown dramatically. In the absence of major industrial human activity, natural processes have maintained atmospheric concentrations of GHGs, and, therefore, global temperatures at constant levels over the last several centuries.[3] As GHG concentrations increase, more infrared radiation is trapped, and the earth is heated to higher temperatures. This process is described as human-induced global warming.

In 2007, the Intergovernmental Panel on Climate Change (IPCC)[4] began releasing components of its Fourth Assessment Report on Climate Change. In February 2007, the IPCC provided a comprehensive assessment of climate change science in its Working Group I Report (IPCC 2007a). It stated that scientific consensus concurs that the global increases in GHGs since 1750 are mainly due to human activities such as fossil fuel use, land use change (e.g., deforestation), and agriculture. In addition, the report stated that it is likely that these changes in GHG concentrations have contributed to global warming. Confidence levels of claims in this report have increased since 2001 due to the large number of simulations run and the broad range of available climate models.

13.1.3 Greenhouse Gases and Their Emissions

The term "greenhouse gases" includes gases that contribute to the natural greenhouse effect, such as CO_2, CH_4, N_2O, and H_2O, as well as gases that are only human-made and that are emitted through the use of modern industrial products, such as hydrofluorocarbons (HFCs), chlorinated fluorocarbons, and sulfur hexafluoride. These last two families of gases, while not naturally present, have properties that also cause them to trap infrared radiation when they are present in the atmosphere, thus making them GHGs. These six gases comprise the major GHGs that are recognized by the Kyoto Accords.[5] Other GHGs are not recognized by the Kyoto Accords, due chiefly to the smaller role that they play in climate change or the uncertainties surrounding their effects. One GHG not recognized by the Kyoto Accords is atmospheric H_2O concentrations because an obvious correlation does not exist between H_2O and specific human activities. H_2O appears to act in a feedback manner; higher temperatures lead to higher H_2O concentrations, which in turn cause more global warming (IPCC 2003).

The effect each of these gases has on global warming is a combination of the volume of their emissions and their global warming potential (GWP). GWP indicates, on a pound for pound basis, how much a gas will contribute to global warming relative to how much warming would be caused by the same mass of CO_2. CH_4 and N_2O are substantially more potent than CO_2, with GWPs of 21 and 310, respectively. However, these natural GHGs are nowhere near as potent as sulfur hexafluoride and fluoromethane, which have GWPs of up to 23,900 and 6,500, respectively (California Climate Action Registry 2008). GHG emissions are typically measured in terms of mass of carbon dioxide equivalent (CO_2e). CO_2e is calculated as the product of the mass of a given GHG and its specific GWP.

The most important GHG in human-induced global warming is CO_2. While many gases have much higher GWPs than the naturally occurring GHGs, CO_2 is emitted in such vastly higher quantities that it accounts for 85 percent of the GWP of all GHGs emitted by the U.S. (USEPA 2006e). Fossil fuel combustion, especially

[3] Examples of natural processes include the addition of GHGs to the atmosphere from respiration, fires, and decomposition of organic matter. The removal of GHGs is mainly from plant and algae growth and absorption by the ocean.

[4] The World Meteorological Organization and the United Nations Environment Programme established the Intergovernmental Panel on Climate Change (IPCC) in 1988; it is open to all members of the United Nations and World Meteorological Organization.

[5] This Kyoto Accord sets legally binding targets and timetables for cutting the GHG emissions of industrialized countries. The U.S. has not ratified the Kyoto treaty.

for the generation of electricity and powering of motor vehicles, has led to substantial increases in CO_2 emissions and, thus, substantial increases in atmospheric CO_2 concentrations. In 2005, atmospheric CO_2 concentrations were about 379 ppm, over 35 percent higher than the pre-industrial concentrations of about 280 ppm (IPCC 2007a). In addition to the sheer increase in the volume of its emissions, CO_2 is a major factor in human-induced global warming because of its long lifespan in the atmosphere of 50 to 200 years.

13.1.4 California Climate Impacts

Global temperature increases may have a series of significant negative impacts on the health of California residents and the California economy. One result of the higher temperatures caused by global warming may be compromised air quality. Warmer temperatures can cause more ground-level ozone, a pollutant that causes eye irritation and respiratory problems. California relies primarily on snowmelt for its drinking water and much of the water used in irrigation during the summer. Global warming could alter the seasonal pattern of snow accumulation and snowmelt and affect water supplies. Climatic changes would also affect agriculture, a major California industry, which could result in economic losses. For example, the heat wave in July 2006 is estimated to have cost the California dairy industry in excess of 1 billion dollars (California Office of the Governor 2006).

13.1.5 Global, National, and California GHG Emission Inventories

Worldwide emissions of GHGs in 2004 were over 20 billion metric tons (where one metric ton is equivalent to 1,000 kilograms) of CO_2e per year (United Nations Framework Convention on Climate Change 2004).[6] In 2004, the U.S. emitted about 7 billion metric tons of CO_2e or about 24 metric tons/year/person (USEPA 2007g). Over 80 percent of the GHG emissions in the U.S. are comprised of CO_2 emissions from energy-related fossil fuel combustion. In 2004, California emitted approximately 0.524 billion metric tons of CO_2e, or about 8 percent of the U.S. emissions. If California were a country, it would be the 16th largest emitter of GHGs in the world (California Energy Commission 2006).[7] This large number is due primarily to the sheer size of California. Compared to other states, California has one of the lowest per capita GHG emission rates in the country. This low rate is due to California's higher energy efficiency standards, its temperate climate, and its reliance on substantial out-of-state energy generation.

In 2004, 81 percent of GHG emissions (in CO_2e) from California comprised CO_2 emissions from fossil fuel combustion. CH_2 and N_2O accounted for 5.7 percent and 6.8 percent of total CO_2e, respectively, and high GWP gases[8] accounted for 2.9 percent of the CO_2e emissions. Transportation is by far the largest end-use category of GHGs. Transportation includes that used for industry (i.e., shipping) as well as residential use (USEPA 2006e).

13.1.6 Potential for Mitigation

In May 2007, the IPCC produced its Working Group III Report on the "scientific, technological, environmental, economic and social aspects" of mitigating climate change (IPCC 2007b). The report concluded that, with current climate mitigation and sustainable development practices and policies left unchanged, global GHG emissions will continue to grow over the next several decades. The amount of mitigation that will be economically achievable in the future will be tied to carbon prices. A summary of both bottom-up and top-down studies indicates that the global economic potential to mitigate GHGs by 2030 will range from 5 to 7 metric gigatons CO_2e per year (bottom-up estimate) if no carbon price exists, 9 to 18 metric

[6] Annex I countries without counting Land Use, Land-Use Change, and Forestry.
[7] Anywhere between the 12th and 16th depending upon methodology.
[8] Such as HFCs and chlorinated fluorocarbons.

gigatons CO_2e per year (top-down estimate) if the carbon price is set at $20 per metric ton CO_2e, or 17 to 26 metric gigatons CO_2e per year (top-down estimate) if the carbon price is set at $100 per metric ton CO_2e. The effects of significant GHG mitigation on global economic productivity could have a positive or negative effect. To stabilize atmospheric concentrations of GHGs in the range of 445 to 710 ppm CO_2e by 2050, the associated macroeconomic costs of multigas mitigation are estimated to be between a 1 percent gain in global gross domestic product and a 5.5 percent fall in global gross domestic product. If a lower GHG stabilization concentration is desired in the long term, mitigation activities in the next 2 to 3 decades will be the most crucial.

13.1.7 Regulatory Setting

Climate change is now widely recognized as a threat to the global climate, economy, and population. As a result, the climate change regulatory setting – federal, state, and local – is complex and evolving. Further complicating the issues, the LBAM Program is a temporary but statewide effort. It is more similar to a construction project than an industrial source in terms of the duration of the emissions. However, neither of those traditional source types typically encompasses projects with statewide emissions.

This section identifies key legislation, executive orders, and seminal court cases related to climate change that are most germane to the Program's GHG emissions. Regulations relating to GHG emissions and fuel combustion are the focus of this section, as regulations pertaining to energy conservation and land use are not relevant to this Program. A more comprehensive list is included in Appendix G, Section G3, Regulatory Setting.

13.1.7.1 Federal Action on Greenhouse Gas Emissions

In 2002, former President George W. Bush set a national policy goal of reducing the GHG emission intensity (tons of GHG emissions per million dollars of gross domestic product) of the U.S. economy by 18 percent by 2012. No binding reductions were associated with the goal. Rather, the USEPA administers a variety of voluntary programs and partnerships with GHG emitters in which the USEPA partners with industries producing and utilizing synthetic GHGs to reduce emissions of these particularly potent GHGs. Since taking office, the Obama administration has announced its intent to implement a cap-and-trade system to reduce GHG emissions 80 percent by 2050 (White House 2009); however, no cap-and-trade legislation has been passed at this time.

