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Small **hydropower** projects are used in locations where water resources are already disturbed. They do not consume additional water resources, impair water quality, or create waste waters.

### **Coal Emission Reduction Standard (Under Evaluation)** **Up to 8 MMT CO<sub>2</sub>E**

Coal-fired turbine-generator plants use water for condenser cooling, boiler make-up water, flue gas desulfurization system spray, ash transport and other plant uses. Non-consumptive water use averages 25,000 gallons per MWh, while consumptive water use averages 470 gallons per MWh. Coal mining can result in acid mine drainage or pools of poor-quality water, brought to the surface by mining activities. The employment of carbon capture storage systems would further increase water resource impacts.

If reducing coal emissions results in a transition to sources of energy with lower water demands, water resource benefits could occur both by reducing water demands and resultant wastewaters.

## **7. INDUSTRY**

### **Regulatory Background**

Before a facility can be constructed, it must obtain permits to emit air pollutants, use water resources, and to develop land. For water supply, water quality and wastewater, the stationary source must comply with:

To obtain water service or a water right, applications are made to the appropriate local water provider or the State Water Resources Board. Water administered by a local agency may be obtained through an application process which may or may not require an environmental review. It may also require the facility to prove it meets a specified degree of water conservation. Water regulated by the state requires a **water right**, which is a lengthy public application process that requires CEQA compliance.

To obtain wastewater service or a permit to discharge to surface waters, applications are made to the appropriate local wastewater provider or the State Water Resources Board. Local wastewater providers will require an engineering analysis to support issuance of a **Permit to Discharge** into the municipal sewer service.<sup>34</sup> Industrial facilities can also fall under a local agency's wastewater **Pretreatment Program**, which may require additional onsite pre-treatment of industrial wastewaters. Facilities with **Zero-Discharge Waste** systems may also have to obtain a local permit. Facilities that wish to discharge wastewater directly into surface waters must comply with the **National Pollutant Discharge Elimination System**, which is administered by the State Water Resources Control Board. This permit restricts magnitude and quality of discharges to avoid degradation of the receiving water body.

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<sup>34</sup> In this case, the municipal wastewater treatment plant is the holder of the state permit to discharge to surface waters.

Depending on the scale and nature of water and wastewater associated with a facility, it may have to comply with **CEQA** to support its permit applications. CEQA requires proposed industrial facilities to analyze and describe the potential for environmental impacts, identify ways to reduce adverse impacts and offer alternatives to the project, and to disclose this information to the public. A Local, Regional, or State government agency serves as the lead or responsible agency for a CEQA document. Local, Regional, and State government agencies also both establish guidance for CEQA analyses and review documents for consistency with established plans and regulations. This process examines projects for localized impacts and proposes measures to mitigate significant impacts.

### **(I-1) Energy Efficiency and Co-Benefits Audits for Large Industrial Sources**

**TBD MMTCO<sub>2</sub>E**

This measure is not anticipated to affect water resources, unless measures are identified and implemented that improve energy efficiency through improving water use efficiency.

### **Carbon Intensity Standard for Cement Manufacturers (Under Evaluation)**

**1.1-2.5 MMTCO<sub>2</sub>E**

### **Carbon Intensity Standard for Concrete Batch Plants (Under Evaluation)**

**2.5-3.5 MMTCO<sub>2</sub>E**

### **Waste Reduction in Concrete Use (Under Evaluation)**

**0.5-1 MMTCO<sub>2</sub>E**

Energy efficiency and blended cements are not expected to impact water resources. As with any sector where biofuels are being considered as alternatives to fossil fuels there is the potential to impact water supply and water quality.

### **Refinery Energy Efficiency Process Improvement (Under Evaluation)** **2-5 MMTCO<sub>2</sub>E**

This measure is not anticipated to affect water resources, unless measures are identified that improve energy efficiency through improving water use efficiency.

### **Removal of Methane Exemption from Existing Refinery Regulations (Under Evaluation)**

**0.01-0.05 MMTCO<sub>2</sub>E**

This measure would not affect water resources, as methane is an air emission.

### **Oil and Gas Extraction GHG Emission Reduction (Under Evaluation)** **1-3 MMTCO<sub>2</sub>E**

### **GHG Leak Reduction from Oil and Gas Transmission (Under Evaluation)**

**0.5-1.5 MMTCO<sub>2</sub>E**

This measure is not anticipated to affect water resources, as this measure addresses combustion and air emissions.

### **Industrial Boiler Efficiency (Under Evaluation)**

**0.5-1.5 MMTCO<sub>2</sub>E**

This measure is not anticipated to affect water resources.

### **Stationary Internal Combustion Engine Electrification (Under Evaluation-Revised)**

**0.1-0.05 MMTCO<sub>2</sub>E**

Under this measure that is under evaluation, electrification or distributed generation (combined heat and power systems) would replace some large fossil-fuel based combustion engines at

industrial facilities. Water effects would depend upon both the engine being replaced and the new source of electricity, but overall the impact on water resources is expected to be minimal.

**Glass Plant Energy Efficiency—Equipment Efficiency and Use of Recycled Materials**

**(Under Evaluation)**

**0.1-0.2 MMTCO<sub>2</sub>E**

This measure is not anticipated to affect water resources.

**Off-Road Equipment (Under Evaluation)**

**Up to 0.5 MMTCO<sub>2</sub>E**

This measure is not anticipated to affect water resources.

## **D. NATIVE SPECIES AND BIOLOGICAL RESOURCES**

Currently there are 58 species on the endangered list in California. Growing population and associated development will also continue to stress California's native species and biological resources, by removing or impairing habitat, or severing habitat corridors. By 2020, several listed or endangered species have the potential to become extinct due to the continued degradation of the natural system. Pressures from population growth come from the development of land for population support infrastructure, the overharvesting of food species, the introduction of invasive species and predation by household pets, and other disturbances to natural features, like the alteration of stream flows.

The Attorney General has suggested that it is difficult to provide a general statement regarding the impacts the changing climate has on the State's varied ecosystems. It is clear that rising temperatures, altered water supplies, and other environmental variations will make some habitats less hospitable for sensitive plants and animals.

### **Regulatory Background**

Native species and biological resources include native and introduced aquatic and terrestrial species, plants, and their habitats. Biological resources are regulated at both federal and state levels, and many water resource regulations also protect biological resources. These regulations help protect and recover resources, by requiring special review and permits of actions that may impact those resources.

Federal Laws and Regulations include:

The **Endangered Species Act (ESA)** (16 U.S.C. 1531–1543) established a program for the conservation of threatened and endangered plants and animals and the habitats in which they are found. The U.S. Fish and Wildlife Service (FWS) of the Department of the Interior maintains a worldwide list which includes 1574 endangered species (599 are plants) and 351 threatened species (148 are plants). Species include birds, insects, fish, reptiles, mammals, crustaceans, flowers, grasses, and trees. The law requires federal agencies, in consultation with the FWS and/or the U.S. National Oceanic and Atmospheric Administration (NOAA) Fisheries Service, to ensure that actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of designated critical habitat of such species. The law also prohibits any action that causes a "taking" of any listed species of endangered fish or wildlife.<sup>35</sup>

The **Fish and Wildlife Coordination Act** (16 U.S.C. 661–666) requires government agencies to consult with FWS prior to modifying the waters or channel of a body of water, with a view to the conservation of wildlife resources. The Act also authorizes land and water acquisition by federal construction agencies for wildlife conservation and development.

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<sup>35</sup> <http://www.epa.gov/lawsregs/laws/esa.html>

The **Coastal Zone Management Act** (16 U.S.C. 1456) establishes federal programs for the management of the nation's coastal resources and the Great Lakes in order to balance economic development with environmental conservation, and for the study of human influences on estuaries. The programs are administered by NOAA's Office of Ocean and Coastal Resource Management (OCRM).