April 2007 Supreme Court Ruling

In *Massachusetts et al. vs. Environmental Protection Agency et al.* (April 2, 2007) the U.S. Supreme Court ruled that the Clean Air Act authorizes the USEPA to regulate CO_2 emissions from new motor vehicles. The Court did not mandate that the USEPA enact regulations to reduce GHG emissions, but found that the only instances where the USEPA could avoid taking action were if it found that GHGs do not contribute to climate change or if it offered a "reasonable explanation" for not determining that GHGs contribute to climate change. On July 11, 2008, the USEPA released an Advanced Notice of Proposed Rulemaking inviting comments on options and questions regarding regulation of GHGs under the Clean Air Act. This notice announced a 120-day public comment period that concluded on November 28, 2008.

USEPA Proposed "Endangerment Ruling"

On April 17, 2009, the USEPA issued a proposed determination that GHGs contribute to air pollution to the extent that may endanger public health or welfare. The 60-day public comment period on the finding ends June 23, 2009, after which, the USEPA will issue its final determination. An "endangerment finding" does not of itself trigger USEPA regulation of GHGs; rather, it would *enable* the USEPA to regulate GHGs under the Clean Air Act. Current debate exists as to whether climate change should be regulated by the USEPA under the Clean Air Act or by legislation. The Obama administration has indicated its preference for comprehensive legislation to address climate change.

Corporate Average Fuel Efficiency Standards

On May 19, 2009, the Obama administration announced a new national policy that would increase the fuel economy and reduce the GHG emissions from cars and trucks in the U.S. The proposed standards would require new cars to achieve an average emissions standard of 250 grams/mile CO_2 by 2016, with interim standards for models sold between 2012 and 2016.[9] The new corporate standards will be issued through collaboration between the USEPA and U.S. Department of Transportation. This policy addresses California's request to set its own GHG regulations. In effect, the nation will adopt California's fuel economy standards by 2016. The new policy would exceed previous Corporate Average Fuel Economy standards established by the Energy Independence and Security Act of 2007, which required an average fuel economy of 35 miles per gallon by model year 2020.

Reporting Requirements

On March 10, 2009, USEPA signed a proposed rule that would require mandating GHG reporting "for all sectors of the economy." The proposal was signed in response to a requirement in the 2008 Consolidated Appropriations Act, enacted in December 2007, that USEPA use its authority under the Clean Air Act to establish a mandatory GHG reporting system by June 26, 2009. Industries targeted by the USEPA's proposed rule generally include (1) facilities operating stationary combustion equipment units, (2) all phases of fossil fuel procurement and processing, (3) manufacturers and processors of iron, steel, aluminum, pulp and paper, chemicals, and industrial gases, (4) manufacturers of mobile sources, and (5) agriculture and waste management, including landfills, wastewater treatment, ethanol production, manure management, and food processing. Depending on the industry, the obligation to report may be triggered at different thresholds. In general, reporting is not necessary unless a facility or entity emits greater than or equal to 25,000 ton CO_2e. For 19 source categories, consisting mostly of large manufacturing operations like petroleum refineries, chemical manufactures, and cement production, reporting is required regardless of whether the 25,000-ton CO_2e threshold is met. Facilities with stationary combustion units would not have to report unless the aggregate maximum rated heat input capacity of the stationary combustion units is greater than or equal to 30 million British thermal units per hour.

The 60-day public comment period ended on June 9, 2009. Although the 2008 Consolidated Appropriations Act imposes a deadline of June 26, 2009, the USEPA will not be able to complete rulemaking by that date and anticipates finalizing its rule by the end of 2009.

13.1.7.2 Regional Agreements

Western Regional Climate Action Initiative

The Western Regional Climate Action Initiative is a partnership among seven states, including California, and four Canadian provinces, that is implementing a regional, economy-wide cap-and-trade system to reduce global warming pollution. This initiative will cap the region's electricity, industrial, and transportation sectors

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9 If the automotive industry were to achieve this standard purely through fuel economy, it would be equivalent to 35.5 miles per gallon. However, it is expected that companies will achieve this emissions standard with GHG savings from air-conditioning improvements as well. Thus, expected fuel economy is expected to be somewhat below 35.5 miles per gallon.

with the goal of reducing the heat-trapping emissions that cause global warming 15 percent below 2005 levels by 2020. California is working closely with the other states and provinces to design a regional GHG reduction program that includes a cap-and-trade approach. As mentioned in its Assembly Bill (AB) 32 Scoping Plan, the CARB plans to develop a cap-and-trade program that will link California and the other member states and provinces.

13.1.7.3 California Legislation

California has enacted a variety of legislation that relates to climate change, much of which sets aggressive goals for GHG reductions within the state. However, none of this legislation provides definitive direction regarding the treatment of climate change in environmental review documents. As discussed below, the OPR has been directed to develop guidelines for the mitigation of GHG emissions and their effects; CARB must adopt regulations by January 1, 2010. OPR recently released a guidance document, discussed below, for treatment of GHG under CEQA, but this document is purely advisory and serves as guidance only. In addition, on October 24, 2008, CARB released a draft staff proposal entitled *Recommended Approaches for Setting Interim Significance Thresholds for Greenhouse Gases under the California Environmental Quality Act* (Draft CARB Thresholds). A draft framework document, revised based on comments received, is not yet released. The Draft CARB Thresholds provide a framework for developing CEQA significance thresholds for industrial, commercial, and residential projects. But as of the release date of this document, many details remain unresolved and the CARB Thresholds document is still in draft form.

No local, state, or regional agency has promulgated binding regulations for the treatment of GHG analysis or mitigation in CEQA documents. However, some air districts are developing guidance on the analysis of GHGs for CEQA, including South Coast Air Quality Management District, Bay Area Air Quality Management District, Sacramento Metropolitan Air Quality Management District, and San Joaquin Valley Air Pollution Control District. The discussion below provides a brief overview of the CARB and OPR documents and of the primary legislation that relates to climate change that may affect the emissions associated with the Proposed Program.

Assembly Bill 32 (Statewide GHG Reductions)

The California Global Warming Solutions Act of 2006, widely known as AB 32, requires CARB to develop and enforce regulations for the reporting and verification of statewide GHG emissions. CARB is directed to set a GHG emission limit, based on 1990 levels, to be achieved by 2020. AB 32 sets a timeline for adopting a scoping plan for achieving GHG reductions in a technologically and economically feasible manner.

The heart of AB 32 is the requirement that statewide GHG emissions must be reduced to 1990 levels by 2020. California needs to reduce GHG emissions by approximately 25 percent below business-as-usual predictions of year 2020 GHG emissions to achieve this goal. AB 32 requires CARB to adopt rules and regulations in an open public process to achieve the maximum technologically feasible and cost-effective GHG reductions. Key AB 32 milestones are as follows:

- **June 30, 2007.** Identification of discrete early action GHG emission reduction measures. On June 21, 2007, CARB satisfied this requirement by approving three early action measures; they were later supplemented by adding six other discrete early action measures.
- **January 1, 2008.** Identification of the 1990 baseline GHG emission level and approval of a statewide limit equivalent to that level. Adoption of reporting and verification requirements concerning GHG emissions; the regulation was finalized in December 2008. On December 6, 2007, CARB approved a statewide limit on GHG emission levels for the year 2020 consistent with the determined 1990 baseline.

- **January 1, 2009.** Adoption of a scoping plan for achieving GHG emission reductions. CARB adopted the Proposed Scoping Plan at its December 11, 2008, meeting. The Proposed Scoping Plan outlines a suite of measures that CARB intends to implement to reach its 2020 and 2050 goals. These measures include the cap-and-trade program, energy efficiency, vehicle GHG standards, and water efficiency programs. The final Scoping Plan was approved by the CARB Executive Officer on May 7, 2009.
- **January 1, 2010.** Adoption and enforcement of regulations to implement the "discrete" actions.
- **January 1, 2011.** Adoption of GHG emission limits and reduction measures by regulation.
- **January 1, 2012.** GHG emission limits and reduction measures adopted in 2011 become enforceable.

Executive Order S-3-05 (Statewide GHG Targets)

California Executive Order S-03-05 (June 1, 2005) mandates a reduction of GHG emissions to 2000 levels by 2010, to 1990 levels by 2020, and to 80 percent below 1990 levels by 2050. Although the 2020 target is the core of AB 32, and has effectively been incorporated into AB 32, the 2050 target remains the goal of the Executive Order.

Low Carbon Fuel Standard

Executive Order S-01-07 (January 18, 2007) requires a 10 percent or greater reduction in the average fuel carbon intensity for transportation fuels in California regulated by CARB. CARB identified the Low Carbon Fuel Standard as a Discrete Early Action item under AB 32, and the draft regulation was released on October 10, 2008. The CARB approved the Low Carbon Fuel Standard on April 23, 2009.