State Laws and Regulations include:

The **California Endangered Species Act (CESA)** (Fish and Game Code § 2050 et seq.) was enacted to protect or preserve all native species of fishes, amphibians, reptiles, birds, mammals, invertebrates, and plants, and their habitats, threatened with extinction and those experiencing a significant decline which, if not halted, would lead to a threatened or endangered designation. The Department of Fish and Game (DFG) is charged with enforcing the Act and with issuing permits authorizing incidental “take” to otherwise lawful development projects.

The **Native Plant Protection Act** (Fish and Game Code § 1900–1913) was enacted to preserve, protect and enhance endangered or rare native plants of this state. Habitats are threatened with destruction, drastic modification, or severe curtailment, or because of commercial exploitation or by other means, or because of disease or other factors. DFG maintains a list of protected plants and negotiates agreements to protect threatened plants.

The **Natural Community Conservation Planning Act** (Fish and Game Code § 2800 et seq.) expands the Endangered Species Act to conserve natural communities at the ecosystem scale while accommodating compatible land use. The program seeks to anticipate and prevent the controversies and gridlock caused by species' listings by focusing on the long-term stability of wildlife and plant communities and including key interests in the process. This program is implemented by DFG.

The **California Coastal Act** (Public Resources Code § 30000, et seq.) is California's version of the federal Coastal Zone Management Act. To protect California's coastal resources, the California Coastal Commission reviews all proposed construction in the defined coastal zone.

#### Process of Evaluation

Where possible, ARB reviewed existing studies, environmental documentation, and regulatory documentation for pertinent information. Documentation and studies for existing activities were used to estimate expansion of those types of activities. Where no information was available, ARB consulted experts at state agencies, including at the Air Resources Board and Climate Action Team agencies. More detailed information about the recommended regulations and the measures under evaluation is provided in Appendix C of the Draft Scoping Plan, as well as in the discussion of the potential impact on air resources (Section 3A).

**1. CALIFORNIA CAP-AND-TRADE PROGRAM LINKED TO WESTERN CLIMATE INITIATIVE**

No direct impacts from the recommended measure were identified at this time that could adversely affect plant or animal species or the resources on which they rely as a result of a compliance-based trading program that complies with AB 32 requirements. Indirect impacts of this recommended measure would be evaluated as part of the rule development process.

**2. TRANSPORTATION AND GOODS MOVEMENT**

**(T-1) Pavley I and Pavley II-Light-Duty Vehicle GHG Standards 31.7 MMT CO<sub>2</sub>E**  
**(T-3) Vehicle Efficiency Measures 4.8 MMT CO<sub>2</sub>E**

At times, the refining, marketing and distribution of gasoline adversely affects water quality due to leaks, spills, and wastewater discharge. These water quality impacts can also impair important habitat, or interfere with critical life-cycles of native species. Any reduction in fuel use would reduce the opportunity for such occurrences. Consequently, the ARB staff projects that the recommended measures could have a positive impact on biological resources.

**(T-2) Low Carbon Fuel Standard 16.5 MMT CO<sub>2</sub>E**

At times, the refining, marketing and distribution of petroleum fuels adversely affects water quality due to leaks, spills, and wastewater discharge. These water quality impacts can also impair important habitat, or interfere with critical life-cycles of native species. Any reduction in petroleum fuel use would reduce the opportunity for such occurrences.

Some biofuels feedstocks have the potential to affect native species and biological resources, if feedstocks are produced through conversion of important habitat to agriculture or increase agricultural activities in species' corridors.

Hydrogen production and use should have little or no affect on native species and biological resources outside of any potential effects from its energy and water source.

**(T-4) Ship Electrification at Ports 0.2 MMT CO<sub>2</sub>E**  
**(T-5) Goods Movement Efficiency Measures 3.5 MMT CO<sub>2</sub>E**

Ports affect the coastal and ocean environments, intersecting with shallow aquatic habitat and species, pelagic species including migrating mammals, and bird species. Some of these species are endangered or threatened. Species and habitats can be impacted by physical activity within or changes to their habitat, water quality degradation through wastes and accidental discharges, and through the introduction of invasive species by international vessels. Ports regularly undertake programmatic and project-level CEQA documentation for their proposed activities, and many coastal environments in California have special environmental regulations and oversight.

One maintenance practice to be considered in the commercial harbor craft measure is the use of anti-fouling products on the hulls to improve hull smoothness. The active ingredient of a number of anti-fouling products is copper. The copper is slowly leached out of the product and thereby inhibits the growth of species that foul vessel hulls. The potential adverse impacts to biological



resources are associated with the leached copper, particularly in harbors and marinas that are relatively shallow and experience a reduced level of water circulation. The use of anti-fouling products containing copper could negatively impact biological resources. ARB staff would promote the use of non-toxic anti-fouling products by vessel owner/operators and educate them about the dangers associated with other products. With non-toxic products, a vessel owner/operator would have to clean the hull more frequently than if they were to use copper-based anti-fouling products. However, non-toxic products do not need to be reapplied as often as copper-based products.

The recommended goods movement measures are to improve efficiencies in port activities to reduce GHG emissions. Many of these efficiencies could result in reduced fossil-fuel combustion. Reduced fossil-fuel combustion at ports has similar potential benefits described in the evaluation of measures T-1 and T-3. Improvements in ocean and harbor vessels could also potentially reduce regular and accidental discharges to water.

<b><u>(T-6) Heavy Duty Vehicle GHG Emission Reduction – Aerodynamic Efficiency</u></b>	<b><u>1.4 MMT CO<sub>2</sub>E</u></b>
<b><u>(T-7) Medium and Heavy-Duty Vehicle Hybridization</u></b>	<b><u>0.5 MMT CO<sub>2</sub>E</u></b>
<b><u>(T-8) Heavy-Duty Engine Efficiency</u></b>	<b><u>0.6 MMT CO<sub>2</sub>E</u></b>

Measures T-6 and T-8 are not expected to affect native species or biological resources, as they are not expected to change the number of vehicles in 2020. Measure T-7 is estimated to avoid some fossil-fuel combustion, and in that respect could have benefits similar to measures T-1 and T-3.

<b><u>(T-10) High Speed Rail</u></b>	<b><u>1 MMT CO<sub>2</sub>E</u></b>
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The Draft Scoping Plan supports the implementation of a high speed rail system. The recommended HSR program has undergone environmental review under CEQA and NEPA. ARB reviewed this documentation for its analysis of biological resources. The programmatic EIR/EIS examined the impacts of the High Speed Rail on biological resources at a statewide level, finding that the HSR has the potential for significant impacts on biological resources and wetlands. This is largely due to the need for new infrastructure corridors in areas of biological resources. The PEIR/EIS identifies program design, mitigation, and further evaluation strategies to minimize these impacts.

<b><u>Feebates (Under Evaluation)</u></b>	<b><u>4 MMT CO<sub>2</sub>E</u></b>
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This measure considers financially incenting the transition from high-GHG emitting vehicles to low-GHG emitting vehicles by imposing a fee on the former and offering a rebate on the latter. This would have upstream impacts on biological resources similar to measures T-1 and T-3.

### 3. LOCAL GOVERNMENT AND REGIONAL TARGETS

#### Regulatory Background

Local governments have the authority to establish allowable land uses within their spheres of influence in **General Plans**. **Government Code § 65040.2** directs cities and counties to develop these comprehensive, long-term plans to guide future development.

The **California Land Conservation Act of 1965**, known as the Williamson Act, enables local governments to enter into contracts with private landowners to restrict properties to agricultural and open space activities.