Assembly Bill 1493 (Mobile Source Reductions)

AB 1493 requires CARB to adopt regulations by January 1, 2005, to reduce GHG emissions from noncommercial passenger vehicles and light-duty trucks of model year 2009 and thereafter. AB 1493 requires the California Climate Action Registry to develop and adopt protocols for the reporting and certification of GHG emission reductions from mobile sources for use by CARB in granting emission reduction credits. AB 1493 authorizes CARB to grant emission reduction credits for reductions of GHG emissions prior to the date of enforcement of regulations, using model year 2000 as the baseline for reduction.

In 2004, CARB applied to the USEPA for a waiver under the federal Clean Air Act to authorize implementation of these regulations. The waiver request was formally denied by the USEPA in December 2007 after California filed suit to prompt federal action. In January 2008, the State Attorney General filed a new lawsuit against the USEPA for denying California's request for a waiver to regulate and limit GHG emissions from these automobiles. In January 26, 2009, President Obama issued a directive to the USEPA to reconsider California's request for a waiver. While the decision is not yet overturned, the USEPA is expected to approve the waiver to implement AB 1493.

Senate Bill 375 (Land Use Planning)

Senate Bill (SB) 375 provides for a new planning process to coordinate land use planning and regional transportation plans and funding priorities to help California meet the GHG reduction goals established in AB 32. SB 375 requires regional transportation plans, developed by Metropolitan Planning Organizations, to incorporate a "sustainable communities strategy" in their regional transportation plans that will achieve GHG emission reduction targets set by CARB. SB 375 also includes provisions for streamlined CEQA review for some infill projects such as transit-oriented development. SB 375 will be implemented over the next several years.

SB 375 is similar to the Regional Blueprint Planning Program, established by the California Department of Transit, which provides discretionary grants to fund regional transportation and land use plans voluntarily developed by Metropolitan Planning Organizations working in cooperation with Council of Governments.

Senate Bill 97 (CEQA Guidelines)

SB 97 requires that OPR prepare guidelines to submit to the California Resources Agency regarding feasible mitigation of GHG emissions or the effects of GHG emissions as required by CEQA. The Resources Agency is required to certify and adopt these revisions to the CEQA Guidelines by January 1, 2010. The CEQA Guidelines will apply retroactively to any incomplete environmental impact report, negative declaration, mitigated negative declaration, or other related document. On April 13, 2009, OPR submitted to the Secretary for Natural Resources proposed amendments to the state CEQA Guidelines for GHG emissions. As currently proposed, these amendments state that the lead agency may consider the following when assessing the significance of impacts from GHG emissions on the environment:

- Extent the project may increase or reduce GHG emissions as compared to the existing environmental setting
- Extent the project complies with regulations or requirements adopted to implement a statewide, regional, or local plan for the reduction or mitigation of GHG emissions
- Extent project impacts or emissions exceed any threshold of significance

No specific methodologies for performing an assessment are indicated, but rather it is left to the lead agency to determine the appropriate methodologies in context of a particular project.

The proposed amendments state that lead agencies should consider all feasible means of mitigating GHG emissions that substantially reduce energy consumption or GHG emissions. These potential mitigation measures may include carbon sequestration and use of off-site measures such as offsets. No threshold of significance or any specific mitigation measures are indicated.

Office of Planning and Research Advisory on CEQA and Climate Change

In June 2008, the OPR published a technical advisory entitled *CEQA and Climate Change: Addressing Climate Change Through CEQA* (OPR Advisory). This guidance, which is purely advisory, proposes a three-step analysis of GHG emissions:

- **Mandatory Quantification of GHG Project Emissions.** The environmental impact analysis must include quantitative estimates of a project’s GHG emissions from different types of air emission sources. These estimates should include both construction-phase emissions and completed operational emissions, using one of a variety of available modeling tools.
- **Continued Uncertainty Regarding “Significance” of Project-Specific GHG Emissions.** Each EIR document should assess the significance of a project’s impacts on climate change. The OPR Advisory recognizes uncertainty regarding what GHG impacts should be determined to be significant and encourages agencies to rely on the evolving guidance being developed in this area. According to the OPR Advisory, the environmental analysis should describe a “baseline” of existing (pre-project) environmental conditions, and then add project GHG emissions on to this baseline to evaluate whether impacts are significant.

- **Mitigation Measures.** According to the OPR Advisory, "all feasible" mitigation measures or project alternatives should be adopted if an impact is significant, defining feasibility in relation to scientific, technical, and economic factors. If mitigation measures cannot sufficiently reduce project impacts, the agency should adopt whatever measures are feasible and include a fact-based statement of overriding considerations explaining why additional mitigation is not feasible. OPR also identifies a menu of GHG emission mitigation measures, ranging from balanced "mixed use" master-planned project designs to construction equipment and material selection criteria and practices.

In addition to this three-step process, the OPR Advisory contains more general policy-level guidance. It encourages agencies to develop standard GHG emission reduction and mitigation measures. The OPR Advisory directs CARB to recommend a method for setting the GHG emission threshold of significance, including both qualitative and quantitative options.

CARB Preliminary Draft Proposal: Recommended Approaches for Setting Interim Significance Thresholds for Greenhouse Gases under the California Environmental Quality Act (Draft CARB Thresholds)

In October 2008, CARB released a preliminary draft proposal for identifying CEQA thresholds of significance for industrial, commercial, and residential developments. They were updated in December 2008, by the release of draft preliminary guidelines on performance standards. The Draft CARB Thresholds propose a framework for developing thresholds of significance that rely upon the incorporation of a variety of performance measures to reduce GHG emissions associated with a project, as well as a numerical threshold of significance above which a project must include detailed GHG analysis in an EIR and incorporate all feasible mitigation measures. Although CARB proposed a 7,000-metric-ton-per-year threshold for industrial projects, a numerical threshold for commercial and residential projects was not proposed, but is under development. In addition, the Draft CARB Thresholds incorporate SB 375 by providing that commercial and residential projects that comply with a previously approved plan, which essentially satisfies SB 375 and for which a certified final CEQA document has been prepared, are presumed to have a less-than-significant impact related to climate change. The CARB thresholds have not been updated since December, and their future development is unclear.

13.1.7.4 Local Air Quality Plans and Policies

A number of California cities and counties have adopted or are in the process of adopting plans and initiatives to address climate change.[10] These plans typically include GHG emission reduction goals and provide specific implementation measures to achieve such goals. As mentioned above, some air districts are developing guidance on the analysis of GHG emissions under the context of CEQA. These districts include South Coast Air Quality Management District, Bay Area Air Quality Management District, Sacramento Metropolitan Air Quality Management District, and San Joaquin Valley Air Pollution Control District. Guidance from these air districts is under various stages of development and none has been finalized. Due to the large quantity of such plans, their evolving nature, the fact that climate change is a regional/global issue rather than a local one, and the LBAM Program's statewide emissions, this analysis focuses on available statewide guidelines.

[10] A representative, noncomprehensive list of local government plans has been compiled by the State of California Governor's Office of Planning and Research. Website (http://www.cted.wa.gov/DesktopModules/CTEDPublications/CTEDPublicationsView.aspx?tabID=0&ItemID=6166&MId=944&wversion=Staging) accessed on March 3, 2009.

13.2 ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

The GHG impacts evaluation is provided below. The evaluation quantitatively compares GHG emissions as a result of the Program alternatives with appropriate thresholds. Significant impacts are summarized for each alternative where one or more potential impacts were identified. The No Program Alternative is addressed qualitatively.

13.2.1 Evaluation Concerns and Criteria

Public agencies are required to identify potentially significant impacts on the environment resulting from proposed projects and to provide mitigation measures to significant impacts when feasible, typically accomplished by using a threshold of significance. A threshold of significance is generally a regulatory standard or set of criteria that quantifies the level at which a lead agency finds a particular environmental effect of a project to be significant. Effects less than the threshold of significance means the impact is considered less than significant.

As discussed in the previous section, the LBAM Program is temporary in nature, the emissions are generated throughout the state rather than in a single particular location, and they are largely attributable to transportation sources. GHG significance thresholds for such a Program have not been established. As such, *CEQA and Climate Change: Addressing Climate Change Through CEQA* (OPR 2008) was used, to assess the significance of the GHG emissions associated with the Program.

Following this guidance:

- GHG emissions are quantified for the Program alternatives.
- Various potential significance thresholds are assessed for applicability. However, none of the thresholds assessed were applicable and a more qualitative approach was followed (see below).
- Mitigation measures are identified.
- GHG emissions are quantified in Section 13.2.2, and mitigation measures are presented in Section 13.2.11. The significance thresholds are listed below.

13.2.1.1 Significance Thresholds

Three options were assessed for establishing significance thresholds for the GHG emissions:

1. GHG significance threshold set at zero.
2. GHG significance threshold set at a nonzero value.
3. No quantitative significance threshold is established, rather a qualitative determination is used.