**CEQA** requires General Plans to describe the potential for environmental impacts through a public process.

**LAFCOs** in each county adopt spheres of influence for each city within the county, and make determinations on changes to those boundaries. Their decisions can influence air quality in the way in which they allow additional development to occur.

**(T-9) Local Government Actions and Regional Targets 2 MMT CO<sub>2</sub>E**

Development that emphasizes low impact, compact growth in urban areas can also emphasize biological-species friendly development, incorporation of wildlife corridors, conservation of open spaces and valuable habitat and reduced overall footprint. These types of activities would benefit biological resources and native species directly. Indirectly, reducing impacts on water quality and air quality could also benefit biological resources and native species.

<b><u>Congestion Pricing (Under Evaluation)</u></b>	<b>up to 1 MMT CO<sub>2</sub>E</b>
<b><u>Pay-As-You-Drive Insurance Premiums (Under Evaluation)</u></b>	<b>up to 1 MMT CO<sub>2</sub>E</b>
<b><u>Indirect Source Rules for New Development (Under Evaluation)</u></b>	<b>up to 1 MMT CO<sub>2</sub>E</b>
<b><u>Programs to Reduce Vehicle Trips (Under Evaluation)</u></b>	<b>up to 1 MMT CO<sub>2</sub>E</b>

The measures are proposed as mechanisms to reduce vehicle use and to encourage higher density developed areas. Increasing density also preserves land from development, and would complement measure T-9.

**4. ELECTRICITY AND NATURAL GAS**

Regulatory Background

For large energy facilities, the **CEC Certification process** serves as an equivalent to the otherwise required state and local permitting requirements. The CEC has authority to certify (permit) the construction and operation of thermal electric power plants 50 megawatts or larger and all related facilities. The site certification process provides a review and analysis of all aspects of a proposed project, including water supply availability and wastewater impacts, equivalent to the CEQA process. The process is also a public process. Smaller facilities with no potentially significant environmental impacts can apply for an exemption process, similar to a mitigated negative declaration approach under CEQA.

The CEC works with local governments to ensure a functionally equivalent permitting process. CEC prepare the necessary evaluation in a “Preliminary Staff Assessment”, working with federal, state, and local government to ensure it provides the information needed for the respective agencies to approve the project and either serves as the appropriate permit or basis for the appropriate permit.

The State Water Resources Control Board’s **“Water Quality Control Policy on the Use and Disposal of Inland Waters Used for Powerplant Cooling”** (Order No. 75-58) encourages the

use of alternative sources of cooling water and/or the use of alternative cooling technology. Alternative sources of cooling water identified in the policy include wastewater, irrigation return flows, and naturally brackish water. The policy also encourages the evaluation of dry or wet/dry cooling technology for those facilities that may require water from the Sacramento-San Joaquin River Delta. A fundamental purpose of this regulation is to protect species from impingement and entrainment by cooling tower intakes and from thermal discharges of cooling towers.

**(E-1) Energy Efficiency and Conservation** **15.2 MMTCO<sub>2</sub>E**

**(CR-1) Energy Efficiency and Conservation** **4.2 MMTCO<sub>2</sub>E**

**Additional Energy Efficiency and Conservation (Under Evaluation)** **4.8 MMT CO<sub>2</sub>E**

These measures are not expected to directly affect native species or biological resources. Avoided demand for electricity would potentially result in a reduction of the number of power plants constructed in the future, some of which may have developed in areas with important habitat.

**(CR-3) Solar Water Heating** **0.1 MMT CO<sub>2</sub>E**

**Expansion of Solar Water Heating (Under Evaluation)** **1 MMT CO<sub>2</sub>E**

These measures are not expected to affect native species or biological resources, as they are located in developed areas. Avoided demand for electricity would potentially result in a reduction of the number of power plants constructed in the future, some of which may have developed in areas with important habitat.

**(E-4) Million Solar Roofs** **2 MMT CO<sub>2</sub>E**

**Expanded Million Solar Roofs (Under Evaluation)** **1.3 MMT CO<sub>2</sub>E**

These measures are not expected to directly affect native species or biological resources, as they are located in developed areas. Avoided demand for electricity would potentially result in a reduction of the number of power plants constructed in the future, some of which may have developed in areas with important habitat.

**(E-3) Increasing Combined Heat and Power** **6.8 MMT CO<sub>2</sub>E**

This recommended measure would not directly impact native species or biological resources, as CHP systems would be installed in existing facilities. Avoided demand for electricity could potentially result in a reduction of the number of power plants constructed in the future, some of which may be developed in areas with important habitat.

**(E-2) Renewables Portfolio Standard** **21.2 MMT CO<sub>2</sub>E**

This recommended measure would increase the overall percentage of renewable energy sources such as wind, solar, biomass and geothermal, of each utility's energy sources. This requirement could be met through any potential mixture of renewable energy sources, and will most likely be driven by a number of factors, including the availability of renewable sources within the geographic region of each utility. For these reasons the benefits and impacts of each renewable resources are evaluated relative to natural gas, and are not individual quantified for potential air emissions.

Wind, solar, and geothermal facilities are located where they can best harness these resources, often in rural areas. Although biological resources and native species are best addressed on a

project-level basis, a higher-level analysis indicates that projects in rural areas and using greater amounts of land have a significantly greater potential for impacts than their urban, small acreage counterpoints.

**Wind** energy projects have potential direct and indirect impacts to birds and bats, including death. Siting and design of wind turbines and related infrastructure can minimize potential impacts. Advances in turbine and wind farm design have resulted in the use of fewer, more powerful turbines and better protection for birds. Wind project developers can also use guidelines developed by the California Energy Commission and the California Department of Fish and Game to evaluate and minimize these impacts.

**A solar thermal** plant requires around 50 times more land than combined-cycle natural gas-fueled power plant per MW. Construction activities associated with solar thermal plants disturb the land, and fencing can interfere with wildlife corridors. Specific impacts will depend on the biological characteristics of the land being developed for solar thermal plants, and sensitive populations and habitat should be avoided as a matter of state policy. The 2007 Environmental Performance Report from the California Energy Commission identifies and discusses the potentially significant and cumulative impacts of a large number of solar plants proposed on Bureau of Land Management (public) lands, including on sensitive species in the Mojave Desert. Projects located in areas where the vegetation and habitat have already been disturbed are preferable. There are also potential issues associated with uncompleted projects, where vast amounts of land are disturbed in facility preparation, but plants are not constructed. Nitrogen dioxide deposition from cooling towers can also degrade vegetation, which is generally mitigated through additional provision of habitat compensation.

There are no current large-scale **solar photovoltaic** plants operating in California, although there are several proposed. Photovoltaic plants use more land per MW than solar thermal plants, and about 80 times the acreage of a combined-cycle natural gas plant per MW. The 2007 Environmental Performance Report states that current technological advances may reduce the land footprint by up to 50 percent. Impacts on biological resources and native species would be determined by the location of the plant.

**Biomass** (forest or agricultural residuals), **anaerobic digesters**, and combustion of **landfill** gases are not expected to affect biological resources and native species outside of their physical construction impacts.

**Geothermal** projects are frequently located in rural areas and undisturbed areas, but have a relatively small footprint. It is possible that new projects would impact biological resources and would be required to reduce or minimize those impacts through habitat compensation. Nitrogen dioxide deposition from cooling towers can also degrade vegetation.

**Small hydropower** projects could potentially affect biological species and native species, if they are present in the already-disturbed habitat that manmade channels may provide.

New transmission infrastructure can also impact biological resources and native species through habitat disturbance and alteration (during and following construction) and through direct harm of

birds and bats from operating power lines. The RETI project is examining these issues and is expected to have recommendations this year.