Setting the GHG significance threshold at zero was considered and rejected for this analysis. Adopting a zero threshold would result in all projects with GHG emissions being determined to have a significant impact. In addition, it would not be feasible to mitigate all projects to less-than-significant thresholds as it would require mitigating 100 percent of all GHG emissions. Finally, there is no scientific basis lists to conclude that any GHG emissions from a single project would have a significant impact on global climate change. As a result of these considerations, and also considering the temporary nature of the Proposed Program, a significance threshold of zero was considered to be too conservative and would not be helpful in identifying a true significant impact for use in assessing this Program.

Setting the GHG significance thresholds at a nonzero value was also considered and rejected for this analysis. The primary rational for rejecting a nonzero value is the fact that no scientific information is available at this time to support a specific numeric value. While preliminary draft guidance has been developed by CARB, they are not final and may undergo substantial revision. SCAQMD has established thresholds for ongoing industrial sources of emissions; however, they would not be applicable to a temporary source such as this Program. Due to these considerations, a single nonzero value was not considered to be appropriate for assessing this Program.

For this GHG assessment, the third option was selected where a more qualitative approach was utilized. The qualitative analysis was based on two primary criteria:

- Will the Program GHG emissions prevent the state from meeting its 2020 GHG emissions reduction goals?
- Do the Program GHG emissions have the potential to contribute considerably to a long-term cumulative impact on climate change?

An answer of yes to either question would indicate the Program GHG emissions would be significant. To determine the answer to each question, the first step was to quantitatively determine the Program GHG emissions, as discussed in Section 13.2.2. The potential impacts of the GHG emissions are discussed in Sections 13.2.3 through 13.2.9. The potential for cumulative impacts are discussed in Section 13.2.9.

13.2.2 Evaluation Methods and Assumptions

13.2.2.1 Greenhouse Gas Emissions Methodology

Detailed discussions of the Program alternatives are provided in PEIR Chapter 2, Program Description. This assessment focuses on the GHG emissions associated with treatment options that may be implemented by the CDFA. As such, all of the Program alternatives, except the No Program Alternative, are included in this analysis. Note that GHG emissions would be associated with all treatment applications in the No Program Alternative. However, due to the large amount of uncertainty regarding what treatments may be applied by private landowners and operations, the methods of application, and most importantly the type of equipment that would be used and their fuel consumption, it was not possible to quantitatively assess the GHG emissions for the No Program Alternative. It is assumed that the GHG emissions from the No Program Alternative would be similar to those from Alternatives Btk and S on a per area basis. The GHG emissions and the analysis methodology are presented in detail in Appendix G, Section G5, Greenhouse Gas Emissions.

Units of Measure

GHGs include a wide variety of pollutants that contribute to the greenhouse effect in the atmosphere. GHG emissions can be measured in CO_2e by using the GWP of each pollutant. According to the European Environment Agency, the GWP is a metric used to compare emissions among GHGs. Million metric tons of carbon dioxide equivalent for a gas is derived by multiplying the metric tons of the gas by the associated GWP.

$$MMTCO_2e = (\text{million metric tons of a gas}) * (\text{GWP of the gas})$$

For example, according to the IPCC Second Assessment Report in 1996, the GWP for CH_4 is 21 and the GWP for N_2O is 310. These numbers mean that emissions of 1 million metric tons of CH_4 and N_2O are equivalent to emissions of 21 and 310 million metric tons of CO_2, respectively (European Environment Agency 2009).

GHG pollutants emitted by the Program during the time period of interest include CO_2 (GWP = 1), CH_4 (GWP = 21), N_2O (GWP = 310), and HFCs (GWP = 140 to 11,700) (USEPA 2002e). The USEPA recommends assuming the CH_4, N_2O, and HFCs account for 5 percent of GHG emissions from onroad vehicles, taking into account their GWPs (USEPA 2005c). Thus for the onroad sources in this assessment, CO_2 emissions from these sources were estimated and these emissions were scaled by 5 percent to account for non-CO_2 GHG emissions (i.e., CH_4, N_2O, and HFCs). For the portable offroad sources and aerial sources, CH_4 and N_2O emissions were estimated in addition to CO_2. For the remainder of this report, “GHG emissions” refer to the combined emissions of CO_2 and other non-CO_2 GHG gases (i.e., CH_4, N_2O, and HFCs [where applicable]).

Emission Sources

Potential GHG emission sources likely to result from Program implementation were identified and are assessed in the remainder of this report. GHG emissions from “business as usual” operations—such as building energy and water consumption for the CDFA and all of its contractors and maintenance activities for equipment associated with the Program—are not included in this assessment, as they are assumed to occur regardless of Program implementation. Life-cycle emissions were not accessed. Because the full life cycle of GHG emissions is not accounted for in available emission models, the information needed to characterize the GHG emissions from the manufacture, transport, and end of life of the treatment compounds would be speculative at the CEQA analysis level; such analysis is not recommended (California Air Pollution Control Officers Association 2008). Construction activities are not anticipated for this Program, so GHG emissions associated with construction have not been estimated. Similarly, GHG emissions associated with field verification activities such as sampling and trapping were not included. These activities are assumed to have low GHG emissions associated with them and the emissions would be comparable to the emissions from the field activities (especially trapping) that would occur if no Program alternatives were implemented. Thus, these activities would not represent a significant source of increased GHG emissions.

As indicated in Table 13-1, GHG emission sources associated with the Program and assessed in this analysis include:

- Offroad Sources
  - Spray pump mounted on hydraulic spray vehicles
- Onroad Sources
  - Passenger vehicles for workers commuting to and from central congregation points
  - Transportation trucks to transport ground-based and vehicle-based crews to and from Program sites
  - Trucks used in vehicle-based treatment applications (including the SPLAT spray vehicles and the hydraulic spray trucks)
  - Trucks used for vendor delivery of compounds/supplies to Program sites
- Aerial Sources
  - Airplanes used for spraying of mating disruption pheromones
  - Airplanes used for sterile insect releases

To determine which GHG emission source would be assessed for each treatment option, refer to Table 13-1. For example, Alternative MD-1 has a check mark under twist ties. Following that column upward indicates the GHG emission sources to be assessed include worker commute vehicles, vendor delivery vehicles, and worker transportation vehicles. Alternatively, for Alternative MD-3, worker commute vehicles, vendor delivery vehicles, and airplanes were included in the GHG emission estimates.

Table 13-1 Program Alternatives: Application Methods and Corresponding GHG Emission Sources

	Application Method								
	Aerial		Vehicle		Ground Crew				
GHG Emissions Source	Spray	Populated Area Release	Hydraulic	SPLAT	Hydraulic Backpack	Caulk Gun	Pod Gun	Twist Ties	Index Cards
Worker Commute Vehicles[1]	●	●	●	●	●	●	●	●	●
Vendor Delivery Vehicles[2]	●	●	●	●	●	●	●	●	●
Worker Transportation Vehicles[3]					●	●	●	●	●
Spray Vehicles[4]			●	●					
Airplanes	●	●							
Portable Offroad Equipment[5]			●						
Program Alternative									
Mating Disruption									
Twist Ties (MD-1)								●	
Ground Application (MD-2)[6]				●		●	●		
Aerial Application (MD-3)	●								
Male Moth Attractant (MMA)				●					
Organically Approved Insecticides (Btk and S)[6]			●		●				
Sterile Insect Technique (SIT)		●							
Inundative Parasitic Wasp Releases (Bio-P)									●

Notes:
1. Worker commute vehicles include workers travelling to/from home to a specific location, such as an airport or congregation point for worker transport vehicles.
2. Vendor delivery vehicles include transportation of materials/supplies (such as treatment compound, parasitic wasps, sterile insects, etc.) to job sites.
3. Worker transportation vehicle include transportation of ground-based crews from central congregation points to job sites.
4. Spray vehicles include transportation of vehicle-based crews from central congregation points to job sites as well as vehicle usage for treatment application.
5. Portable offroad equipment includes vehicle-mounted pump engines.
6. For the Program treatment alternatives that include both vehicle and ground application methods (MD-2 and Btk and S), only one method will be used if the alternative is chosen.

OFFROAD Model

Emission factors from OFFROAD were used to estimate CO_2, CH_4, and N_2O emissions from all gas-powered, portable offroad sources to be used in the Program (CARB 2009a). The CARB developed the OFFROAD model to estimate the relative contribution of gasoline-, diesel-, compressed-natural-gas, and liquefied-petroleum-gas-powered vehicles to the overall emission inventory of the state (CARB 2009b). OFFROAD generates emission inventories by equipment type, accounting for equipment age and calendar year.

Onroad Sources: EMFAC Model

The EMission FACtors (EMFAC) model is used to calculate emission rates from motor vehicles, such as passenger cars to heavy-duty trucks, operating on highways, freeways, and local roads in California (CARB 2009c). EMFAC allows the user to specify a variety of inputs to best characterize emissions from motor vehicles. The EMFAC model was run for calendar year 2010, the first full year in which Program alternatives may be implemented. Although Program alternatives will likely extend beyond 2010, future years will reflect improvements in fuel efficiency that will yield less conservative emission estimates, so only the most conservative 2010 calendar year was used. Based on the user inputs into EMFAC as well as round-trip distance traveled by each vehicle and number of vehicle trips per day for each vehicle category, total annual CO_2 running and starting exhaust emissions were estimated for the onroad fleet associated with the Program.

Aerial Sources: IPCC Emission Factors

The IPCC released its *Guidelines for National Greenhouse Gas Inventories* in 2006. Among other data, the IPCC guidance provides emission factors for various activities, including mobile sources and more specifically, civil aviation. IPCC Tier I CO_2 emission factors for civil aviation are based on fuel type and carbon content. Program airplanes were conservatively assumed to use jet kerosene, as the CO_2 emission factor for jet kerosene is higher than the CO_2 emission for aviation gasoline. Although literature suggests that little or no N_2O or CH_4 emissions occur from modern gas turbines (IPCC 1999), IPCC has developed Tier I emission factors for these pollutants. Emission factors for CH_4 and N_2O are developed based on the assumption that emissions will be approximately constant based on fuel consumption across all aircraft types. Uncontrolled emission factors for N_2O and CH_4 were used based on IPCC Tier I guidelines.

13.2.2.2 Greenhouse Gas Emissions

A summary of the GHG emission estimation methodology is presented in Section 13.2.2.1 and detailed discussions of the GHG emission estimates are located in Appendix G, Section G5, Greenhouse Gas Emissions. Annual GHG emissions were estimated for each Program alternative. A summary of the annual GHG emissions for each Program alternative, broken down by emissions source, is shown in Table 13-2.

Table 13-2 Summary of Greenhouse Gas Emissions

Program Alternative		Offroad Equipment	Onroad Vehicles	Airplanes	Total GHG Emissions[1]	Total GHG Emissions[2]
		[metric ton CO_2e/year]				[metric ton CO_2e/day]
Mating Disruption[3]						
Ground-Based Application (Caulk Gun / Pod Gun)	MD-2	0	320	0	320	1.0
Ground-Based Application (Twist-Ties)	MD-1	0	367	0	367	1.2
Vehicle-Based Application	MD-2	0	653	0	653	2.1
Aerial Application	MD-3	0	100	6,117	6,217	20
Male Moth Attractant	MMA	0	653	0	653	2.1
Organically Approved Insecticides						
Ground-Based Application	Btk and S	0	320	0	320	1.0
Vehicle-Based Application	Btk and S	43	320	0	363	1.2
Inundative Parasitic Wasp Releases	Bio-P	0	367	0	367	1.2
Sterile Insect Technique	SIT	0	100	6,117	6,217	20

Notes:
1. Total GHG emissions calculated as the sum of GHG emissions from offroad equipment, onroad vehicles, and airplanes.
2. Total GHG emissions per day is calculated by dividing the total GHG emissions (per year) by the number of days of treatment per year.
3. Aerial application for mating disruption may be conducted in conjunction with either ground-based application or vehicle-based application methods.

Wherever possible, information and data provided by the CDFA, its contractors, and others responsible for implementing the Program alternatives were utilized. This information is noted in both this section and Appendix G, Section G5, Greenhouse Gas Emissions. However, some of the information used in the GHG emission estimates is based on estimates and engineering judgment. The most appropriate estimates possible were made, and an emphasis was made to be conservative (i.e., to overestimate emissions) whenever appropriate to present a worst-case analysis to avoid underestimating impacts under CEQA. This section provides additional details on some of these estimates.

Offroad Equipment Emissions

The Program is expected to have emissions from gas-powered, portable offroad equipment, including spray pumps mounted on hydraulic spray vehicles. Table 13-3 details the annual GHG emissions for the equipment used in the Program. As indicated in Table 13-3, only Alternatives Btk and S have emissions from offroad equipment.

Table 13-3 Summary of Offroad Equipment Greenhouse Gas Emissions

Program Treatment Alternative	Application Method	Equipment	LBAM CO_2e Emissions [metric ton/ year]	LBAM CO_2e Emissions [metric ton/ day]
Organically Approved Insecticides (Btk and S)	Vehicle-Based - Hydraulic Spraying	Vehicle-Mounted Pump Engine	43	0.1

The OFFROAD model was employed to estimate emissions of CO_2, CH_4, and N_2O. Since OFFROAD incorporates default assumptions about horsepower, engine load, operating time, and equipment population, the output of the model was scaled to account for Program-specific information. Details for these calculations are provided in Appendix G, Section G5.1, Offroad Equipment Emissions, and Attachment G-1**.**

Onroad Sources Emissions

The Program has onroad source emissions from:

- Passenger vehicles for workers commuting to and from congregation points
- Transportation trucks to transport ground-based and vehicle-based application crews to and from Program sites
- Trucks used in vehicle-based treatment applications (including the SPLAT spray vehicles and the hydraulic spray trucks)
- Trucks used for vendor delivery of compound/supplies to Program sites

EMFAC was used to determine CO_2 emission factors from onroad fleet vehicles for a calendar year (these estimates use 2010, see the discussion in Section 13.2.2.1). EMFAC was run for all model years.

Vehicle speeds and distances traveled were determined using a combination of default and site specific values. When Program-specific data were unavailable, default values for all four types of onroad sources were obtained from the URBan EMISsions (URBEMIS) model, which draws upon compiled trip data taken from within California. However, site-specific values were used to estimate trip length and vehicle speed for the trucks used in vehicle-based treatment applications once the trucks have reached the Program site. Distances traveled by the hydraulic spray trucks and the ground application crew trucks and SPLAT vehicles during a day of application were estimated using the vehicle-based application coverage rates, provided by the CDFA, and a typical urban block size assumed to be traveled by the vehicles. The vehicles were assumed to travel at a much slower rate to accommodate the application of the compounds.

With the exception of hydraulic spray vehicles and transport vehicles associated with the ground-based application crews (using hydraulic backpacks, caulk guns, pod guns, twist ties, and index cards), all vehicles are assumed to have two starts per round-trip. Based on the assumption that hydraulic spray vehicles and vehicles used to transport ground-based application crews travel to approximately 6 to 10 properties per day, these vehicles were assumed to start approximately 10 times per round-trip. The startup emission factor depends on the settling period before driving, with longer settling periods generally resulting in higher emissions due to cold starting of the engine. Worker commute vehicles and worker transportation vehicles were assumed to remain idle 10 hours between starts, while hydraulic spray vehicles and transport vehicles used by the ground-based application crews were assumed to remain idle 50 minutes between starts (10 starts evenly spread out across an 8-hour workday). Vendor delivery vehicles were assumed to remain idle 4 hours between starts (2 starts evenly spread out across an 8-hour workday).

USEPA recommends assuming that CH_4, N_2O, and HFCs account for 5 percent of GHG emissions from onroad vehicles, taking into account their GWPs (USEPA 2005c). Thus, to estimate GHG emissions from onroad sources, CO_2 emissions were divided by 0.95 to obtain total GHG emissions (CO_2e) from onroad sources. Table 13-4 presents the GHG emissions for the onroad sources used in the Program. Details for these calculations are provided in Appendix G, Section G5.2, Onroad Sources Emissions, and Attachment G-2.