**Coal Emission Reduction Standard (Under Evaluation) Up to 8 MMT CO<sub>2</sub>E**

The operation of coal plants has associated air emissions and local depositions of selenium, mercury, and other toxics, as well as sulfates and nitrates. These toxics, nitrates and sulfates have the potential to impact biological resources and native species. Acid mine drainage and habitat destruction associated with coal mining also pose significant impacts to local biological resources and native species. Reducing coal-fired power plants in the future could potentially avoid these types of impacts in new locations. Replacement of those plants with energy sources in California could result in affects on biological resources and native species. Types and scale of effects are described in the evaluation of measure E-2.

**7. INDUSTRY**

**Regulatory Background**

Before a facility can be constructed, it must obtain various permits to emit air pollutants, use water resources, and to develop land. If the proposed facility construction occurs in a location with identified habitat or species, or occurs in the vicinity of a surface water or protected area, the stationary source must comply with:

CEQA requires proposed electricity and natural gas facilities to analyze and describe the potential for environmental impacts, identify ways to reduce adverse impacts and offer alternatives to the project, and to disclose this information to the public.

**(I-1) Energy Efficiency and Co-Benefits Audits for Large Industrial Sources** **TBD MMTCO<sub>2</sub>E**

These measures are not expected to affect native species or biological resources, as all actions would occur on already developed lands.

**Carbon Intensity Standard for Cement Manufacturers (Under Evaluation)** **1.1-2.5 MMTCO<sub>2</sub>E**

**Carbon Intensity Standard for Concrete Batch Plants (Under Evaluation)** **2.5-3.5 MMTCO<sub>2</sub>E**

**Waste Reduction in Concrete Use (Under Evaluation)** **0.5-1 MMTCO<sub>2</sub>E**

Energy efficiency and blended cements are not expected to impact biological resources. As with any sector where biofuels are being considered as alternatives to fossil fuels there is the potential to impact biological resources through changes in land and water resources.

**Refinery Energy Efficiency Process Improvement (Under Evaluation)** **2-5 MMTCO<sub>2</sub>E**  
**Removal of Methane Exemption from Existing Refinery Regulations (Under Evaluation)** **0.01-0.05 MMTCO<sub>2</sub>E**

These measures are not expected to affect native species or biological resources, as all actions would occur on already developed lands.

**Oil and Gas Extraction GHG Emission Reduction (Under Evaluation)** **1-3 MMTCO<sub>2</sub>E**  
**GHG Leak Reduction from Oil and Gas Transmission (Under Evaluation)**  
**0.5-1.5 MMTCO<sub>2</sub>E**

These measures are not expected to affect native species or biological resources, as all actions would occur on already developed lands.

**Industrial Boiler Efficiency (Under Evaluation)** **0.5-1.5 MMTCO<sub>2</sub>E**  
**Stationary Internal Combustion Engine Electrification (Under Evaluation-Revised)**  
**0.1-0.5 MMTCO<sub>2</sub>E**

These measures are not expected to affect native species or biological resources, as all actions would occur on already developed lands.

**Glass Plant Energy Efficiency—Equipment Efficiency and Use of Recycled Materials**  
**(Under Evaluation)** **0.1-0.2 MMTCO<sub>2</sub>E**

This measure is not expected to affect native species or biological resources, as all actions would occur on already developed lands.

**Off-Road Equipment (Under Evaluation)** **Up to 0.5 MMTCO<sub>2</sub>E**

This measure is not expected to affect native species or biological resources, as the number of vehicles and equipment would not change as a result of this measure.

## **E. WASTE DISPOSAL AND HAZARDOUS WASTE**

### Regulatory Background

Solid waste and hazardous materials are regulated at a federal level by the U.S. EPA.

Solid and hazardous waste management is regulated through the **Resource Conservation and Recovery Act** (RCRA, Title 40 of the Code of Federal Regulations parts 239 through 299). RCRA established a solid waste program (subtitle D) that set guidelines for solid waste management and disposal facilities and prohibits open dumping; a hazardous waste program (subtitle C) which established a “cradle to grave” approach of hazardous material handling; and an underground storage tank program (subtitle I) that regulates tanks storing hazardous substances and petroleum products.

States have developed permitting programs to implement RCRA. In California, there are a number of statutes:

**Title 14 of the California Code of Regulations (CCR)** enacted the State’s solid waste management program. **Title 27 CCR** imposes restrictions on land disposal to protect water resources. The California Integrated Waste Management Board (CIWMB) is the state agency charged with overseeing enforcement of these regulations. Local agencies are responsible for developing, implementing, and enforcement waste management programs that are certified and enforced by the CIWMB.

The Department of Toxic Substances Control (DTSC) implements and enforces California’s hazardous materials management program (**Title 22 Division 4.5 CCR**), in conjunction with Certified Unified Program Agencies (CUPA). Hazardous materials are codified as materials that are toxic, reactive, ignitable or corrosive and have special disposal requirements. Hazardous materials are tracked from generator to waste facility, and handlers have to meet tracking and handling requirements.

### Process of Evaluation

Where possible, ARB reviewed existing studies, environmental documentation, and regulatory documentation for pertinent information. Documentation and studies for existing activities were used to estimate expansion of those types of activities. Where no information was available, ARB consulted experts at state agencies, including at the Air Resources Board and Climate Action Team agencies. More detailed information about the recommended regulations and the measures under evaluation is provided in Appendix C of the Draft Scoping Plan, as well as in the discussion of the potential impact on air resources (Section 3A).

## **1. CALIFORNIA CAP-AND-TRADE PROGRAM LINKED TO WESTERN CLIMATE INITIATIVE**

The recommended measure is not anticipated to result in a substantial increase in the generation of solid or hazardous wastes. There may be a potential for GHG emission reduction technologies to result in the use of hazardous materials (e.g., ammonia from electricity generation). The cap and trade program will comply with the environmental considerations required by AB 32 as well

as existing state and federal regulations. As part of the regulatory development of this measure, this potential will be further examined.

**2. TRANSPORTATION AND GOODS MOVEMENT**

<b>(T-1) Pavley I and Pavley II-Light-Duty Vehicle GHG Standards</b>	<b>31.7 MMT CO<sub>2</sub>E</b>
<b>(T-3) Vehicle Efficiency Measures</b>	<b>4.8 MMT CO<sub>2</sub>E</b>

These measures are not expected to affect waste disposal or hazardous materials, as they do not recommend significantly or materially changing vehicles. Reduced upstream transport of fuels would reduce the potential for accidental spills.

<b>(T-2) Low Carbon Fuel Standard</b>	<b>16.5 MMT CO<sub>2</sub>E</b>
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**Biodiesel:** Biodiesel production uses sodium hydroxide, hexane, sulfuric acid, and methanol. These will be present in any waste generated and stearates are also likely generated during the esterification process. An EIR for a Biodiesel facility in CA lists: “Glycerol Disposal– The glycerol by-product contains unused catalyst, salt, water, methanol, and soaps that the facility is planning to dispose of as a dust inhibitor for roads or used for producing hydrogen.” Biodiesel biodegrades much more rapidly than regular diesel.

**Ethanol:** Current state-of-the-art dry milling plants are expected to generate minimal waste, including little to no waste water (due to recycling). EIRs for facilities indicate hydraulic oil as being the only hazardous waste that needs disposal.

**Hydrogen:** Precious metals, such as platinum, are expected to be recovered from fuel cells at the end of their useful life. Carbon fiber used in hydrogen tanks is highly valuable as a recycled material.