Table 13-4 Summary of Onroad Fleet Greenhouse Gas Emissions

Program Alternative	Emission Source	Application Method	Total CO_2e Emissions[1]	
			[metric ton/year]	[metric ton/day]
Mating Disruption	Worker Commute Vehicles	Aerial – Spray	95	0.3
		Vehicle – SPLAT	95	0.3
		Ground – Caulk Gun / Pod Gun	238	0.8
		Ground – Twist-Ties	286	0.9
	Worker Transport Vehicles – Transportation	Ground – Caulk Gun / Pod Gun / Twist-Ties	69	0.2
	Worker Transport Vehicles – Application		5	0.02
	Spray Vehicles – Spray	Vehicle – SPLAT	484	1.6
	Spray Vehicles – Transportation		67	0.2
	Vendor Delivery Vehicles	Aerial – Spray	4	0.01
		Vehicle – SPLAT	7	0.02
		Ground – Caulk Gun / Pod Gun / Twist-Ties	7	0.02
Total (assuming ground-based application [caulk gun / pod gun])			320	1.0
Total (assuming ground-based application [twist-ties])			367	1.2
Total (assuming vehicle-based application)			653	2.1
Total (assuming aerial-based application)			100	0.3
Male Moth Attractant	Worker Commute Vehicles	Vehicle – SPLAT	95	0.3
	Spray Vehicles – Spray	Vehicle – SPLAT	484	1.6
	Spray Vehicles – Transportation		67	0.2
	Vendor Delivery Vehicles	Vehicle – SPLAT	7	0.02
Total			653	2.1

Table 13-4 Summary of Onroad Fleet Greenhouse Gas Emissions

Program Alternative	Emission Source	Application Method	Total CO_2e Emissions[1] [metric ton/year]	Total CO_2e Emissions[1] [metric ton/day]
Organically Approved Insecticides	Worker Commute Vehicles	Vehicle – Hydraulic	238	0.8
		Ground - Hydraulic Backpack	238	0.8
	Worker Transport Vehicles - Transportation	Ground - Hydraulic Backpack	69	0.2
	Worker Transport Vehicles - Application	Ground - Hydraulic Backpack	5	0.02
	Spray Vehicles - Spray	Vehicle - Hydraulic	4	0.01
	Spray Vehicles - Transportation		70	0.2
	Vendor Delivery Vehicles	Vehicle – Hydraulic	7	0.02
		Ground - Hydraulic Backpack	7	0.02
Total (assuming ground-based application)			320	1.0
Total (assuming vehicle-based application)			320	1.0
Inundative Parasitic Wasp Releases	Worker Commute Vehicles	Ground - Index Cards	286	0.9
	Worker Transport Vehicles - Transportation	Ground - Index Cards	69	0.2
	Worker Transport Vehicles - Application		5	0.02
	Vendor Delivery Vehicles	Ground - Index Cards	7	0.02
Total			367	1.2
Sterile Insect Technique	Worker Commute Vehicles	Aerial - Populated Release	95	0.3
	Vendor Delivery Vehicles	Aerial - Populated Release	4	0.01
Total			100	0.3

Notes:

1. $CO_2e = CO_2 / 0.95$: USEPA (2005c) recommends assuming that CH_4, N_2O, and HFCs account for 5 percent of GHG emissions from onroad vehicles, taking into account their GWPs.
2. For Mating Disruption, ground-crew-based application includes twist ties, caulk guns, pod-guns, or other handheld applicators.
3. For Mating Disruption, the vehicle-based ground application is the SPLAT spray truck.
4. For Organically Approved Insecticides, ground-crew-based application is the hydraulic backpack sprayers.
5. For Organically Approved Insecticides, the vehicle-based ground application is the hydraulic spray truck.

References: CARB 2007a; USEPA 2005c

Aerial Sources Emissions

The Program has aerial source emissions from the airplanes used for spraying and for populated releases. Tier I emission factors from the *Guidelines for National Greenhouse Gas Inventories* (IPCC 2006) were used. The CO_2 emission factor is based on the combustion of jet kerosene, while the CH_4 and N_2O emission factors are based on combustion of all aviation fuels.

To estimate emissions from the airplanes, the airplanes were assumed to consume 64 gallons per hour, which represents an average fuel consumption rate provided by Dynamic Aviation (2005) for the PT6A-20 Pratt & Whitney engines anticipated to be used in the Beechcraft King Air A90. For both Alternatives MD-3 and SIT, four airplanes were assumed to operate statewide for 8 hours per day, 6 days per week, and 52 weeks per year (Schnabel 2009).

Emissions of CO_2, CH_4, and N_2O were summed for all airplanes operating each year, and then multiplied by their respective GWPs to determine CO_2e emissions. Table 13-5 presents the GHG emissions from aerial sources used in the Program. Details for these calculations are provided in Appendix G, Section G5.3, Aerial Sources Emissions, and Attachment G-3.

Table 13-5 Summary of Airplane Greenhouse Gas Emissions

Program Alternative	Application Method	CO_2e Emissions [metric ton/year]	CO_2e Emissions [metric ton/day]
Mating Disruption (MD-3)	Aerial – Spray	6,117	20
Sterile Insect Technique (SIT)	Aerial - Populated Release	6,117	20

13.2.2.3 Greenhouse Gas Emission Assumptions

The primary assumptions and uncertainties associated with the GHG assessment include the definition of the "Program boundary" and the assumptions required to determine the types and number of equipment used in the application processes. The first level of uncertainty lies in the selection of which sources to include in the GHG assessment, also known as defining the Program boundary. Potential GHG emission sources likely to result from Program implementation were identified as noted above. GHG emissions from "business as usual" operations—such as building energy and water consumption for the CDFA and all of its contractors and maintenance activities for equipment associated with the Program—are not included in this assessment, as they are assumed to occur regardless of Program implementation. In addition, life-cycle emissions were not accessed. Because the full life cycle of GHG emissions is not accounted for in available emission models, the information needed to characterize the GHG emissions from the manufacture, transport, and end of life of the treatment compounds would be speculative at the CEQA analysis level; such analysis is not recommended (California Air Pollution Control Officers Association 2008). The boundary for the various Program alternatives was set according to the best information available and best applicable methodology. However, either expanding or contracting the boundary (including or excluding emission sources) would change the magnitude of the estimated emissions and the resulting impacts.

In addition, as specific information was not available for all parameters, several assumptions were made in determining the source characteristics and parameters. These assumptions are discussed in detail in Appendix G, Section G5, Greenhouse Gas Emissions, and Attachments G-1, G-2, and G-3. Some of the key assumptions regarding parameters include:

- Although the CDFA provided an estimate for the number of units (crews, planes, vehicles), it is likely that uncertainty exists about the precise number of work crews and equipment that would be used statewide. It was assumed that the number of people per crew ranged from two to six, depending on application method. It was further assumed that no more than 50 percent of the total statewide crews would be active in any one air district on a given day. If the number of units or the number of people per crew were adjusted up or down, GHG emissions would change correspondingly.
- Equipment specifications for mobile sources were not provided, so assumptions were made to determine the vehicles sizes/types. For example, all work vehicles were assumed to be light heavy-duty trucks (8,501 to 10,000 pounds), while the hydraulic spray truck was modeled as a slightly heavier light heavy-duty truck (10,001 to 14,000 pounds). In addition, fuel type consumed and vehicle age were determined using statewide fleet averages from EMFAC. If the vehicles are different than those assumed for this assessment, the GHG emissions would be affected, although it is not possible to determine if the resulting emissions would be higher or lower.
- Vehicle speeds and distances traveled were determined using a combination of default and site-specific values. When Program-specific data were unavailable, default values were obtained from URBEMIS, which draws upon compiled trip data taken from within California. Distances traveled by the hydraulic spray trucks, the ground application crew trucks, and SPLAT vehicles during a day of application were estimated using the vehicle-based application coverage rates, provided by the CDFA, and a typical urban block size assumed to be traveled by the vehicles.

- All application methods were assumed to occur for 8 hours per day, 6 days per week, and 52 weeks per year. While this estimate of the time required is considered reasonable, GHG emissions would change if these values were adjusted up or down.

- The assessment of GHG emissions for the LBAM Program did not include a full Life Cycle Analysis (LCA). LCA is a method developed to evaluate the mass balance of inputs and outputs of systems and to organize and convert those inputs and outputs into environmental themes or categories. A LCA would assess the GHG emissions from the processes used to manufacture and transport materials used for the Program, mainly the treatment formulations. The LCA field is still relatively new, and while general standards for goals and general practices for LCAs (ISO 14044 and ISO 14040) exist, the specific methodologies and, in particular, the boundaries chosen for the LCA introduce considerable uncertainty and makes intercomparison of various studies difficult. In addition, the Attorney General of California has stated that "CEQA does not require independent research to trace back to its source every single material used in construction, but there is no reason that existing, readily available information about lifecycle emissions should not be included in the CEQA analysis" (Brown 2009). Although the LBAM Program does not have any construction associated with it, independent research on every single material used in the Program is not required for a CEQA analysis. Given that no information on the GHG emissions associated with the manufacture of the specific treatment formulations was available and the uncertainty associated with a LCA, such an assessment was not included in the GHG emission analyses.

13.2.2.4 Program Impacts

As discussed in Section 13.2.1.1, lacking a quantitative significance threshold, the Program impacts were assessed in a more qualitative manner by determining if the Program alternatives would prevent California from meeting its 2020 GHG emission reduction goals under AB 32. The GHG emissions from the various treatment options are presented in Table 13-2. In addition, Table 13-6 compares the Program GHG emissions to GHG alternatives and emissions in California, the U.S., and the world. Without a quantitative significance threshold, Table 13-6 puts the Program GHG emissions in perspective (which is also useful for consideration of cumulative impacts).

Table 13-6 Comparison of Program Greenhouse Gas Emissions to Relevant Benchmarks

	Alternative	2004 World CO_2e Emissions	2004 USA CO_2e Emissions	2004 California CO_2e Emissions
Benchmark Emissions [metric ton CO_2e/year][1]		3.20E+10	6.38E+09	5.24E+08
		Percentage of Benchmark CO_2e Emissions[2]		
Mating Disruption[2]				
Ground-crew-based Application (Caulk Gun/Pod Gun)	MD-2	0.000001%	0.000005%	0.00006%
Ground-crew-based Application (Twist Ties)	MD-1	0.000001%	0.000006%	0.00007%
Vehicle-based Application	MD-2	0.000002%	0.00001%	0.0001%
Aerial Application	MD-3	0.00002%	0.0001%	0.001%
Male Moth Attractant	MMA	0.000002%	0.00001%	0.0001%

Table 13-6 Comparison of Program Greenhouse Gas Emissions to Relevant Benchmarks

	Alternative	2004 World CO_2e Emissions	2004 USA CO_2e Emissions	2004 California CO_2e Emissions
Organically Approved Insecticides				
Ground-crew-based Application	Btk and S	0.000001%	0.000005%	0.00006%
Vehicle-based Application	Btk and S	0.000001%	0.000006%	0.00007%
Inundative Parasitic Wasp Releases	Bio-P	0.000001%	0.000006%	0.00007%
Sterile Insect Technique	SIT	0.00002%	0.0001%	0.001%

Sources: USEPA 2007g, CARB 2007b, UNFCCC 2004, UNFCCC 2005.

Notes:

1. World CO_2e emissions from United Nations Framework Convention on Climate Change data (UNFCCC 2004, 2005). Value includes Annex I and non-Annex I countries, including Land-Use, Land-Use Change and Forestry.
   USA CO_2e emissions from USEPA's *Inventory of US Greenhouse Gas Emissions and Sinks: 1990-2005* (USEPA 2007g). Value represents net USA emissions (including sources and sinks).
   California CO2e emissions from CARB's Draft California Greenhouse Gas Inventory by IPCC Category (CARB 2007b). Value represents net California emissions (including sources and sinks).
2. Aerial application may be conducted in conjunction with a ground application method. The ground application method has been split into two methods, either a ground crew-based application or vehicle-based application method.

The impacts for each Program alternative are discussed below. This assessment focuses on the GHG emissions associated with treatment options that may be implemented by the CDFA. As such, all of the Program alternatives, except the No Program Alternative, are included in this analysis.

13.2.3 No Program Alternative

GHG emissions would be associated with all treatment applications by the private sector in the No Program Alternative. However, due to the large amount of uncertainty regarding what treatments may be applied, the methods of application, and most importantly the type of equipment that would be used and their fuel consumption, it was not possible to quantitatively assess the GHG emissions for the No Program Alternative. It is assumed that the GHG emissions from the No Program Alternative would be similar to those from Alternatives Btk and S on a per area basis. Therefore, it is anticipated that the No Program Alternative would have the same impacts as Alternatives Btk and S, which are **less than significant**.

13.2.4 Mating Disruption (Alternative MD)

13.2.4.1 Twist Ties (Alternative MD-1)

Twist ties would be distributed using worker methods, which would result in GHG emissions from the vehicle operations taking them to and from the site.

Prevent the State from Meeting 2020 GHG Emission Reduction Goals

As shown in Table 13-2, the GHG emissions from the twist ties would emit 367 metric tons of CO_2e per year, which as shown in Table 13-6, represent 0.00007 percent of California's overall GHG emissions. The generation of the GHG emissions would be temporary as the emissions would terminate with the completion of the Program before 2020, when the state must meet AB 32 goals.

Impact GHG-1: Alternative MD-1 would generate GHG emissions, but their temporary nature and small contribution to the statewide inventory would not prevent the state from meeting its GHG emission reduction goals by 2020, and the impact is less than significant. Therefore, mitigation is not required.

Although mitigation is not required, the CDFA has decided to consider several optional mitigation measures to further reduce the small GHG impact. These mitigation measures are presented later in Section 13.2.11.

13.2.4.2 Ground Application (Alternative MD-2)

Alternative MD-2 would use worker and vehicle-based methods for application, which would result in GHG emissions from the engine operations.

Prevent the State from Meeting 2020 GHG Emission Reduction Goals

As shown in Table 13-2, the worst-case GHG emissions from Alternative MD-2 would result in 653 metric tons of CO_2e per year, which as shown in Table 13-6, represents 0.0001 percent of California's overall GHG emissions. The generation of the GHG emissions would be temporary as the emissions would terminate with the completion of the Program prior to 2020 when the state must meet AB 32 goals.

Impact GHG-2: Alternative MD-2 would generate GHG emissions, but their temporary nature and small contribution to the statewide inventory would not prevent the state from meeting its GHG emission reduction goals by 2020, and the impact is less than significant. Therefore, mitigation is not required.

Although mitigation is not required, the CDFA has decided to consider several optional mitigation measures to further reduce the small GHG impact. These mitigation measures are presented in Section 13.2.11.

13.2.4.3 Aerial Application (Alternative MD-3)

Alternative MD-3 would use aircraft for application, which would result in GHG emissions from the aircraft operations.

Prevent the State from Meeting 2020 GHG Emission Reduction Goals

As shown in Table 13-2, the GHG emissions from Alternative MD-3 would result in 6,217 metric tons of CO_2e per year, which as shown in Table 13-6, would represent 0.001 percent of California's overall GHG emissions. The generation of the GHG emissions would be temporary as the emissions would terminate with the completion of the Program before 2020, when the state must meet AB 32 goals.

Impact GHG-3: Alternative MD-3 would generate GHG emissions, but their temporary nature and small contribution to the statewide inventory would not prevent the state from meeting its GHG emission reduction goals by 2020, and the impact is less than significant. Therefore, mitigation is not required.

Although mitigation is not required, the CDFA has decided to consider several optional mitigation measures to further reduce the small GHG impact. These mitigation measures are presented in Section 13.2.11. However, mitigation measures for aerial applications have not been established or identified. The CDFA will continue to research the alternatives and will consider implementing mitigation measures for aerial application if appropriate mitigation measures are identified. In the meantime, the CDFA will consider obtaining carbon offsets for a portion of the GHG emissions associated with the aerial application.

13.2.5 Male Moth Attractant (Alternative MMA)

Alternative MMA would involve application of a LBAM-specific pheromone plus permethrin, distributed using vehicle-based methods, which would result in GHG emissions from the engine operations.

Prevent the State from Meeting 2020 GHG Emission Reduction Goals

As shown in Table 13-2, the worst-case GHG emissions from Alternative MMA would result in 653 metric tons of CO_2e per year, and as shown in Table 13-6, would represent 0.0001 percent of California's overall GHG emissions. The generation of the GHG emissions would be temporary as the emissions would terminate with the completion of the Program prior to 2020 when the state must meet AB 32 goals.

Impact GHG-4: Alternative MMA would generate GHG emissions, but their temporary nature and small contribution to the statewide inventory would not prevent the state from meeting its GHG emission reduction goals by 2020, and the impact is less than significant. Therefore, mitigation is not required.

Although mitigation is not required, the CDFA has decided to consider several optional mitigation measures to further reduce the small GHG impact. These mitigation measures are presented in Section 13.2.11.

13.2.6 Organically Approved Insecticides (Alternatives Btk and S)

Organically approved pesticides under Alternatives Btk and S would be distributed using worker and vehicle-based methods, which would result in GHG emissions from the engine operations.

Prevent the State from Meeting 2020 GHG Emission Reduction Goals

As shown in Table 13-2, the worst-case GHG emissions from Alternatives Btk and S would result in 363 metric tons of CO_2e per year, which as shown in Table 13-6, would represent 0.00007 percent of California's overall GHG emissions. The generation of the GHG emissions would be temporary as the emissions would terminate with the completion of the Program before 2020, when the state must meet AB 32 goals.

Impact GHG-5: Alternatives Btk and S would generate GHG emissions, but their temporary nature and small contribution to the statewide inventory would not prevent the state from meeting its GHG emission reduction goals by 2020, and the impact is less than significant. Therefore, mitigation is not required.

Although mitigation is not required, the CDFA has decided to consider several optional mitigation measures to further reduce the small GHG impact. These mitigation measures are presented in Section 13.2.11.

13.2.7 Inundative Parasitic Wasp Releases (Alternative Bio-P)

Parasitic wasps would be distributed using worker methods, which would result in GHG emissions from the vehicle operations taking them to and from the site.

Prevent the State from Meeting 2020 GHG Emission Reduction Goals

As shown in Table 13-2, the GHG emissions from Alternative Bio-P would result in 367 metric tons of CO_2e per year, which as shown in Table 13-6, would represent 0.00007 percent of California's overall GHG emissions. The generation of the GHG emissions would be temporary as the emissions would terminate with the completion of the Program prior to 2020, when the state has to meet AB 32 goals.