<b>(T-4) Ship Electrification at Ports</b>	<b>0.2 MMT CO<sub>2</sub>E</b>
<b>(T-5) Goods Movement Efficiency Measures</b>	<b>3.5 MMT CO<sub>2</sub>E</b>

These measures are not expected to affect waste disposal or hazardous materials, as they do not recommend significantly or materially changing vehicles, vessels, structures, or equipment. Reduced upstream transport of fuels would reduce the potential for accidental spills.

<b>(T-6) Heavy Duty Vehicle GHG Emission Reduction – Aerodynamic Efficiency</b>	<b>1.4 MMT CO<sub>2</sub>E</b>
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<b>(T-7) Medium and Heavy-Duty Vehicle Hybridization</b>	<b>0.5 MMT CO<sub>2</sub>E</b>
<b>(T-8) Heavy-Duty Engine Efficiency</b>	<b>0.6 MMT CO<sub>2</sub>E</b>

These measures are not expected to affect waste disposal or hazardous materials, as they do not recommend significantly or materially changing vehicles. Reduced upstream transport of fuels would reduce the potential for accidental spills.

<b>(T-10) High Speed Rail</b>	<b>1 MMT CO<sub>2</sub>E</b>
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The Draft Scoping Plan supports the implementation of a high speed rail system. The recommended HSR program has undergone environmental review under CEQA and NEPA. ARB reviewed this documentation for its analysis of biological resources. The programmatic EIR/EIS examined the impacts of the High Speed Rail on waste and hazardous resources at a



statewide level, finding no specific statewide impacts on waste and hazardous materials, but identifying the need to further evaluate this issue through the subsequent project-level EIR/EIS.

**Feebates (Under Evaluation)** **4 MMT CO<sub>2</sub>E**

This measure considers financially incenting the transition from high-GHG emitting vehicles to low-GHG emitting vehicles by imposing a fee on the former and offering a rebate on the latter. This would have upstream impacts on land resources similar to measures T-1 and T-3.

**3. LOCAL GOVERNMENT AND REGIONAL TARGETS**

**(T-9) Local Government Actions and Regional Targets** **2 MMT CO<sub>2</sub>E**

Reductions in vehicle miles traveled would have effects similar to those described for vehicle measures (T-1, T-3).

**Congestion Pricing (Under Evaluation)** **up to 1 MMT CO<sub>2</sub>E**

**Pay-As-You-Drive Insurance Premiums (Under Evaluation)** **up to 1 MMT CO<sub>2</sub>E**

**Indirect Source Rules for New Development (Under Evaluation)** **up to 1 MMT CO<sub>2</sub>E**

**Programs to Reduce Vehicle Trips (Under Evaluation)** **up to 1 MMT CO<sub>2</sub>E**

Reductions in vehicle miles traveled would have effects similar to those described for vehicle measures (T-1, T-3).

**4. ELECTRICITY AND NATURAL GAS**

**(E-1) Energy Efficiency and Conservation** **15.2 MMTCO<sub>2</sub>E**

**(CR-1) Energy Efficiency and Conservation** **4.2 MMTCO<sub>2</sub>E**

**Additional Energy Efficiency and Conservation (Under Evaluation)** **4.8 MMT CO<sub>2</sub>E**

Appliance and building efficiency standards are designed to reduce energy and water consumption. Overall, the appliance and building turnover rate would not change with this recommended measure, so the production of waste would not be accelerated. Efficiency standards occasionally result in the use of new or new versions of products that contain hazardous materials and require special recycling. One example of this is the fluorescent lamp, which uses a small amount of mercury vapor. To minimize impacts on the environment and landfills, new technologies are being researched and consumers are being encouraged to recycle the lamps.

**(CR-3) Solar Water Heating** **0.1 MMT CO<sub>2</sub>E**

**Expansion of Solar Water Heating (Under Evaluation)** **1 MMT CO<sub>2</sub>E**

**(E-4) Million Solar Roofs** **2 MMT CO<sub>2</sub>E**

**Expanded Million Solar Roofs (Under Evaluation)** **1.3 MMT CO<sub>2</sub>E**

In operation, solar water heaters do not produce any waste materials. However, some solar cell manufacturing requires trace amounts of potentially toxic chemicals, and many solar cells are being manufactured in California. The Public Interest Energy Research Program of the California Energy Commission investigated this issue and concluded:

“The greatest environmental risk with silicon cells is associated with the use of gases (arsine and phosphine) during the manufacturing process. Thin-film technologies, such as cadmium

telluride cells and copper indium diselenide cells, are being developed to increase conversion efficiency and decrease production costs. The most likely routes for environmental release of trace elements are from accidental spills during the manufacturing process. At sites with installed PV modules, release of trace elements from sealed modules is unlikely except due to explosion or fire. Leaching of trace metals from modules is not likely to present a significant risk due to the sealed nature of the installed cells and the plan for recycling of spent modules in the future.”<sup>36</sup>

**(E-3) Increasing Combined Heat and Power 6.8 MMT CO<sub>2</sub>E**

Waste or hazardous materials associated with combined heat and power systems are a function of the fuel used for the system. Natural gas would not produce physical waste. Potential waste impacts of biomass, solar, wind, and fuel cells are discussed in the Electricity and Natural Gas section.

**(E-2) Renewables Portfolio Standard 21.2 MMT CO<sub>2</sub>E**

**Wind** projects do not generate waste during operation, or require hazardous materials for construction.

**Solar thermal plants** do not produce any waste materials or require toxic or hazardous materials to manufacture. **Photovoltaic** operation and manufacturing is discussed under measures CR-3 and E-4.

**Biomass** energy is a promising use of waste to create energy and reduce the lands needed for landfill, or the air pollutants associated with open-air combustion. Waste materials used for biomass include corn stover, rice hulls, wheat straw, orchard prunings, forest residuals wooden construction debris, and yard and tree trimmings. The combustion by-product (ash) can be mixed with soils for use as landfill cover, or in pavement aggregate.

**Anaerobic digestion** is a form of biological waste processing that destroys harmful biological microorganisms, reduces odors, and physically reduces overall waste mass. This anaerobic process produces methane that would otherwise need to be combusted.

**Landfill** gas is a byproduct of our current waste management practices, which can be harvested either as natural gas or through combustion.

**Municipal solid waste** may contain hazardous materials, which could result in solid and gaseous hazardous by-products. Air emissions and ash can be treated to reduce this hazard, ash can be shipped to special landfills, or hazardous materials can be diverted from the waste prior to combustion.

**Geothermal** projects do not produce waste or hazardous materials, other than those described in the air and water resources sections.

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<sup>36</sup> *Potential Health and Environmental Impacts Associated with the Manufacture and Use of Photovoltaic Cells*, EPRI, Palo Alto, CA, and California Energy Commission, Sacramento, CA:2003, 1000095.

**Small hydropower** projects do not generally have any waste or hazardous materials impacts.

**Coal Emission Reduction Standard (Under Evaluation)** **Up to 8 MMT CO<sub>2</sub>E**

Switching from coal to other sources of energy also offers some waste benefits: Coal mining, processing, and combustion all have waste products associated with them that are regulated by the U.S. EPA and by the Office of Surface Mining, Reclamation and Enforcement under the United States Bureau of Reclamation. Some combustion byproducts, such as fly ash, are currently repurposed in construction, mine reclamation, and landscaping applications. Several environmental groups are currently petitioning the U.S. EPA to regulate coal combustion byproducts.<sup>37</sup>

**7. INDUSTRY**

**(I-1) Energy Efficiency and Co-Benefits Audits for Large Industrial Sources**

**TBD MMTCO<sub>2</sub>E**

The potential energy efficiency improvements that may result from this measure are not expected to impact waste disposal.