Impact GHG-6: Alternative Bio-P would generate GHG emissions, but their temporary nature and small contribution to the statewide inventory would not prevent the state from meeting its GHG emission reduction goals by 2020, and the impact is less than significant. Therefore, mitigation is not required.

Although mitigation is not required, the CDFA has decided to consider several optional mitigation measures to further reduce the small GHG impact. These mitigation measures are presented in Section 13.2.11.

13.2.8 Sterile Insect Technique (Alternative SIT)

Alternative SIT would use aircraft for aerial application, which would result in GHG emissions from the aircraft operations.

Prevent the State from Meeting 2020 GHG Emission Reduction Goals

As shown in Table 13-2, the GHG emissions from Alternative SIT would result in 6,217 metric tons of CO_2e per year, which as shown in Table 13-2, would represent 0.001 percent of California's overall GHG emissions. The generation of the GHG emissions would be temporary as the emissions would terminate with the completion of the Program prior to 2020, when the state must meet AB 32 goals.

Impact GHG-7: Alternative SIT would generate GHG emissions, but their temporary nature and small contribution to the statewide inventory would not prevent the state from meeting its GHG emission reduction goals by 2020, and the impact is less than significant. Therefore, mitigation is not required.

Although mitigation is not required, the CDFA has decided to consider several optional mitigation measures to further reduce the small GHG impact. These mitigation measures are presented in Section 13.2.11. However, mitigation measures for aerial applications have not been established or identified. The CDFA will continue to research the alternatives and will consider implementing mitigation measures for aerial application if appropriate mitigation measures are identified. In the meantime, the CDFA will consider obtaining carbon offsets for a portion of the GHG emissions associated with the aerial application.

13.2.9 Cumulative Impacts

Scientific consensus concurs that global climate change will increase the frequency of heat extremes, heat waves, and heavy precipitation events. Currently accepted models predict that continued GHG emissions at or above current rates will induce more extreme climate changes during the 21st century than were observed during the 20th century. A warming of about 0.2°C per decade is projected. Even if the concentrations of all GHGs and aerosols are kept constant at year 2000 levels, a further warming of about 0.1°C per decade would be expected. A faster temperature increase will lead to more dramatic, and more unpredictable, localized climate extremes. Other likely direct effects of global warming include an increase in the areas affected by drought, an increase in tropical cyclone activity and higher sea level, and the continued recession of polar ice caps. Already some identifiable signs exist that global warming is taking place. In addition to substantial ice loss in the Arctic, the top 7 warmest years since the 1890s have been after 1997 (IPCC 2007a, 2007c).

The overall global climate change will be of social and economic losses. These negative effects will likely be disproportionately shouldered by the poor who do not have the resources to adapt to a change in climate. Some of the main ecosystem changes anticipated are that biodiversity of terrestrial and freshwater ecosystems could be reduced and that the ranges of infectious diseases would likely increase.

Cumulative impacts were assessed in a qualitative manner by determining if the Program alternatives, in conjunction with other projects throughout the Program Area, would have the potential to contribute to a long-term cumulative impact on climate change. Given that GHG emissions and climate change are global issues, a statewide framework or cumulative approach for consideration of environmental impacts may be most appropriate. Virtually every project in the state of California, as well as those outside the state, would have GHG emissions.

All Program alternatives would generate some GHG emissions individually but would not conflict with present regulations, even if ground and aerial methods are used on the same day, subject to plane (4) and ground crew (12) limitations. No potentially significant impact would occur as a result of any of the Program alternatives, and mitigation is not required for GHGs and climate change. However, optional mitigation measures for Alternatives MD-1, MD-2, MMA, Btk and S, and Bio-P are listed in Section 13.2.11. Even with mitigation, these alternatives would generate GHG emissions and incrementally contribute to climate change but only in the short term.

When all Program emissions are viewed in combination with global emissions levels that are contributing to the existing cumulative impact on global climate change, the incremental contribution of these Program emissions would not be cumulatively considerable because they occur in the short term and would conclude by 2015. Therefore, all Program alternatives (either individually or in combination) would not have a cumulatively considerable impact on global climate change. If optional mitigation measures are implemented, the Program alternatives' incremental contribution would be reduced further.

Mitigation measures for MD-3 and SIT, which involve aerial applications, have not been established or identified. However, the CDFA will continue to research the alternatives and will consider implementing mitigation measures for aerial application if appropriate mitigation measures are identified. In the meantime, the CDFA will consider obtaining carbon offsets for a portion of the GHG emissions associated with the aerial application, which is discussed further in Section 13.2.11 below.

13.2.10 Environmental Impacts Summary

Table 13-7 is a summary comparison of all the potential GHG impacts, including no impacts, associated with No Program and Program alternatives in comparison to existing conditions. The number of each statement correlates to its number in the text.

Table 13-7 Summary Comparison of Impacts of Alternatives

Impact Statement	No Program	MD-1	MD-2	MD-3	MMA	Btk and S	Bio-P	SIT
Greenhouse Gases and Climate Change								
Prevent the State from Meeting 2020 GHG Emission Reduction Goals	LS	LS	LS	LS	LS	LS	LS	LS
Impact GHG-1: Alternative MD-1 would generate GHG emissions, but their temporary nature and small contribution to the statewide inventory would not prevent the state from meeting its GHG emission reduction goals by 2020, and the impact is less than significant.	na	LS	na	na	na	na	na	na
Impact GHG-2: Alternative MD-2 would generate GHG emissions, but their temporary nature and small contribution to the statewide inventory would not prevent the state from meeting its GHG emission reduction goals by 2020, and the impact is less than significant.	na	na	LS	na	na	na	na	na
Impact GHG-3: Alternative MD-3 would generate GHG emissions, but their temporary nature and small contribution to the statewide inventory would not prevent the state from meeting its GHG emission reduction goals by 2020, and the impact is less than significant.	na	na	na	LS	na	na	na	na
Impact GHG-4: Alternative MMA would generate GHG emissions, but their temporary nature and small contribution to the statewide inventory would not prevent the state from meeting its GHG emission reduction goals by 2020, and the impact is less than significant.	na	na	na	na	LS	na	na	na
Impact GHG-5: Alternatives Btk and S would generate GHG emissions, but their temporary nature and small contribution to the statewide inventory would not prevent the state from meeting its GHG emission reduction goals by 2020, and the impact is less than significant.	na	na	na	na	na	LS	na	na
Impact GHG-6: Alternative Bio-P would generate GHG emissions, but their temporary nature and small contribution to the statewide inventory would not prevent the state from meeting its GHG emission reduction goals by 2020, and the impact is less than significant.	na	na	na	na	na	na	LS	na
Impact GHG-7: Alternative SIT would generate GHG emissions, but their temporary nature and small contribution to the statewide inventory would not prevent the state from meeting its GHG emission reduction goals by 2020, and the impact is less than significant.	na	na	na	na	na	na	na	LS

Key:

LS = Less-than-significant impact
N = No impact
na = Not applicable
PS = Potentially significant impact (Applies to No Program only. Program alternatives have either feasible mitigations or unavoidable impacts.)
SM = Potentially significant but mitigable impact
SU = Potentially significant and unavoidable impact

13.2.11 Mitigation and Monitoring

The CDFA and its contractors may implement the following optional measures to reduce GHG emissions from fuel combustion due to employee commuting:

- **Mitigation Measure GHG-1:** Provide storage and parking facilities for bicycles.
- **Mitigation Measure GHG-2:** Subsidize costs for workers to take public transportation or participate in ride-sharing programs.
- **Mitigation Measure GHG-3:** Offer preferential parking for electric, hybrid, or alternative low-carbon fuel vehicles.

The CDFA and its contractors may implement the following optional measures to reduce GHG emissions from fuel combustion in the working vehicles:

- **Mitigation Measure GHG-4:** Check and reinflate tires at regular intervals.
- **Mitigation Measure GHG-5:** Use lower-carbon fuels such as biodiesel blends where feasible.
- **Mitigation Measure GHG-6:** Encourage ride-sharing when transporting work crews from the base of operations to the job site.
- **Mitigation Measure GHG-7:** Limit idling time of all vehicles and equipment.
- **Mitigation Measure GHG-8:** Service and maintain equipment according to manufacturer's instructions to remain in good working order.

Finally, as discussed in Sections 13.2.4.3 and 13.2.8, no GHG emission mitigation measures are established for airplanes. As a result, the CDFA will consider obtaining offsets for a portion of the estimated GHG emissions due to aerial sources. To fully offset Alternative MD-3 or SIT would cost approximately $56,000. However, the CDFA may decide to offset only a portion of the overall emissions, or, in addition to the aircraft offsets, the CDFA may choose to offset portions of its GHG emissions from the other Program alternatives. At approximately $9 per metric ton of CO_2e, the range of offset costs varies depending on which alternative and how much would be offset. These offsets would be obtained from an accredited and verifiable source, such as a member of the Chicago Climate Exchange.