**Carbon Intensity Standard for Cement Manufacturers (Under Evaluation)**

**1.1-2.5 MMTCO<sub>2</sub>E**

**Carbon Intensity Standard for Concrete Batch Plants (Under Evaluation)**

**2.5-3.5 MMTCO<sub>2</sub>E**

**Waste Reduction in Concrete Use (Under Evaluation)** **0.5-1 MMTCO<sub>2</sub>E**

The potential energy efficiency improvements associated with these measures under evaluation are not expected to impact waste disposal. Blended cements could reduce problems associated with the disposal fly ash and slag by recycling those materials.

**Refinery Energy Efficiency Process Improvement (Under Evaluation)** **2-5 MMTCO<sub>2</sub>E**

**Removal of Methane Exemption from Existing Refinery Regulations (Under Evaluation)**

**0.01-0.05 MMTCO<sub>2</sub>E**

These measures are not expected to affect waste disposal or hazardous materials.

**Oil and Gas Extraction GHG Emission Reduction (Under Evaluation)** **1-3 MMTCO<sub>2</sub>E**

**GHG Leak Reduction from Oil and Gas Transmission (Under Evaluation)**

**0.5-1.5 MMTCO<sub>2</sub>E**

These measures are not expected to affect waste disposal or hazardous materials.

**Industrial Boiler Efficiency (Under Evaluation)** **0.5-1.5 MMTCO<sub>2</sub>E**

This measure could potentially accelerate the turnover of industrial boilers, in favor of newer models or fuel cell systems. This is not anticipated to have a significant effect on waste disposal.

**Stationary Internal Combustion Engine Electrification (Under Evaluation-Revised)**

**0.1-0.5 MMTCO<sub>2</sub>E**

This measure is not expected to affect waste disposal or hazardous materials.

<sup>37</sup> Earthjustice, et. al., *Proposal for the Federal Regulation of Coal Combustion Waste*, January 2007.

**Glass Plant Energy Efficiency—Equipment Efficiency and Use of Recycled Materials**  
**(Under Evaluation)** **0.1-0.2 MMTCO<sub>2</sub>E**

This measure under evaluation proposes the use of additional cullet (waste glass) in container glass manufacturing and fiberglass manufacturing, which would reduce the amount of raw material needed for the processes, and reduce the overall waste disposal needs.

**Off-Road Equipment (Under Evaluation)** **Up to 0.5 MMTCO<sub>2</sub>E**

This measure is not expected to affect waste disposal or hazardous materials.

## 4. PUBLIC HEALTH AND SAFETY

Public health and safety in California can be expected to be adversely impacted by climate change. Several recent studies have addressed potential implications for human health at the national and international levels.<sup>38</sup> Greater climate variability and changes in climate patterns would potentially cause both direct and indirect health effects. Direct health and safety impacts would result from extreme events, such as heat waves, droughts, increased fire frequency, and increased storm intensity resulting in flooding and landslides. Secondary or indirect health effects would be associated with damages to infrastructure that cause, for example, sanitation and water treatment problems that increase water-borne infections. Air quality impacts such as increases in tropospheric ozone due to higher temperatures would also have health impacts.

### A. AIR QUALITY AND PUBLIC HEALTH

ARB has many program and plans that are designed to identify and mitigate public health problems due to air quality throughout the State. ARB has identified harbor communities and sensitive populations as a priority when addressing toxic and criteria air contaminants. The Draft Scoping Plan builds on ARB's priorities and on-going efforts to reduce air pollution. Within this environmental evaluation ARB staff has quantified, where possible, the potential changes to NOx, VOC, primary and secondary PM2.5, and air toxics that would result from implementation of the recommended measures and measures under evaluation in the Draft Scoping Plan.

For this section of the evaluation, staff estimated the health impacts associated with PM2.5 exposure on a State level. This evaluation focuses on PM 2.5 because this pollutant accounts for the majority of premature deaths associated with air pollution in California. Although we have estimated statewide changes to emissions of key criteria pollutants in 2020, we have not specifically assigned emission changes to individual facilities or transportation corridors. Because of this, we cannot reliably model future air quality conditions across the state. Without such modeling, it is difficult to estimate health outcomes of criteria pollutants like ozone, whose chemistry is highly dependent on precursors and weather conditions and whose health outcomes are highly dependent on length and magnitude of exposure.

We have estimated statewide health outcomes for PM2.5 because the sources of PM2.5 are distributed in similar proportions and patterns to populations, and are not strongly dependent on meteorology for their formation or for their direct emission and exposure pathways. Staff based the evaluation on the GMERP public health methodology, which is provided as a reference in Attachment F. The GMERP methodology is based on diesel sources of PM2.5, and the majority of criteria pollutant reductions from the Draft Scoping Plan are from diesel sources. There are many assumptions made in this exercise which add to the uncertainty of the estimates, including translating regional emission and health outcome information to statewide information, estimating criteria pollutant reductions for measures, and assuming that emissions and exposures are geographically proportional. This analysis is intended to provide the public with comparative information on the recommended measures.

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<sup>38</sup> Patz et al., 2000.

### Regulatory Background

ARB's first priority continues to be the protection of public health, and now it joins with other agencies, states, and countries to protect public health on a global level, through the reduction of greenhouse gases. All of the recommended measures and measures under evaluation in this Draft Scoping Plan are designed to reduce greenhouse gases, and many of these measures would also contribute to ARB's goals of reducing criteria pollutants and toxic air contaminants. Some of the recommended measures may result in minor increases to co-pollutants, but these minor increases must be evaluated in the overall context of both the AB 32 program and existing ARB programs, which are briefly described below:

Federal clean air laws require areas out of attainment with national ambient air quality standards to prepare **State Implementation Plans (SIP)** identifying actions to bring areas into compliance in a set timeframe. Under State law, ARB has the responsibility to develop SIP strategies for mobile sources and consumer products, to coordinate SIP strategies with the Bureau of Automotive Repair and the Department of Pesticide Regulation, and to oversee local district programs for stationary sources. In 2007, ARB adopted the State Strategy for Implementation of Ozone and PM<sub>2.5</sub> Standards.

The **Air Toxics "Hot Spots" Information and Assessment Act** (AB 2588, 1987, Connelly) requires stationary sources to report the types and quantities of certain substances routinely released into the air. The goals of the Air Toxics "Hot Spots" Act are to collect emission data, to identify facilities having localized impacts, to ascertain health risks, to notify nearby residents of significant risks, and to reduce those significant risks. The public has access to facility emissions and risk data for specific facilities. The "Hot Spots" Act also requires local air districts to prioritize which facilities must perform a health risk assessment based on the potency, toxicity, and quantity of emissions released from the facility to determine if the facility poses a significant risk. High-risk facilities must reduce their toxic emissions and risk to acceptable levels that are determined by the local air districts. District annual reports summarize the results and progress of health risk assessments, and rank and identify facilities that pose a risk to public health.<sup>39</sup>

An important source of directly emitted PM<sub>2.5</sub> is diesel exhaust. The particulate matter from diesel-fueled engines (diesel PM) was identified as a toxic air contaminant by the ARB in 1998. Nearly 70 percent of the known cancer risk caused by air toxics in California is attributed to diesel PM. In 2000, ARB adopted a **Diesel Risk Reduction Plan** to reduce diesel PM emissions by 85 percent by 2020. ARB has since adopted a number of regulatory measures to reduce diesel PM emissions statewide including requirements for in-use trash trucks, public agency-owned trucks, buses, stationary engines, transportation refrigeration units, cargo handling equipment, and off-road equipment. ARB will soon consider adoption of a regulation to reduce emissions from in-use heavy-duty trucks. Diesel control measures reduce both direct diesel PM and NO<sub>x</sub> emissions through a combination of engine retrofits and replacements. Upcoming mobile source fleet measures to reduce diesel PM and NO<sub>x</sub> emissions are a critical part of the new State Implementation Plan strategy, Diesel Risk Reduction Plan, and the Draft Scoping Plan.

The **Emission Reduction Plan for Ports and Goods Movement in California (GMERP)**, approved by ARB in April 2006 identified key new measures necessary to meet federal air

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<sup>39</sup> <http://www.arb.ca.gov/ab2588/reports.htm>

quality standards and reduce health risk in communities near ports and railyards. Ships are the largest source of SO<sub>x</sub> emissions in the State. Heavy-duty trucks move most goods within and through the state, and are the largest statewide source of NO<sub>x</sub> emissions. This makes it essential to address goods movement emissions in order to meet PM<sub>2.5</sub> air quality standards. Likewise, emission reduction targets for ozone will not be met without reducing emissions related to goods movement.

The strategies included in the GMERP target ships and trucks, as well as the other three main sources of goods movement emissions: harbor craft, cargo handling equipment, and locomotives. By 2020, these strategies will cut statewide goods movement emissions of NO<sub>x</sub> by 63 percent, SO<sub>x</sub> emissions by 78 percent, and will also reduce the statewide health risk from goods movement-related diesel particulate matter by 85 percent.

Many of the strategies in the GMERP are adopted and will provide essential new emission reductions needed for regional attainment, while they reduce the air pollution-related health risk for those who live near our ports, rail yards, distribution centers, and other goods movement facilities.

In addition, ARB's **Harbor Communities Monitoring Study (HCMS)** is designed to improve tools for measuring pollutant concentrations in the air and detecting areas where concentrations of these pollutants are high. This study consists of three types of air pollution sampling: a network of passive samplers, a mobile platform, and a network of particle counters. The sampling will characterize temporal and spatial variations of air pollution in the study region. The sampling was conducted during 2007. The pollutants being measured include, but are not limited to black carbon, carbon monoxide, nitrogen oxides, particulate matter, ultrafine particles, volatile organic chemicals, and hydrogen sulfide.

The communities being studied include Wilmington and parts of San Pedro, West Long Beach, and Carson. These communities were chosen because of the emission sources in the area and the close proximity of residents to these emission sources. The Harbor Communities are located just north of the Ports of Los Angeles and Long Beach, which handle 40 percent of all container traffic entering the United States; the area is also surrounded by some of the most heavily traveled freeways in Southern California, is home to several large refineries, and a number of rail facilities.

#### Health Impacts of Ozone (Criteria Pollutant)

The formation and health impacts of ozone are well studied.<sup>40</sup> Ozone is a highly reactive gas that forms in the atmosphere through reactions between chemicals emitted from motor vehicles, industrial plants, consumer products and many other sources. It forms in greater quantities on hot, sunny, calm days making the summer season the key exposure period.

Considerable research over the past 35 years has investigated how people respond to inhaling ozone. These studies have consistently shown that inhalation of ozone can lead to inflammation and irritation of the tissues lining the human airways. This causes inflammation and also causes

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<sup>40</sup> CARB, 2005; Anderson, et al, 2004; Thurston, et al 2001; Stieb, et al, 2003; Bell et al, 2004; Levy et al, 2001; and Gryparis, et al, 2004.

the muscle cells in the airways to constrict, thus reducing the amount of air that can be inhaled. Symptoms and responses to ozone exposure vary widely, even when the amount inhaled and length of exposure is the same. Typical symptoms include cough, chest tightness, and increased asthma symptoms. Ozone in sufficient doses can also increase the permeability (“leakiness”) of lung cells, making them more susceptible to damage from environmental toxins and infection.

Studies of large populations have found that ozone exposure is associated with an increase in hospital admissions and emergency room visits, particularly for lung problems such as asthma and chronic obstructive pulmonary disease. Several studies have also associated ozone exposure with increased premature mortality in elderly people with chronic diseases of the lungs and circulatory system.

People who exercise or work outdoors are at greater risk of experiencing adverse health effects from ozone exposure because they inhale more ozone. Some evidence has linked the onset of asthma to exposure to elevated levels of ozone in exercising children. Children and adolescents are at increased risk because they are more likely to spend time outdoors engaged in vigorous activities than adults and because they inhale more ozone per pound of body weight.

In order to protect public health, the federal government previously set the national ozone standard at 0.08 parts per million for 8 hours, not to be exceeded, based on the fourth highest concentration averaged over three years. ARB and local air districts have proposed a State Implementation Plan describing the strategies and measures that California will pursue to reduce ozone.<sup>41</sup> However, in March 2008, due to new studies that show health effects at lower concentrations of ozone, U.S. EPA set a new 8-hour ozone standard at 0.075 parts per million. States have less than one year (from March 27, 2008) to provide air quality information to U.S.EPA, which will be used to designate non-attainment areas by 2010. By 2011, states must submit SIPs demonstrating how they will attain the new, more stringent, standard.

#### Health Impacts of PM<sub>2.5</sub> (Criteria Pollutant)

Particulate matter (PM) air pollution is also well studied. Particulate matter pollution is a complex mixture that consists of dry solid fragments, solid cores with liquid coatings, and small droplets of liquid. PM can be directly emitted into the air in forms such as dust and soot. It can also be formed in the atmosphere from the reaction of various gases. Inhalable particulate matter is less than 10 microns in diameter (a micron is one-millionth of a meter) and is called PM<sub>10</sub>. Even smaller particles, those 2.5 microns or less in diameter, are called “fine particles” or PM<sub>2.5</sub>. PM<sub>2.5</sub> is a component of PM<sub>10</sub>. Diesel PM is particulate matter emitted from diesel-fueled combustion; diesel PM has been classified as a TAC by ARB.

Extensive research has shown that PM can be inhaled into the deep portions of the lungs. Some inhaled particles are exhaled again, but others deposit in the lungs, which can lead to inflammation in both the lungs and the circulatory system. Fine particulate matter may also pose an increased health risk as it can penetrate deeper into the lungs.

Population-based studies in hundreds of cities around the world have demonstrated a strong link between exposure to elevated particulate matter levels and premature death, especially in people

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41 <http://www.arb.ca.gov/planning/sip/2007sip/2007sip.htm>



with pre-existing heart or lung disease. The two most relevant of these studies were performed in many cities in the United States, and have been ongoing for over 15 years. Both of these studies found a strong relationship between long-term PM exposure and premature death.

Scientists have observed higher rates of hospitalization, emergency room visits and doctor's visits for respiratory illnesses or heart disease during times of high PM concentrations. During these periods of high PM levels, scientists also observed the worsening of both asthma symptoms and acute and chronic bronchitis, and reductions in various measures of lung function.

The elderly and people with heart and/or lung diseases are particularly at risk of experiencing adverse effects from PM exposure. Studies have also shown that children may be particularly vulnerable to PM effects. There is evidence from the ongoing Children's Health Study, funded by the ARB for over ten years, that in communities with high levels of PM children's lungs develop more slowly and that at maturity they tend to have lower lung capacity than children who grow up in communities with lower levels of PM. Just as with ozone, children and infants may also be more at risk of experiencing adverse effects from PM because they inhale more air per pound of body weight than do adults, they breathe faster, and have smaller body sizes. In addition, there is some evidence that children's developing immune systems may cause them to be more susceptible to the effects of PM than adults.

#### Health Outcomes

ARB most recently updated its methodology for quantifying the health impacts of fine particulate matter during the development of the Goods Movement Emissions Reduction Plan (GMERP). This methodology has been peer-reviewed during the development of the GMERP. To develop quantitative health outcome estimates in the GMERP, ARB reviewed relevant scientific literature on health impacts associated with air pollution exposure and chose a subset of the studies based on strength of methodology and applicability to California residents or conditions. From these studies, concentration-response functions,<sup>42</sup> a measure of observed relative risk, and the associated error terms (95 percent confidence intervals) were obtained for the following health outcomes:

- **Premature death:** A death that occurs at a younger age than would be expected. Air pollution is not implicated as the *cause* of death, but rather a contributing factor in someone whose health is typically already compromised, thereby accelerating the time of death by about 14 years.
- **Hospital admissions for respiratory and cardiovascular causes:** Hospitalization admissions for conditions including pneumonia, chronic obstructive pulmonary disease (COPD), asthma, heart attack, stroke, congestive heart failure and cardiac arrhythmia.
- **Asthma and lower respiratory symptoms:** Symptoms such as cough, phlegm production, chest pain, or wheeze, associated with the lower respiratory tract (windpipe, lungs, and airways leading to/associated with the lungs).
- **Acute bronchitis:** Inflammation of the main airways to the lungs, resulting in symptoms such as hacking cough and phlegm production.
- **Work loss days:** Days of missed work for members of the population age 18 through 65.

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<sup>42</sup>A concentration-response function relates changes in exposures to ambient concentrations of a pollutant to changes in an adverse health effect.

- **Minor restricted activity days:** Days when a person is not able to engage in their usual range of activities due to minor health conditions. This does not include work loss or bed confinement.

The methodology that ARB uses for quantifying premature death and other health outcomes from PM exposure is similar to a peer-reviewed methodology developed by the U.S. EPA<sup>43</sup> for their risk assessments. This methodology is regularly updated by ARB staff as new epidemiological studies and other related studies are published that are relevant to California's health impacts analysis.

#### Estimation/Quantification Process

For this analysis, ARB used a methodology similar the GMERP process, which is described in Attachment E.

#### Estimated Health Outcomes

For this initial version of the public health evaluation of the Draft Scoping Plan, ARB focused on the criteria pollutant reductions estimated for the recommended regulations in the transportation and electricity and natural gas sectors. The health outcomes estimated for these sectors are presented in Table 7.

**Table 7: Estimates of Statewide Health Benefits in 2020\***  
(number of cases)

<b>Health Endpoint</b>	<b>Health Benefits of Existing Measures and 2007 SIP</b>	<b>Health Benefits of Recommended Draft Scoping Plan Measures (Transportation and Electricity and Natural Gas Sectors)</b>
	<i>mean</i>	<i>mean</i>
Avoided Premature death	3,700	320
Avoided Hospital admissions for respiratory causes	770	67
Avoided Hospital admissions for cardiovascular causes	1,400	120
Avoided Asthma and lower respiratory symptoms	110,000	8,800
Avoided Acute bronchitis	8,700	730
Avoided Work loss days	620,000	53,000
Avoided Minor restricted activity days	3,600,000	310,000

\* Uncertainty intervals for each estimated benefit range within 20-70 percent of the mean benefit (presented in this table). For example, the number of premature deaths avoided due to the scoping plan could be between 88 to 550.

<sup>43</sup> U.S. Environmental Protection Agency, *Regulatory impact analysis for the final Clean Air Interstate Rule*, Office of Air and Radiation, EPA-452/R-05-002, 2005.

## **B. OTHER POTENTIAL PUBLIC HEALTH AND SAFETY ISSUES**

**Electric, Hydrogen, and Hybrid Vehicles:** High voltage wiring within electric-drive vehicles must be handled appropriately in the case of an accident. Emergency response personnel are trained to identify high voltage wiring to avoid electric shock in the case of an extraction. Hydrogen appears to be as safe as gasoline as a vehicle fuel. Hydrogen is extremely light and buoyant, so it dissipates into the open air very quickly, making any flammable concentration of hydrogen unlikely.

**High Speed Rail:** The High Speed Rail PEIR/EIS evaluated the potential for public safety issues related to electromagnetic frequency exposures due to the wireless communication system associated with the project. The evaluation concludes that the potential adverse effects could be avoided or mitigated to a less-than-significant level.

**Regional GHG Targets:** Various studies suggest that community design has an impact on public health. A greater mix of land uses in a neighborhood can produce a number of public health benefits. A more diverse neighborhood can reduce trips and therefore facilitate walking, biking, and use of transit. Studies show that more compact development is correlated with increased walking and transit trips. Additionally, public health research has shown that there is a direct connection between compact development and lower body mass indices, lower levels of obesity and decreased instances of hypertension. Although there are limitations with the studies, the findings suggest that low impact development may improve quality of life in many ways. The following co-benefits represent just a few of the many improvements in quality of life.<sup>44</sup>

Social capital has various components. It is generally described as the sense of belonging and civic participation experienced in a community. It is a series of social networks that provide trust and reciprocity and promote cultural and political life. Studies indicate that social capital may increase as people spend less time alone in their vehicles due to improved transportation planning and conducive land uses.<sup>45</sup> Improved social capital has been linked with improved mental health, prolonged life and better overall health.<sup>46</sup> More pedestrian- and cyclist-friendly development and amenities may also help to increase public safety, furthermore strengthening community ties.

There are also many potential health benefits, such as increased access to health care via public transit for people without access to vehicles, and decreased violence and pedestrian injuries and fatalities due to more pedestrian- and cyclist-friendly development. As open spaces and desirable locations (such as shopping, entertainment, schools, etc) become more plentiful, proximate and accessible to pedestrians and cyclists, residents are likely to increase their levels of physical activity. Moderate physical activity reduces many serious health risks, including coronary heart disease, diabetes mellitus, hypertension, anxiety and depression, and obesity.

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<sup>44</sup> Many of these benefits are taken from the CCAP report “CCAP Transportation Emissions Guidebook” ([http://www.ccap.org/safe/guidebook/guide\\_complete.html](http://www.ccap.org/safe/guidebook/guide_complete.html)) and “Understanding the Relationship Between Public Health and the Built Environment” report prepared for the LEED-ND Core Committee.

<sup>45</sup> Sullivan and Kuo 1996, *Community & Environment Design*, 2006.

<sup>46</sup> Ibid.

Access to green space has also been shown to lessen the impacts of mental fatigue and improve cognitive functioning in children.<sup>47</sup>

Decreased commute times and traffic congestion lessen driver-induced stress and the amount of traffic injuries and fatalities. Less vehicle use translates into improved air quality and reductions in adverse health impacts, such as death, cancer and exacerbation of asthma, which are most realized in particularly vulnerable populations, the elderly, the young and the health-impaired.

In order to bring about positive change, as well as avoid situations where attempts to solve one problem exacerbate another, it is essential that all levels of government continue to consider other societal, economic and environmental priorities in their decision-making processes related to land use, transportation, and local government operations. For example, some compact development may increase proximity to large sources of pollution, such as high traffic arterials, distribution centers, and industrial facilities, which increases exposure to vehicle air pollution and other toxics and particulates. Communities should be designed to ensure that sensitive land uses such as residences and schools are an adequate distance from these sources. In addition community design should decrease vehicle use, through increasing transit service and walkability, and include buildings with indoor air quality mitigation to further reduce exposure. Agencies should also consider housing supply and affordability needs so that long term housing affordability is not compromised. To maximize benefits and minimize unintended consequences, agencies will need to continually balance multiple priorities through an integrated planning approach.

Agencies should also consider housing supply and affordability needs so that long term housing affordability is not compromised. To maximize benefits and minimize unintended consequences, agencies will need to continually balance multiple priorities through an integrated planning approach.

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<sup>47</sup> NACCHO 2008.







**PUBLIC HEALTH**

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